Performance Management and Performance Measurement

Certified Management Accountants™

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CMA Ontario
February 2011

Entrance Examination Study Manual

Performance Management

CMA Ontario
2011

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Common Management Accounting Terms

Skill Level:
This topic is not separately identified in the CMA Competency Map. It is included for reference purposes only.

Absorption (full) costing is the accounting method that considers all manufacturing costs as product costs. These costs include variable and fixed manufacturing costs whether direct or indirect.

Actual costing is a costing system that assigns actual direct costs to cost objects and assigns indirect costs by multiplying the indirect cost rate by the quantity of the allocation basis. Contrast with normal costing.

Applied (absorbed) overhead is factory (manufacturing) overhead that has been allocated to a cost object. Overhead is over- or under-applied (absorbed) when overhead charged is greater or less than the actual overhead incurred.

Appraisal costs are the costs an organization incurs to identify whether products conform to specification.

Avoidable costs are costs that can be avoided by eliminating a cost object such as a department, product or activity.

Backflush costing delays costing until goods are finished. Standard or normal costs are then pushed backward through the system to assign costs to products.

Budgeting is the process of preparing budgets, which are quantitative (usually financial) expressions of management plans.

Committed costs are unavoidable costs resulting from past decisions.

Common cost, also called indirect cost, is the cost of a resource that is used by more than one cost object.

Controllable cost is a cost that is determined by an individual manager

Conversion costs are direct labour and factory overhead incurred when converting raw materials into finished goods.

Cost allocation is the process of assigning indirect costs to cost objects.

Cost centre is a responsibility centre whose manager is accountable for costs only.

Cost driver is a measure of activity deemed to determine some cost.

Cost object anything for which a cost is to be determined.

Cost of goods manufactured (CGM) equals the manufacturing costs (direct materials, direct labour and factory overhead) of goods completed and transferred to finished goods inventory during an accounting period.

Cost of goods sold (CGS) equals the manufacturing costs of goods sold during an accounting period.

Cost pools are accounts used to accumulate costs.

Cost-volume-profit (breakeven) analysis uses knowledge about a product's price, variable cost and fixed cost to predict the profit associated with any volume of activity. The analysis can be adapted to multi-product settings.

Differential (incremental) cost is the cost difference between two courses of action.

Direct cost is a cost that is related to a cost object and can be traced without excessive accounting costs.

Direct labour costs are wages paid to labour that vary directly with some measure of output activity and can be traced to a cost object for a reasonable accounting cost.

Direct materials costs are the costs of raw materials that can vary directly with some measure of output activity and can be traced to a cost object for a reasonable accounting cost.

Direct method of support cost allocation allocates the costs of support department to production departments ignoring any services provided to other support departments.

Discretionary costs are costs that arise through periodic budgeting decisions rather than through variations in some measure of production activity.

Efficiency variances compare the actual use of inputs with the quantity of inputs allowed for the activity level achieved.

Engineered costs are costs having a proportional relationship to some measure of production activity.

External failure costs are costs incurred to rework non-conforming products or services customers found to be defective.

Factory (manufacturing) overhead (indirect manufacturing) costs consists of all costs other than direct materials and direct labour that are associated with the manufacturing process.

Fixed costs are costs that remain unchanged over a specified range of activity.

Imputed costs are decision relevant costs that are not recognized by conventional accounting practice.

Indirect costs cannot be specifically associated with a given cost object in an economically feasible way.

Internal failure costs are costs incurred because of non-conformance of products and services. These costs are identified before delivery to outside parties.

Investment centre is a responsibility centre whose manager is accountable for revenues, costs and invested capital.

Job-order cost system of accounting is used to compute the cost of an individual job.

Joint cost (see common costs.)

Joint products are two or more separate economically relevant products produced by a manufacturing process using a common input.

Just-in-time (JIT) production systems are organized so that each component in the value chain produces only when demanded from the next component in the value chain.

Kaizen is a management system that focuses on continuous performance improvement of organization activities.

Life-cycle costing accumulates a product's costs from conception to termination.

Margin of safety is the difference between budgeted revenues and breakeven revenues.

Marginal cost is the cost increase resulting in a unit increase in an activity level. .

Mix variances measure the effect on costs or revenues that arise from changes the proportion of product inputs or product sales.

Mixed (semi-variable) costs are costs that have a fixed and variable component.

Normal capacity is the level of activity that will accommodate average demand over a period that includes seasonal, cyclical and trend variations.

Normal costing assigns actual direct costs to cost objects. It assigns overhead using budgeted overhead rates and the quantity of the cost allocation basis.

Operating leverage is the change in operating income resulting from a change in sales.

Operation costing is a hybrid of job-order and process costing systems.

Opportunity cost is the maximum benefit forgone by using a scarce resource for a given purpose.

Out-of-pocket (incremental) costs is the additional cost resulting from an increase in some activity.

Outsourcing is the acquisition of products and services from outside suppliers.

Period costs are all organization costs other than costs of goods sold.

Periodic inventory systems rely on physical counts to determine quantities.

Perpetual inventory records provide for continuous record keeping of the quantities of inventory (and possibly unit costs or total costs).

Practical capacity is the maximum level at which output is produced efficiently

Prevention costs are the costs of quality that are incurred to avoid defects in products or services.

Price (rate) variance equals the difference between the actual and standard price of an input, multiplied by the actual quantity acquired.

Prime costs are the costs of direct materials and direct labour.

Process costing is a costing system that develops a product cost by accumulating and computing average direct materials and conversion costs.

Process re-engineering involves a redesign of a business process to improve its cost, quality or timeliness performance.

Product (inventoriable) costs have two definitions. In financial accounting, these include only manufacturing costs attributable to a product. In management accounting, these include all costs attributable to a product.

Productivity is computed by dividing a measure of output to a measure of input.

Profit centre is a segment of an organization whose manager is held responsible for both revenues and costs.

Quantity (usage) variance is the difference between the amount of a resource that was used and the amount budgeted for that level of output multiplied by the standard cost of that resource.

Rate variance is the difference between the actual price paid for a resource and the budgeted price for that resource multiplied by the quantity of the resource acquired.

Reciprocal method allocates support department costs to operating departments recognizing services provided to both support departments and operating departments.

Relevant costs are those expected future costs that vary with the action taken.

Relevant range is the range of activity within which assumed cost relationships are thought to remain unchanged.

Residual income is the difference between accounting net income and the required dollar return on invested capital.

Responsibility accounting assigns responsibility and accountability for the performance of an organization segment by comparing actual results with target or budgeted results.

Return on investment (ROI) equals net income divided by an accounting measure of investment.

Revenue centre is a segment of an organization whose manager is accountable for revenues only.

Sales value at split-off method allocates joint cost to joint products in proportion of each product's sales value to the total sales value of all joint products.

Sales mix variance is the difference between the contribution margin (measured using standard prices and variable costs) of the actual sales mix and the contribution margin of the budgeted sales mix.

Sales quantity variance is the difference between the actual units of all products sold minus the budgeted units of all products sold multiplied by the budgeted sale mix percentage and the budgeted contribution margin per unit.

Sales volume variance is the difference in the contribution margin attributable to the difference between actual sales and budgeted sales.

Scrap is product or raw materials that have small or no sales value.

Separable costs are those incurred by joint products beyond the split-off point.

Spending variance is a factory overhead variance. For variable overhead, it is the difference between actual costs and the product of the actual activity and the budgeted application rate. For fixed overhead, the spending (also known as the budget) variance is the difference between actual and budgeted fixed costs.

Split-off point is the stage of production at which joint products become separately identifiable.

Standard cost is a predetermined unit cost.

Step-cost functions are costs are that are constant over small ranges of output but increase by steps (discrete amounts) as levels of activity increase.

Step-down method is a sequential approach to support cost allocation that recognizes some but not all inter-support department services.

Sunk cost is an unavoidable cost resulting from a past commitment.

Theoretical (ideal) capacity is the maximum capacity assuming continuous efficient operations.

Theory of constraints is an approach to maximizing income by relaxing bottleneck constraints in an optimal way.

Total factor productivity is the quantity of output divided by the cost of all inputs.

Total quality management (TQM) focuses on continuously improving operations to eliminate defects and inefficiency.

Transfer price is the price charged in an intra-company transaction.

Transferred-in costs are those incurred in a preceding department and received in a subsequent department in a multi-department production setting.

Variable costs are costs that vary directly with some level of activity.

Variable (direct) costing considers only variable manufacturing costs to be product (inventoriable) costs.

Variance analysis computes and evaluates deviations between actual and budgeted costs.

Volume (idle capacity or production volume) variance is the difference between budgeted fixed factory overhead and the factory overhead applied based on a predetermined rate and the standard input allowed for actual output.

Waste is raw materials that are left over from a production process or production cycle that has minimal or no value.

Work-in-process (manufacturing) account is used to accumulate the costs of goods that have been placed in production but have not yet been completed.

Yield variances determine the effect of varying the total input of a factor of production (e.g. direct materials or labour) while holding constant the input mix (the proportions of the types of materials or labour used) and the weighted average unit price of the factor of production.

Cost Classification and Behaviour

Skill Level:	R/U	A/A
3.1.1.1 Explains cost classification		
a) Defines, identifies, differentiates and illustrates different classifications of costs (variable vs. fixed, period vs. product, opportunity, sunk, relevant, inventoriable, capital, direct vs. indirect, prime vs. conversion, production, marketing, distribution)	✓	
3.1.1.2 Explains cost behaviour (e.g. fixed costs vs. variable costs) and the use of various cost estimation approaches		
a) Understands and explains the behaviour patterns of various types of costs, including linear and non-linear costs and their relevance to decision making	✓	
b) Understands the parameters, underlying assumptions and difficulties encountered in cost estimation and explains the steps in estimating a cost function	✓	
c) Understands various approaches for estimating costs (account analysis, work measurement, conference, etc.) and determines the cost function using the high-low method	✓	✓
d) Interprets and explains the results of cost estimation and regression analysis	✓	✓
e) Differentiates between simple and multiple regression	✓	
f) Understands and applies appropriate criteria for choosing among cost functions (goodness of fit, significance of explanatory variables, economic plausibility and specification analysis)	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Cost Types

Variable:	Costs that vary with activity levels over the relevant range.
Fixed:	Costs that do not vary with activity levels over the relevant range.
Mixed:	Costs that have both a fixed and a variable component.

Relevant range: The relevant range is the range of output levels for which estimated cost behaviour patterns remain unchanged.

Product:	Costs that are identifiable with a product or service.
Period:	Costs that are expensed directly to the income statement.

Cost Classifications

Financial presentation:	Presentation of costs according to IRFS.
Decision-related:	Classification of costs according to the decision being made. For example, costs included in a make or buy decision are only those costs relevant to the decision.

Cost Function

Cost Function:

- A mathematical description of the relationship between cost behaviour and activity levels.
- Cost functions are used to model past relationships and are used to estimate future costs.
- A simple cost function equation:

  y = a + bx

  y = the total cost to be predicated is called the dependent variable

  x = the activity level assumed to drive costs in the short run is called the independent variable.

  a = the cost that is fixed over the relevant range

  b = variable cost per unit

- Steps in estimating a cost function:

  1. Choose an approach, such as high low method, engineering method, regression analysis or account analysis.
  2. Determine the dependent variable (i.e. cost to be predicted). This variable must be chosen in accordance with the decision that will be made.
  3. Determine the independent variable. This variable should be an activity variable that has a presumed cause and effect relationship with short-term changes in total costs. (e.g. units of output, machine hours and direct labour hours).

4. Collect data on the dependent and independent variables.
5. Estimate the cost function by plotting the data on a graph. Plotting the data reveals the general relationship between the independent and dependent variables and allows outliers/errors to be identified.
6. Review the resulting cost function for reasonableness.

- Difficulties in cost estimation:
  - To obtain accurate data, observations must take place over an extended period of time. This creates difficulties since other unmeasured variables may be changing cost behaviour.
  - Accurate cost estimation requires accurate cost accruals, which may not be forthcoming.
  - Use of allocation methods that treat fixed costs as variable. For example, depreciation may be calculated on a unit of production basis, which can result in depreciation being treated as a variable, rather than a fixed cost.
  - Data is unavailable. This can occur due to error or failure to record all data observations.
  - Outliers occur due to errors or inappropriate inclusion of observation points.
  - The effects of inflation must be factored into cost estimation. Various components of total costs are subject to varying inflation rates.

Approaches to Cost Estimation

High-Low Method
(also known as algebraic method or two-point approach)

- Use the high and low observation points within the relevant range to determine the cost function. The highest and lowest values for the independent variable are used.

Example:

	Direct Labour Hours (x) (independent variable)	Factory Overhead Cost (y) (dependent variable)
High point	45,600 hours	\$48,780
Low point	5,200 hours	10,400
Difference	40,400 hours	\$38,380

Cost function formula: y = a + bx

$$b = \text{slope} = \frac{\text{difference in } y}{\text{difference in } x} = \frac{\$38{,}380}{40{,}400} = \$0.95 \text{ per direct labour hour}$$

a = constant = y – bx

= 48,780 - 0.95 (45,600) = \$5,460
OR
= 10,400 – 0.95 (5,200) = \$5,460

y = \$5,460 + \$0.95x

The constant, a, represents the portion of total costs that did not vary of the range of observations.

Note to candidates: On the Entrance Examination, the high-low method is frequently examined, but in the context of other topics (e.g. need to use high-low to calculate total cost, fixed overhead cost or variable cost and using the calculated amount to determine another value).

Comprehensive Example – High-Low Method

Problem:

The HiLo Company incurred the following expenses and volume during the past year.

Month	Direct Material	Direct Labour	Overhead	Volume in Units
January	$1,153,868	$3,250,000	$2,000,000	60,350
February	664,928	1,800,000	1,910,000	34,900
March	512,050	1,468,775	1,890,000	26,950
April	825,508	2,500,000	1,940,000	43,250
May	1,143,218	3,275,000	2,000,000	59,825
June	1,006,268	2,950,000	1,975,000	52,900
July	800,893	2,500,000	1,950,000	42,005
August	589,268	1,700,000	1,900,000	30,800
September	967,718	2,800,000	1,975,000	50,950
October	1,199,958	3,450,000	2,010,000	63,000
November	1,326,770	3,805,735	2,025,072	69,830
December	1,019,928	3,000,000	1,975,000	53,490

Required:

Use the high-low method of cost analysis to calculate:
- i) direct material cost per unit
- ii) direct labour cost per unit
- iii) fixed overhead costs and variable overhead costs per unit

Solution:

Since direct materials and direct labour are variable costs, the high-low method can be used to calculate the variable direct material and variable direct labour cost per unit. If a cost is purely variable, the value for a in the equation y = a + bx should be 0 (or a small immaterial number if rounding).

If a cost is a mixed cost (i.e. the cost has both a fixed component and a variable component), there should be a non-zero value for a. The value for a represents the costs that are fixed over the relevant range. On the Entrance Examination, the high-low method must often be used to calculate the fixed or variable portion of overhead. Overhead is normally a mixed cost, with both fixed and variable components.

Calculations are on the next page.

Calculations:

	Volume	Costs		
		Direct Material	Direct Labour	Overhead
High	69,830	$1,326,770	$3,805,735	$2,025,072
Low	26,950	512,050	1,468,775	1,890,000
Change	42,880	$ 814,720	$2,336,960	$ 135,072

MATERIAL:

$$\text{Material} = \frac{\$814{,}720}{42{,}880} = \$19 \text{ per unit}$$

Total cost	=	fixed	+	variable
y	=	a	+	bx
$1,326,770	=	a	+	19 (69,830)
a	=	$0		

Fixed = $0
Variable = $19 per unit

LABOUR:

$$\text{Labour} = \frac{\$2{,}336{,}960}{42{,}880} = \$54.50 \text{ per unit}$$

Total cost	=	fixed	+	variable
y	=	a	+	bx
$3,805,735	=	a	+	54.50 (69,830)
a	=	$0		

Fixed = $0
Variable = $54.50 per unit

OVERHEAD:

$$\text{Overhead} = \frac{\$135{,}072}{42{,}880} = \$3.15 \text{ per unit}$$

Total cost	=	fixed	+	variable
y	=	a	+	bx
$2,025,072	=	a	+	3.15 (69,830)
a	=	$1,805,107.50		

Fixed = $1,805,107.50
Variable = $3.15 per unit

Account analysis method:

The management accountant reviews all general ledger accounts and classifies as fixed, variable or mixed. The classifications are made based on knowledge of the production process, industry/company experience and review of cost behaviour over several time periods.

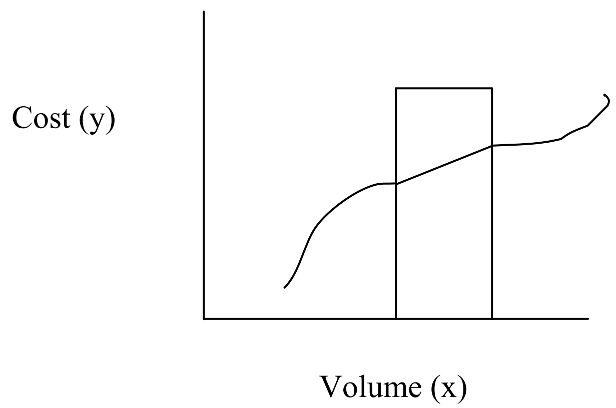
Engineered cost method:

The management accountant develops a cost for the materials, labour and overhead cost for a product or service based on knowledge of similar products. For example, the cost of making a hamburger would be estimated by identifying the cost of raw material, the amount of labour required to make the hamburger and an allocation of overhead.

Differentiation between Linear and Non-Linear Cost Functions

Linear: There is a strict cause and effect relationship between the independent variable and the dependent variable.

Non-linear: When there is not a strict cause and effect relationship between the independent and the dependent variable. This typically occurs when reviewing costs over a long period of time or when there are extremely high or low volume levels. This phenomena is also known as curvilinear:



Note that over the relevant range denoted as the vertical sides of the rectangle in the above exhibit, costs are linear.

Regression Analysis

Simple linear regression analysis is a statistical method to estimate the constant (a) and the slope (b) in the cost function equation:

$$y = a + bx$$

Regression analysis relies on a sample of past costs to estimate the cost behaviour of the population.

To determine the appropriate regression analysis to use, the management accountant must ensure the independent variable in the regression analysis meets four important criteria:

- Economic Plausibility:
  The regression equation must make sense – there is a plausible cause and effect relationship between the independent variable and the dependent variable.

- Goodness of Fit:
  The independent variable must explain a significant percentage of the variation in the dependent variable. This is measured by the coefficient of determination (r^2). The coefficient of determination (r^2) assumes values between 0 and 1. The closer r squared is to 1, the more the independent variable explains changes in the dependent variable.

- Significance of the Independent Variable:
  The measure of the relationship between changes in the dependent variable and changes in the independent variable. The significance of this relationship is measured by the t-value of the slope coefficient. (i.e. b in the relationship $y = a + bx$). As a rule of thumb, the t-value with an absolute value greater than 2 suggests there is a relationship between changes in the dependent variable and changes in the independent variable.

- Specification analysis:
  Ensure the regression analysis meets the following four assumptions:

  i) The relationship between the independent variable and the dependent variable appears to be linear over the relevant range.

     To test whether a regression is linear, the management accountant plots all the observation points on a scatter graph and visually inspects the graph for linearity.

  ii) The variance of the difference between the estimated and actual values of the independent variable is constant about the regression line.

     If the assumption is not valid, the reliability of the estimates of the standard errors is reduced. Standard errors refers to standard error of the residuals or standard error of the estimates. This is a measure of the scatter of the actual observation points around the regression line and is determined by the following formula:

$$S_e = \sqrt{\frac{\sum (y - y^1)}{nn2}}$$

Where:

S_e = standard error of the estimates
y = actual observation point of y
y^1 = calculated value using regression equation
n = sample size

If this assumption is not valid, it affects only the reliability of the estimates of the standard errors. It does not affect the coefficients a and b in the regression equation (y = a + bx)

iii) Independence of residuals must hold true. This means, the error terms (u's) are independent of each other or, in other words, the deviation of one observation point around the regression line is unrelated to the deviation of any other point. If this assumption is not valid, there is serial correlation (also known as autocorrelation). This assumption is measured with the Durbin – Watson Statistic.

iv) The points around the regression line are normally distributed with a mean of zero. This can be determined by plotting the observation points and visually inspecting the points around the regression line.

Multiple Regression Analysis

Multiple regression involves the use of more than one independent variable to explain a dependent variable. This results in improved accuracy of the regression equation. Most spreadsheets have functions that can undertake multiple regression analysis.

The criteria and assumptions for simple regression must hold for multiple regression with one additional assumption, which is, the independent variables are not correlated with each other. When there is a significant degree of correlation among independent variables, the estimates of the independent variable coefficients become less reliable.

Cost of Goods Sold and Cost of Goods Manufactured

Skill Level:	R/U	A/A
3.1.1.3 Explains the components of cost of goods sold		
a) Identifies and calculates the components of cost of goods sold for service, merchandising and manufacturing organizations (work-in-process, finished goods, purchases, materials, labour and indirect costs)	✓	✓
b) Prepares a schedule of cost of goods manufactured and cost of goods sold		✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Cost of Goods Manufactured and Cost of Goods Sold

Manufacturing companies will typically hold three types of inventories:

Raw materials inventories
Work-in-process inventories
Finished goods inventories

The schedules of cost of goods manufactured and cost of goods sold show how manufacturing costs flow through these accounts:

Schedule of Cost of Goods Manufactured

Direct materials used:		
Direct materials inventory, beginning	XXX	
Direct materials purchases	XXX	
Direct materials inventory, ending	-XXX	XXX
Direct labour		XXX
Manufacturing overhead:		
Indirect materials	XXX	
Indirect labour	XXX	
Plant supervision	XXX	
Plant utilities	XXX	
Amortization of plant and equipment	XXX	XXX
Total manufacturing costs		XXX
Work-in-process inventory, beginning		XXX
Work-in-process inventory, ending		-XXX
Cost of goods manufactured		XXX

Schedule of Cost of Goods Sold

Finished goods inventory, beginning	XXX
Cost of goods manufactured	XXX
Finished goods inventory, ending	-XXX
Cost of goods sold	XXX

Cost of Capacity

Skill Level:	R/U	A/A
3.1.1.4 Explains cost of capacity (practical, normal and full)		
a) Defines the concept of capacity and distinguishes between theoretical (design) and practical (effective) capacity	✓	
b) Understands the concept of capacity utilization and differentiates between normal, full and master budget capacity utilization	✓	
c) Identifies the costs of capacity and explains the relationship between the costs of capacity and the choice of alternative capacity measures	✓	
d) Understands and determines the effects of alternative choices of capacity concepts and capacity levels on management decisions, e.g. product costing decisions, pricing decisions, performance evaluation, etc.	✓	✓
e) Understands downward demand spirals	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Cost of Goods Manufactured and Cost of Goods Sold

There are four commonly used production volumes:

1. Theoretical capacity
2. Practical capacity
3. Normal capacity
4. Expected annual capacity

- Theoretical capacity
  The theoretical capacity (also referred to as ideal capacity) is the production volume that could be achieved under 100% operating efficiency. It is the estimated absolute maximum production potential at all times. There are no delays, shutdowns on weekends or holidays or machine breakdowns. Theoretical capacity cannot be achieved in a real world situation and, accordingly, is seldom used.

- Practical capacity
  Practical capacity is a feasible level of output. The practical capacity of a plant or department is the theoretical capacity less ordinary, regular and unavoidable operating interruptions. The level of efficiency indicated by practical capacity is difficult, but not impossible, to achieve.

- Normal capacity
  Normal capacity is the long-term (usually three to 10 years) expected average use of capacity. The normal capacity measure takes into consideration idle time brought about by year-to-year fluctuations and economic cycles. It represents the practical capacity less the estimated idle

capacity. An advantage of using normal capacity in calculating the fixed overhead standard cost is it represents a level of activity the enterprise can reasonably expect to achieve on average over some long-range planning period.

- Expected annual capacity
  Expected annual capacity is the level of activity budgeted for the upcoming year. Expected annual capacity will result in product or service costs that more closely reflect their actual annual costs if costs are properly controlled.

The relevance of the capacity choice is that fixed costs are divided by the capacity measure to determine the cost driver rate that will be used to allocate fixed costs. The capacity measure chosen is called the denominator volume. There is considerable debate among management accountants about what is the appropriate capacity measure to use in computing the denominator volume.

What capacity measure should be used as an appropriate denominator volume? The answer is the capacity measure that best motivates management and workers to achieve the goals of the company. The larger the volume (denominator), the smaller the unit cost, and the less fixed overhead cost is applied. Theoretical capacity, which is the absolute capacity, provides the largest denominator.

Some accountants argue the cost driver rate from using expected annual capacity will probably be most relevant to marketing managers setting sales prices because it reflects the amount of fixed overhead that will need to be covered in the sales price, given the current annual sales forecast and production quota. Other accountants argue if cost is used for pricing purposes as expected demand falls, the cost driver rate will increase, causing the price to increase, which may cause demand to decline further, resulting in a cycle of falling expected demand, causing higher unit costs and higher prices – a process called a death spiral.

Some accountants argue the normal capacity provides the best total product cost as it represents the long-range average fixed overhead cost per unit. Other accountants argue that using normal capacity will result in over-allocating (under-allocating) fixed costs in years when use is above (below) normal levels.

Some accountants argue fixed overhead standard costs should be based on practical capacity because practical capacity is the actual cost driver for fixed costs. These advocates will also argue that prices should be based on what the market is willing to bear and not costs and costs should only be used to estimate whether a product is profitable or unprofitable.

In situations where a contract specifies a cost-based price, the parties negotiate the denominator activity level used to choose the fixed cost allocation rate.

Normal Costing

Skill level:	R/U	A/A
3.1.2.1 Defines, describes and applies methods of calculating product and service costs a) Defines, describes and compares alternative costing systems and concepts and explains the circumstances under which each is appropriate: normal vs. actual, job vs. process, activity-based, variable (direct) vs. absorption	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Note to candidates: This section is limited to coverage of normal costing. The other topics listed in the CMA Competency Map, specifically, job costing, process costing, activity-based costing and direct vs. absorption costing are covered in subsequent sections in this manual.

Normal Costing

Normal costing is a method that applies costs to a cost object as:

Direct costs	actual direct cost	x	actual quantity
Indirect costs	budgeted indirect cost rate	x	actual quantity

The budgeted indirect cost rate is calculated and applied in the same manner as indirect factory overhead (see job order costing section). In fact, job order costing, which often uses actual direct material and actual direct labour costs and a predetermined overhead rate to apply indirect costs, is using a normal costing system. In a manufacturing environment, normal costing can be summarized as:

Cost source:	Cost used:
Direct material	Actual
Direct labour	Actual
Indirect factory overhead	Budget (or standard) using a predetermined overhead rate

Example:

Data:

Budgeted manufacturing overhead	$960,000
Budgeted direct manufacturing labour hours	120,000
Job order #203:	
Actual direct material traced to the job	$5,000
Actual direct labour traced to the job (265 hours)	$3,975

Solution:

$$\text{Predetermined overhead rate} = \frac{\$960,000}{120,000}$$

Predetermined rate per direct labour hour $8

Total cost of job order #203 using normal costing:

Direct material		$5,000
Direct labour		$3,975
Manufacturing overhead	$8 x 265 hours	$2,120
		$11,095

Activity-Based Costing

Skill Level:	R/U	A/A
3.1.2.1 b) Cost allocation and activity-based costing (ABC)		
• Explains the concept of cost drivers in relation to cost management and provides examples of cost drivers for various business functions and activities	✓	
• Differentiates actual from applied overhead costs	✓	
• Demonstrates the distortions in product costing and profitability that can occur from using a single overhead cost driver vs. multiple overhead cost pools		✓
• Understands the concept of activity and cost hierarchies in an activity-based costing system such as output unit level, batch level, product sustaining, facility sustaining, customer level, etc.	✓	
• Applies activity-based costing techniques for a given organization		✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Definition

ABC costing is a method of allocating indirect costs to cost objects. Costs are traced from the general ledger accounts to indirect cost pools associated with significant activities. Costs are then allocated from the activity cost pools to the final cost objects based on the demand each cost object places on the various activities.

Usefulness of ABC:
- to compare the cost of activities with other departments or divisions
- allows managers to make better choices regarding the use of scarce resources
- allows managers to identify problems in activities and make necessary changes
- highlights relationships between activities

Example:

Numerical data:

Activity	Cost Driver* Events/Transactions	Costs	Number of Events/Transactions Product X	Product Y	Total
Material delivery to production	Number of requests	$ 96,000	600	400	1000
Machine set up	Number of production runs	108,000	2000	3000	5000
Machine production	Number of productions runs	488,000	2000	3000	5000
Manual insertion of parts	Number of manually inserted parts	85,000	6000	11000	17000
Equipment maintenance	Number of requests for service	325,200	400	800	1200
Quality inspection	Hours of test time	120,064	160	288	448
		$1,222,264			

*The cost driver is used as the denominator to compute the cost driver rate, which, in turn, is used to allocate the total cost of the activity.

Overhead rates by activity:

Activity	A Costs	B Total Number of Events/Transactions	A ÷ B Cost Driver Rate
Material delivery	$ 96,000	1000	$96.00/request
Machine set up	108,000	5000	$21.60/run
Machine production	488,000	5000	$97.60/run
Manual insertion of parts	85,000	17000	$5.00/part
Equipment maintenance	325,200	1200	$271.00/request
Quality inspection	120,064	448	$268.00/hour

Total cost per product:

Activity		Cost Per Event/ Transaction	Product X Use	Product X Amount	Product Y Use	Product Y Amount
Material delivery		$96.00	600	$57,600	400	$38,400
Machine set up		21.60	2000	43,200	3000	64,800
Machine production		97.60	2000	195,200	3000	292,800
Manual insertion of parts		5.00	6000	30,000	11000	55,000
Equipment maintenance		271.00	400	108,400	800	216,800
Quality inspection		268.00	160	42,880	288	77,184
Total	a			$477,280		$744,984
Units produced	b			32,360		13,670
Cost per unit	a ÷ b			$14.75		$54.50

Job Order Costing

Skill Level:	R/U	A/A
3.1.2.1 c) Job costing		
• Applies manufacturing overhead to determine product costs given the choice of an appropriate overhead cost driver		✓
• Calculates product or service costs in a job costing system using normal, standard and actual costing		✓
• Prepares the income statement for an organization that uses job costing, including accounting for end-of-period, under- or over-applied (allocated) indirect costs		✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Description

Job order costing is used to assign costs to a distinct unit, batch or lot of a product. It is also used in service industries, such as accounting and law firms. Examples of industries/products that may use job costing include:

Service Sector	Merchandising Sector	Manufacturing Sector
• Accounting firm audits • Advertising agency campaigns	• Sending a catalogue to a mailing list • Special promotion of a new store product	• Aircraft assembly • House construction

Measuring costs in a job order environment: The costs of production: actual materials, actual labour and allocated overhead are collected on a job cost sheet.

Materials: The cost of materials used to complete the job is entered on the job cost sheet. The material cost included here is direct material costs only. Indirect materials costs are included in overhead.

Direct labour: Labour costs are tracked on time sheets/tickets and are then charged to the job cost sheet based on the number of hours spent on each job.

As with direct material, this includes direct labour only. Indirect labour is included in factory overhead.

Factory overhead: Factory overhead includes all indirect costs of production: that is, costs that are not directly traceable to specific jobs. These costs are allocated to each job. To allocate these costs, an activity base common to all jobs must be determined. Common activity bases are machine hours, direct labour hours or number of units. An overhead application rate is calculated based on the common activity and is then applied to each job based on the level of the chosen activity for that job.

The predetermined overhead rate (POR) is calculated as:

$$\frac{\text{estimated total manufacturing overhead cost}}{\text{estimated total activity level}}$$

(machine hours, direct labour hours, etc.)

Estimated cost and activity are used because the application rate must be applied during the year and total cost and activity is not known until the year has ended.

The activity chosen should be the cost driver – there is a correlation between changes in overhead cost and changes in the activity.

Job order costing often uses actual materials costs, actual labour costs and applies overhead based on the predetermined overhead rate. This is called normal costing. However, it is important to recognize that job order costing could also use standard costs.

Applied Overhead vs. Actual Overhead

Overhead is applied to units based on the predetermined overhead rate and some activity measure. At year-end there will likely be a difference between applied overhead and actual overhead. The difference is called under-applied or over-applied overhead.

Factory overhead example:

	Company X		Company Y	
Estimated factory overhead for year	$490,000	A	$384,000	A
Estimated activity level:				
Machine hours	**100,000**	B	**N/A**	
Direct labour hours	N/A		32,000	B
Predetermined factory overhead rate (A ÷ B)	**$4.90/MH**		$12.00/DLH	
Actual activity level for the year:				
Machine hours	92,000		N/A	
Direct labour hours	N/A		38,000	
Factory overhead applied:				
Company X (92,000 x $4.90)	$450,800	(a)	--	
Company Y (38,000 x $12)	--		$456,000	(a)
Actual factory overhead:	$486,000	(b)	$424,000	(b)
Under/over applied factory overhead [(a) – (b)]	($35,200)		$32,000	
	under-applied-		over-applied	

Summary of under/over applied factory overhead:

	Company X	Company Y
Difference between estimated and actual overhead cost:		
Company X ($490,000 - $486,000)	$4,000 over	--
Company Y ($384,000 - $424,000)	--	**$40,000 UNDER**
Difference between estimated and actual activity level:		
Company X [(100,000 – 92,000) x $4.90]	$39,200 under	--
Company Y [(32,000 – 38,000) x $12]	--	$72,000 over
	$35,200 under	$32,000 over

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The concept of under- over-applied overhead for Company X can also be depicted as:

Actual	Flexible Budget numerator when calculating P.O.R.	Applied AQ x predetermined OH rate
486,000	490,000	92,000 x 4.90 = 450,800

flexible budget variance = 4,000 F

production volume variance = (100,000 – 92,000) x .4.90 = 39,200 U

Under-applied = $35,200 (unfavourable variance)

The concept of under- over-applied overhead for Company Y can also be depicted as:

Actual	Flexible Budget numerator when calculating P.O.R.	Applied AQ x predetermined OH rate
424,000	384,000	38,000 x 12 = 456,000

flexible budget variance = 40,000 U

production volume variance = (32,000 – 38,000) x .12 = 72,000 F

Over-applied = $32,000 (favourable variance)

This is identical to the fixed overhead variances in the variance section of this manual. Note that the concept of under- over-applied overhead is the same concept as fixed manufacturing variances.

Disposition of Under- Over-Applied Overhead

Options:

1. Charge to cost of goods sold – in effect, treated as a period cost.

2. Allocate between WIP, finished goods and COGS proportionately, based on the dollar value of these accounts – in effect, treated as a product cost.

3. Allocate between WIP, finished goods and COGS proportionately based on the accumulated activity level (i.e. activity level used to determine the predetermined overhead rate) in each of these accounts – in effect, treated as a product cost.

Process Costing

Skill Level:	R/U	A/A
3.1.2.1 d) Process costing		
• Explains the concept of equivalent units of production and costs per equivalent unit under the weighted average and first-in first-out (FIFO) methods	✓	
• Prepares a production report and determines product/service costs under weighted average and FIFO methods		✓
• Differentiates between normal and abnormal spoilage and how to account for them	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Description of Process Costing

Process costing is used to cost products that are mass-produced and are identical. Since the products are identical, the assumption is the same amount of direct materials, direct labour and factory overhead is used in the production of each unit. Examples of products where process costing would be used include:

<u>Service Sector</u>

- Postal delivery (standard items)

<u>Merchandising Sector</u>

- Processing new magazine subscriptions

<u>Manufacturing Sector</u>

- Oil refining
- Beverage production (e.g. breweries)
- Chemical production

There are two different methods of process costing: weighted average; and FIFO. FIFO (first-in, first-out) treats beginning WIP inventory separately from goods started and completed during the current period and, therefore, all calculations are based on work done during the current period only. The weighted average method takes into consideration total work done to date, regardless of the period in which the work took place.

Steps in Process Costing

- Summarize physical units (trace the physical flow of production)
- Compute equivalent units of production (convert the physical flow into equivalent units of production)
- Summarize total production costs to be accounted for
- Compute cost per equivalent unit by dividing total costs (Step 3) by equivalent units (Step 2)
- Allocate production costs to ending WIP and units completed using the cost per equivalent unit calculated in Step 4.

Step 1: Summarize Physical Units:

This step reflects actual units of production and not equivalent units. It is an accounting of the number of units that have been started and may, or may not, be complete:

	Physical Units	
Beginning WIP inventory	xxx	
+ units started	xxx	
Total physical units to account for	xxx	total units to account for must equal total units accounted for
Ending WIP	xxx	
+ units completed	xxx	
Total physical units accounted for	xxx	

Step 1 is identical for both the FIFO and weighted average methods.

Step 2: Compute equivalent units of production:

This is a measure of the amount of production that is complete. It is calculated as follows:

physical units	x	percentage complete	=	equivalent units of production

For example, 10,000 units that are 40% complete represent 4,000 equivalent units.

Equivalent units must be calculated separately for each category of production cost (direct materials and conversion costs) and for beginning WIP inventory (only for FIFO), production, ending WIP and units completed and transferred out:

	Equivalent Units			
	Direct Materials		Conversion Costs	
Beginning WIP inventory	xxx		xxx	
+ current production	xxx		xxx	
Total equivalent units	xxx	must equal	xxx	must equal
Ending WIP inventory	xxx		xxx	
+ units completed	xxx		xxx	
Total equivalent units	xxx		xxx	

Formulas to calculate equivalent units for each category:

Beginning WIP in equivalent units	=	physical units		x	percentage complete	
Ending WIP in equivalent units	=	physical units		x	percentage complete	
Units completed in equivalent units	=	physical units		x	100% (these units are 100% complete by definition)	
Current production in equivalent units	=	ending WIP + in equivalent units	units completed	-		beginning WIP in equivalent units

The weighted average method uses total equivalent units, which represents work done to date and FIFO uses current production only as this method is based on work done during current period only. Another format for calculating equivalent units for each method:

	Physical Units (Step 1)	Equivalent Units Direct Material	Equivalent Units Conversion Costs
Beginning WIP inventory	xxx		
+ units started	xxx		
Physical units to account for	xxx		
Completed	xxx	xxx	xxx
WIP, ending (at percentage complete for DM and conversion costs)	xxx	xxx	xxx
Physical units accounted for	xxx		
Work done to date (equivalent units under weighted average method)		xxx	xxx
Less: equivalent units for work done on beginning inventory in prior period (at percentage complete in prior year for DM and conversion costs)		(xxx)	(xxx)
Work done in current period only (equivalent units under FIFO method)		xxx	xxx

Step 3: Summarize total production costs:

Total production cost is the total in the WIP account:

Beginning inventory	$xx
+ current production costs:	
Direct materials	+ xx
Direct labour	+ xx
Factory overhead applied	+ xx
Total costs to account for	$xx

The costs for beginning WIP inventory were calculated at the end of the prior period. Current production costs are for all units started during the period. It is necessary to separate production costs into direct materials and conversion costs, as these categories usually have different equivalent units.

	Direct Materials	Conversion Costs	Total	
Beginning WIP inventory	xxx	xxx	xxx	
+ current production costs	xxx	xxx	xxx	
Total production costs	xxx	xxx	xxx	*

* This total must equal the total cost in the WIP account

Step 4: Compute cost per equivalent unit

Cost per equivalent unit is calculated separately for direct materials and conversion costs because the number of equivalent units for each of these cost categories is usually different.

FIFO
Since this method is based on work done during the current period only, the costs included are only current period production costs and the equivalent units are the equivalent units for the work done in the current period only.

Weighted average
This method incorporates total production costs and total equivalent units regardless of the period the costs were incurred or the work took place.

	Direct Materials		Conversion Costs	
Production costs (current production costs only for FIFO; total production costs for weighted average)	$xxx	A	$xxx	A
Number of equivalent units per Step 2 (based on work done in current period for FIFO; total work to date for weighted average)	xxx	B	xxx	B
Cost per equivalent unit (A ÷ B)	$xxx		$xxx	

Step 5: Allocate production costs to ending WIP and units completed and beginning WIP to complete (for FIFO)

The cost per equivalent unit is applied to ending WIP and units completed. As FIFO and weighted average are calculated differently, the dollar value of ending WIP and units completed will usually be different under each method.

Format for Steps 3, 4 and 5

Method for calculating cost per equivalent unit:

	Weighted Average				FIFO				
	Total	Direct Materials	Conv. Costs	Equiv. Units	Total	Direct Materials	Conv. Costs	Equiv. Units	
WIP, beginning	$xxx	$xxx	$xxx		$xxx	---	---		Note 2
Current production costs	xxx	xxx	xxx		xxx	$xxx	$xxx		
Costs to account for (Step 3)	$xxx	$xxx	$xxx		$xxx	$xxx	$xxx		
Equivalent units (Step 2)		÷ xxx	÷ xxx			÷ xxx	÷ xxx		Note 3
Cost per equivalent unit		$x	$x	x		$x	$x		
Application of costs:									
Ending WIP:									
Direct materials (EU x cost/EU)	$xx	$xx			$xx	$xx			Note 4
Conversion costs (EU x cost/EU)	xx		$xx		xx		$xx		
Completed units (units x total cost/unit)	xx			$xx	xx			$xx	Note 1
Total costs accounted for	$xxx				$xxx				

Notes:

Note 1: Calculation of cost of completed units

Weighted average method:

completed units x cost per equivalent whole unit

FIFO method:

total costs to account for - cost of ending WIP

OR

cost of beginning WIP inventory + cost to complete beginning WIP inventory (i.e. % completed during current period x cost/unit to complete during current period) + units started and completed during current period (i.e. (units completed – units in beginning WIP) x cost/EU)

Note 2: Note that under the weighted average method, the direct material and conversion costs of beginning WIP are included in the calculation of cost per equivalent unit, whereas, under the FIFO method, they are not.

Note 3: The number of equivalent units used to calculate cost per equivalent unit is calculated in Step 2. Under FIFO, the calculation of equivalent units is restricted to work done in the current period; the weighted average method uses work done to date.

Note 4: EU = Equivalent Unit

Comprehensive Example

Basic data:

The following information pertains to Neleh Company for the month ended October 31, 2000:

Beginning WIP inventory		21,000
(100% complete for direct materials and 40% complete with respect to conversion costs)		
Units started		140,000
Units completed + transferred		147,000
Ending WIP inventory		14,000
(100% complete for direct materials and 50% complete for conversion costs)		
Direct materials cost		$132,000
Conversion costs		$142,200
Beginning WIP:		
Direct materials	$33,830	
Conversion costs	$11,800	$45,630

Step 1: Summary of physical units

	Physical Units
Beginning WIP inventory	21,000
Units started	140,000
Total physical units to account for	161,000
Ending WIP	14,000
Units completed	147,000
Total physical units accounted for	161,000

total units to account for and total units accounted for are equal

Step 2: Equivalent units of production

Method A:

	Weighted Average			FIFO		
		Equivalent Units			Equivalent Units	
	Physical Units (Step 1)	DM	Conver-sion	Physical Units (Step 1)	DM	Conver-sion
Beginning WIP (Note 1)	21,000	21,000	8,400 (21,000 x 40%)	21,000	---	---
+ current production (Note 2)	140,000	140,000	145,600	140,000	140,000	145,600
Total units to account for	161,000			161,000		
Equivalent units		161,000	154,000		140,000	145,600

Note 1: FIFO excludes beginning WIP

Note 2: Calculation of current production

	Physical Units	DM	Conversion	
Ending WIP in equivalent units	14,000	14,000	7,000	(14,000 x 50%)
+ units completed	147,000	147,000	147,000	
- beginning WIP	(21,000)	(21,000)	(8,400)	(21,000 x 40%)
	140,000	140,000	145,600	

Method B:

	Physical Units (Step 1)	Direct Materials	Conversion Costs
Beginning WIP inventory	21000		
+ units started	140000		
Physical units to account for	161000		
Complete	147000	147000	147000
WIP, ending (at percentage complete for DM and conversion costs)	14000	14000	7000 (14000 x 50%)
Physical units accounted for	161000		
Work done to date (equivalent units used under weighted average method)		161000	154000
Less: equivalent units for work done on beginning inventory in prior period (at percentage completed in prior year for DM and conversion costs)		(21000)	(8400) (21000 x 40%)
Work done in current period only (equivalent units used under FIFO method)		140,000	145,600

Step 3: Total production costs

Beginning WIP		$45,630
Current production costs:		
Direct materials	$132,000	
Conversion costs	$142,200	274,200
Total costs to account for		$319,830

Costs included in cost per equivalent unit:

FIFO: Current production costs of $274,200
Weighted average: Total production cost of $319,830

Step 4: Cost per equivalent unit

	Weighted Average		FIFO	
	DM	Conversion	DM	Conversion
Production costs				
Beginning WIP	$33,830	$11,800	---	---
Current production costs	132,000	142,200	$132,000	$142,200
Total production costs	$165,830	$154,000	$132,000	$142,200
Equivalent units	161,000	154,000	140,000	145,600
Cost per equivalent unit	1.03	1.00	0.94	.98

Step 5: Allocation of production costs to ending WIP and units complete

	Weighted Average				FIFO			
	Total	Direct Materials	Conv. Costs	Equiv. Whole Units	Total	Direct Materials	Conv. Costs	Equiv. Whole Units
Cost per equivalent unit		$1.03	$1.00	$2.03		$0.94	$0.98	$1.92
Application of costs:								
Ending WIP:								
Direct materials	$14,420	$14,420 (14000 x $1.03)			$13,160	$13,160 (14000 x $.94)		
Conversion costs	7,000		$7,000 (7000 x $1)		6,860		$6,860 (7000 x $.98)	
	21,420				$20,020			
Completed Units	298,410			$298,410 (147000 x $2.03)	299,810 *			
Total costs accounted for	$319,830				$319,830			

*Check:

Cost of beginning WIP	$45,630
Cost to complete beginning WIP	
Direct materials	0
Conversion:	
21000 x 60% x .98	12,348
Cost of units started and completed	241,920
(147,000 – 21,000) x $1.92	
	299,898
Less: rounding difference	(88)
Total	$299,810

Summary of all steps – FIFO

Neleh Company
Production Cost Report
for the month of October 2000

	Physical Units	Equivalent Units: Direct Materials	Equivalent Units: Conversion Costs
Physical Flow of Production			
Beginning WIP inventory	21,000		
Units started	140,000		
Units to account for	161,000		
Units completed		147,000	147,000
Add: ending WIP inventory			
Direct materials (14,000 x 100%)		14,000	
Conversion (14000 x 50%)			7,000
Less: work done on beginning inventory in prior periods			
Direct materials (21000 x 100%)		(21,000)	
Conversion (21000 x 40%)			(8,400)
Total equivalent units for work done in current period		140,000	145,600
Financial Flow of Production			
Beginning WIP inventory	$45,630	---	---
Current production costs	274,200	$132,000	$142,200
Total costs to account for	$319,830		
Equivalent units		÷ 140,000	÷ 145,600
Cost per equivalent unit		$.94	$.98
Total cost per equivalent unit =			$1.92
Application of total costs:			
Ending WIP inventory			
Direct materials	$13,160	14,000 x $.94	
Conversion	6,860		7,000 x $.98
	$20,020		
Completed	299,810		
Total costs accounted for	$319,830		

Summary of all steps – Weighted Average

Neleh Company
Production Cost Report
for the month of October 2000

	Physical Units	Equivalent Units: Direct Materials	Equivalent Units: Conversion Costs
Physical Flow of Production			
Beginning WIP inventory	21,000		
Units started	140,000		
Units to account for	161,000		
Units completed		147,000	147,000
Add: ending WIP inventory			
Direct materials (14,000 x 100%)		14,000	
Conversion (14000 x 50%)			7,000
Total equivalent units for work done to date		161,000	154,000
Financial Flow of Production			
Beginning WIP inventory	$45,630	$33,830	$11,800
Current production costs	274,200	$132,000	$142,200
Total costs to account for	$319,830	$165,830	$154,000
Equivalent units		÷ 161,000	÷ 154,000
Cost per equivalent unit		$1.03	$1.00
		Total cost per equivalent unit =	$2.03
Application of total costs:			
Ending WIP inventory			
Direct materials	$14,420	14,000 x $1.03	
Conversion	7,000		7,000 x $1
	$21,420		
Completed and trfrd to FG (147,000x$2.03)	298,410		
Total costs accounted for	$319,830		

Comparison of FIFO and weighted average:

	FIFO	Weighted Average
Ending WIP inventory	$ 20,020	$ 21,420
Completed units	299,810	298,410
Total costs	$319,830	$319,830

Spoilage

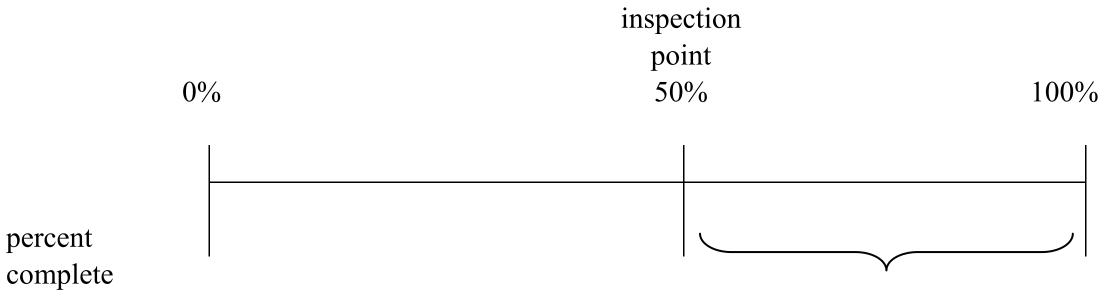
Normal vs. Abnormal Spoilage

The treatment of spoilage cost depends on whether the spoilage is normal or abnormal.

Normal spoilage is expected as a result of the manufacturing process. An efficient manufacturing process usually has a minor amount of spoilage. This spoilage is called normal, as it is expected. Since this spoilage is considered to be an inherent part of an efficient production process, it is uncontrollable in the short run.

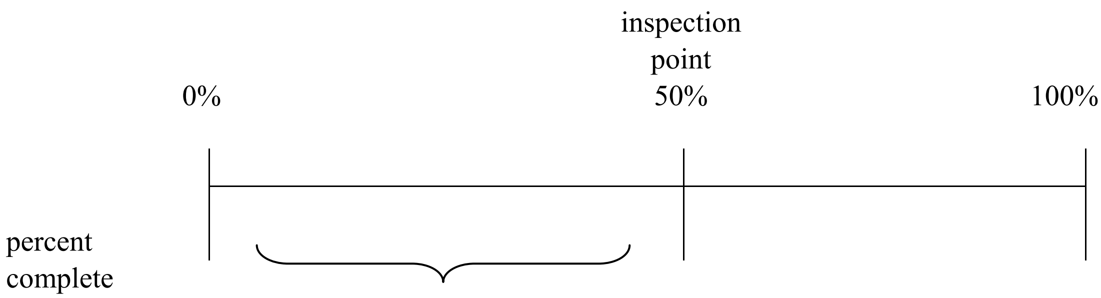
Since normal spoilage is treated as an inherent part of the manufacturing process, the cost of normal spoilage is included in the cost of units transferred to finished goods or, in some cases, is also included in the cost of ending WIP inventory (i.e. cost of normal spoilage is allocated to both good units transferred to finished goods and to ending WIP). Allocating a portion of spoilage costs to ending WIP inventory is dependent on whether the goods have passed the point of inspection.

The logic in allocating normal spoilage to ending WIP is that before the inspection point, spoilage would not be identified and, therefore, no spoilage is added to WIP that has not passed the inspection point. At the inspection point, spoilage would be identified; therefore, any WIP that passed this point (i.e. has a percentage complete after the inspection point), should bear normal spoilage costs. This is illustrated below:



ending WIP > 50% complete
WIP that is > 50%, which is the inspection point, bears normal spoilage costs (i.e. allocate normal spoilage cost to WIP)*

* Of note here is the percentage of DM or conversion costs to apply to ending WIP. If inspection occurs at 50% completion, no further costs will be incurred for spoiled units. Therefore, if a product is 100% complete with respect to DM (added at beginning) and 80% complete with respect to conversion, and the inspection point occurs at 50%, then 50% is used both in the equivalent units calculation and also to calculate the conversion costs included in the normal spoilage. DM would be included at 100% since DM is added at the beginning of the production process. BE CAREFUL WITH PROCESS COSTING QUESTIONS AND PAY ATTENTION TO THE INSPECTION POINT RELATIVE TO THE PERCENTAGE COMPLETE. THIS IS A COMMON ERROR ON THE EXAM.



ending WIP < 50% complete
Since WIP is < 50%, no normal spoilage is allocated to ending WIP. This is because the normal spoilage associated with the ending WIP is not yet identified (i.e. is identified when the goods are inspected, which is at 50% completion).

Abnormal spoilage exceeds normal spoilage. This type of spoilage is considered controllable since the belief is manufacturing supervisors can influence some control over inefficiency.

Calculating Spoilage

Normal spoilage is usually stated as a percentage of total good units that passed the point of inspection, not the total units started. Once normal spoilage has been calculated, abnormal spoilage is calculated as the difference between total spoiled units and units identified as normal spoilage.

Example:

Total number of good units passing inspection	500,000	units
Normal spoilage rate	3%	
Units discarded	20,000	

Units discarded	20,000
Less: normal spoilage (500,000 x .03)	(15,000)
Abnormal spoilage	5,000

Accounting for Spoilage

The accounting treatment of spoilage depends on whether the spoilage is normal or abnormal. The cost of abnormal spoilage is written-off as an expense in the period it occurs – that is, the abnormal spoilage is treated as a period cost and not a product cost.

Example:

Basic data:
All direct materials are added at the beginning of the process and conversions costs are added evenly during the process. Spoiled units are detected at the 80% completion stage during the process.

	Physical Units	Direct Materials	Conversion Costs
WIP beginning [a]	30,000	$240,000	$180,000
Started in production	50,000		
Good units completed and transferred	40,000		
WIP ending [b]	32,000		
Costs added during the month		$420,000	$583,200

Normal spoilage rate 15% of good units

[a] Degree of completion: direct materials 100%; conversion costs 60%
[b] Degree of completion: direct materials 100%; conversion costs 75%

Note that since none of the units in opening or ending inventory have passed the inspection point the number of good units passing the inspection point will equal the number of units completed and transferred out. Note also that the sum of units transferred out and ending WIP is 72,000. Given that units to account for is 80,000 this means spoilage is 8,000 units (80,000 - 72,000). Therefore, abnormal spoilage will equal 8,000 minus normal spoilage, provided this is a positive number. (There is no such concept as negative abnormal spoilage)

Solution:

	Physical Units	
Beginning WIP inventory	30,000	
+ units started	50,000	
Total physical units to account for	80,000	
		total units to account for must equal total units accounted for
Ending WIP	32,000	
+ good units completed and transferred	40,000	
Normal spoilage (40,000 x .15)	6,000	
Abnormal spoilage (8,000 - -6,000)	2,000	
Total physical units accounted for	80,000	

Note that since the inspection point is at 80% complete and ending WIP is at 75%, normal spoilage is excluded from ending WIP.

Summary of all steps – FIFO

	Physical Units	Equivalent Units Direct Materials	Equivalent Units Conversion Costs
Physical Flow of Production			
Beginning WIP inventory	30,000		
Units started	50,000		
Units to account for	80,000		
Good units completed + transferred		40,000	40,000
Normal spoilage (6,000 x 100%;6,000 x 80%)[1]		6,000	4,800
Abnormal spoilage (2,000 x 100%;2000 x 80%)[1]		2,000	1,600
Add: ending WIP inventory[2]			
Direct materials (32,000 x 100%)		32,000	
Conversion (32,000 x 75%)			24,000
Less: work done on beginning inventory in prior periods			
Direct materials (30,000 x 100%)		(30,000)	
Conversion (30,000 x 60%)			(18,000)
Total equivalent units for work done in current period		50,000	52,400
Financial Flow of Production			
Beginning WIP inventory	$420,000	---	---
Current production costs	1,003,200	$420,000	$583,200
Total costs to account for	$1,423,200		
Equivalent units		÷ 50,000	÷ 52,400
Cost per equivalent unit		$8.40	$11.13
Total cost per equivalent unit =			$19.53
Application of total costs:			
Ending WIP inventory[2]:			
Direct materials	$268,800	32,000 x $8.40	
Conversion costs	267,120		24,000x$11.13
Total ending WIP balance	$535,920		
Transferred to finished goods:			
Completed this month (40,000-30,000)	195,300	10,000 x $19.53	
Beginning WIP inventory:	420,000		
Direct materials	0	0	
Conversion costs (30,000x.40)	133,560		12,000 x $11.13
Normal spoilage	103,824	6,000 x $8.40	4,800 x $11.13
Total transferred to finished goods	$852,684		
Abnormal spoilage (write-off to inc. statement)	34,608	2,000 x $8.40	1,600 x $11.13
Total costs accounted for (rounding)	$1,423,212 [3]		

[1] Since normal and abnormal spoilage is identified at the inspection point, which occurs when the units are 80% complete, the equivalent units for normal and abnormal spoilage is calculated using 80%.
[2] Since normal and abnormal spoilage is identified at the inspection point, which is 80%, spoilage that 'resides' in ending WIP (which is 75% complete) will be identified once these units have reached the inspection point.
[3] Small difference of $12 (1,423,200 minus 1,423,212) due to rounding.

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T-accounts and journal entries:

WIP

Beginning WIP	420,000		
Current production costs	1,003,200		
		852,684	Trfrd to FG (includes normal spoilage)
		34,608	Abnormal spoilage
Balance[1]	535,908		

Finished Goods

Trfd from WIP	852,684	
Balance	852,684	

1. Slight difference of $12 (535,920 minus 535,908) due to rounding.

Loss from Abnormal Spoilage

Trfd from WIP	34,608	
Balance	34,608	

Journal entries:

Finished goods inventory	852,684	
WIP		852,684
To transfer units completed.		
Loss from Abnormal Spoilage	34,608	
WIP		34,608
To write-off abnormal spoilage costs.		

Summary of all steps – weighted average

	Physical Units	Equivalent Units: Direct Materials	Equivalent Units: Conversion Costs
Physical Flow of Production			
Beginning WIP inventory	30,000		
Units started	50,000		
Units to account for	80,000		
Good units completed + transferred		40,000	40,000
Normal spoilage (6,000 x 100%;6,000 x 80%)[1]		6,000	4,800
Abnormal spoilage (2,000 x 100%;2000 x 80%)[1]		2,000	1,600
Add: ending WIP inventory[2]			
Direct materials (32,000 x 100%)		32,000	
Conversion (32,000 x 75%)			24,000
Total equivalent units for work done in current period		80,000	70,400
Financial Flow of Production			
Beginning WIP inventory	$420,000	$240,000	$180,000
Current production costs	1,003,200	$420,000	$583,200
Total costs to account for	$1,423,200	$660,000	$763,200
Equivalent units		÷ 80,000	÷ 70,400
Cost per equivalent unit		$8.25	$10.84
Total cost per equivalent unit =			$19.09
Application of total costs:			
Ending WIP inventory[2]:			
Direct materials	$264,000	32,000 x $8.25	
Conversion costs	260,160		24,000x $10.84
Total ending WIP balance	$524,160		
Transferred to finished goods:			
Good units completed and trfrd this month (40,000)	763,600	40,000 x $19.09	
Normal spoilage	101,532	6,000 x $8.25	4,800 x $10.84
Total transferred to finished goods	$865,132		
Abnormal spoilage (write-off to inc. statement)	33,844	2,000 x $8.25	1,600 x $10.84
Total costs accounted for (rounding)	$1,423,136 [3]		

[1] Since normal and abnormal spoilage is identified at the inspection point, which occurs when the units are 80% complete, the equivalent units for normal and abnormal spoilage is calculated using 80%.
[2] Since normal and abnormal spoilage is identified at the inspection point, which is 80%, spoilage that 'resides' in ending WIP (which is 75% complete) will be identified once these units have reached the inspection point.
[3] Small difference of $64 (1,423,200 minus 1,423,136) due to rounding.

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T-accounts and journal entries:

WIP

	Dr	Cr	
Beginning WIP	420,000		
Current production costs	1,003,200		
		865,132	Trfrd to FG (includes normal spoilage)
		33,844	Abnormal spoilage
Balance[1]	524,224		

Finished Goods

	Dr	Cr
Trfd from WIP	865,132	
Balance	865,132	

1. Slight difference of $64 (524,224 minus 524,160) due to rounding.

Loss from Abnormal Spoilage

	Dr	Cr
Trfd from WIP	33,844	
Balance	33,844	

Journal entries:

Finished goods inventory	865,132	
WIP		865,132
To transfer units completed.		

Loss from abnormal spoilage	33,844	
WIP		33,844
To write-off abnormal spoilage costs.		

Spoilage – Inspection Point and Ending WIP

In the above example, neither the units in opening WIP nor the units in ending WIP had passed the inspection point. When there are units in WIP that have passed the inspection point, they will be allocated their share of normal spoilage costs.

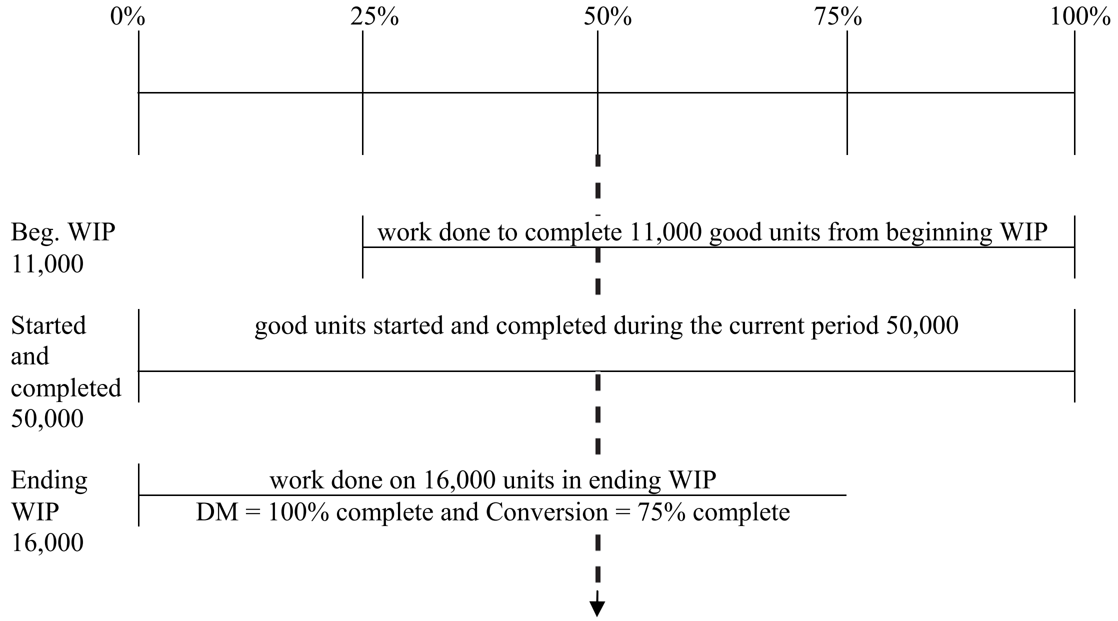
Example:

Beginning WIP	11,000	units
• 25% complete for conversion		
• 100% complete for direct materials		
Good units started and completed	50,000	units
Ending WIP	16,000	units
• 75% complete for conversion		
• 100% complete for direct materials		
Normal spoilage	10%	of good units passing inspection
Abnormal spoilage	300	units
Inspection point	occurs at 50% complete	

Costs:

	DM	Conversion
Beginning inventory	60,000	47,500
Current period	680,000	700,000
	740,000	747,500

Normal spoilage units is calculated as follows:



Since inspection occurs at 50%, both good units completed (61,000) and the units in ending WIP are used to calculate normal spoiled units. Calculation :

Beginning WIP	11,000
Started & completed	50,000
Ending WIP	16,000
	77,000
	x10%
	7,700

Since ending WIP has passed the inspection point, the ending WIP must be allocated its share of the normal spoilage costs.

Normal spoilage costs would be allocated as:

Included in amount transferred to finished goods inventory:				
Beginning WIP	11,000			
Started and completed	50,000			
	61,000	x 10%	=	6,100
Included in ending WIP inventory				
Ending WIP	16,000	x 10%	=	1,600
				7,700

OR

Total normal spoilage	7,700
Less: normal spoilage units attributable to ending WIP (16,000 x 10%)	(1,600)
Normal spoilage to include with good units transferred to FG inv.	6,100

Physical flow of production:

		Physical Units
Beginning WIP inventory		11,000
Started:		
Good units started and completed	50,000	
Normal spoilage	7,700	
Abnormal spoilage	300	
Ending WIP	16,000	74,000
		85,000

Ending WIP		16,000
Good units completed		
From beginning inventory	11,000	
Started and completed this period	50,000	61,000
Normal spoilage		7,700
Abnormal spoilage		300
		85,000

Equivalent units are calculated as follows:

		Equivalent Units		
Physical Flow of Production	Physical Units	Direct Materials	Conversion Costs	
Normal spoilage:				
Included in:				
Amount transferred to ending FG inventory	6,100	6,100	3,050 (6100 x 50%)	(Note 1)
Ending WIP	1,600	1,600	800 (1600 x 50%)	(Note 1)
Total normal spoilage	7,700	7,700	3,850	
Good units completed and trfrd out (50,000 + 11,000)	61,000	61,000	61,000	
Abnormal spoilage	300	300	150 (300 x 50%)	(Note 1)
Work-in-process, ending	16,000	16,000	12,000 (16,000 x 75%)	
Equivalent units, weighted average	85,000	85,000	77,000	
Less: work done on beginning inventory in prior period	(11,000)	(11,000)	(2,750) (11,000 x 25%)	
Equivalent units, FIFO	74,000	74,000	74,250	

Note 1:

Since the inspection point was at 50%, once the spoiled units were identified, no further conversion costs would be incurred. Therefore, the conversion percentage applied to the normal spoilage is 50%. This also applies to the abnormal spoilage. Candidates are advised that this concept is often not applied correctly on the Entrance Exam. Always remember to pay attention to the inspection point relative to both the conversion and direct material percent complete.

Allocation of costs to inventory based on the weighted average approach is: (per unit cost amounts rounded to four decimals)

	Total	Direct Materials	Conversion Costs
Financial Flow of Production			
Beginning WIP inventory	$107,500	$60,000	$47,500
Current production costs	$1,380,000	$680,000	$700,000
Total costs to account for	$1,487,500	$740,000	$747,500
Equivalent units		÷ 85,000	÷ 77,000
Cost per equivalent unit		$8.7059	$9.7078
		Total cost per equivalent unit =	$18.4137
Application of total costs:			
Ending WIP inventory:			
Good units in WIP:			
Direct materials	$139,294	139,294 (16,000 x $8.7059)	
Conversion costs	116,494		116,494 12,000 x $9.7078
Spoilage in WIP:			
Direct materials	13,929	13,929 (1,600 x $8.7059)	
Conversion costs	7,766		7,766 800 x $9.7078
Total ending WIP balance	$277,483		
Transferred to finished goods:			
Good units completed and trfrd this month (61,000)	1,123,236	531,060 (61,000 8.7059)	592,176 (61,000 x 9.7078)
Normal spoilage	82,715	53,106 (6,100 x $8.7059)	29,609 (3,050 x $9.7078)
Total transferred to finished goods	1,205,951		
Abnormal spoilage (write-off to inc. statement)	4,068	2,612 (300 x $8.7059)	1,456 (150 x $9.7078)
Total costs accounted for (diff of $2 due to rounding)	$1,487,502		

Transferred In Costs

Process costing is typically applied to each processing department; that is, costs are accumulated for each processing department as the units physically move from one processing department to another processing department, the costs must be removed from the preceding department's accounting records and become the current department's transferred in costs. Once the units have been received by a processing department, additional material and/or conversion must occur to those units before they are forwarded to finished goods or another processing department.

The five steps in process costing still apply; however, transferred in costs are considered separately from direct material and conversion costs (transferred in costs are considered to be a separate cost 'category'). By their nature, transferred in costs will always be 100% complete with respect to work done in the prior department since the work of the preceding department is complete.

The costing method used, FIFO or weighted average, will determine how transferred in units and costs are treated. Under weighted average, the transferred in costs related to beginning WIP must be included in the cost per equivalent unit since this method includes costs and work done to date, regardless of the period in which it occurred. Under the FIFO method, the transferred in costs related to beginning WIP are not included in the cost per equivalent unit since the FIFO method isolates both costs and production to work done in the current period.

Example:

Basic Data:

– direct materials are added at the beginning of the process	
– conversion cost (labour and factory overhead) occurs evenly throughout the process	
– inspection occurs when products are 75% complete	
– units transferred in during period	36,000
– good units completed	28,510
– WIP, ending is 70% complete	11,800
– units in beginning WIP, 60% complete	5,800
– beginning WIP costs:	
- transferred in cost	$12,180
- material cost	$29,580
- conversion cost	$19,140
– direct material cost, incurred during current period	$151,200
– conversion cost, incurred during current period	$226,750
– transferred in costs during the current period	$64,800
– normal spoilage rate is 4% of good units	

	Physical Units
Beginning WIP inventory	5,800
+ units started	36,000
Total physical units to account for	41,800
Ending WIP	11,800
+ good units completed + transferred	28,510
Normal spoilage (28,510 x .04)	1,140
Abnormal spoilage (41800-11,800-28,510-1,140)	350
Total physical units accounted for	41,800

total units to account for must equal total units accounted for

Solution: Weighted Average

	Physical Units	Equivalent Units: Transferred In	DM	Conversion	
WIP, beginning	5,800				
Units transferred in	36,000				
To account for	41,800				
Abnormal spoilage	350	350	350	262	(350 x 75%)
Normal spoilage	1,140 [1]	1,140	1,140	855	(1140 x 75%)[1]
Good units completed	28,510 [1]	28,510	28,510	28,510	
WIP, ending (70%)	11,800	11,800	11,800	8,260	(11,800 x 70%)
	41,800				
		41,800	41,800	37,887	

	Total	Cost of Production: Transferred In	DM	Conversion
WIP, beginning	$60,900.00	$12,180	$29,580	$19,140
Current costs	442,750.00	64,800	151,200	226,750
		$76,980		
To account for	$503,650.00		$180,780	$245,890
Divide by equivalent units		41,800	41,800	37,887
Cost per equivalent unit		$1.8416	$4.3249	$6.4901
Application of total costs:				
Units completed:				
Good units	$360,836.82	28,510 ($1.8416)	28,510 ($4.3249)	28,510 ($6.4901)
Normal spoilage	12,578.76	1,140 ($1.8416)	1,140 ($4.3249)	855 ($6.4901)
	$373,415.58			
Abnormal spoilage	$3,858.66	350 ($1.8416)	350 ($4.3249)	262 ($6.4901)
Ending WIP				
Transferred In	$21,730.88	11800 ($1.8416)		
DM	51,033.82		11800 ($4.3249)	
Conversion	53,607.40			8260 ($6.4901)
Normal spoilage	0 [3]			
	$126,372.10			
Total costs accounted for	$503,646.34 [3]			

[1] Since normal and abnormal spoilage is identified at the inspection point, which occurs when the units are 75% complete, the equivalent units for normal and abnormal spoilage is calculated using 75%.
[2] Since normal and abnormal spoilage is identified at the inspection point, which is 75%, spoilage that 'resides' in ending WIP (which is 70% complete) will be identified once these units have reached the inspection point.
[3] Slight difference of $3.66 ($503,646.34 - $503,650) due to rounding.

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Solution: FIFO

	Physical Units	Equivalent Units: Transferred In	DM	Conversion	
WIP, beginning	5,800				
Units transferred in	36,000				
To account for	41,800				
Abnormal spoilage	350 [1]	350	350	262	(350 x 75%)[1]
Normal spoilage	1,140 [1]	1,140	1,140	855	(1140 x 75%)[1]
Good units completed	28,510	28,510	28,510	28,510	
WIP, ending (70%)	11,800	11,800	11,800	8,260	(11,800 x 70%)
	41,800				
Work done to date		41,800	41,800	37,887	
Less: work done on beginning inventory in prior periods:					
Trfrd in (5,800 x 100%)		(5,800)			
DM (5,800 x 100%)			(5,800)		
Conversion (5,800 x 60%)				(3,480)	
Work done during current periood only		36,000	36,000	34,407	

	Total	Cost of Production: Transferred In	DM	Conversion
WIP, beginning	$60,900.00	-	-	-
Current costs	442,750.00	$64,800	$151,200	$226,750
To account for	$503,650.00	$64,800	$151,200	$226,750
Divide by equivalent units		36,000	36,000	34,407
Cost per equivalent unit		$1.80	$4.20	$6.59
Application of total costs:				
Units completed:				
WIP, beginning	$60,900.00			
Cost to complete beg WIP:				
Transferred In	-	-		
DM	-		-	
Conversion	15,288.80			5800 x .4 x 6.59
Good units started and completed (28,510-5,800)	285,918.90	22,710 ($1.80)	22,710 ($4.20)	22,710 ($6.59)
Normal spoilage	12,474.45	1,140 ($1.80)	1,140 ($4.2)	855 ($6.59)
	$374,582.15			
Abnormal spoilage	$3,826.58	350 ($1.80)	350 ($4.20)	262 ($6.59)
Ending WIP				
Trfrd In	$21,240.00	11800 ($1.80)		
DM	49,560.00		11800 ($4.20)	
Conversion	54,433.40			8,260 ($6.59)
Normal spoilage	0 [2]			
	$125,233.40			
Total costs accounted for	$503,642.13 [3]			

[1] Since normal and abnormal spoilage is identified at the inspection point, which occurs when the units are 75% complete, the equivalent units for normal and abnormal spoilage is calculated using 75%.
[2] Since normal and abnormal spoilage is identified at the inspection point, which is 75%, spoilage that 'resides' in ending WIP (which is 70% complete) will be identified once these units have reached the inspection point.
[3] Slight difference of $7.87 ($503,650 - $503,642.13) due to rounding.

Comparison of FIFO and weighted average:

Physical units and equivalent units:

	Beginning WIP	Good units started and completed	Abnormal spoilage	Normal spoilage	Ending WIP	TOTAL
Weighted Average						
Physical Units	5,800	22,,710	350	1,140	11,800	41,800
Equivalent units:						
Transferred in	5,800	22,710	350	1,140	11,800	41,800
Direct materials (added at beginning)	5,800	22,710	350	1,140	11,800	41,800
Conversion (occurs evenly throughout)	5,800	22,710	262	855 (1,140 x 75%)	8,260 (11800 x 70%)	37,887
FIFO						
Physical units	5,800	22,710	350	1,140	11,800	41,800
Equivalent units:						
Transferred in	-[1]	22,710	350	1,140	11,800	36,000
Direct materials (added at beginning)	-[1]	22,710	350	1,140	11,800	36,000
Conversion (occurs evenly throughout)	2,320 (5800 x 40% to complete the beginning WIP)[1]	22,710	262	855 (1,140 x 75%)	8,260 (11800 x 70%)	34,407

1. Remember that FIFO only considers work done in the current period

Cost allocations:

	FIFO	Weighted Average
Ending WIP inventory	$125,233.40	$126,372.10
Completed units	$374,582.15	$373,415.58
Abnormal spoilage	$3,826.58	$3,858.66
	$503,642.13	$503,646.34

Note: Slight difference of 4.21 between FIFO and WA due to rounding.

Ending WIP inventory	$125,233.40	$126,372.10

Process Costing and Standard Costs

Recall that process costing is most suited to industries with mass, continuous and repetitive production. Due to the homogenous and mass production nature of production, standard costing can be readily used in process costing. When standard costing is applied to process costing the standard cost becomes the cost per equivalent unit and it is not necessary to calculate a cost per equivalent unit. However, when using standard costs in process costing, the calculation of equivalent units follows the FIFO methodology and isolates work done in the current period only.

Example:

– direct materials are added at the beginning of the process	
– conversion cost (labour and factory overhead) occurs evenly throughout the process	
– inspection occurs when products are 75% complete	
– units transferred in during period	25,000
– good units completed	22,200
– WIP, ending is 70% complete	5,220
– units in beginning WIP, 60% complete	3,200
– standard costs per unit	
- transferred in cost	\$.50
- material cost	\$.30
- conversion cost	\$.70
– normal spoilage rate is 2.25% of good units finished	
– FIFO is used	

	Physical Units
Beginning WIP inventory	3,200
+ units started	25,000
Total physical units to account for	28,200
Ending WIP	5,220
+ good units completed + transferred	22,200
Normal spoilage (22,200 x .0225)	500
Abnormal spoilage (28,200-5,220-22,200-500)	280
Total physical units accounted for	28,200

total units to account for must equal total units accounted for

Solution: Standard Costs

	Physical Units	Equivalent Units: Transferred In	DM	Conversion	
WIP, beginning	3,200				
Units transferred in	25,000				
To account for	28,200				
Abnormal spoilage (100%)	280	280	280	210	(280 x 75%)[1]
Normal spoilage	500	500	500	375	(500 x 75%)[1]
Good units completed	22,200	22,200	22,200	22,200	
WIP, ending (70%)	5,220 [2]	5,220	5,220	3,654	(5,220 x 70%)
	28,200				
Work done to date		28,200	28,200	26,439	
Less: work done on beginning inventory in prior periods:					
Trfrd in (3,2000 100%)		(3,200)			
DM (3,200 x 100%)			(3,200)		
Conversion (3,200 x 60%)				(1,920)	
Work done during current periood only		25,000	25,000	24,519	

	Total	Cost of Production: Transferred In	DM	Conversion
Standard cost per equiv. unit		$.50	$.30	$.70
Work done during current period		25,000	25,000	24,519
Current costs at standard	37,163	$12,500	$7,500	$17,163
WIP, beginning				
Trfrd in $.50 x 3200	1,600	1,600		
Direct mat. $.30 x 3200	960		960	
Conversion $.70 x 3200*.6	1,344			1,344
Total costs to account for	41,067	14,100	8,460	19,104
Application of total costs:				
Units completed:				
WIP, beginning (1,600+960+1,344)	$3,904			
Cost to complete beg WIP:				
Transferred in and DM	---	---	---	
Conversion	896			896 (3200 x .4 x .70)
Good units started and completed (22,200-3,200 = 19,000)	28,500	9,500 (19,000 x $.50)	5,700 (19,000 x $.30)	13,300 (19,000 x $.70)
Normal spoilage	662	250 (500 x $.50)	150 (500 x $.30)	262 (375 x $.70)
	33,962			
Abnormal spoilage	$371	140 (280 x $.50)	84 (280 x $.30)	147 (210 x $.70)
Ending W-I-P: Trfrd In + DM + con. + normal Spoilage[2]	$6,733	2,610 (5220 x $.50)	1,566 (5220 x $.30)	2,557 (3654 x $.70)
Total costs accounted for	$41,067			
Costs applied to current period work, at std		$12,500	$7,500	$17,760

Summary of work and costs during current period (for variances, discussed later):	Transferred In	DM	Conversion
Work done in current period only	25,000	25,000	25,372
Costs applied to current period work, at standard	$12,500	$7,500	$17,760

[1] Since normal and abnormal spoilage is identified at the inspection point, which occurs when the units are 75% complete, the equivalent units for normal and abnormal spoilage is calculated using 75%.
[2] Since normal and abnormal spoilage is identified at the inspection point, which is 75%, spoilage that 'resides' in ending WIP (which is 70% complete) will be identified once these units have reached the inspection point.

Standard Costs and Variances

Since standard costs usually differ from actual costs, using standard costs for process costing often gives rise to variances. In the previous example, assume actual costs per unit were:

Transferred in costs	$.53
Direct materials	$.35
Conversion	$.74

Therefore, since actual costs do not equal standard costs, this gives rise to variances as follows:

Current output in equivalent units	25,000		25,000		24,519	
Costs applied to output (at standard)	$12,500		$7,500		$17,163	
Actual costs:						
Trfrd in: 25,000 x .53	$13,250					
Materials: 25,000 x .35			$8,750			
Conversion: 24,519 x .74					$18,144	
Variance between applied and actual	$750	U	$1,250	U	$981	U

Direct and Absorption Costing

Skill Level:	R/U	A/A
3.1.2.1 e) Direct (variable) and absorption costing		
• Identifies and compares the features of direct (variable) costing and absorption costing	✓	
• Applies direct and absorption costing approaches in inventory costing, financial statement preparation and decision making		✓
• Interprets and utilizes financial statements under direct and absorption costing for decision making and financial analysis	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Description - Direct vs. Absorption Costing

The difference between direct costing (also known as variable costing) and absorption costing is each method's treatment of fixed factory overhead.

Under direct costing, fixed factory overhead is considered a period cost and is expensed in the period incurred. As it is expensed immediately, it is not included in inventory cost. Proponents of direct costing argue that fixed factory overhead represents the cost of production capacity for a certain period and, thus, should be recognized in the period incurred. Under direct costing, only variable production costs are included in inventory.

Under absorption costing, fixed factory overhead is included in the cost of inventory. This approach is based on the premise that these costs must exist in order to produce goods and, therefore, represent costs that should be included in the cost of inventory.

For financial reporting purposes, IFRS requires the use of absorption costing. Therefore, the direct vs. absorption differences are relevant only for internal decision making purposes. The examples that follow are intended to highlight the relevant decision making insights provided by direct and absorption costing.

Example

XYZ Company began operations on January 1, Year 1 and has a year-end of December 31. The following information pertains to XYZ Company's production and sales:

Production during year	140,000	units
Sales during year	98,000	units
Beginning WIP	0	
Selling price	$24.00	per unit
Direct material cost	$4.25	per unit
Direct labour cost	$6.25	per unit
Variable factory overhead	$2.00	per unit
Fixed factory overhead	$420,000	
Variable selling and administration expenses	$210,000	
Fixed selling and administration expenses	$320,000	

Production cost per unit:

		Absorption Costing	Direct Costing
Direct materials:		$4.25	$4.25
Direct labour		$6.25	$6.25
Variable factory overhead		$2.00	$2.00
Fixed factory overhead Application rate:	$\frac{\$420{,}000}{140{,}000 \text{ units}}$ =	$3.00	N/A
Production cost per unit		$15.50	$12.50

Impact of Direct and Absorption Costing on Income

Net income under direct and absorption costing for any period will differ due to the treatment of fixed factory overhead.

Under absorption costing, the portion of fixed overhead applied to ending inventory is reflected on the balance sheet, whereas, under direct costing, this amount is expensed. Any year in which units produced do not equal units sold results in different net income under the two methods. If more units are produced than sold, net income under absorption costing will be higher than direct costing. This is because the portion of fixed factory overhead applied to ending inventory is on the balance sheet and is not reflected in the income statement. Conversely, if production is less than sales, absorption costing will have a lower net income because the fixed overhead in beginning inventory now flows to the income statement.

Summary of impact of production and sales on net income if the fixed manufacturing overhead rate is the same year over year: (The table that follows assumes that the fixed cost rate per unit does not change.)

If production = sales ⇒ absorption costing income = direct costing income.
If production = sales, then beginning inventory = ending inventory (i.e. no change in inventory) ⇒ absorption costing income = direct costing income.

If production > sales ⇒ absorption costing income > direct costing income.
If production > sales, then ending inventory > beginning inventory (i.e. inventory has increased) ⇒ absorption costing income > direct costing income.

If production < sales ⇒ absorption costing income < direct costing income.
If production < sales, then ending inventory < beginning inventory (i.e. inventory has decreased) ⇒ absorption costing income < direct costing income.

Note: The underlying assumption in the above is that production costs remain consistent year-over-year.

Example:

Using XYZ Company's information, net income under absorption and direct costing for Year 1 is:

	Absorption Costing	Direct Costing
Sales (98,000 x $24)	$2,352,000	$2,352,000
Cost of goods sold		
98,000 x $15.50	1,519,000	
98,000 x $12.50		1,225,000
Fixed factory overhead	**N/A**	420,000
Fixed selling and administration	**320,000**	**320,000**
Variable selling and administration	**210,000**	**210,000**
	$2,049,000	**$2,175,000**
Net income	**$303,000**	**$177,000**

Note that the difference in income of $126,000 ($303,000 - $177,000) can be calculated as:

Ending inventory = 140,000 units produced – 98,000 units sold = 42,000 remaining in inventory
Fixed overhead included in ending inventory = fixed overhead rate x number of units remaining
= $3 x 42,000 = $126,000

Assume that in Year 2 the ending inventory is 50,000 units and the fixed manufacturing overhead rate is $3.80 for Year 2. Under these assumptions, what is the difference between direct and absorption costing?

	Units	Fixed OH Rate	$
Year 1 ending inventory	42,000	3.00	126,000
Year 2 ending inventory	50,000	3.80	190,000
	8,000		64,000

Absorption income is higher by $64,000. This is because under absorption, $126,000 of the prior years' costs flow <u>into</u> the income statement from the balance sheet and $190,000 of costs related to the current year flow <u>out</u> of the income statement and onto the balance sheet.

IFRS Financial Statements and Absorption Costing

IFRS requires the use of absorption costing when preparing financial statements. This means the financial statements are prepared with fixed manufacturing overhead applied to products.

On the Entrance Examination, candidates may be asked for absorption based income, which means fixed manufacturing overhead is applied to products (i.e. both the units in inventory and the units in cost of goods sold). It also means normal period costs, such as selling and administration, should be deducted when calculating income.

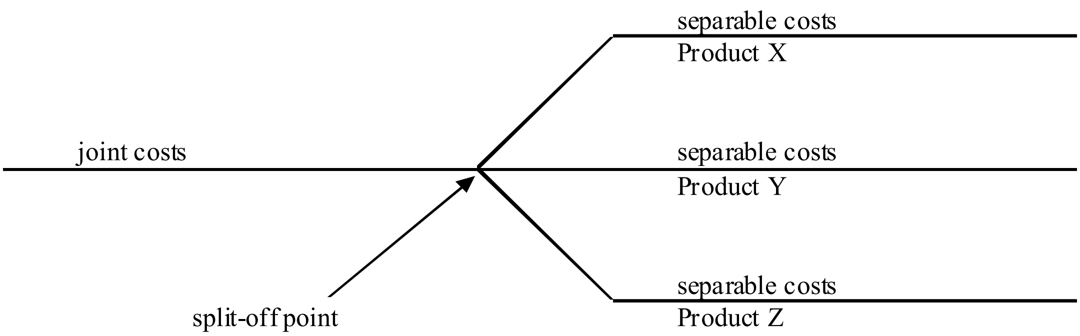
Joint Costing

Skill Level:	R/U	A/A
3.1.2.2 Defines, describes and applies joint cost allocation methods		
a) Describes the role of joint and by-product costs in decision making	✓	
b) Identifies and calculates product and by-product costs using various joint cost allocation methods (physical measure, sales value at split-off, estimated net realizable value, constant gross margin percentage net realizable value)	✓	✓
c) Understands and applies the methods of accounting for by-products	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Description of Joint Costing

Joint costing is required when a single process produces a group of products. The products are called joint products and the point at which they are identified as separate products is called the split-off point. Joint costs are incurred up to this point and are applicable to all the joint products. Costs that are incurred after the split off point are separable costs and are applied only to the joint product for which the cost is incurred.

Production process:



Methods of Allocating Joint Costs

There are four main methods of allocating joint costs:

1. Physical units method
2. Sales value method
3. Net realizable value method
4. Constant gross margin percentage NRV method

Physical Volume (Physical Measures) Method

Under this method, the base for allocating joint costs is a physical measure of outputs, such as weight (pounds, kilograms) or volume (gallons, litres). Joint costs are allocated proportionately according to each product's weight/volume relative to total weight/volume. The volume amount to use when calculating the joint cost allocation under the physical units method is the volume at the split-off point and not the volume after separable processing.

An example is provided at the end of this section.

Sales Value Method

Under this method, joint costs are allocated based on the sales value of each product at the split-off point proportionately to the total sales value of all products at this point.

Steps:

1. Compute sales value of each product at split-off (units produced x selling price at split-off)
2. Determine total sales value by summing the sales value of all products.
3. Determine the proportion of each products sales value to the total sales value. (individual products' sales value ÷ total sales value).
4. Allocate joint costs based on the proportions calculated in Step 3.

It is important to remember that the volume amount to use when calculating the joint cost allocation under this method is the volume at the split-off point and not the volume after separable processing.

An example is provided at the end of this section.

Net Realizable Value Method

This method allocates joint costs based on the net realizable value of each product at the point of sale relative to the total net realizable value of all products at the point of sale.

The formula to calculate net realizable value at split-off is:

net realizable value at split off point = sales value at completion – the cost incurred in behalf of the product between the split off point and the point of sale

An example is provided at the end of this section.

Constant Gross Margin Percentage Method

This method allocates joint costs so that the gross margin percentage is identical for each product. The steps under this method are:

Steps:

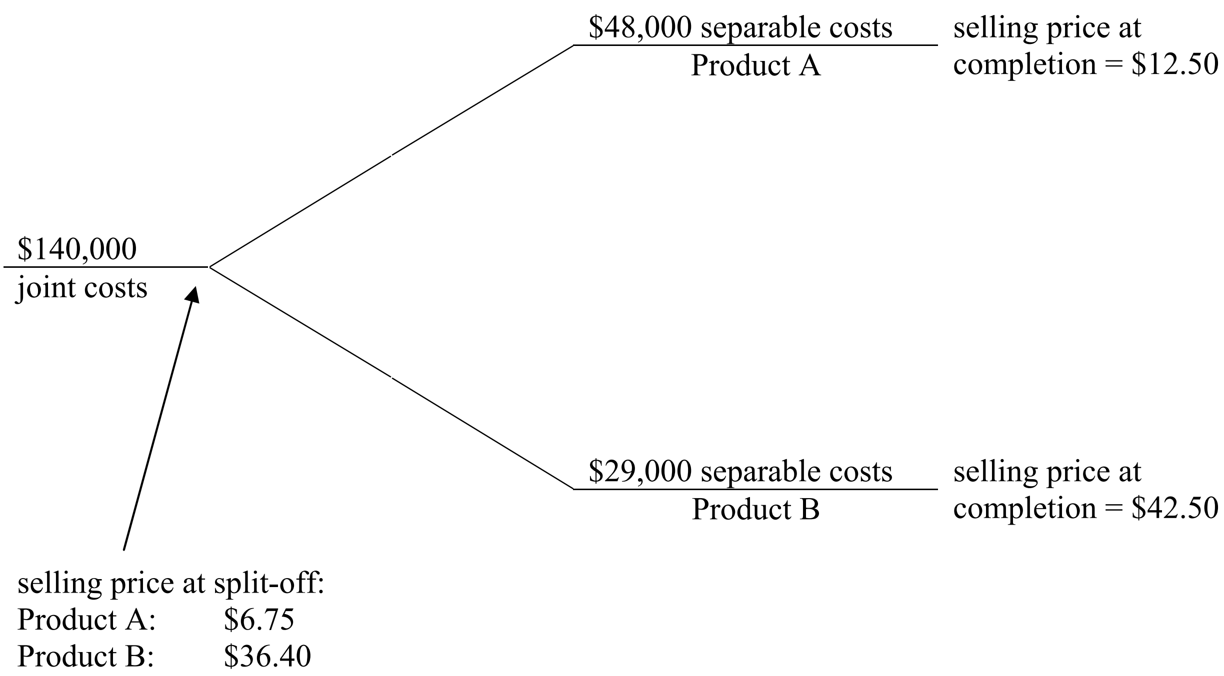
1. Compute overall gross margin percentage
2. Using the percentage calculated in 1, subtract the gross margin from the sales value for each product to arrive at the total cost each product should bear.
3. For each product, subtract the separable cost from the total cost the product should bear to determine that product's share of joint costs.

An example is provided at the end of this section.

Comprehensive Example of Joint Cost Allocation

Neleh Company produces two products, which are jointly manufactured. Numerical information is:

	Product A	Product B	Total
Joint costs			$140,000
Units at split-off	28,800	4,800	33,600
Inputs required per unit of output	1.2 litres	.6 litres	
Units sold	24,000	8,000	32,000
Separable costs	$48,000	$29,000	$77,000
Sales price per unit at split-off	$6.75	$36.50	
Sales price per unit at completion	$12.50	$42.50	



Allocation of joint costs under the physical volume (measures) method:

	Product A	Product B	Total
Volume at split-off in litres	28,800	4,800	33,600
Proportion of total litres input	28,800 / 33,600 = 85.7143%	4,800 / 33,600 = 14.2857%	
Allocation of joint costs based on proportion of litres at split-off	$140,000 x 85.7143%	$140,000 x 14.2857%	
	$120,000	$20,000	$140,000

Allocation of joint costs based on the sales value method:

	Product A	Product B	Total
Sales value at split-off	$6.75 x 24,000 = $162,000	$36.50 x 8,000 = $292,000	$454,000
Proportion of sales value at split-off	$162,000 / $454,000 = 36%	$292,000 / $454,000 = 64%	
Allocation of joint costs based on proportion of sales value at split-off	$140,000 x 36%	$140,000 x 64%	
	$50,400	$89,600	$140,000

Allocation of joint costs based on the net realizable value method:

	Product A	Product B	Total
Sales value at completion	$12.50 x 24,000 = $300,000	$42.50 x 8,000 = $340,000	
Less: separable costs	$48,000	$29,000	
Net realizable value at completion	$252,000	$311,000	$563,000
Proportion of total net realizable value	$252,000 / $563,000 = 45%	$311,000 / $563,000 = 55%	
Allocation of joint costs based on proportion of net realizable value	$140,000 x 45%	$140,000 x 55%	
	$63,000	$77,000	$140,00(

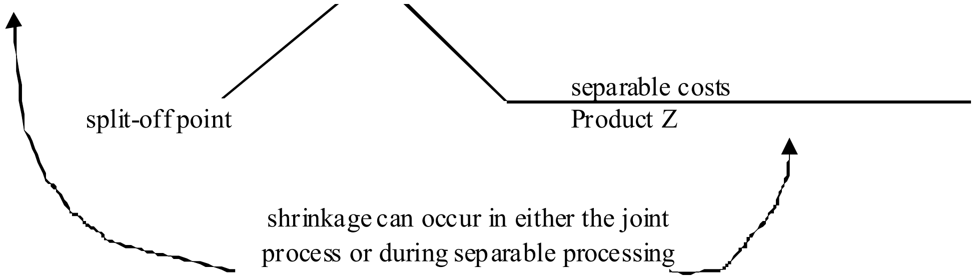
Allocation of joint costs based on the constant gross margin percentage method:

Total sales value (12.50 x 24,000) + (42.50 x 8,000)	$640,000
Less: joint and separable costs (140,000 + 48,000 + 29,000)	217,000
	$423,000
Gross margin percentage	66.09375%

	Product A	Product B	Total
Sales value at completion A: $12.50 x 24,000 B: $42.50 x 8,000	$300,000	$340,000	
Gross margin (at calculated % of 66.09375%)	198,281	224,719	
Cost of goods sold	$101,719	$115,281	
Less: separable costs	48,000	29,000	
Joint costs allocated	$ 53,719	$ 86,281	$140,000

Dealing with Shrinkage/Evaporation

Shrinkage (e.g. due to evaporation) can occur as an inherent part of the manufacturing process. Shrinkage can occur during the joint process or during the separable processing:



The issue is which units to use when allocating joint costs. To answer this question, one needs to consider the underlying principles of the joint costing methods. There are two approaches to joint costing, the first is the "benefits received" approach and the second is the "market value" approach:

Two approaches

Benefits Received vs. Market Value

Benefits Received

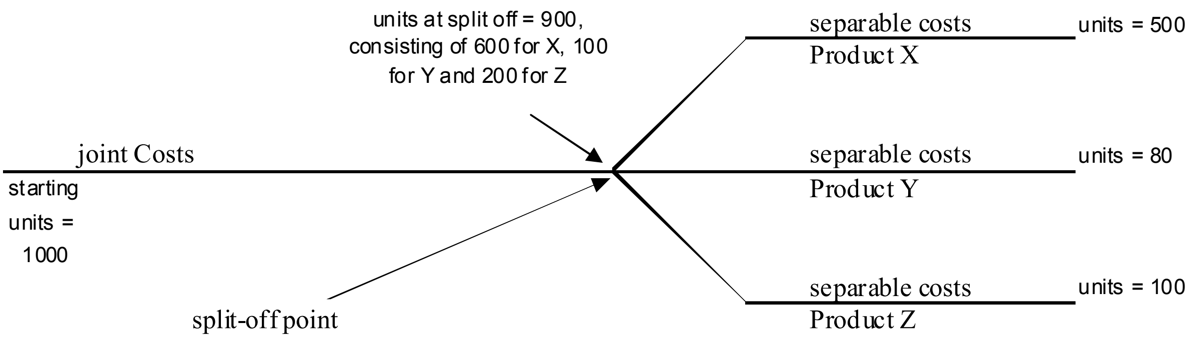
- This principle states that because of the joint process, there are benefits received by each of the product lines – the benefits are the inputs ("raw material") into each of the separable processes. Therefore, the units/volume to use is the volume at the split-off point.

Market Value

- Under this approach, joint costs are allocated based on the dollar (or economic) value the products ultimately bring in to the company. The dollars ultimately received by the company are based on how much can be sold. Therefore, under this approach, the units to use when proportioning joint costs are the units after separable processing.

Benefits Received	vs.	Market Value
• The most common methods under this approach are the physical units and sales value at split-off methods.		• The most common methods under this approach are the estimated net realizable value and constant gross margin percentage. However, it should be noted that under both these methods (estimated NRV and constant gross margin percentage), there could be one product sold at split-off and other products sold after separable processing. In situations like this, the production units to use in allocating joint costs are driven by the point of sale.

Example of shrinkage:



In this example the units at the split-off point, 600, 100 and 200, respectively, would be used to proportion joint costs under the physical units or sales value at split-off method. Under the net realizable value or constant gross margin percentage, the units to use are 500, 80 and 100 for X, Y and Z, respectively, assuming the company processes further (i.e. does not sell any of the three products at split-off).

Sell or Process Further

When producing joint products, a company must determine whether to sell a product at the split-off point or to sell it at completion (i.e. after further processing).

It is important to note that joint costs are irrelevant to the decision.

The decision to sell or process further is based on a comparison of:

1. Sales value at split-off
2. Sales value at completion minus separable costs

Process further only if sales value at completion minus separable cost is greater than sales value at split off.

Example:

Based on the previous numerical data should Neleh Company sell at split-off or process further?

	Product A	Product B
Sales value at completion	\$300,000 (\$12.50 x 24,000)	\$340,000 (\$42.50 x 8,000)
Less: separable costs	\$ 48,000	\$ 29,000
	\$252,000	\$311,000
Sales value at split-off	\$162,000 (\$6.75 x 24,000)	292,000 (\$36.50 x 8,000)
Conclusion	Process further	Process further

Accounting for By-Products

By-products are produced from a joint process along with the joint products. In effect, by-products are joint products that have little sales value and are accounted for differently than the joint products.

There are two methods of accounting for by-products, which are described below.

Method 1: Recognize By-Products when Produced

Under this method the by-product is recognized at its NRV when produced. As by-product is produced, it is recorded as by-product inventory at its NRV, with the offsetting credit recorded against the cost of the main product(s), which has the effect of reducing the cost of the main product(s). This method is required by IFRS Reporting Standards and is preferred treatment for internal accounting because it removes management's discretion regarding when to recognize the value of the by-product.

Example:

Assume a two product company, with one main product and one by-product. Numerical data for the month of March for the two products:

	Main Product	By-Product
Beginning finished goods inventory, in units	0	0
Production during the year, in units	100,000	8,000
Sales, in units	90,000	6,000
Sales price per unit	$28.00	$1.50
Separable costs	$907,200	$2,200

Joint cots are $580,000. There is zero beginning and ending WIP inventory.

Solution:

The easiest means of understanding this method of accounting for by-products is to review the journal entries, T-accounts and income statement. Each is presented below.

Journal entries:

1. To record costs as incurred:

WIP inventory	907,200	
WIP inventory	2,200	
WIP inventory	580,000	
A/P and various other accounts		1,489,400

2. To record finished goods inventory for the main product:

Finished goods inventory – main product	1,489,400	
WIP inventory		1,489,400

Note that the separable processing costs related to the by-products are included with the main product inventory cost. The by-product inventory is adjusted against the main product finished goods inventory account in the next entry.

3. To record the by-product inventory at NRV

By-product inventory	9,800	
Finished goods inventory – main product		9,800

Note that by-product inventory is carried at its NRV, which is:
8,000 x (1.50 - .275) = 9,800 (The .275 is calculated as $2,200 ÷ 8,000)

In addition, note that the effective cost of the main product is:
1,489,400 – 9,800 = 1,479,600 ÷ 100,000 = $14.796

4. To record sales and cost of sales of the main product
Cost of sales entry:

Cost of goods sold	1,331,640	
Finished goods inventory – main product		1,331,640

90,000 units x 14.796/unit

Revenue entry:

Accounts receivable (or cash)	2,520,000	
Revenue		2,520,000

90,000 x $28

5. To record sales of the by-product:

Accounts receivable (or cash)	7,350	
By-product inventory		7,350

6,000 x $1.225/unit (recall that the by-product inventory is carried at NRV, which is 1.50 - .275 = 1.225)

T-accounts:

WIP Inventory

907,200	
580,000	
2,200	
	1,489,400
0	

FG Inventory – Main Product

1,489,400	
	9,800
	1,331,640
147,960	

By-Product Inventory

9,800	
	7,350
2,450	

COGS

1,331,640	
1,331,640	

Accounts Receivable

2,520,000	
7,350	
2,527,350	

Revenue

	2,520,000
	2,520,000

Income statement:

Revenue		$2,520,000
COGS	90,000 x $14.796	1,331,640
Gross margin		1,188,360

Ending inventory values:

Finished goods inventory – main product	10,000 x 14.796	147,960
By-product inventory	2,000 x 1.225	2,450

Method 2: Recognize By-Product when Sold

Under this method, by-product inventory is not recorded (i.e. by-product inventory is carried at zero). When the by-products are sold, the revenue is recorded. If there are separable costs, they are expensed as incurred. Note that this can result in a miss-match in timing and a violation of the matching principle. For example, if 1,000 units of by-product are produced at a separable cost of $.50/unit and 700 of those units are sold at $.85/unit, the following would be recognized in the income statement:

Revenue	700 x $.85	$595
Expenses	1000 x $.50	$500

This obviously violated the matching principle, since revenue related to 700 units is recognized in the income statement, but costs related to 1,000 units and not 700 units, is recognized as an expense. However, since by-products are incidental to the main product(s) and have an immaterial impact on the financial statements, recording in this manner is acceptable.

Example of accounting for by-products under this method**:**

Note that data for this example is identical to data provided for the example under Method 1. The same data is used to illustrate the result of using a different accounting method when accounting for by-products.

Assume a two product company, with one main product and one by-product. Numerical data for the month of March for the two products:

	Main Product	By-Product
Beginning finished goods inventory, in units	0	0
Production during the year, in units	100,000	8,000
Sales, in units	90,000	6,000
Sales price per unit	$28.00	$1.50
Separable costs	$907,200	$2,200

Joint cots are $580,000. There is zero beginning and ending WIP inventory.

<u>Solution:</u>

The easiest means of understanding this method of accounting for by-products is to review the journal entries, T-accounts and income statement. Each is presented below.

Journal entries;

1. To record costs of main product as incurred:

WIP inventory	907,200	
WIP inventory	580,000	
A/P and various other accounts		1,487,200

2. To record production costs for the by-product

COGS (or other expense a/c, which is included in COGS)	2,200	
A/P and various other accounts		2,200

3. To record finished goods inventory for the main product:

Finished goods inventory – main product	1,487,200	
WIP inventory		1,487,200

Note that the cost per unit of the main product is:
1,487,200 ÷ 100,000 = \$14.872

4. To record sales and cost of sales of the main product

Cost of sales entry:

Cost of goods sold	1,338,480	
Finished goods inventory – main product		1,338,480

90,000 units x 14.872/unit

Revenue entry:

Accounts receivable (or cash)	2,520,000	
Revenue		2,520,000

90,000 x \$28

5. To record sales of the by-product:

Accounts receivable (or cash)	9,000	
Revenue		9,000

6,000 x \$1.50

T-accounts:

WIP Inventory

907,200	
580,000	
	1,487,200
0	

FG Inventory – Main Product

1,487,200	
	1,338,480
148,720	

By-Product Inventory

by-product inventory is not recorded under Method 2	

COGS

2,200	
1,338,480	
1,340,680	

Accounts Receivable

2,520,000	
9,000	
2,529,000	

Revenue

	2,520,000
	9,000
	2,529,000

Income statement:

Revenue	2,520,000 + 9,000	$2,529,000
COGS	2,200 + (90,000 x $14.872)	1,340,680
Gross margin		1,188,320

Ending inventory values:

Finished goods inventory – main product	10,000 x 14.872	148,720
By-product inventory		not applic.

Departmental Costing and Cost Allocation

Skill Level:	R/U	A/A
3.1.2.3 Defines, describes and applies departmental costing and cost allocation methods		
a) Explains the purpose, process and behavioural implications of departmental cost allocation and identifies the criteria used in cost allocation decisions	✓	
b) Compares and contrasts the various methods of cost allocations (direct, step-down, reciprocal)	✓	
c) Allocates costs among departments utilizing the reciprocal, step-down and direct methods		✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Purpose of Cost Allocation

Cost allocation is the process of assigning costs to cost objects. Cost objects are any item (e.g. product, division, department) requiring a measure of cost. Costs are allocated for many reasons. Products are costed to determine the value of inventory and cost of goods sold and to make pricing decisions. Costs are assigned to departments/divisions as a means of measuring performance. Cost assignment is also used to motivate managers.

The purposes of cost allocation can be summarized as:

1. Economic decisions, such as pricing, adding/dropping product lines, utilization of scarce resources, etc.

2. Motivation –motivate managers to make efficient use of resources, such as internal legal or computer services

3. External financial reporting – income and assets must be measured according to IFRS. This often requires cost allocations. A prime example is the allocation of fixed costs to inventory.

4. Contractual settings such as cost reimbursement contracts, insurance reimbursement, legal settings requiring a cost valuation and international transfer pricing settings where costs are used to set the transfer price.

Criteria in Cost Allocation Decisions

It is important to recognize that since all cost allocations are arbitrary and since no economic decision requires a cost allocation, management accountants have developed different criteria to guide the choice of a cost allocation method in a decision making setting.

There are four main criteria:

1. Cause and effect – costs are allocated to the cost object (e.g. product, department, etc.) in proportion to the cost object's use of the resource to which the cost relates. For example, a department using a mainframe computer could be assigned its share of the costs of the computer based on the number of hours used.

2. Benefits received – costs are assigned according to the benefits believed to have been received. For example, the costs of a corporate–wide marketing program that enhances the image of the company or its products could be allocated based on sales. Divisions with higher sales levels are assumed to receive greater benefit from the marketing program than divisions with lower sales levels.

3. Ability to bear – allocates costs according to the cost object's ability to bear. For example, corporate head office overhead is often allocated to divisions based on sales or operating income because these divisions have a greater ability to absorb these costs.

4. Negotiation or agreement – allocates costs based on what is considered fair by two or more parties to a contract. These negotiations often reflect benefits received or ability to bear considerations.

Process of Cost Allocation

The process of cost allocation follows four steps:

1. Choose the cost object
2. Examples are products, departments, divisions, contracts, services, etc. Trace direct costs directly to the cost objects. Accumulate indirect costs in indirect cost pools using an organizing framework such as departments or activities.
3. Choose a basis to allocate indirect costs from the indirect cost pools to the cost objects. This cost allocation basis should be the variable thought to drive costs in the indirect cost pool.
4. Allocate costs.
   Allocate indirect costs using the cost allocation basis chosen in Step 3.

Behavioural Implications of Departmental Cost Allocation

Often, costs are allocated as a means of influencing managers' behaviour. For example, head office overhead costs are often arbitrarily allocated to divisions/departments. This ensures divisional managers recognize these costs and may induce managers to make suggestions, which improve efficiency.

Note that cost allocation is not the only means of influencing behaviour, but is one of a variety of methods. Other methods used in conjunction with cost allocation, include: bonus schemes, the budgeting process, head office mandates, special performance awards, etc.

Support Department Allocations

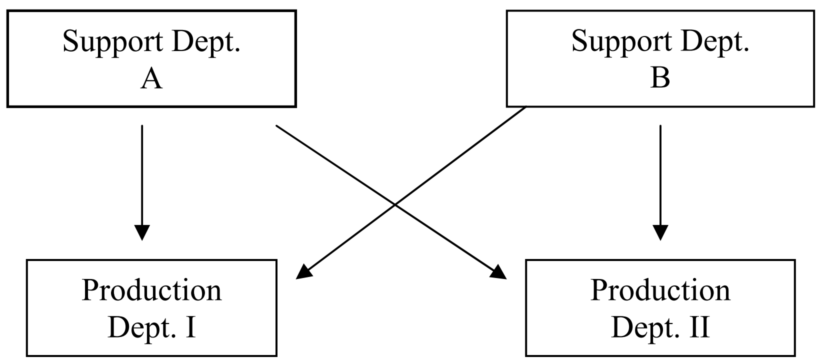
Methods of allocating support department costs:

1. Direct
2. Step-down
3. Reciprocal

Direct Method

Under this method, support department costs are allocated directly to operating departments ignoring any services provided to other support departments:

Allocation of costs:



Steps in applying the direct method:

1. Determine the base to use to allocate support department costs.
   This base should be the estimated cost driver for the services consumed. For example, the cost of a company's cafeteria could be allocated using the number of employees in each operating department that use the cafeteria.

2. Determine the total allocation base used to assign costs.
   This represents the sum of each operating department's allocation base. In the example above, the number of employees in each operating department is summed together to arrive at a total allocation base.

3. Determine each operating department's proportion of the allocation base.
   Using the cafeteria example, this translates into:

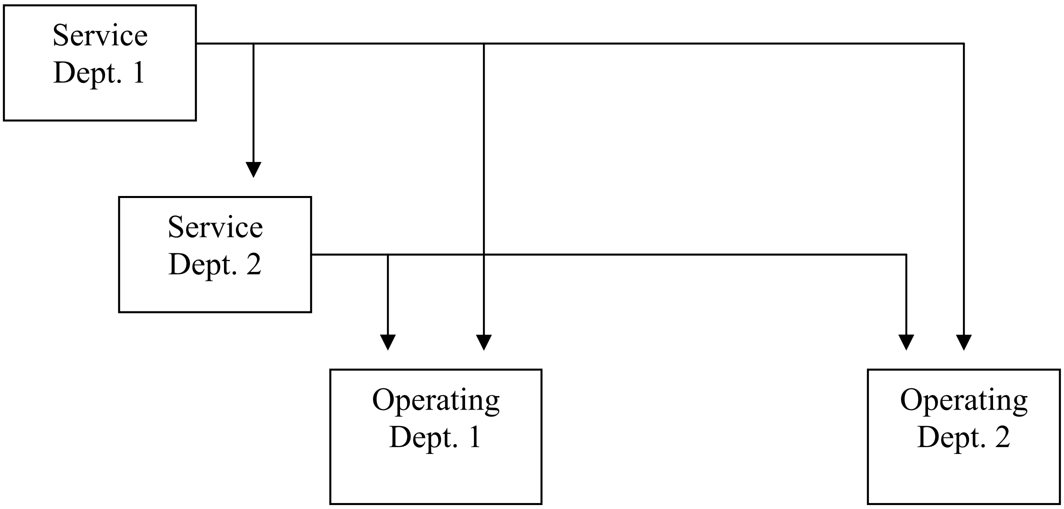
$$\frac{\text{number of employees in operating department}}{\text{total employees included in allocation base}}$$

4. Allocate support department costs based on the proportions determined in Step 3.

A numerical example is provided at the end of this section.

Step-Down method
(also known as Step or Sequential Method)

This method allocates support department costs to support service departments and then to other service or operating departments in a sequential fashion. This method takes into consideration some of the services provided by a service department to other service departments.



Steps in applying the step-down method:

1. Determine the order of allocating support department costs.
   A common approach when doing this is to allocate the costs of the service departments in order of those providing the greatest proportion of their services to other service departments.

2. Determine the base to use to allocate service department costs.
   This step is identical to Step 1 in the direct method.

   In Steps 3-5, only service departments whose costs have not already been allocated are considered in each step.

3. Determine the total allocation base used to assign costs.
   This step is identical to Step 2 in the direct method except costs are allocated to the remaining service departments as well as the operating departments..

4. Determine each department's proportion of the total cost to be allocated.
   This step is identical to Step 3 in the direct method except the departments include both the remaining service departments and the operating departments.

5. Allocate service department costs based on the proportions determined in Step 4.

Reciprocal Method

Unlike the direct and step-down methods, the reciprocal method considers all service department interactions. The reciprocal method begins by developing a set of equations that identify the reciprocal cost of each service department, then each service department's reciprocal cost is allocated to the operating departments. This approach will be illustrated below.

Example of Direct and Step-Down Methods

Colla Manufacturing Company has two support departments – administration and maintenance and two production departments, A and B. Administration costs are allocated based on total labour hours and maintenance costs and allocated based on square footage. Assume the administration department provides services to the maintenance department.

	Administration Department	Maintenance Department	Production Dept. A	Production Dept. B
Overhead costs	$148,000	$120,000	$968,000	$643,000
Total labour hours	12,000	29,200	96,360	166,440
Square footage	950	1,250	3,715	1,445

Direct method:

Allocation of costs:

			Administration Department
			$148,000
Allocated to:			
Production Department A			
$\frac{96{,}360 \text{ LH's}}{(96{,}360 + 166{,}440) \text{ LH's}}$	=	36.66667%	54,267
Production Department B			93,733
$\frac{166{,}440 \text{ LH's}}{(96{,}360 + 166{,}440) \text{ LH's}}$	=	63.33333%	
			0
Unallocated			

			Maintenance Department
			$120,000
Allocated to:			
Production Department A			
$\frac{3715 \text{ Sq. Feet}}{(3715 + 1445) \text{ Sq. Feet}}$	=	71.99612%	86,395
Production Department B			
$\frac{1445 \text{ Sq. Feet}}{(3715 + 1445) \text{ Sq. Feet}}$	=	28.00388%	33,605
			0
Unallocated			

Recap:

	Production Department A	Production Department B
Administration department	$54,267	$93,733
Maintenance department	$86,395	$33,605
	$140,662	$127,338

Alternate method to calculate the allocations – Direct Method

Administrative department:

Cost per LH:

Admin. Dept. cost to allocate	÷ total volume of depts. allocated to =	\$/LH to allocate
148,000	÷ (96,360 LH + 166,440 LH) =	.563166/LH

Admin. cost to be allocated		148,000
<u>Allocated to</u>:		
Production Department A	96,360 x .563166/LH =	54,267
Production Department B	166,440 x .563166/LH =	97,733
	Amount unallocated	0

Maintenance department:

Cost per foot:

Maintenance cost to allocate	÷ total volume of depts. allocated to	
120,000	÷ (3715 Feet + 1445 Feet) =	23.25581/FT

Maintenance cost to be allocated		120,000
Allocated to:		
Production Department A	3715 FT x 23.25581/FT =	86,395
Production Department B	1445 FT x 23.25581/FT =	33,605
	Amount unallocated	0

Step Down Method:

Allocation of costs:

		Administrative Department
		$148,000
Allocated to:		
Production Department A		
$\frac{96{,}360 \text{ LH's}}{(29{,}200 + 96{,}360 + 166{,}440) \text{ LH's}}$	= 33%	48,840
Production Department B		84,360
$\frac{166{,}440 \text{ LH's}}{(29{,}200 + 96{,}360 + 166{,}440) \text{ LH's}}$	= 57%	
Maintenance Department		
$\frac{29{,}200 \text{ LH's}}{(29{,}200 + 96{,}360 + 166{,}440) \text{ LH's}}$	= 10%	14,800
Unallocated		0

		Maintenance Department
Original Overhead cost		$120,000
add: costs allocated from Administration Dept.		14,800
Costs to allocate		$134,800
Allocated to:		
Production Department A		
$\frac{3715 \text{ Sq. Feet}}{(3715 + 1445) \text{ Sq. Feet}}$	= 71.996124%	97,051
Production Department B		37,749
$\frac{1445 \text{ Sq. Feet}}{(3715 + 1445) \text{ Sq. Feet}}$	= 28.003876%	
Unallocated		0

Recap:

	Production Dept. A	Production Dept. B
Administration department.	$48,840	$84,360
Maintenance department.	$97,051 *	$37,749 *
	$145,891	$122,109

* Note that administration costs are included in these amounts as a portion of the total administration costs was allocated to the maintenance department.

Alternate method to calculate the allocations – Step-Down Method

Administrative Department:
Cost per LH:

Admin. dept. cost to allocate	÷ total volume of depts. allocated to =	$/LH to allocate
148,000	÷ (29,200+ 96,360 LH + 166,440 LH) =	.5068493/LH

Administration cost to be allocated to:		148,000
Maintenance department	29,200 x .5068493/LH =	14,800
Production Department A	96,360 x .5068493/LH =	48,840
Production Department B	166,440 x .5068493/LH =	84,360
	Amount unallocated	0

Maintenance Department:

Main Cost to allocate:	
Original overhead cost	120,000
add: costs allocated from Administration department.	14,800
Costs to allocate	$134,800

Cost per foot:

Maintenance cost to allocate	÷ total volume of depts. allocated to	
134,800	÷ (3715 Feet + 1445 Feet) =	26.124031/FT

Maintenance cost to be allocated		134,800
Allocated to:		
Production Department A	3715 FT x 26.124031/FT =	97,051
Production Department B	1445 FT x 26.124031/FT =	37,749
	Amount unallocated	0

Reciprocal Method

The reciprocal method begins by developing a reciprocal cost equation for each service department. The reciprocal cost equation includes the service department's direct cost plus its share, based on the relative amount of services consumed, of the other service departments' reciprocal costs. Ignoring self-service costs does not change the reciprocal cost allocation, so when the reciprocal method is done by hand, self-service costs are ignored.

Continue the Colla Manufacturing Company example and ignoring the self-service costs, the administration department provides 292,000 (29200+96360+166440) service units and the maintenance department provides 6,110 (950+3715+1445) service units.

Here are the reciprocal cost equations for administration department and the maintenance department:

RCADMIN = 148000 + (950/6110)*RCMAINT
RCMAINT = 120000 + (29200/292000)*RCADMIN

We have two equations in two unknowns and can use basic algebra to find:

RCADMIN = $169,290.11
RCMAINT = $136,929.01

These service department reciprocal costs are now allocated to the production departments based on each production department's share of services. Here are the allocation equations.

Service department cost allocations:

To Department A: (3715/6110)*RCMAINT + (96360/292000)*RCADMIN
To Department B: (1445/6110)*RCMAINT + (166440/292000)*RCADMIN

The final service department allocations to the operating departments are:

Department A: $139,121.26
Department B: $128,878.74

Other Costing Systems

Skill level:	R/U	A/A
3.1.2.4 Describes current innovations in costing systems and explains the conditions under which these would be appropriate a) Understands other costing systems (hybrid, project, operations, backflush, etc.)	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Candidates are advised that the topics of hybrid costing, project costing, operations costing and backflush costing have rarely been examined on the Entrance Examination as individual questions. However, these topics have occasionally been included in a theory multiple choice question, where several of these costing methodologies were listed as the answer choices.

Project Costing

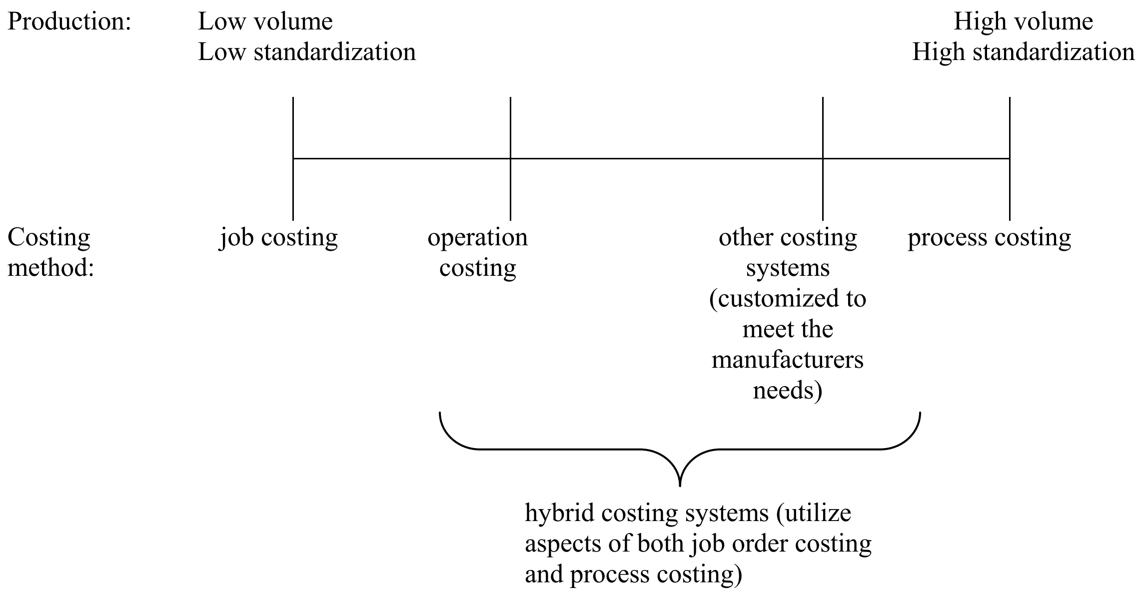
Projects, as opposed to regular production activities, are complex jobs that take months (or years) to complete and involve many departments in an organization. Given the magnitude of projects, to ensure timely and 'on-budget' completion requires management control of the project. Typically, controlling a project involves four aspects: scope, quality, schedule and cost.

Typically, projects are broken into various stages or tasks. Project costing is concerned with the budgeting of these various tasks and tracking actual costs and comparing them to the budget.

Hybrid Costing

An organization's costing system is dependent on the underlying production process. Job order costing is used when the products produced are heterogeneous and process costing is utilized when products are mass produced or in continuous flow production. The two production processes and the underlying costing methodologies, job order and process costing can be considered to be the extreme ends of a continuum. However, production processes often do not fall on either end, but somewhere in between. For example batch processing, which involves producing unique batches of homogenous products, would fall between the two continuums. The costing methods employed by these manufacturers have attributes from both job order costing and process costing. These 'blended' methodologies are called hybrid costing systems.

The production process continuum and the associated costing methodology is depicted below:



Operation Costing

Operation costing (also known as specification costing) is a hybrid-costing system that uses aspects of both job order costing and process costing. It is often used in batch manufacturing. In an operation cost system, direct material costs are traced directly to batches, while conversion costs (labour and overhead) is assigned to products based on an average. Conversion costs are accumulated by each operation and, as a product passes through the operation, an average cost is applied.

Operation costing is best illustrated through an example.

Example:
Lumber company has five operations and Batch 1, which is an order for raw lumber, passes through three of the operations and Batch 2, which is an order for finished lumber, passes through all five:

Operation:	Batch 1	Batch 2
1. Gang saw area	Y	Y
2. Edger saw area	Y	Y
3. Trimming area	Y	Y
4. Planer area	not applicable	Y
5. Packaging area	not applicable	Y

Batch 1 is for 4,000 units while batch 2 is for 6,800 units and the direct material cost for each batch is $9,000 and $15,300, respectively for Batch 1 and Batch 2.

For each operation, it is necessary to calculate a budgeted application rate for the conversion costs:

Operation:	A Estimated annual conversion (DL + OH) costs	B Estimated annual production for each operation, in units	A ÷ B Budgeted conversion cost rate per unit
1. Gang saw area	$1,500,000	1,000,000	1.5000
2. Edger saw area	$800,000	400,000	2.0000
3. Trimming area	$500,000	320,000	1.5625
4. Planer area	$600,000	200,000	3.0000
5. Packaging area	$300,000	200,000	1.5000

The cost of each of the batches can easily be calculated:

		Batch 1		Batch 2	
		Units	$	Units	$
Direct material		4,000	9,000	6,800	15,300
Conversion cost:					
Operation:	Conv. cost application rate				
1. Gang saw area	1.5000	4,000	6,000	6,800	10,200
2. Edger saw area	2.0000	4,000	8,000	6,800	13,600
3. Trimming area	1.5625	4,000	6,250	6,800	10,625
4. Planer area	3.0000		Not appl.	6,800	20,400
5. Packaging area	1.5000		Not appl.	6,800	10,200
	Total	4,000	$29,250	6,800	$65,025

Backflush Costing

JIT manufacturing is a concept that is based on minimizing inventory. In JIT costing, both raw materials and finished goods inventory are kept to a minimum. Reducing inventory levels is achieved by ordering raw materials "just in time" for production and producing finished goods only when the customer's order has been received.

Since inventory is kept to a minimum, the accounting entries associated with JIT can also be kept to a minimum. Under a traditional costing system, journal entries are recorded on a sequential basis as production takes place:

Stage A	Stage B	Stage C	Stage D
Purchase of DM inventory	As production takes place, labour and OH costs are incurred	Production is complete	Sale of product
Journal entries to record DM inventory are recorded	Journal entries to record WIP inventory are recorded	Journal entries to transfer WIP inventory to finished goods inventory are recorded	Journal entries to record the sale of the finished goods inventory are recorded

Since inventories are limited under JIT production, JIT manufacturing often employs a costing method called backflush costing. Backflush costing is a system that omits recording some or all journal entries relating to the production cycle form the purchase of the direct materials to the sale of finished goods. Where journal entries for one or more stages are omitted, the journal entries for a subsequent stage use normal or standard costs to work backward to flush out costs in the cycle for which journal entries were not made. The diagram on the following page illustrates accounting in a backflush system. For simplicity, the illustration assumes standard costs, which are used in a backflush system, are the same as actual costs.

Traditional costing system:

Stage A	Stage B	Stage C	Stage D
Purchase of DM inventory	As production takes place, labour and OH costs are incurred	Production is complete	Sale of product

Stage A

DM inv.	1,950	
Cash		1,950

Stage B

Labour	950	
OH	310	
Cash		1,260
WIP inv.	1900	
DM inv.		1900
WIP	1,260	
Labour		950
OH		310

Stage C

FG inv.	3,160	
WIP inv.		3,160

Stage D

COGS	3,160	
FG inv.		3,160

JIT Company Example 1 – only records inventory entries at Stages A and D

Stage A	Stage B	Stage C	Stage D
Purchase of DM inventory	As production takes place, labour and OH costs are incurred	Production is complete	Sale of product

Stage A

DM inv.	1,950	
Cash		1,950

Stage B

Labour	950	
OH	310	
Cash		1,260

NO WIP entries

Stage C

NO FG inventory entries

Stage D

COGS	3,160	
Labour		950
OH		310
DM inv.		1900

JIT Company Example 2 – only records inventory entries at Stages A, C and D

Stage A	Stage B	Stage C	Stage D
Purchase of DM inventory	As production takes place, labour and OH costs are incurred	Production is complete	Sale of product

Stage A

DM inv.	1,950	
Cash		1,950

Stage B

Labour	950	
OH	310	
Cash		1,260

No WIP entries

Stage C

FG inv.	3,160	
Labour		950
OH		310
DM inv.		1,900

Stage D

COGS	3,160	
FG inv.		3,160

Business Process Re-Engineering

Skill Level:	R/U	A/A
3.1.3 Identifies and describes strategic cost management techniques for a given organization a) Business process re-engineering (BPR) • Describes BPR and explains its relevance for cost management	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Description

Process re-engineering has been defined as:

> "The fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service and speed."
>
> L.J. Krajewski and L.P. Ritzman

Process improvement is the study of processes to determine how improvements can be made. It is not radical, but focuses on minor or greater improvements, but not major changes.

Benefits of process re-engineering:

- productivity gains
- increased employee satisfaction
- enhancements in quality and, more generally, improvement in meeting customers' requirements
- cost reduction

Problems with process re-engineering:

- resistance to change by employees
- may be costly
- if the re-engineering is not successful it can have extremely adverse effects
- re-engineering can result in layoffs for employee
- often there is not sufficient current knowledge of the processes and much time must be spent obtaining this knowledge before re-engineering can take place

Steps in Business Process Re-Engineering

- Establish goals of the process and specifications for performance.

  Goals are developed by studying the existing process, benchmarking (internally and externally), analyzing customer needs and reviewing overall corporate objectives. Compare current performance to these goals; if the goals are not met, re-engineering is required.

- Develop a high-level process map.

  This is a flow chart or map detailing essential sub-processes. Create the chart by starting with customer needs and working backward through the goal of the process, the output required, sub-processes and inputs.

- Develop process maps.

  This is a map or flow chart of each sub-process in the high-level process map. Only activities that are value-added (e.g. contribute to the goal of the process) are included. In addition, key performance measures may be included.

- Conduct pilot study.

  Problems can be identified and resolved before implementation.

- Implement new process.

  During this process, change management is crucial to ensure acceptance by employees.

Process Re-Engineering Tools and Techniques

- Relationship map
  - identifies functions and depicts the relationship between functions, suppliers and customers

- Process map
  - illustrates the sequential order of activities from input to outputs
  - other information, such as performance measures (e.g. cost, quality measures) can be denoted on the map
  - have more detail than relationship maps

- Process chart
  - diagram depicting existing or proposed process
  - used to identify parts of the process that can be improved or eliminated
  - shows details such as movements of employees, equipment or material by plotting:
    - operations – where job is performed
    - transportation between locations
    - inspection of goods
    - delays in the process
    - storage of goods (documents all three – raw material, WIP and finished goods)

- Flow diagram
  - diagram outlining the flow of material, employees and equipment throughout a process

- Ten-P business re-engineering checklist
  - represents a series of questions about a process, such as:
    i) purpose
    ii) procedure
    iii) practice
    iv) participants
    v) pace
    vi) place
    vii) frequency of occurrence
    viii) product
    ix) purchasing
    x) performance

- Throw it away analysis
  - list of activities in a process, followed by questions such as:
    - why perform the activity
    - should the activity be eliminated (i.e. 'thrown away') and what would happen if it was?

- Touched vs. elapsed analysis
  - comparison of actual time to complete a process with that on the process map
  - actual time is determined by sending a product or document through the process and noting where the delays are taking place

- Improvement activities may indicate a need for re-engineering

Activity-Based Management

Skill Level:	R/U	A/A
3.1.3 b) Activity-based management (ABM)		
• Distinguishes ABM from ABC and understands how ABM is used to improve operations and processes, satisfy customers and generate profits	✓	✓
• Describes and applies process value analysis (PVA) (e.g. identifies root causes of problems through driver analysis, identifies non-value added activities, etc.)	✓	✓
• Describes how cost reduction is achieved through activity management	✓	
• Describes activity-based financial performance measurement	✓	
• Distinguishes financial-based from activity-based responsibility accounting with regard to assignment of responsibilities, establishing performance measures and evaluating performance	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Description

Activity-based costing (ABC) is directly linked to activity-based management (ABM). The main purposes of ABC are to:

- Provide costing information on activities and cost objects, and
- Provide information to support re-engineering the business if necessary and attain continuous improvement.

Activities are the building blocks of organizations. Activities are what people do every day. Therefore, if an organization is to change, the change must ultimately be made at the activity level. Activity-based management (ABM) is the process of understanding, re-engineering, measuring and making decisions about activities to put the enterprise on the road to continuous improvement and excellence. It turns out that the information collected when developing an ABC system also reveals an organization's activities and how they are performed. Workers and managers can use this knowledge to make their activities faster, higher quality and more productive. ABM is an ongoing process involving four phases: (1) identify value-added and non-value-added activities; (2) re-engineer the enterprise; (3) benchmark value-added activities; and (4) develop a performance measurement system for continuous improvement.

The Steps

1. Identify value-added and non-value-added activities.

   Value-added activities contribute something that is worthwhile to customers. By definition, customers are willing to pay for value-added activities.

   Value-added activities are of two types. One type adds value to the customer (e.g. painting a car or delivering a shipment on time). The second type is support activities that enable or support the activities that add value to the customer (e.g. paying employees is not of direct concern to customers, but it does satisfy an organizational need).

   Non-value-added activities represent waste. These activities can be reduced or eliminated without decreasing the enterprise's ability to compete and meet customer demands. Common non-value-added activities within the organization are: storing, moving, inspecting and repairing. Armed with a list of non-value-added activities, the organization can create teams to find innovative ways to eliminate, reduce or re-engineer those activities. One of the costliest things a company can do is investing in equipment and people to make non-value-added activities more efficient. The goal is to eliminate them altogether or subject them to a major overhaul, not to make them more efficient.

2. Re-engineer the enterprise.

   Re-engineering is the redesign of how work is done through activities. Because activities are what an organization does, to re-engineer the organization, activities must be re-engineered. Such a radical effort may take several years to be completed successfully in most organizations. The re-engineering of the enterprise involves changing the enterprise to what it should be.

   In some instances, non-value-added activities cannot be totally eliminated. The organization may be tempted to try to make his non-value-added activity more efficient. The focus, however, should be on the root cause of the costs and determining what can be done to reduce these costs. Simplicity is the watchword of re-engineering. Generally, complexity is what drives costs and represents the root cause of costs.

3. Benchmark value-added activities.

   The “should-be" model prepared during the re-engineering phase represents an organization that contains only value-added activities. Just because an activity is value-added, however, doesn't mean it is performed efficiently and effectively. So, the next phase in the ABM process is benchmarking, which involves comparing activities to world-class best practices. Comparisons are made to a similar activity in another company or another part of the organization. The enterprise doing the benchmarking tries to set targets that equal or surpass the best practices benchmark.

4. Develop a performance measurement system for continuous improvement.

   It is necessary to measure the improvements to determine if the expected improvements are actually achieved and to take corrective action when necessary.

Quality Management

Skill Level:	R/U	A/A
3.1.3 d) Total quality management		
• Explains the different concepts of quality (e.g. fitness for use, design, conformance to specifications, customer satisfaction, etc.) and distinguishes total quality management from the traditional approach to quality management	✓	
• Explains and applies various quality management tools for a given organization (e.g. Pareto analysis, fishbone cause-and-effect diagram, scatter diagram, control chart, run chart, process capability analysis, etc.)	✓	✓
3.1.3 e) Costs of quality		
• Describes, distinguishes and calculates the various classifications of costs of quality (prevention, appraisal, internal failure and external failure) and explains the effect each has on the other	✓	✓
• Explains the concept of continuous improvement and the impact it has on reducing the costs of quality	✓	
• Describes the Taguchi loss function and explains its use for management and control of quality	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Perceptions and Definitions of Quality

<u>Definer</u>	<u>Perception</u>	<u>Definition/View</u>
Manufacturer or Service Provider	Conformance	Conformance to required specifications or stated requirements.
Customer/manufacturer or Service Provider	Value	Relationship between quality and price
Customer	Satisfaction	Meeting the customers requirement.
Manufacturer or Service Provider	Design Quality	Building quality features into the product or service (e.g. features that enhance reliability and safety).

Characteristics of Quality

Product quality:

The nine characteristics of product quality are:

- performance – primary product characteristics
- features – “bells and whistles”
- conformance – how well product characteristics match specifications
- reliability –frequency of failure
- durability – length of the product’s life
- serviceability – how easy and fast it is to service or repair the product
- aesthetics – appearance
- perceived quality – reputation and intangibles
- safety – enhancements to improve safety

Service Quality:

The five characteristics of service quality are:

- reliability – the ability of the service provider to perform a service reliably and dependably
- responsiveness – the willingness of the service provider to help customers and provide prompt service
- assurance – the ability to communicate to the customer at a level of competence and to provide the service with the necessary courtesy
- empathy – the approachability and ability to communicate with and understand the customer’s needs
- tangibles – the appearance of the physical facilities, equipment, personnel, documents, etc.

Quality Control, Quality Assurance and Total Quality Management

Total quality management (TQM) has been defined as activities involving everyone in a company (from upper management to clerical staff) in a totally integrated effort toward improving performance. This improved performance is directed towards satisfying goals such as product or service quality, cost, scheduling, employee development and new product development. Ultimately, these activities lead to improved customer satisfaction. The underlying definition of quality in the TQM approach is conformance to specification. That is, did the activity, product or service meet expectations.

Elements of TQM

The elements of TQM are:

- customer
- organizations exist to serve customers and, therefore, TQM must focus on the customer
- customers want features beyond meeting specifications
- an effective TQM system relies on feedback from customers
- customers needs must identified and met
- continual improvement
    - continual process improvement to reduce defects, improve yield and productivity
    - includes enhancement of goods and services
    - if possible, company's should benchmark their processes against other companies or published Good Manufacturing Practices guidelines.
- participation and teamwork
    - for TQM to be effective, top management must actively support TQM initiatives
    - employee training
    - reward employees for suggestions that improve quality
    - use quality circles (a small group that performs quality control activities) and cross-functional work teams

Definition of QC and QA

Quality control – monitoring and controlling the production process to ensure a pre-set level of quality is achieved. This encompasses activities such as quality inspections.

Quality assurance – programs designed to ensure products and services meet quality requirements

Note that these are broad definitions and there are many different definitions used in today's business world. For example, Toyota defines quality assurance as "quality assurance means assuring the quality of the product is satisfactory, reliable and yet, economical for the customer".

Classifications of Cost of Quality and their Inter-Relationships

Quality Process

Description

Prevention

Activities to prevent defects (e.g. improving manufacturing process, training employees, implementing TQM programs, preventative maintenance). Prevention costs are the costs of these activities.

Detection
(detection and appraisal)

Activities to detect defects (e.g. quality inspections). Detection costs are the costs of these activities.

Detection controls are ineffective

Detection controls are effective

External failure:
- defects are not identified and the the product is shipped to the customer
-external failure costs include:
  - warranty costs
  - customer complaints department
  - returns department
  - potential product liability lawsuits
  - lost opportunity for future sales due to lost repeat business and diminished reputation

Internal failure:
-defects are produced but are identified before shipping to customer
-internal failure costs include:
  - rework or replacement
  - scrap disposal
  - downtime

Cost of Quality - Conformance and Non-Conformance Costs

Conformance costs – includes prevention and detection costs. Prevention and detection focuses on conformance to specifications.

Non-conformance – internal and external failure costs. These are the costs of non-conformance to specification.

There are two schools of thought with respect to conformance and non-conformance cost. The first is there is a trade-off between conformance and non-conformance costs. That is, by spending more on prevention and detection activities, internal and external failure costs can be reduced. In this view, spending on prevention and detection activities are increased until they exceed the reductions in internal and external failure costs. The second school believe that total quality costs include indirect and intangible costs and the only means of eliminating or minimizing these costs is to eliminate external and internal failures. This implies that implicit external failure costs (for example loss of company reputation from poor quality) are so large that, in turn, a company should aim for zero defects.

Quality Assurance in Services

Since services are often labour intensive, enhancing quality usually means additional employees, which can be expensive. However, external failure costs can be high in service industries, which means service providers must compare increased labour costs to external failure costs.

Measures of Quality

For a quality program to be successful, objective measurements of performance must be designed and compared to target performance levels. Differences and acceptable tolerance levels established define instances of quality failures. Measures vary from company to company and depend on the product or service offered.

Examples of measures of quality:

Manufacturer
- defect rate
- volume or cost of rework and scrap
- volume or cost of returned items
- delivery time

Financial institutions
- number of complaints
- waiting time for service
- volume or value of customers closing accounts
- changes in value or volume of deposits or loans

Internet service providers
- amount of down time
- number of customer complaints
- change in number of customers
- number of customers logging on
- number of customers receiving busy signals (e.g. due to lack of capacity)

Quality Management Tools

Statistical Quality Control (SQC)

The process of using statistical techniques to assess quality – examples:
- statistical process control (SPC)
  - use of statistical methods to measure processes (to ensure they are working properly)
- acceptance sampling
  - use of statistical sampling methods to ascertain whether to accept or reject a population (e.g. batch)
  - for example, a sample of 100 products is selected from a batch of 10,000 products and the 100 items are subjected to quality control tests. Whether to accept or reject the 10,000 items depends on the outcome of the quality tests on the 100 items.

Statistical Process Control (SPC)

SPC involves monitoring goods or services to determine whether there are changes that impact quality. In SPC, charts are used to plot the number or percent of defects. This is done in successive samples, so changes are readily apparent and corrective action can be taken.

Steps in SPC:
1. Process is defined and the quality control measurement (e.g. defect rate, waiting time) is determined.
2. A control graph is drawn up, which includes:
   - centre line
   - upper control limit
   - lower control limit

3. Random samples are taken and the quality control measurement used (e.g. defect rate, waiting time) is measured and plotted on the control graph. Any observation point that falls above the upper control limit or below the lower control limit or sequence of observations that show a trend to the process going out of control is considered indicative of a problem (sometimes referred to as "out of control"). In these cases, the process should be halted and the cause of the problem identified and repaired.

Other Statistical Quality Control Tools

- Check sheet or tally sheet – a tool for keeping track of the number of times a recurring quality problem occurs
- Flowchart – a diagram identifying the steps in a process, which allows the reader to identify places where problems might occur
- Scatter diagram – a graph that shows the relationship between two variables in a process
- Histogram and other graphical methods that show the distribution of the frequency of various quality problems
- Pareto chart – a bar chart that shows the number or percentage of various problems individually, allowing improvement efforts to be focussed on the problems that occur most often
- Cause-and-effect diagram (fishbone diagram, Ishikawa diagram) – a chart for identifying possible causes of quality problems in which the spine bone represents the major cause of the problem and the connecting bones represent contributing causes

Target Costing

<table>
<tr><td>Skill level:</td><td>R/U</td><td>A/A</td></tr>
<tr><td>3.1.3 f) Target costing
• Distinguishes traditional costing from target costing and explains how target costing relates to target pricing
• Explains the concepts of value engineering, cost incurrence and locked-in costs in the target costing framework
• Computes the target cost of a product</td><td>
✓
✓
</td><td>

✓</td></tr>
<tr><td>3.2.1.6 Describes innovative ways to improve the value proposition (e.g. new product development)
d) Describes the impact of appropriate strategic cost management initiatives (e.g. target costing, lifecycle costing) on improvements to the value proposition</td><td>✓</td><td>✓</td></tr>
<tr><td>R/U = Remembering and Understanding A/A = Application and Analysis</td><td></td><td></td></tr>
</table>

Target Costing

This method applies when a company knows the price to charge (e.g. through market research, competitor's prices, etc.) and must ensure the product costs are such that the product can meet customer requirements and be sold profitably at that price. A target cost is set based on the price and desired mark-up. If the target cost is not met, the product is refined by eliminating or changing features of the product while, at the same time, ensuring the product still meets customer requirements. This process is repeated until the target cost is met. The costs included in target costing are all costs relevant to the product being developed. In addition, companies often include a return on the capital investment required to produce the product in the target cost.

Example of target costing:

Basic data for Product X, a new product to be developed:

Selling price	$52
Estimated sales volume	31,000
Investment required to produce Product X	$1,750,000
Desired return on investment	15%
Selling and administrative costs associated with Product X	$475,000

Target cost:

Estimated sales (31,000 x $52)		$1,612,000
Less: required mark-up:		
Return on investment ($1,750,000 x 15%)	$262,500	
Selling and administration	$475,000	$737,500
Total cost to manufacture 31,000 units of Product X		$874,500

Target cost per unit = $874,500 ÷ 31,000
= $28.21 per unit

Theory of Constraints

Skill Level:	R/U	A/A
3.1.3 g) Theory of constraints (TOC)		
• Describes the concept of TOC and explains the operational measures of system performance defined by TOC (e.g. throughput contribution, investments (inventory), operating costs)	✓	
• Explains and performs a TOC analysis to improve system performance (e.g. drum-buffer and rope)	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Theory of Constraints

The theory of constraints focuses on limitations due to resource constraints. Its approach to scheduling is to first focus on the processes where bottlenecks occur and then schedule the other activities such that they alleviate the bottleneck. Some processes or resources cause bottlenecks and, therefore, they control the flow of products through the system. To reduce the impact of these bottlenecks, processes or resources should always have raw material readily available, spend as much time as possible on productive activities, be fully staffed and should be the focus of continuous improvement. Synchronous manufacturing is the application of the theory of constraints and optimized production is the initial systems (scheduling and software) that applied the theory of constraints.

Candidates should note that the theory of constraints is also included in common management accounting terms (the first topic in this manual).

Kaizen Costing and Kaizen Budgeting

Skill level:	R/U	A/A
3.1.3 h) Kaizen costing • Explains the kaizen cost reduction process and the concept of kaizen standards	✓	
3.1.4.1 c) Describes kaizen budgeting and activity-based budgeting and explains the merits of each	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Note that each of the CMA Competency Map requirements listed above have been extracted from different subtopics in the performance measurement section of the CMA Competency Map to facilitate efficient studying.

Candidates are advised that this topic has rarely been examined on the Entrance Examination as an individual question. However, it has occasionally been included in theory multiple choice questions where it was one of five choices.

Kaizen Costing

Kaizen is the Japanese word for continuous improvement. Kaizen costing is the application of continuous improvement methods to reduce the cost of a process or group of processes by a targeted amount. Note that kaizen costing does not focus on individual products, but rather on the organizations' processes.

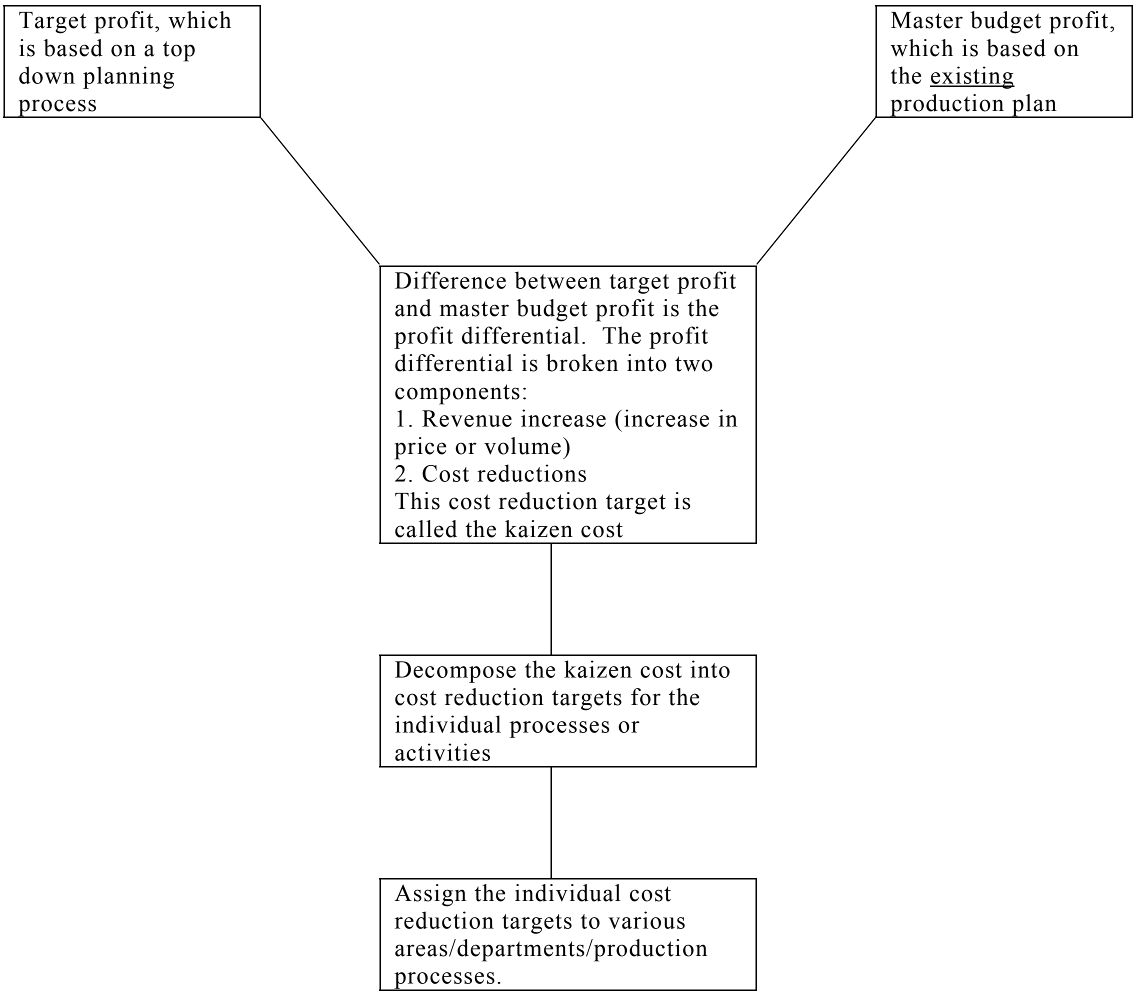
The goal of kaizen costing is to drive small continuous improvements in the existing process as opposed to innovation. In other words, creating new products or completely reengineering the production process, which radically change the existing process and/or require large capital investment, are not the focus of kaizen costing. Kaizen costing focuses on small continuous improvements only.

The steps in kaizen costing are:

1. Identify a cost reduction target;
2. Decompose the overall cost reduction target into components; and
3. Assign the component cost reduction targets to responsibility units within the kaizen team.

The first step in identifying a cost reduction target is to calculate the 'profit differential', which is the difference between the target profit and the master (static) budget profit. This differential is then broken into two components – profit increase due to revenue generating opportunities (e.g. increases in price or volume) and profit increase due to cost reductions. Kaizen costing focuses on this second component, profit increase due to cost reductions. This cost reduction target is called the kaizen cost.

The process of kaizen costing is depicted below:



 Please report errors or omissions to studymanual_errata@cmaontario.org

Kaizen budgeting involves incorporating the individual cost reduction targets into a budget for the various departments that have the responsibility for meeting the targeted cost reductions. The variance of actual to kaizen budget quickly identifies whether the cost reduction targets are being achieved. Since the cost reduction targets are achieved through continuous improvement, kaizen budgeting is explicitly incorporating continuous improvement into budgeting. For example, a kaizen budget could be:

	Budgeted labour hours to produce machine parts		
Period	Regular Part	Heavy duty part	
Q1 Jan. – March	4.00	6.00	The budgeted direct labour hours decrease over time as the continuous improvements in production processes are made.
Q2 April – June	3.90	5.85	
Q3 July – Sept.	3.80	5.70	
Q4 Oct. – Dec.	3.70	5.55	

If these budgeted labour hours are not achieved, there will be unfavourable variances. It is obvious that the benefits of a kaizen budgeting system include greater efficiency and decreased costs.

Kaizen costing example:

A sawmill has a kaizen cost target of $1,500,000. Five departments have been identified as areas where cost reduction could be achieved. These are:

	Production area	Production activity	Annual cost of the department (excludes kaizen cost target reduction)
1.	Gang saw area	where trees are cut into a rectangular shape or cant	$15,000,000
2.	Edger saw area	where the cant is cut into individual pieces	$8,000,000
3.	Trimming area	where the individual pieces are cut into their final length	$5,000,000
4.	Planer area	where finishing operations are performed on the lumber	$6,000,000
5.	Packaging area	where the final products are packaged and wrapped for shipping	$3,000,000

After studying each area, it is determined the following cost reduction targets should be assigned:

	Production area	Cost reduction target
1.	Gang saw area	$300,000
2.	Edger saw area	$200,000
3.	Trimming area	$400,000
4.	Planer area	$200,000
5.	Packaging area	$400,000

To achieve these cost reduction targets, the areas could undertake the following activities:

	Production area	Cost reduction activities
1.	Gang saw area	design or align a laser sighting mechanism that provides information to a computer that controls the gang saw so the saw will cut the tree optimally, thereby improving yield and reducing costs for a given level of output
2.	Edger saw area	improve the saw's feed mechanism so the cant is held firmly while it is cut, thereby improving yield and quality
3.	Trimming area	design a system to align the wood pieces as they are trimmed, thus reducing handling time and improving yield
4.	Planer area	design a system to identify when the planer blades are becoming dull so they can develop an optimal balance between set up costs as blades are changed and the cost of downgrades resulting from wood being damaged by dull blades
5.	Packaging area	the packaging crew might identify the optimal amount of packaging for each product in order to provide a balance between losses from products damaged in shipment and packaging costs

The idea in all these examples is that operations personnel continuously look for improvements to the existing process.

Product Life-Cycle Costing

Skill level:	R/U	A/A
3.1.3 i) Life-cycle costing		
Describes life-cycle costing and the components of a product's life-cycle costs	✓	
Explains the role of life-cycle costing in budgeting and pricing decisions	✓	
3.2.1.6 d) Describes the impact of appropriate strategic cost management initiatives (e.g. target costing, life-cycle costing) on improvements to the value proposition	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Note that each of the CMA Competency Map requirements listed above have been extracted from different subtopics in the performance management section of the CMA Competency Map to facilitate efficient studying.

Product Life Cycle Costing

Life-cycle costing is the practice of estimating and accumulating costs over a product's lifetime. This allows planners to anticipate a product's costs over each phase of its lifetime.

Note that the term "product" refers to a good or a service, not just products.

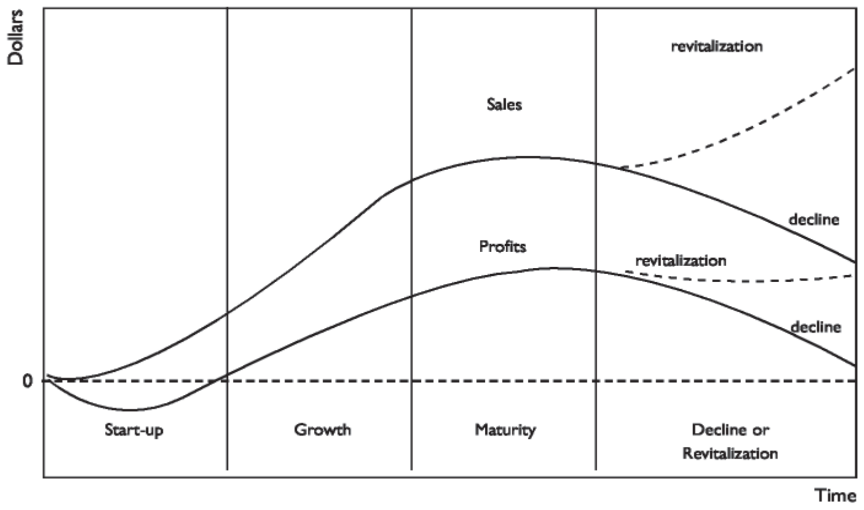
There are five distinct phases in a product's life-cycle:

1. Planning and development;
2. Introduction and growth;
3. Maturity;
4. Decline; and
5. Abandonment or renewal.

These phases and the sales, costs and profits associated with them can be depicted as:

Figure 3500-1

The Relationship Between Product and Profit Life-Cycles



Source; Figure 3500-1 CMA Canada Management Accounting Standard Life Cycle Costing.

Product life-cycle costing is particularly valuable for products that create significant cost burdens at discrete points, rather than continuously during the product's life. Examples include planning and development costs for a new jet aircraft and decommissioning costs for a nuclear generating facility.

Because different types of costs tend to predominate in different phases of the product life-cycle, by identifying the timing and nature of significant costs in advance, organizations can develop more effective means of budgeting and controlling these costs.

For example, research and development costs tend to predominate during the product's planning and development phase; whereas, warranty and service costs tend to predominate during the late stages of product maturity when the greatest number of products are in the customer's hands.

Life-cycle cost, typically include the following general product costs:
1. Design costs;
2. Development costs;
3. Introduction costs;
4. Manufacturing costs;
5. Selling and logistical costs;
6. Service and warranty costs; and
7. Abandonment costs

While the primary role of life-cycle costing is to support, during the product planning stage, the analysis of the product's lifetime profitability, life-cycle costing information also helps planners control costs more effectively since it focuses on cost behaviour during each unique phase of the product life-cycle.

Budgeting

Skill Level:	R/U	A/A
3.1.4.1 Identifies and describes the different types of budgets		
a) Explains the role of budgets and describes the features of the budgeting process	✓	
b) Describes various types of budgets and their components (e.g. master, revenue, cash, capital, operating, discretionary cost, etc.)	✓	
3.1.4.2 Identifies the information inputs needed to prepare the different types of budgets		
a) Describes the role of sales forecasts, interest rates, exchange rates, probabilities and other inputs in the preparation of budgets	✓	
b) Prepares various types of budgets for a given organization (e.g. master, revenue, cash, purchases, capital, marketing, pro forma financials, etc.)		✓
c) Prepares an analysis of the impact of investing and borrowing decisions on cash flow and budgeting		✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Sales, Discretionary Cost and Operating Budget

Sales Budget

This budget is usually the first budget prepared as estimated sales volume drives most of the other budgets, such as the production or cash budget. This budget includes the estimated quantity and price of each product to be sold.

Methods of estimating sales:

1. Statistical forecast – a forecast is made based on historical sales levels, general market and business conditions.
2. Opinions of internal experts – consultations with key executives and/or salespeople are used to forecast sales.
3. Analysis of factors influencing sales – this represents a managers "best guess" after analyzing factors such as:
   - historical sales levels and pricing
   - economic and market conditions
   - market research
   - planned marketing efforts
   - performance of sales force
   - competitor actions
   - seasonality of products
   - availability of capacity

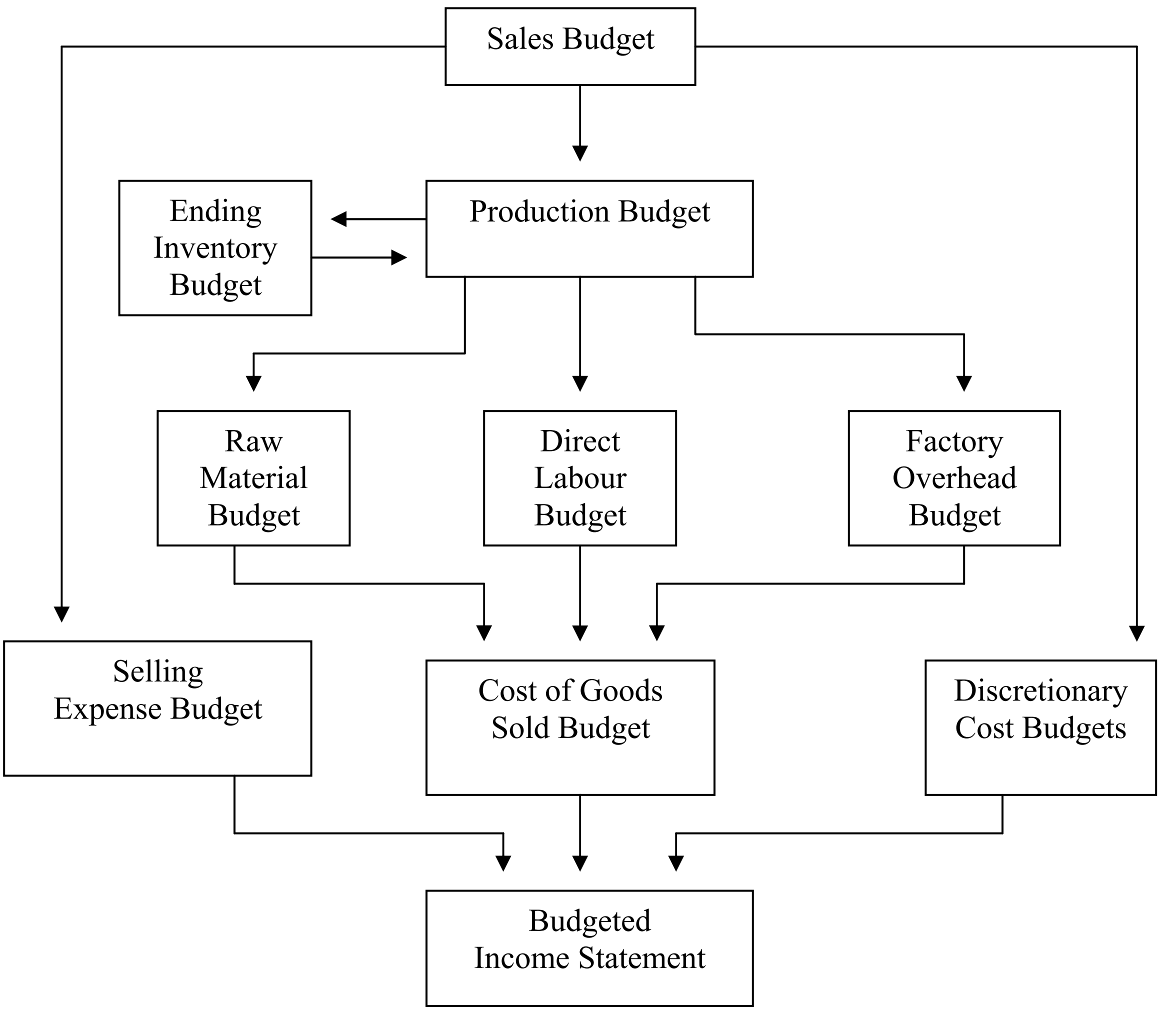
Discretionary Cost Budget

Discretionary costs are costs that arise from periodic decisions to spend in certain areas. There is no relationship between the amount spent on discretionary costs and revenue or production levels.

Generally, discretionary cost decisions are made on a yearly basis. As these costs are yearly and there is no cause and effect relationship, these costs are normally treated as period costs. Examples of discretionary costs are research and development, marketing and training.

Operating Budget

The operating budget is a budget encompassing many other budgets and normally covers a one year period. It is the total expectations from operations and is ultimately expressed as the income statement. The operating budget "rolls up" the following budgets:



Types of Budgets

Annual Budget

A budget for the next year. It is often separated into quarters or months. This budget is not updated.

Rolling Budget

The rolling budget is also known as a continuous or a perpetual budget. This budget is constantly updated – a month or quarter in the future is added as the month or quarter just ended is dropped. This type of budgeting requires constant planning, which can result in better decisions regarding use of available resources.

Five Year Budget

This budget covers a five year time span. It includes operating budgets for each of the next five years, capital and cash budgets. A capital budget is the budget for capital acquisitions, such as land, buildings and capital equipment. If often extends over a long period into the future, such as 10, 20 or 30 years. The capital budget applicable to the next five years is included in the five year budget.

The Cash Budget

Cash budgets are a statement of expected cash inflows and outflows over a specified period. Often the cash budget is categorized into monthly periods, which allows greater monitoring and control of cash levels.

The cash budget must be prepared after the operating budget and the capital budget. The information in each of these budgets is required to determine cash flows from operations and capital investments.

Cash budgets are a useful tool and are often used by managers. The cash budget allows a manager to determine shortfalls in cash and, therefore, can arrange financing before the shortfall occurs. Conversely, in periods of surplus cash, the manager can plan short-term investment strategies, which result in higher investment income.

The cash budget is broken into four sections:

1. Cash receipts
2. Cash disbursements
3. Excess or deficiency (calculated as cash receipts less cash disbursements)
4. Financing

Cash Receipts

This section represents cash inflows. Most cash inflows will be from sales. If customers are allowed to purchase on account, the change in accounts receivable must be considered. Cash receipts are calculated as:

	Impact on Cash	
A/R at end of prior period	increase	XX
A/R at end of current period	(decrease)	(XX)
Increase (decrease) in cash flows from A/R		XX
Sales during period	increase	XX
Cash inflow from sales increase (decrease)		XX

Another method of calculating this is:

	Impact on Cash	
Sales during period	increase	XX
A/R from prior period collected	increase	XX
		XX
A/R from sales during current period	(decrease)	(XX)
Cash inflow from sales increase (decrease)		XX

Example of cash receipt section:

Sales during period	$4,000
A/R at end of prior period	1,000
A/R at end of current period	1,500

Cash inflow from sales:

Method 1

	Impact on Cash	
A/R at end of prior period	increase	$1,000
A/R at end of current period	(decrease)	(1,500)
Increase (decrease) in cash flow from A/R		(500)
Sales during period	increase	4,000
Cash inflow from sales	net increase	3,500

Method 2

	Impact on Cash	
Sales during period	increase	$4,000
A/R from prior period collected	increase	1,000
		5,000
A/R from current period sales	(decrease)	(1,500)
Cash inflow from sales	net increase	3,500

Cash Disbursements

This section includes all cash outflows, except those associated with financing. Examples of cash payments include direct materials, wages and salaries, overhead, capital purchases, dividend payments and income taxes. Differences in accounts payable must be included in calculating cash outflows:

	Impact on Cash		
A/P at end of current period	increase	XX	
A/P at end of prior period	(decrease)	(XX)	
Increase (decrease) in cash from A/P		XX	
Purchases in current period	(decrease)	(XX)	
Cash outflow from purchases	net (decrease)	(XX)	*

* This amount should be negative (i.e. should be a decrease, which is why there are brackets around the number) as it represents outflows.

The second method is calculated as:

	Impact on Cash		
Purchases during period	(decrease)	(XX)	*
A/P from prior period paid	(decrease)	(XX)	*
		(XX)	*
A/P at end of current period	increase	XX	**
Cash outflow from purchases	net (decrease)	(XX)	

* These amounts are negative as they represent cash outflows.
** This amount is positive as it represents purchases not yet paid, which is a source of cash.

Example of cash disbursements section:

Basic data:

Purchases (or disbursements) during period	$15,000
A/P at end of prior period	3,600
A/P at end of current period	4,200

Cash outflow from disbursements:

Method 1:

	Impact on Cash	
A/P at end of current period	increase	$4,200
A/P at end of prior period	(decrease)	(3,600)
Increase (decrease) in cash from A/P		600
Purchases in current period	(decrease)	(15,000)
Cash outflow from purchases increase (decrease)		$(14,400)

Method 2

	Impact on Cash	
Purchases during period	(decrease)	($15,000)
A/P from prior period paid	(decrease)	(3,600)
		(18,600)
A/P at end of current period	increase	4,200
Cash outflow from purchases increase (decrease)		$(14,400)

Excess or Deficiency

This represents the total cash plus receipts, less cash disbursements plus any minimum cash balance required. Some companies require a minimum cash balance to ensure funds are always available to pay disbursements.

Financing Section

This section includes cash inflow from borrowing, cash outflow from loan repayments and interest on these loans.

Other Information

The cash budget begins with the beginning cash balance. Frequently, accounting students fail to include the beginning cash balance, which results in an inaccurate ending cash balance.

Example of a Cash Budget

XYZ Company
Cash Budget
for the quarter ended June 30, 2000

		Q1	Q2
Cash balance, beginning		$15,100	$30,680
Add cash receipts (Schedule 1)		42,200	55,030
Total cash available	A	57,300	85,710
Less: cash disbursements			
Cash disbursements from operations (Schedule 2)		22,100	28,900
Income taxes		7,520	7,520
Equipment purchases		30,000	---
Dividends		4,000	4,000
Total disbursements	B	63,620	40,420
Excess (deficiency) of total cash available over total disbursements	A - B	(6,320)	45,290
Financing:			
Borrowings (at end of period) (Note 1)		37,000	---
Interest on borrowings (at end of period) (Note 2)		---	(1,110)
Repayments (at end of period) (Note 3)		---	(14,000)
Total financing		37,000	(15,110)
Cash balance, ending		$30,680	$30,180

Note 1: The company requires that its cash balance be kept at a minimum of $30,000 at all times. Therefore, assuming the company can only borrow and repay in $1,000 increments, the company must borrow $37,000 ($30,000 + $6,320 = $36,320 rounded to $37,000). Assume the interest on this loan is 12% per annum.

Note 2: Interest payments on borrowings:

	Q2	
Amount borrowed	$37,000	
Interest rate per annum	12%	
Interest for the year	$1,680	
Period of time outstanding	3/12	months
	$1,110	

Note 3: Since the company wishes to keep its cash balance at a minimum of $30,000, the amount of repayment in Q2 is $45,290 – $1,110 = $44,180 – $30,000 = $14,180. If $14,000 is repaid, then the ending cash balance becomes $44,180 – $14,000 = $30,180.

Schedule 1 – cash receipts from sales

	Q1	Q2
Sales during period	$41,200	$56,830
A/R from prior period collected	10,600	9,600
	51,800	66,430
A/R from current period sales	(9,600)	(11,400)
Cash inflow (outflow) from sales	42,200	55,030

Note that the A/R at the end of Quarter 1 ($9,600) is collected in Quarter 2, and is, therefore, included in Quarter 2.

Schedule 2 – cash disbursements from purchases

	Q1	Q2
Purchases during period	($24,000) *	($27,300) *
A/P from prior period paid	(1,300) *	(3,200) *
	(25,300) *	(30,500) *
A/P at end of current period	3,200 **	1,600 **
Cash inflow (outflow) from purchases	(22,100)	(28,900)

* These amounts are negative as they represent cash <u>outflows</u>.
** These amounts are positive as they represent unpaid purchases, which is a source of cash.

Note that A/P at the end of Quarter 1 is paid in Quarter 2 and, therefore, is included in Quarter 2.

The Master Budget

The budgets listed are prepared separately and in sequential order. All of these budgets taken together, along with the capital budget, are the master budget.

Budgets included in the master budget:

1. Sales budget, including cash receipts
2. Production budget
3. Direct material budget, including cash payments for raw materials
4. Direct labour budget
5. Manufacturing overhead budget
6. Ending finished goods inventory budget
7. Selling and administrative expense budget
8. Discretionary cost budgets, such as research and development
9. Cash budget
10. Budgeted income statement
11. Budgeted balance sheet

Sales Budget

Example of a sales budget, including cash collected:

ABC Company
Sales Budget
for the year ended December 31, 2000

	Q1	Q2	Q3	Q4	Total
Expected sales in units	65,000	58,000	40,000	43,000	206,000
Selling price per unit	x $40	x $40	x $40	x $40	x $40
Total sales	$2,600,000	$2,320,000	$1,600,000	$1,720,000	$8,240,000

Schedule of Expected Cash Collections:

	Q1	Q2	Q3	Q4	Total	
Accounts receivable, beginning of year	$370,664	$92,666	---	---	$463,330	
First quarter sales	1,950,000	520,000	$130,000	---	2,600,000	
Second quarter sales	---	1,740,000	464,000	116,000	2,320,000	
Third quarter sales	---	---	1,200,000	320,000	1,520,000	*
Fourth quarter sales	---	---	---	1,290,000	1,290,000	**
	$2,320,664	$2,352,666	$1,794,000	$1,726,000	$8,193,330	

Note: In the quarter of sale, 75% of total sales is collected, in the quarter after sale, 20% is collected and the remaining 5% is collected in the second quarter after the quarter of sale.

* Total sales = $1,600,000 less $1,420,000 = $80,000 or $1,600,000 x 5% collected in the first quarter of the next period.

** Total sales = $1,720,000 x 75% collected = $1,290,000

Ending accounts receivable:

From Q3 sales	=	$1,600,000 x 5%	=	$ 80,000
From Q4 sales	=	$1,720,000 x 25%	=	430,000
				$510,000

The Production Budget

This is a budget, in units, of production for the year. It relies on the sales budget, as estimated sales levels drive production levels. In addition, planned inventory levels must be incorporated into the production budget.

Example:

ABC Company
Production Budget (in units)
for the year ended December 31, 2000

	Q1		Q2	Q3	Q4	Total
Expected sales level	65,000		58,000	40,000	43,000	206,000
Add: planned ending finished goods inventory	11,600		8,000	8,600	14,000	14,000
Total units required	76,600		66,000	48,600	57,000	220,000
Less: beginning finished goods inventory	13,000	*	11,600	8,000	8,600	13,000
Units to be produced	63,600		54,400	40,600	48,400	207,000

* 20% of expected sales level of 65,000 were produced in the prior quarter (65,000 x 20% = 13,000).

Note: Planned ending finished goods inventory is 20% of the next quarters' sales. For example, the planned ending finished goods inventory for quarter 1 is quarter two sales x 20% or 58,000 x 20% = 11,600.

Assume that sales for quarter 1 in the subsequent year are expected to be 70,000 units, which results in 14,000 units as the planned ending inventory in quarter 4 (70,000 x 20% = 14,000).

Direct Materials Budget

Once production levels have been determined, a budget for direct materials can be prepared. Often companies will keep extra raw material supplies on hand for the next quarter. When preparing a direct materials budget, companies often include a budget of the expected cash disbursements for direct material purchase.

Example:

ABC Company
Direct Materials Budget
for the year ended December 31, 2000

	Q1	Q2	Q3	Q4	Annual
Units to be produced (see production budget)	63,600	54,400	40,600	48,400	207,000
Direct material required per unit (in kgs)	x 4	x 4	X 4	X 4	x 4
Production needs (in kg)	254,400	217,600	162,400	193,600	828,000
Add: required ending raw materials (in kg)*	32,640	24,360	29,040	40,800 **	40,800
Total raw material required (kg)	287,040	241,960	191,440	234,400	868,800
Less: beginning raw materials (kg)	38,160	32,640	24,360	29,040	38,160
Raw material to be purchased (kg)	248,880	209,320	167,080	205,360	830,640
Cost of raw material per kg	$1.40	$1.40	$1.40	$1.40	$1.40
Cost of raw materials	$348,432	$293,048	$233,912	$287,504	$1,162,896

Notes:
* Required ending raw material is 15% of the next quarters production. For example, ending raw material inventory at the end of quarter 1 equals 217,600 x 15% = 32,640.
** Assume Q1 production the next period is 68,000 units (68,000 x 4 = 272,000 x .15 = 40,800)

Schedule of Expected Cash Disbursements

	Q1	Q2	Q3	Q4	Annual
Accounts payable, beginning	$116,664	---	---	---	$116,664
First quarter purchases	209,059	$139,373	---	---	348,432
Second quarter purchases	---	175,829	$117,219	---	293,048
Third quarter purchases	---	---	140,347	$93,565	233,912
Fourth quarter purchases	---	---	---	172,502	172,502
Total Cash Disbursements	$325,723	$315,202	257,566	$266,067	$1,164,558

Note: 60% of a quarter's purchases are paid in the quarter of purchase and 40% is paid in the next quarter.

Ending accounts payable:
Q4 purchases $287,504 x 40% = $115,002

Ending raw material inventory:
Q4 required ending RM inventory 40,800 kg x $1.40/kg = $57,120

The Direct Labour Budget

This budget is for labour costs. The production information in the production budget is required to produce this budget.

Example:

ABC Company
Direct Labour Budget
for the year ended December 31, 2000

	Q1	Q2	Q3	Q4	Annual
Units to be produced (see production budget)	63,600	54,400	40,600	48,400	207,000
Direct labour hours required per unit	x .6	x .6	x .6	x .6	x .6
Total labour hours required	38,160	32,640	24,360	29,040	124,200
Direct labour cost per hour	x 11.25	x 11.25	x 11.25	x 11.25	x 11.25
Total direct labour cost	$429,300	$367,200	$274,050	$326,700	$1,397,250

Factory (or Manufacturing) Overhead Budget

This budget includes all costs of production other than direct materials or direct labour. It is important to separate these costs between fixed and variable. This is necessary to determine the fixed overhead rate to apply to units produced. When preparing this budget, some companies include a calculation of cash disbursements for manufacturing overhead and this information is used in the cash budget.

Example:

The variable factory overhead rate is $3 per direct labour hour. The total fixed factory overhead for the year is estimated to be $496,800 and is applied based on direct labour hours.

$$\text{Predetermined fixed factory overhead} = \frac{\text{total estimated fixed factory overhead}}{\text{total estimated direct labour hours}}$$

$$= \frac{\$496{,}800}{124{,}200 \text{ (see DL budget)}}$$

$$= \$4 \text{ per DLH}$$

ABC Company
Manufacturing Overhead Budget
for the year ended December 31, 2000

	Q1	Q2	Q3	Q4	Annual
Budgeted direct labour hours (per direct labour budget)	38,160	32,640	24,360	29,040	124,200
Variable manufacturing overhead @ $3 /DLH	$114,480	$97,920	$73,080	$87,120	$372,600
Fixed manufacturing overhead @ $4 /DLH	152,640	130,560	97,440	116,160	496,800
Total budgeted overhead	$267,120	$228,480	$170,520	$203,280	$869,400
Less: non-cash overhead costs					
Amortization	25,000	25,000	25,000	25,000	100,000
Cash disbursements for overhead	$242,120	$203,480	$145,520	$178,280	$769,400

Ending Finished Goods Inventory Budget

This budget uses the information from the following budgets: production, direct materials, direct labour and manufacturing overhead. This budget calculates the cost of goods sold and ending finished goods inventory, which are needed for the budgeted income statement and budgeted balance sheet.

Example:

ABC Company
Ending Finished Goods Inventory Budget
for the year ended December 31, 2000

Production Inputs	Quantity	Cost		Total
Direct materials	4 kilos	$1.40	per kilo	$5.60
Direct labour	.6 hours	$11.25	per hour	6.75
Variable manufacturing Overhead	.6 hours	$3	per DLH	1.80
Fixed manufacturing overhead	.6 hours	$4	per DLH	2.40
				$16.55 per unit

Budgeted finished goods inventory:	
Ending finished goods inventory in units (per production schedule)	14,000
Total production cost per unit	x 16.55
Ending finished goods inventory	$231,700

Selling and Administration Budget

This budget includes all estimated expenses that are not manufacturing or discretionary expense budgets, such as research and development. This budget is in total; more detailed line-by-line budgets are prepared for each item. This budget should be separated into variable and fixed expenses.

Example:

ABC Company
Selling and Administrative Expense Budget
for the year ended December 31, 2000

		Q1	Q2	Q3	Q4	Total
Variable:						
Budgeted sales in units (per sales budget)		65,000	58,000	40,000	43,000	206,000
Variable selling and administration per unit (assumed)		x 2.00	x 2.00	x 2.00	x 2.00	x 2.00
Variable selling and administration	**A**	$130,000	$116,000	$80,000	$86,000	$412,000
Fixed:						
Advertising		$35,000	$35,000	$35,000	$35,000	$140,000
Insurance		10,000	10,000	10,000	10,000	40,000
Property taxes		4,500	4,500	4,500	4,500	18,000
Depreciation		12,000	12,000	12,000	12,000	48,000
Fixed selling and administration	**B**	61,500	61,500	61,500	61,500	$246,000
Total selling and administration	**A+B**	$191,500	$177,500	$141,500	$147,500	$658,000

Cash Budget

A cash budget can now be prepared using the information in the previous budgets. For the cash budgeting process, see the example under the cash budget section.

Budgeted Income Statement

The budgeted income statement is prepared using the information in all the other budgets.

Example:

ABC Company
Budgeted Income Statement
for the year ended December 31, 2000

	Supporting Budget	
Sales	Sales budget	$8,240,000
Less cost of goods sold (206,000 x $16.55)	Sales budget & ending FG budget	3,409,300
Gross margin		$4,830,700
Less: selling and administration	S&A expense budget	658,000
Operating income		$4,172,700
Less: interest (assumed	Cash budget	298,700
Income before taxes		$3,874,000
Less: income taxes at 42%		1,627,080
Net income		$2,246,920
Retained earnings, beginning		1,721,880
Retained earnings, ending		$3,968,800

Budgeted Balance Sheet

This budget is prepared by adjusting the opening balance sheet for the budgeted activity included in the other budgets.

Example:

ABC Company
Budgeted Balance Sheet
as at December 31, 2000

Assets		
Current Assets		
Cash	$1,243,272	
Short-term investments	650,000	
Accounts receivable	510,000	
Raw material inventory	57,120	
Finished goods inventory	231,700	
Total current assets		$2,692,092
Plant and Equipment		
Land and building	$5,300,000	
Equipment	2,460,000	
Accumulated depreciation	(4,868,290)	
Total plant and equipment		2,891,710
Total assets		$5,583,802
Liabilities and shareholders' equity		
Current liabilities		
Accounts payable		$115,002
Shareholders' equity		
Common shares	$1,500,000	
Retained earnings	3,968,800	
Total shareholders' equity		5,468,800
		$5,583,802

Standard Costs

Skill Level:		R/U	A/A
3.1.4.3	a) Explains the differences in accounting systems between standard, normal and actual costing environments	✓	
	b) Describes the advantages and disadvantages of using standard costs	✓	
	c) Defines and identifies different types of standards and distinguishes between ideal and practical standards	✓	
	d) Explains how standards are set for direct materials and direct labour	✓	
R/U = Remembering and Understanding A/A = Application and Analysis			

Standard Costs

Standard costs are predetermined costs per unit of production and represent what production costs should be under normal operating conditions. Standard costs are used to monitor and control performance – actual costs are compared to standard costs and the variance is analyzed.

Advantages and Disadvantages of Standard Costs

Advantages:

- Allows monitoring and control over performance by comparing actual results to standards.
- Facilitates budgeting
- Encourages greater planning – details of raw material prices, wage rates, etc. must be obtained to set standards
- Eases bookkeeping because actual costs do not need to be accumulated on a detailed per unit basis
- Promotes economy and efficiency as employees strive to meet standards.
- Identifies problem areas as large variances from standard are highlighted.
- Less costly than actual costing systems, as all inventory and production is carried at a standard unit cost. The fewer hours of bookkeeping required translates into lower administration costs.
- Encourages teamwork, as standard setting typically crosses functional boundaries (e.g. the production manager and accountant must work together to develop a standard).
- More timely reporting as there is not a need to accumulate actual costs.

Disadvantages:

- It may be difficult to obtain the necessary data to set an appropriate standard.
- Standards may be difficult to set in industries subject to large price fluctuations in raw materials, such as oil.
- When implementing a standard costing system, the start-up costs can be high.
- It may be difficult to determine when variances are material.
- Focus may be solely on large variances, thereby, ignoring performance as a whole.
- Standard cost variance reports may not be timely as actual costs are needed to calculate variances.

Types of Standards

Perfection (ideal) standards: These standards represent the absolute minimum cost under the most efficient operating conditions possible. This standard is also known as ideal, maximum efficiency or theoretical standards. These standards do not allow for spoilage, machine malfunctions, waste, etc. These standards are virtually impossible to achieve.

Practical standards: These standards represent costs under efficient operating conditions. These standards allow for normal spoilage, expected machine malfunctions, etc. These standards are also known as currently attainable standards.

As ideal standards are virtually impossible to achieve, using these standards can demotivate employees, whereas practical standards can result in greater efforts by employees to contain costs.

Expected variances: If ideal standards are used in production planning, they are not attainable and, therefore, expected variances should be incorporated into the cash budget. Using ideal standards in the cash budget could result in unexpected cash shortfalls.

Continual improvement standards: This is when a standard is successively reduced over future time periods. The purpose is to focus employee awareness on costs, so they will continually take action that reduces overall cost.

Setting Direct Material and Direct Labour Standards

Direct Material

Standards are set for both price and usage of direct materials.

Price – the standard price per unit should represent the target invoice cost of the materials net of any discounts, such as early payments or volume discounts, shipping costs and receiving and handling costs. The sum of these represents the total standard price per unit of direct materials.

Usage – the standard quantity of material inputs into each unit of production should include the amount of material used, plus an allowance for unavoidable waste, spoilage and any other normal consumption activities.

DM cost per unit – once the standard cost and inputs required has been determined, a standard materials cost per unit can be determined by multiplying the standard price per unit of raw material by the allowed use of raw material for each unit of production:

Example:
5 kilos/unit x $6/kilo = $30/unit

Direct Labour

As with direct materials, standards are set for both the labour rate and standard hours per unit.

Rate – the standard rate includes the target wage plus an allowance for fringe benefits and other wage-related costs, such as Employment Insurance and CPP. An average rate for all employees could be used or separate rates for different departments could be used.

Hours – this is the amount of direct labour time required to complete one unit of production. To determine this, a company may carry out a time and motion study or use published tables of standard times for movements such as reaching, pulling and pushing.

DL cost per unit – once the standard cost and standard hours allowed are determined, a standard labour cost per unit can be determined:

Example:
1.5 standards hours allowed x $15/hour = $22.50/unit

Standard Costing vs. Actual Costing

Standard Costing

As units are produced, the standard cost is applied to each unit. At year-end, the difference between actual costs and those applied represent a variance. For external reporting purposes, this amount must be prorated and allocated to WIP, finished goods inventory and cost of goods sold, in order to value ending inventories at actual, which is required by IFRS. However, the treatment for internal decision making purposes will reflect the approach that best reflects decision making needs.

Example:

Cost variances (direct materials, direct labour and overhead)	$252,000	U
Balances before proration of costs variances:		
WIP inventory	$50,000	
Finished goods inventory	$80,000	
Cost of goods sold	$400,000	

Proration:

	WIP	Finished Goods	COGS	Total
Balances, unadjusted	$50,000	$80,000	$400,000	$530,000
Proration:				
WIP $252,000 \times \frac{50,000}{530,000}$	23,774	---	---	$23,774
FG $252,000 \times \frac{80,000}{530,000}$	---	38,038	---	38,038
COGS $252,000 \times \frac{400,000}{530,000}$	---	---	190,188	190,188
				252,000
Balances, Adjusted	$73,774	$118,038	$590,188	$782,000

Actual Costing

As actual costs are used, no adjustment is required at year-end.

Normal Costing

Note that this material is a repeat of the material found in the normal costing section of this manual. It has been reprinted so candidates understand the context within which this topic may be examined.

Normal costing is a costing method that applies costs to a cost object as follows:

Direct costs	actual direct cost	x	actual quantity
Indirect costs	budgeted indirect cost rate	x	actual quantity

The term normal is used to reflect the fact that a predetermined (normalized) manufacturing overhead rate is used to allocate fixed manufacturing costs to production. The budgeted indirect cost rate is calculated and applied in the same manner as indirect factory overhead (see job order costing section). In fact, job order costing, which often uses actual direct material and actual direct labour costs and a predetermined overhead rate to apply indirect costs, is using a normal costing system. In a manufacturing environment, normal costing can be summarized as:

Cost source:	Cost used:
Direct material	Actual
Direct labour	Actual
Indirect factory overhead	Budget (or standard), using a predetermined overhead rate

Flexible Budgets

Skill Level:	R/U	A/A
3.1.4.3 a) Explains and prepares flexible and static budgets for a given organization	✓	✓
3.1.4.3 b) Calculates the following cost and revenue variances for a given organization:		
• Static budget variances		✓
• Flexible budget variances		✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Flexible Budget vs. Static Budget

The static budget is based on a fixed, usually planned, production level. The static budget is often called the master budget. The flexible budget (also known as variable budget) is prepared to reflect different volume levels. Standard costs are used in both the static and flexible budget. A flexible budget allows a company to compare actual costs at a particular activity level to what costs should have been at that activity level or to predict income for different levels of activity.

Developing a Static Budget

This is similar to developing the master budget, but usually refers to the sales and production budgets only. This topic is covered in the budgeting section.

Developing a Flexible Budget

Steps:
1. Identify the standards for price, variable costs and fixed costs.
2. Use these standards to develop the standard product cost.
3. Use these standards to derive a unit cost.
4. Prepare a flexible budget using the unit costs determined in Step 3,

Example:

Haon Inc. sales volumes vary between 50,000 and 95,000 units per year. Over this range, variable and fixed costs are:

Cost	Variable Cost/Unit
Variable:	
Direct materials	$22
Direct labour	12
Variable overhead	6
Selling and administration	2
Total	42
Fixed:	
Fixed manufacturing overhead	$1,640,000
Selling and administration	820,000

The flexible budget:

Haon Inc.
Flexible Budget
for the year ended December 31, 2000

		Sales Levels (in 000s)			
	Unit Value	50,000	65,000	80,000	95,000
Sales	$82	$4,100	$5,330	$6,560	$7,790
Variable expenses:					
Direct materials	22	1,100	1,430	1,760	2,090
Direct labour	12	600	780	960	1,140
Variable overhead	6	300	390	480	570
Selling and administration	2	100	130	160	190
Total variable expenses	42	2,100	2,730	3,360	3,990
Contribution Margin	40	2,000	2,600	3,200	3,800
Fixed expenses:					
Manufacturing overhead		1,640	1,640	1,640	1,640
Selling and administration		820	820	820	820
Total fixed expenses		2,460	2,460	2,460	2,460
Net income (loss) before tax		(460)	140	740	1,340

Flexible Budget and Sales Volume Variance

The flexible budget variance is the difference between the flexible budget based on actual sales volume and actual results based on actual sales volume.

The flexible budget formula is:

$$\text{flexible budget variance} = \text{actual results} - \text{flexible budget}$$

It is important to note that the flexible budget is based on actual sales volume.

The sales volume variance is the difference between the flexible budget based on actual sales volume and the static budget.

The sales volume variance formula:

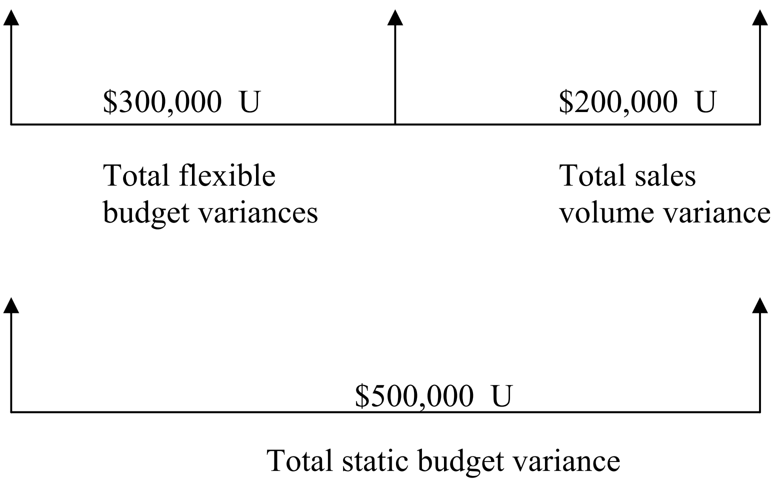
$$\text{sales volume variance} = \left(\begin{array}{l}\text{flexible budget} \\ \text{units}\end{array} - \begin{array}{l}\text{static budget} \\ \text{units}\end{array} \right) \times \begin{array}{l}\text{budgeted unit} \\ \text{contribution margin}\end{array}$$

Example:

Assume Haon Inc. planned on selling 85,000 units, but actually sold 80,000 units.. The flexible budget variance and sales volume variance are:

Haon Inc.
Flexible Budget and Sales Volume Variances
for the year ended December 31, 2000

	A Actual	(A-B) Flexible Budget Variance	B Flexible Budget	(B-C) Sales Volume Variances	C Static (Master) Budget
Sales in units	80,000		80,000	5,000 U	85,000
Revenue	6,712,000	152,000 F	$6,560,000	$410,000 U	$6,970,000
Variable costs	3,830,000	470,000 U	3,360,000	210,000 F	3,570,000
Contribution margin	2,882,000	318,000 U	3,200,000	200,000 U	3,400,000
Fixed costs	2,442,000	18,000 F	2,460,000		2,460,000
Net income before tax	440,000	300,000 U	740,000	200,000 U	940,000



Variances

Skill Level:	R/U	A/A
3.1.4.3 f) Calculates the following cost and revenue variances for a given organization:		
• Direct materials price, quantity/efficiency, mix and yield variances		✓
• Direct labour rate, efficiency, mix and yield variances		✓
• Variable overhead spending and efficiency variances		✓
• Fixed overhead production-volume/denominator and budget/spending variances		✓
• Sales/revenue price variance		✓
• Sales/revenue volume, mix and quantity variances based on contribution margin		✓
• Market share and market size/volume variances		✓
g) Interprets and explains the significance of various cost and sales/revenue variances	✓	
h) Explains and applies the various approaches used by managers for deciding when to investigate variances and which variances to investigate for a given organization	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Variable Cost Variances

A price and quantity variance can be calculated for the three variable costs, direct materials, direct labour and variable overhead. It is important to note that the terms used for the price and quantity variance under each variable cost category is not the same, although the underlying fundamental concept is the same. For example, a price variance for direct materials is called direct materials price variance, but the direct labour and variable overhead variances are called labour rate variance and variable overhead spending variance. The illustration on the following page depicts the price and quantity variances and the related terms for the three main variable cost categories, materials, direct labour and variable overhead.

The quantity variance can be subdivided into two variances, mix and yield. Mix and yield variances are common for direct materials and direct labour. It is usually not calculated for variable overhead.

Variable Cost Variances – Model for Variance Analysis

Price and Quantity:

Actual quantity of inputs at actual price	Actual quantity of inputs at standard price	Standard quantity allowed for output at standard price
(AQ x AP)	(AQ x SP)	(SQ for actual output x SP)

price variance

quantity variance

flexible budget variance (except for DM)

Terms:

DM: materials price variance DL: labour rate variance VOH: variable overhead spending variance	DM: materials quantity (usage) variance DL: labour efficiency variance VOH: variable overhead efficiency variance

Mix and Yield:

The quantity variance can be broken down into the mix and yield variance.

Actual quantity of inputs at standard price	Standard quantity allowed for output at standard price
(AQ x SP)	(SQ x SP)

Mix (see formulas on following pages)

Yield (see formulas on following pages)

Legend:

AQ: Actual quantity
SQ: Standard quantity
AP: Actual price
SP: Standard price
DM: Direct materials
DL: Direct labour
VOH: Variable overhead

Direct Material Variances

It is important to note that the price variance is calculated at the time of purchase; whereas, the quantity variance is calculated at the time of use. This results in different quantities for the price and quantity variances and, therefore, these two variances cannot be added together to determine the flexible budget variance. The only exception is when there is nil beginning direct material inventory and nil ending direct material inventory. In this case, the quantity of direct materials purchased equals all materials used.

It is important to compute the variances at the time they are realized since timeliness is important both for external reporting and internal control purposes. The recognition points for price and use variances differ because the price variance occurs at the time of purchase and the use variance occurs at the time of use.

Mix and Yield Variances

There are three different formulas for calculating the mix and two different formulas for yield variances.

Mix variance

Both formulas are calculated based on a "per input" basis (i.e. each direct material mix variance is calculated separately and the sum of the separate direct material mix variances is the total mix variance).

Formula 1:

$$\left[\begin{matrix}\text{actual quantity} \\ \text{used of input}\end{matrix} - \left(\left(\begin{matrix}\text{standard mix \%} \\ \text{for input}\end{matrix} \times \begin{matrix}\text{actual quantity} \\ \text{of all inputs used}\end{matrix} \right) \right) \times \begin{matrix}\text{standard price} \\ \text{of input}\end{matrix} \right]$$

$$= \left(AQ - \left(SM \times \begin{matrix}\text{sum of actual} \\ \text{quantity of all inputs}\end{matrix} \right) \right) \times SP$$

Formula 2:

$$\left[\left(\left(\begin{array}{c}\text{actual mix \%}\\ \text{for input}\end{array} - \begin{array}{c}\text{standard mix \%}\\ \text{for input}\end{array}\right) \times \begin{array}{c}\text{actual quantity}\\ \text{of all inputs used}\end{array}\right) \times \left(\begin{array}{c}\text{standard individual}\\ \text{price per unit}\\ \text{of input}\end{array} - \begin{array}{c}\text{standard average}\\ \text{price per unit}\\ \text{of input}\end{array}\right)\right]$$

$$= \left[\left(\left(\text{AM\%} - \text{SM\%}\right) \times \begin{array}{c}\text{sum of actual}\\ \text{quantity of all}\\ \text{inputs used}\end{array}\right) \times (\text{SIP} - \text{SAP})\right]$$

Formula 3:

$$\left[\left(\left(\begin{array}{c}\text{actual mix \%}\\ \text{for input}\end{array} - \begin{array}{c}\text{standard mix \%}\\ \text{for input}\end{array}\right) \times \begin{array}{c}\text{actual total quantity}\\ \text{of all inputs used}\end{array}\right) \times \begin{array}{c}\text{budgeted}\\ \text{cost}\\ \text{per unit}\end{array}\right]$$

Yield Variance

As with the mix variance, the yield variance is calculated based on a "per input" basis (i.e. each direct material yield variance is calculated separately and the sum of the separate direct material yield variances is the total yield variance).

Formula 1:

$$\left[\text{standard mix \% for input} \left(\begin{array}{c}\text{actual quantity}\\\text{of all inputs used}\end{array} \right) - \begin{array}{c}\text{standard quantity}\\\text{of input for}\\\text{actual output achieved}\end{array} \right] \times \begin{array}{c}\text{standard price}\\\text{of input}\end{array}$$

$$= \left[\text{SM} \left(\begin{array}{c}\text{sum of actual quantity}\\\text{of all inputs}\end{array} \right) - \begin{array}{c}\text{SQ}\\\text{of input}\end{array} \right] \times \text{SP}$$

Formula 2:

$$\left(\begin{array}{c}\text{actual quantity}\\\text{of inputs used}\end{array} - \begin{array}{c}\text{standard quantity of}\\\text{inputs based on}\\\text{actual output}\end{array} \right) \times \begin{array}{c}\text{standard}\\\text{average}\\\text{price}\end{array}$$

$$= \left(\text{AQ} - \begin{array}{c}\text{SQ of inputs}\\\text{for actual outputs}\end{array} \right) \times \text{SAP}$$

Quantity Variance: Sum of mix and yield

The sum of the mix and yield variances is the quantity variances (AQ – SQ) x SP.

Example:

Basic data:

Material A and Material B are required to produce a widget.
Standard mix: four units of material A and six units of material B to produce one widget.

Material A standard cost	$3.00
Material B standard cost	$5.50
Number of finished units produced	300
Amount of material actually used to produce finished units:	Material A: 1460
	Material B: 1880

Mix Variance

Formula 1

$$= \left(AQ - \left(SM \times \text{sum of actual quantity of all inputs} \right) \right) \times SP$$

Material A	(1460 -	4/10 (1460 + 1880))	x	\$3.00	=	\$372 U
Material B	(1880 -	6/10 (1460 + 1880))	x	\$5.50	=	682 F
			Total mix variance			310 F

Students often have difficulty with this formula and with identifying whether the variance for each separate input is favourable or unfavourable. Breaking the formula into its component pieces makes this simpler:

$$\underbrace{\left(AQ \right.}_{\text{actual quantity of inputs used for each individual input}} - \underbrace{\left(\text{standard mix} \times \text{sum of actual quantity of all inputs} \right) \left. \right)}_{\text{quantity of each input that should have been used based on the standard mix percent.}} \times \underbrace{SP}_{\text{standard cost for each input.}}$$

for each of the individual inputs, if actual quantity > quantity that should have been used, then the variance is unfavourable. Conversely, if actual quantity is < quantity that should have been used, the variance is favourable.

Mix Variance

Formula 2

	Actual Mix Percentage		Standard Mix Percentage		Standard Individual Price Per Unit	Standard Average Price Per Unit
Material A	$\frac{1460}{1460 + 1880}$	= .4371257485	$\frac{4}{10}$	= 40%	\$3.00	(\$3.00 x .4) + (\$5.50 x .6) = \$4.50
Material B	$\frac{1880}{1460 + 1880}$	= .56287425149	$\frac{6}{10}$	= 60%	\$5.50	\$4.50

$$= \left[\left(\left(AM\% - SM\%\right) \times \text{sum of actual quantity of all inputs used}\right) \times (SIP - SAP)\right]$$

Material A	((.4371257485 - .40)	x	(1460 + 1880))	x (3.00 – 4.50)		
=	124	x		– 1.50	=	-\$186.00F
Material B	((.56287425149 - .60)	x	(1460 + 1880))	x (5.50 – 4.50)		
=	-124	x		1.00	=	-124.00F
				Total mix variance		310.00F

Hint: Remember to watch the positive and negative signs.

Formula 3

$$\left[\left(\left(\text{actual mix \% for input} - \text{standard mix \% for input}\right) \times \text{actual total quantity of all inputs used}\right) \times \text{budgeted cost per unit}\right]$$

Material A	((.4371257485 - .40)	x	(1460 + 1880))	x 3.00	=	\$372.00U
Material B	((.56287425149 - .60)	x	(1460 + 1880))	x 5.50	=	-682.00F
				Total mix variance		310.00F

Yield Variance

Formula 1

$$\left[\text{SM \% for input}\left(\text{sum of actual quantity of all inputs}\right) - \text{SQ of input for actual output achieved}\right] \times \text{SP}$$

Material A	[(4/10 (1460 + 1880)) - (300 X 4)]	x	$3.00		
	= [1336 - 1200]	x	$3.00	=	$408 U
Material B	[(6/10 (1460 + 1880)) - (300 X 6)]	x	$5.50		
	= [2004 - 1800]	x	$5.50	=	1,122 U
		Total yield variance			$1,530 U

Yield Variance

Formula 2

$$= \left(\text{AQ} - \text{SQ of inputs for actual outputs}\right) \times \text{SAP}$$

Material A	(1460 - (300 X 4))	x	$4.50	=	$1,170 U
Material B	(1880 - (300 X 6))	x	$4.50	=	360 U
		Total yield variance			1,530 U

Quantity Variance

Quantity variance	=	(AQ – SQ)	x	SP	
Material A		(1460 - (300 X 4))	x	$3.00	= $780 U
Material B		(1880 - (300 X 6))	x	$5.50	= 440 U
		Total quantity variance			$1,220 U

Proof of mix and yield variances:

These two variances must equal the total quantity variance:

Formula 1:

Mix	$ 310	F
Yield	1,530	U
	$1,220	U

Formula 2:

Mix	$ 310	F
Yield	1,530	U
	$1,220	U

Variable Cost Variances – Their Meaning

Price Variance (materials purchase price, labour rate and variable overhead spending)

This variance is a measure of the difference between the price actually paid and the budgeted (standard) price. Differences could arise from many factors, such as a price increase due to a shortage of the direct material, a price decrease due to unanticipated volume rebates or switching suppliers or the standard could be inappropriate.

A price variance is favourable if the actual price is less than the standard price and is unfavourable if the actual price is higher than the standard price.

Quantity Variance (materials quantity, labour efficiency, variable overhead efficiency)

The quantity variance is a measure of the difference between the quantity (e.g. kilos of material, number of direct labour hours) that was actually used and the quantity that was allowed for the achieved level of production.

A favourable variance results when the actual quantity used is less than the quantity that was allowed (per standard) and is unfavourable when the actual quantity is more than the quantity that was allowed.

Differences between actual and allowed quantities can occur due to lost efficiency caused by machine breakdowns, lower quality materials resulting in greater rework time, abnormal spoilage, among others.

Mix Variance

This variance is a measure of the financial impact of the actual mix of inputs used vs. the standard mix given the total quantity of the actual inputs used.

In other words, this variance isolates the financial impact of the difference in the mix. For example, if the standard mix was two kilos of material A to one kilo of material B, this variance determines the financial impact of an actual mix of 2.5 kilos of material A to .50 kilos of material B.

Unfavourable and favourable mix variances:

A favourable variance means the actual mix used compared to the standard mix resulted in savings to the company. An unfavourable variance means the actual mix used was more costly than the standard mix.

Unfavourable and favourable variances for the two mix formulas can be determined as:

Formula 1:

> Unfavourable – when actual quantity used is greater than quantity that should have been used given standard mix applied to actual total inputs.
>
> Favourable – when actual quantity used is less than quantity that should have been used given standard mix applied to actual total inputs

Formula 2:

> Favourable – when there is an increase in the percentage of inputs used with below average price per unit.
>
> OR
>
> When there is a decrease in the percentage of inputs with above average price per unit
>
> Unfavourable – when there is a decrease in percentage of inputs with below average price per unit
>
> OR
>
> When there is an increase in percentage of inputs with above average price per unit.

Yield Variance

This variance measure the financial impact of the difference between actual quantity and standard quantity holding the sales mix constant. In other words, the yield actually achieved as opposed to that which should have been achieved with a given mix of inputs. This variance treats the different inputs as though they are the same – in the previous example, Formula 1 adds together material A and B, as if there is no difference and Formula 2 uses a standard average price, which in effect treats A and B as being alike.

Unfavourable and favourable yield variances:

In essence, a favourable variance means the actual yield achieved is higher than expected given a standard mix and actual inputs. An unfavourable variance means the actual yield achieved is lower than expected given a standard mix and actual inputs.

Unfavourable and favourable variances for the two yield formulas can be determined as:

Formula 1:

Unfavourable – occurs when the quantity based on standard mix of actual inputs is greater than the standard quantity given actual outputs achieved.

Favourable – occurs when the quantity based on standard mix of actual inputs is less than the standard quantity given actual outputs achieved.

Formula 2:

Unfavourable – occurs when the actual quantity of inputs used is higher than the standard quantity of inputs that should have been used given actual output achieved.

Favourable – occurs when the actual quantity of inputs used is less than the standard quantity of inputs that should have been used given actual output achieved.

Fixed Overhead Cost Variances

There are two fixed overhead cost variances, the flexible budget variance and the production volume variance.

Actual	Flexible Budget	Applied
	lump sum amount	AQ x predetermined OH rate
flexible budget variance	production volume variance	
under- or over-applied overhead		

Flexible Budget Variance

Also known as the fixed overhead spending variance, this variance is the difference between estimated fixed overhead and actual fixed overhead. If actual is higher than budget, it is unfavourable and, if actual, is lower than budget it is favourable.

Formula: Actual overhead – Budgeted overhead

Production Volume Variance

This variance measures the dollar impact of the difference between estimated production volume, which was used to determine the predetermined overhead rate and actual production volume, which is used to apply overhead to units.

Formula:

$$\text{production volume variance} = \left(\underset{\text{(also known as denominator volume)}}{\text{estimated production volume}} - \text{actual volume achieved} \right) \times \text{predetermined overhead rate}$$

OR

$$\text{budgeted overhead} - \text{applied overhead, (calculated as actual volume x predetermined overhead rate)}$$

The production volume variance is applicable only when absorption costing is used. It arises because estimated production volume does not equal actual production volume. When actual volume is less than estimated volume, the production volume variance is unfavourable. When actual volume is more than estimated volume, this variance is favourable. If the variance is unfavourable, it is considered to be a cost of idle capacity – estimated volume was not achieved and, therefore, there was idle capacity.

Sales Variances

The difference between the master (static) budget and actual results can be broken into the sales price and sales volume variances. The sales volume variance can be broken into the sales mix and sales quantity variances. The sales quantity variance can be further broken down into the market size and market share variance.

Sales Variances - Model for Variance Analysis

Actual <u>results</u> AQ x AP	Flexible <u>budget</u> AQ x BP	Master <u>budget</u> BQ x BP
AQ x (AP – BP)	(AQ – BQ) x BICM or (AQ – BQ) x BIP	
sales price variance	sales volume variance	

(ASM % - BSM %) x Total actual sales vol. of all products x (BICM – BACM)	(AQ – BQ) x BACM per unit
sales mix variance	sales quantity variance

(BMS %) x (AISV in units - BISV in units) x BACM per unit	(AMS % - BMS %) x AISV in units x BACM per unit
market size variance (also known as industry volume variance)	market share variance

Legend:

AQ: Actual quantity
BQ: Budgeted quantity
AP: Actual price
BP: Budgeted price
BICM: Budgeted individual contribution margin
BIP: Budgeted individual price
BACM: Budgeted average contribution margin
ASM%: Actual sales mix percentage
BSM%: Budgeted sales mix percentage
AISV: Actual industry sales volume
BISV: Budgeted industry sales volume
BMS%: Budgeted market share percentage
AMS%: Actual market share percentage

Sales Variances – Their Meaning

Sales price variance – a measure of the financial impact of the difference between the actual price obtained and the budgeted price.

Sales volume variance – the financial impact due to the difference between actual volume sold and that budgeted.

Sales mix variance – the impact of the difference between budgeted and actual sales mix percentage, calculated on a per product basis, taking into consideration the difference between the product's budgeted contribution margin and the average budgeted contribution margin for all products. This variance is calculated using contribution margin because total fixed costs are the same in the flexible and master budget.

Sales quantity variance – isolates the dollar impact using the budgeted average contribution margin of the difference between actual and budgeted volume. This variance is calculated using contribution margin because total fixed costs are the same in the flexible and master budget.

Market size variance – measures the impact of changes in the size of the market

Market share variance – measure the impact of changes in a company's share of the market

Comprehensive Example – Revenue and Cost Variances

ASICS Body Health Incorporated (ABH) manufactures two products, regular body lotion (“regular”) and extra smooth body lotion (“smooth”). Regular was budgeted to sell for $12 and smooth was budgeted to sell for $18. Expected sales volume for the year was 60,000 units of regular and 40,000 units of smooth.

Budgeted Costs:

The standard (budgeted) variable costs for both products are:

	Regular	Smooth
Direct materials	17.50 per kilo	19.00 per kilo
Direct materials required per unit	.2 kilos	.25 kilos
Direct labour	$8.00 per hour	$11.70 per hour
Number of units produced in one DL hour	8 units	12 units
Variable overhead, assigned based on machine hours (“MH”)	$5.00 per MH	$6.00 per MH
Number of units produced in one machine hour	10 units	10 units
Variable selling and administration	1.25	1.75

Fixed manufacturing costs were budgeted at $75,000 and fixed selling and administrative costs were expected to be $55,000. Fixed manufacturing costs are applied to products based on units produced. Other fixed costs are not applied to products. The total market for the two products together was expected to be 2,000,000 units.

Actual Results:

Information from industry sources indicate the total number of units actually sold by all manufacturers was 2,160,000. The average sales prices earned during the year were $11 for the regular lotion and $16 for the smooth and actual sales quantities were 58,200 for regular and 60,600 for smooth. There were no beginning or ending finished goods inventories and there was no beginning direct materials inventory. Actual costs and other data for both products are:

	Regular	Smooth
Direct materials cost per kilo	17.0475 per kilo	19.5089 per kilo
Direct materials purchased	12,000 kilos	15,000 kilos
Direct materials used	11,710 kilos	14,848 kilos
Direct labour	$49,470	$62,418
Total direct labour hours per product line	5,721	5,180
Variable overhead	$37,830	$38,178
Total machine hours per product line	6,984	6,260
Variable selling and administration	$73,914	$96,960

Actual fixed costs were $88,000 for manufacturing and $58,000 for selling and administrative.

Required:

a) Prepare a flexible budget report.

b) Calculate the following cost variances for both the regular and smooth:
Direct material
Direct labour
Variable overhead
Variable selling
Fixed selling and administrative
Fixed manufacturing flexible budget variance
Fixed manufacturing production volume variance

c) Calculate the following revenue variances:
Sales revenue (price), sales mix, sales quantity, market share and market size (industry volume)

d) Reconcile the variances calculated in b) and c) to the master budget vs. actual variance calculated in a).

Solution:

a) Preparation of a flexible budget (to create a flexible budget, both the master budget and actual results must be determined).

Master Budget:

	Regular		Smooth		Year
	Unit	Total	Unit	Total	Total
Quantity		60,000		40,000	100,000
Price	$12.00		$18.00		
Total revenue		$720,000		$720,000	$1,440,000
Variable costs	6.25	375,000	8.075	323,000	698,000
Contribution margin	$5.75	$345,000	$9.925	$397,000	$742,000
Fixed costs:					
Manufacturing					$75,000
Selling and administration					55,000
Total fixed costs					$130,000
Net income before taxes					$612,000

Where:	Regular		Smooth		Year
Variable costs:	Unit	Total	Unit	Total	Total
Direct material					
Regular:	3.50	$210,000			210,000
$17.50/kilo ÷ # of units per kilo					
# of units per kilo = 1 ÷ .20 = 5					
17.50 ÷ 5 units = 3.50/unit					
OR					
17.50 x 0.20					
Smooth:			4.75	$190,000	190,000
$19/kilo ÷ # of units per kilo					
# of units per kilo = 1 ÷ .25 = 4					
19 ÷ 4 units = 4.75/unit					
OR					
19 x 0.25					
Direct labour					
Regular:	1.00	60,000			60,000
$8/hour ÷ # of units per hour					
# of units per hour = 8 units					
8 ÷ 8 = 1/unit					
Smooth:			0.975	39,000	39,000
$11.70/hour ÷ # of units per hour					
# of units per hour = 12 units					
11.70 ÷ 12 = .975/unit					
Variable overhead					
Regular:	0.50	30,000			30,000
$5/MH ÷ # of units per MH					
5 ÷ 10 = .50/unit					
Smooth:			0.60	24,000	24,000
$6/MH ÷ # of units per MH					
6 ÷ 10 = .60/unit					
Variable selling and administration	1.25	75,000	1.75	70,000	145,000
	6.25	375,000	8.075	323,000	698,000

Performance Management

Actual Results:

	Regular		Smooth		Year
	Unit	Total	Unit	Total	Total
Quantity		58,200		60,600	118,800
Price	$11.00		$16.00		
Total revenue		$640,200		$969,600	$1,609,800
Variable costs	6.20	360,840	8.04	487,224	848,064
Contribution margin	$4.80	$279,360	$7.96	$482,376	$761,736
Fixed costs:					
Manufacturing					$88,000
Selling and administration					58,000
Total fixed costs					$146,000
Net income before taxes					$615,736

Where:	Regular		Smooth		Year
Variable costs:	Unit	Total	Unit	Total	Total
Direct material					
Regular:	3.43	$199,626			199,626
$17.0475/kilo x # of kilos					
$17.0475/kilo x 11,710 = 199,626					
$199,626 ÷ 58,200 = 3.43/unit					
Smooth:			4.78	$289,668	289,668
$19.5089/kilo x # of kilos					
$19.5089/kilo x 14,848 = 289,668					
$289,668 ÷ 60,600 = 4.78/unit					
Direct labour					
Regular:					
$49,470 ÷ 58,200 = .85/unit	0.85	49,470			49,470
Smooth:					
$62,418 ÷ 60,600 = 1.03/unit			1.03	62,418	62,418
Variable overhead					
Regular:					
$37,830 ÷ 58,200 = .65 /unit	0.65	37,830			37,830
Smooth:					
$38,178 ÷ 60,600 = .63/unit			0.63	38,178	38,178
Variable selling and administration					
Regular:					
$73,914 ÷ 58,200 = 1.27 /unit	1.27	73,914			73,914
Smooth:					
$96,960 ÷ 60,600 = 1.60/unit			1.60	96,960	96,960
	6.20	360,840	8.04	487,224	848,064

Flexible Budget Report
for the year ended December 31

	Master Budget	Volume Variances		Flexible Budget		Efficiency Variances		Actual Result
Quantity	100,000			118,800				118,800
Sales	$1,440,000	$349,200	F	$1,789,200	1	($179,400)	U	$1,609,800
Variable costs	698,000	(155,095)	U	853,095	2	5,031	F	848,064
Contribution margin	742,000	194,105	F	936,105		(174,369)	U	761,736
Fixed costs	130,000	0		130,000		(16,000)	U	146,000
Net income	$ 612,000	$194,105	F	$ 806,105		($190,369)	U	$ 615,736

Total variance = $3,736 favourable

Note 1: Flexible budget sales are computed as follows:

Regular	$12	x	58,200	=	$ 698,400
Smooth	$18	x	60,600	=	1,090,800
					$1,789,200

Note 2: Flexible budget variable costs are computed as follows:

Regular	$6.250	x	58,200	=	$363,750
Smooth	$8.075	x	60,600	=	489,345
					$853,095

b) Cost Variances

Direct Material Variances (see chart on next page for chart of the DM variances)

Price Variance:

Price Variance = (actual quantity)(standard price – actual price)

Important: Remember the price variance is based on quantity purchased, whereas the use (efficiency) variance is based on quantity used.

Regular:	12,000 kilos x (17.50/kilo – 17.0475/kilo)		5,430.00	F
Smooth:	15,000 kilos x (19.00/kilo – 19.5089/kilo)		(7,633.50)	U
	Total direct material price variance	A	(2,203.50)	U

Efficiency Variance:

Usage (efficiency) variance = (standard price)(standard quantity allowed for actual output achieved – actual quantity)

Important: Remember the use variance is based on quantity used, whereas the price variance is based on quantity purchased.

Regular: SP (SQ allowed for actual output – AQ used)

> Calculation of SQ allowed:
> 58,200 ÷ standard units per kilo = kilos required to produce 58,200 units
> Units per kilo: since each unit takes .2 kilos, 1 kilo will make 1 ÷ .2 = 5 units
> 58,200 ÷ 5 units = 11,640 kilos
> OR
> 58,200 x 0.2

AQ used = 11,710 (given)

Variance = 17.50/kilo x (11,640 – 11,710) = 1,225 U

Smooth: SP (SQ allowed for actual output – AQ used)

> Calculation of SQ allowed:
> 60,600 ÷ standard units per kilo = kilos required to produce 60,600 units
> Units per kilo: since each unit takes .25 kilos, 1 kilo will make 1 ÷ .25 = 4 units
> 60,600 ÷ 4 units = 15,150 kilos
> OR
> 60,600 x 0.25

AQ used = 14,848 (given)

Variance = 19/kilo x (15,150 –14,848) = 5,738 F

Total use (efficiency) variance	B	4,513	F
Total direct material variance (price variance + usage variance)	A + B	$2,309.50	F

Direct Material Variances

	Actual Costs			Flexible Budget
	actual input quantity x AP per input	actual input x SP per input		Budgeted input allowed for actual output achieved x SP per input
		purchase	usage	
Regular	12,000 kilos x 17.0475 = 204,570	12,000 kilos x 17.50 = 210,000	11,710 kilos x 17.50 = 204,925	11,640 kilos x 17.50/kilo = 203,700

price variance = 5,430 F | efficiency variance = 1,225 U

total DM variance = $4,205 F

	Actual Costs			Flexible Budget
Smooth	actual input quantity x AP per input	actual input x SP per input		budgeted input allowed for actual output achieved x SP per input
		purchase	usage	
	15,000 kilos x 19.5089 = 292633.50	15,000 kilos x 19.00 = 285,000	14,848 kilos x 19.00 = 282,112	15,150 kilos x 19.00/kilo = 287,850

price variance = 7,633.50 U | efficiency variance = 5,738 F

total DM variance = $1,895.50 U

Direct Labour Variances (see chart on next page for greater explanations of the DL variances)

Rate variance:

Rate variance = (actual quantity)(standard rate – actual rate)

Regular: (5,721 DLH's)($8.00/DLH – ($49,470 ÷ 5,721))			
= (5,721 DLH's)($8/DLH - $8.64709/DLH) =		($3,702)	U
OR			
49,470 given – (5,721 DLH's x $8/ DLH) =			
Smooth: (5,180 DLH's)($11.70/DLH – ($62,418 ÷5,180)			
= (5,180 DLH's)($11.70/DLH - $12.04981/DLH) =		(1,812)	U
OR			
62,418 given – (5,180 DLH's x $11.70/ DLH) =			
Total direct labour rate variance	A	$(5,514)	U

Efficiency variance:

Efficiency variance = (standard rate)(standard quantity of DLH allowed for actual output achieved – actual quantity of DLH)

Regular: ($8)((58,200 ÷ 8 DLH's/unit) – 5,721 hours))			
($8)(7,275 hours – 5,721 hours) =		$12,432	F
Smooth: ($11.70)((60,600 ÷ 12 DLH's/unit) – 5,180 hours))		(1,521)	U
($11.70)(5,050 hours – 5,180 hours) =			
Total efficiency variance	B	10,911	F
Total direct labour variance (rate variance + efficiency variance)	A + B	$5,397	F

Direct Labour Variances

	Actual Costs		Flexible Budget
	actual input quantity x AP per input	actual input x SP per input	budgeted input allowed for actual output achieved x SP per input (Note A)
Regular	5,721DLH's x ?? (not given) = 49,470	5,721 hours x $8/hour = 45,768	(58,200 ÷ 8 units /hr) x $8 =
	?? = 49,470/5,721	OR	OR
	??? = 8.64709	(5,721 hours x 8 units/hour) x 1 /unit	(7275 DLH's x 8 units/DLH) x 1/unit
	49,470	45,768	58,200

rate variance = 3,702 U

efficiency variance = 12,432 F

total DL variance = $8730 F

Note A: Students often have difficulty understanding what is being measured in this calculation. This calculation represents "given the number of units produced, how many direct labour hours should have been used?" The cost is held constant at the standard rate since the efficiency variance is isolating efficiency. Therefore, there are two methods of calculating this (candidates need to know both for the exam, as the information provided in the exam question may only provide sufficient information to calculate one or the other).

The calculations are:

58,200 units produced ÷ 8 units per hour = 7,275 standard DL hours allowed x $8 per hour

OR

7,275 DLH's x 8 units/DLH = 58,200 units x 1/unit

	Actual Costs		Flexible Budget
	actual input quantity x actual rate per input	actual input x std rate per input	budgeted input allowed for actual output achieved x std rate per input
Smooth	5,180 DLH's x ??? (not given) = 62,418	5,180 DLH's x 11.70 hr = 60,606	(60,600 ÷ 12 units /hr) x $11.70 =
	?? = 62,418/5,180	OR	OR
	??? = 12.04981	5,180 DLH's x 12 units /hour) x .975/unit	(5,050 DLH's x 12 units/DLH) x .975/unit
	62,418	60,606	59,085

rate variance = 1,812 U

efficiency variance = 1,521 U

total DLH variance = $3,333 U

Variable Overhead (see chart on next page for greater explanations of the VOH variances)

Spending variance:

Spending variance = (actual quantity of MH)(standard rate – actual rate)			
Regular: (6,984 MH's)($5/MH – ($37,830 ÷ 6,984))			
= (6,984 MH's)($5/MH - $5.41666/MH) =		($2,910)	U
OR			
37,830 given – (6,984 MH's x $5/ MH) =			
Smooth: (6,260 MH's)($6/MH – ($38,178 ÷ 6,260)			
= (6,260 MH's)($6/MH - $6.09872/MH) =		(618)	U
OR			
38,178 given – (6,260 MH's x $6/ MH) =			
Total variable overhead spending variance	A	$(3,528)	U

Usage (efficiency) variance:

Usage (efficiency) variance = (standard price)(standard quantity of MH allowed for actual output achieved – actual quantity of MH)			
Regular: ($5)((58,200 ÷ 10 units/MH) – 6,984 hours))			
($5)(5,820 hours – 6,984 hours) =		($5,820)	U
Smooth: ($6)((60,600 ÷ 10 units/MH) – 6,260 hours))		(1,200)	U
($6)(6,060 hours – 6,260 hours) =			
Total usage (efficiency) variance	B	($7,020)	U
Total variable overhead variance (spending variance + efficiency variance)	A + B	$(10,548)	U

Variable overhead variances expressed pictorially:

	Actual Costs		Flexible Budget
	actual input quantity x AP per input	actual input x SP per input	budgeted input allowed for actual output achieved x SP per input (Note A)
Regular	6,984 MH's x ?? (not given) = 37,830	6,984 hours x $5/hour = 34,920	(58,200 ÷ 10 units /hr) x $5 =
	?? = 37,830/6,984	OR	OR
	??? = 5.41666	(6,984 hours x 10 units/hour) x .50/unit	(5,820 MH's x 10 units/MH) x .5/unit
	37,830	34,920	29,100

spending variance = 2,910 U | efficiency variance = 5,820 U

total VOH variance = $8,730 U

Note A: Students often have difficulty understanding what is being measured in this calculation. This calculation represents "given the number of units produced, how many machine hours should have been used?" The cost is held constant at the standard rate since the efficiency variance is isolating efficiency. Therefore, there are two methods of calculating this (candidates need to know both for the exam, as the information provided in the exam question may only provide sufficient information to calculate one or the other).
The calculations are:

58,200 units produced ÷ 10 units per hour = 5,820 hours x $5 standard rate per hour

OR

5,820 MH's x 10 units/MH = 58,200 units x .5/unit

	Actual Costs		Flexible Budget
	actual input quantity x AP per input	actual input x SP per input	budgeted input allowed for actual output achieved x SP per input
Smooth	6,260 MH's x ?? (not given) = 38,178	6,260 MH's x 6 hr = 37,560	(60,600 ÷ 10 units /hr) x $6 =
	?? = 38,178/6,260	OR	OR
	??? = 6.09872	(6,260 MH's x 10 units /hour) x .60/unit	(6,060 MH's x 10 units/MH) x .6/unit
	38,178	37,560	36,360

spending variance = 618 U | efficiency variance = 1,200 U

total VOH variance = $1,818 U

Total variable overhead spending variance = regular $2910 U + smooth $618 U = $3528 U.
Total variable overhead efficiency variance = regular $5,820 U + smooth $1,200 U = $7,020 U.

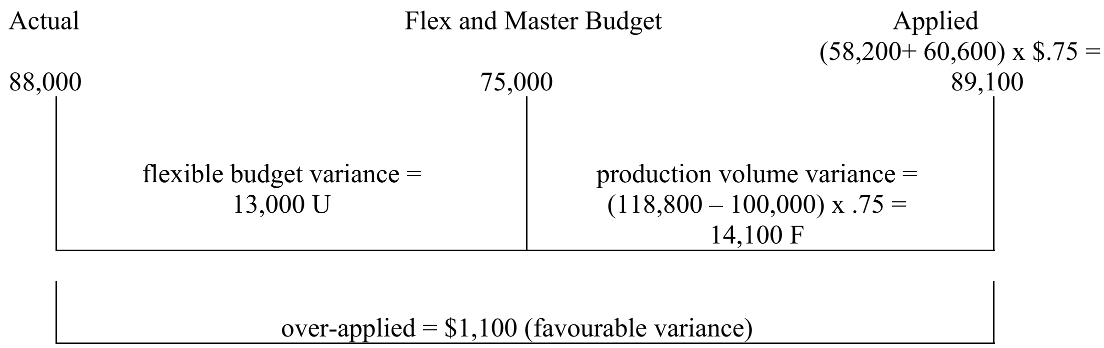
Variable Selling and Administration

Regular:	Actual cost (given) – budgeted cost for actual output		
	$73,914 – (58,200 x 1.25)	1,164	U
Smooth	Actual cost (given) – budgeted cost for actual output		
	$96,960 – (60,600 x 1.75)	9,090	F
		7,926	F

Fixed Manufacturing Expenses

Flexible budget variance:		
Master (and flexible) budget amount (given)	$75,000	
Actual amount spent (given)	88,000	
Total fixed manufacturing budget variance	$(13,000)	U
Production volume variance:		
Fixed manufacturing costs applied to products:		
AQ produced x predetermined overhead rate		
118,800 x ($75,000 ÷ 100,000)	$89,100	
Flexible budget amount (given)	$75,000	
	14,100	F
Over applied manufacturing overhead	1,100	F

Fixed cost variances expressed pictorially:



Fixed Selling and Administrative Expenses

Master (and flexible) budget amount (given)	$55,000	
Actual amount spent (given)	58,000	
Total fixed selling and administration budget variance	$(3,000)	U

Summary of cost variances:		
Total direct material variance	$2,309.50	F
Total direct labour variance	5,397.00	F
Total variable overhead variance	(10,548.00)	U
Total variable selling and administration variance	7,926.00	F
Total fixed manufacturing budget variance	(13,000.00)	U
Total fixed selling and administration budget variance	(3,000.00)	U
Total efficiency and spending variance explained	$(10,915.50)	U

c) Sales variances:

Note: Sales variances are presented pictorially subsequent to the formula calculations.

Sales Revenue Price Variance

Selling price variance = actual quantity sold (AP – budgeted price) for individual products.

Product	Actual Price A	Budgeted Price B	Price Change C = A - B	Actual Volume D	Variance C x D	
Regular:	$11	$12	($1)	58,200	($58,200)	U
Smooth:	16	18	(2)	60,600	(121,200)	U
				118,800	($179,400)	U

Sales Volume Variance

Sales volume variance = (AQ sold – static budget quantity) x budgeted CM per unit

Product	Actual volume A	Budgeted volume B	C = A - B	Budgeted Individual CM D	Variance B x D	
Regular:	58,200	60,000	(1,800)	5.75	(10,350)	U
Smooth:	60,600	40,000	20,600	9.925	204,455	F
					194,105	F

Supporting calculation of CM:

	Regular	Smooth	Total
Selling price	$12.00	$18.00	
Variable costs:			
Direct material	3.50	4.75	
Direct labour	1.00	.975	
Variable overhead	.50	.60	
Variable selling and administration	1.25	1.75	
Total variable costs	6.25	8.075	
Contribution margin per unit	5.75	9.925	
Budgeted sales volume	x 60,000	x 40,000	
Budgeted CM	345,000	397,000	742,000
Budgeted sales volume (60,000 + 40,000)			÷ 100,000
Budgeted average CM per unit			$7.42

alternative calc:

RCM: 5.75 x 0.6 = 3.45
SCM: 9.925 x 0.4 = 3.97
WAVG $\boxed{= 7.42}$

Sales Mix Variance

(actual sales mix % – budgeted sales mix %) x actual total units sold x (budgeted individual contribution per unit – budgeted weighted average contribution per unit)

Regular:	(48.9899% - 60.000%) x 118,800 x ($5.75 - $7.42) =	$21,844	F
Smooth:	(51.0101% - 40.000%) x 118,800 x ($9.925 - $7.42) =	32,765	F
		$54,609	F

Supporting calculation of sales mix percentages (results were rounded off to four decimal places):

	Actual Sales Mix %	Budgeted Sales Mix %
Regular:	58,200 ÷ 118,800 = 48.9899%	60,000 ÷ 100,000 = 60.000%
Smooth:	60,600 ÷ 118,800 = 51.0101%	40,000 ÷ 100,000 = 40.000%

Alternative method to calculate sales mix variance:

[ASM% - BSM%] x actual total quantity sold x BICM

Regular: (48.9899%-60.00%) x 118,800 x 5.75 =	($75,210)	U
Smooth: (51.0101% - 40.0%) x 118,800 x 9.925 =	129,819	F
	$54,609	F

Note that the final answer is the same regardless of the method used.

Sales Quantity Variance

(actual quantity – budgeted quantity) x budgeted weighted average contribution margin
Explanation: (actual quantity – budgeted quantity) x $\underbrace{\text{unit CM x budgeted sales mix}}_{\text{weighted average CM}}$

Regular: (58,200 – 60,000) x $7.42 =	($13,356)	U
Smooth: (60,600 – 40,000) x $7.42 =	152,852	F
	$139,496	F

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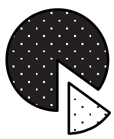
Market Share and Market Size variance

Market share variance = (actual market share % – budgeted market share %)(actual industry volume)(budgeted weighted average CM per unit)
= ((118,800÷ 2,160,000) – (100,000 ÷ 2,000,000)) (2,160,000) ($7.42)
= (5.5% - 5%)(2,160,000) ($7.42)
= $80,136 F

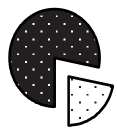
Industry volume (market size) variance = (budgeted market share %)(actual industry volume – budgeted industry volume)(budgeted weighted average CM per unit)
= (100,000 ÷ 2,000,000) (2,160,000 – 2,000,000) ($7.42)
= (5%) (160,000) ($7.42)
= $59,360 F

Many candidates find these two variances, market share and market size, difficult to remember. The key concept to keep in mind is "what is the variance measuring?", which is described below.

Market share:



budgeted market share %
->at the beginning of the year, ABH estimated its share of the market to be 5%.



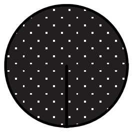
actual market share %
-> ABH's actual market share was 5.5% (118,800 ÷2,160,000).

Market share variance measures the cost (or benefit) to the company of not attaining (or exceeding) its expected market share. In this case, ABH exceeded its estimate by 0.5% (5% – 5.5%).

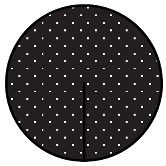
The actual industry volume, as opposed to estimated industry volume, is used to calculate the variance since market share is concerned with the percentage held of the total market and the total market is the actual industry volume.

The budgeted average CM is used because the market is defined as "body lotion", which includes both regular and smooth; therefore, to measure this variance, the average CM of both products must be used.

Market size (industry volume):



estimated market size (industry volume)
->at the beginning of the year, ABH estimated the market size (industry volume) to be 2,000,000.



actual market size (industry volume)
-> the actual market size (industry volume) was 2,160,000.

Market size variance measures the cost (or benefit) to the company of the industry volume being lower (or higher) then estimated. In this case, actual industry volume exceeded estimated (2,160,000 actual vs. 2,000,000 estimated).

Since this variance is isolating the impact of the industry volume being different then estimated, the budgeted market share percentage, and not the actual percentage, is used. This variance answers the question: “If we meet our estimated market share %, what is the impact of the industry volume being higher or lower than expected?”

The budgeted average CM is used because the market is defined as “body lotion”, which includes both regular and smooth; therefore, to measure this variance, the <u>average</u> CM of both products must be used.

Performance Management

Summary of sales variances, expressed pictorially:

Sales price variance			Sales volume variance		
	AQ x (AP – BP)			(AQ – BQ) x BICM	
Regular	58,200 x (11-12) =	58,200 U	Regular	(58,200 – 60,000) x 5.75 =	10,350 U
Smooth	60,600 x (16-18) =	121,200 U	Smooth	(60,600 –40,000) x 8.075 =	166,345 F
		179,400 U			**155,995 F**

Sales Mix Variance			Sales quantity variance		
(ASM % - BSM %) x total sales volume x (BICM – BACM)			(AQ x- BQ) x BACM		
Regular:	(48.9899% - 60%) x 118,800 x (5.75 - 7.42) =	21,844 F	Regular:	(58,200 – 60,000) x 7.42 =	13,356 U
Smooth:	(51.0101% - 40%) x 118,800 x (9.925 - 7.42) =	32,765 F	Smooth:	(60,600–40,000) x 7.42 =	152,852 F
		54,609 F			**139,496 F**

Market size var. = 59,360 F Calculation above	Market share var. = 80,136 F Calculation above

Abbreviations:

AQ: Actual quantity
BQ: Budgeted quantity
AP: Actual price
BP: Budgeted price
BICM: Budgeted individual contribution margin
BIP: Budgeted individual price
BACM: Budgeted average contribution margin

ASM%: Actual sales mix percentage
BSM%: Budgeted sales mix percentage
AISV: Actual industry sales volume
BMS%: Budgeted market share percentage
BISV: Budgeted industry sales volume
AMS%: Actual market share percentage

d) Reconciliation of variances

Variance reconciliation schedule:

Sales volume variance:

Sales quantity:						
Market size	59,360	F				
Market share	80,136	F	139,496	F		
Sales mix			54,609	F	194,105	F
Sales price variance					(179,400)	U
Variable cost variances:						
Direct material						
- Price (see Note 1 below)	($2,257)	U				
- Usage	4,513	F	2,256	F		
Direct labour						
- Rate	(5,514)	U				
- Efficiency	10,911	F	5,397	F		
Variable overhead						
- Spending	(3,528)	U				
- Efficiency	(7,020)	U	(10,548)	U		
Variable selling and administration						
- Cost	7,926	F	7,926	F	5,031	F
Fixed manufacturing budget variance					(13,000)	U
Fixed selling and admin. budget variance					(3,000)	U
Total variance (agrees to flexible budget report)					$3,736	F

Note 1: For the purposes of the reconciliation the DM price variance must be calculated based on usage since it is the cost of the quantities used that are included in the master and flexible budgets. The unused direct materials are in direct material inventory.
DM price variance for amount used:

Regular: 11,710 x (17.50/kilo – 17.0475/kilo)	5,298.7750	F
Smooth: 14,848 x (19.00/kilo – 19.5089/kilo)	(7,556.1472)	U
rounded	(2,257)	U

Investigating Variances

Approaches to Investigating Variances

Approaches used to determine when to investigate variances:

- Statistical procedures – The expected value table (see decision making under uncertainty) could be used to determine whether to investigate a variance. The alternatives would be to investigate or not to investigate, while the future events could be "system functioning properly" and "system not functioning properly". To use this model, the manager needs both probabilities of the future events and estimated costs. If these cannot be obtained or reasonable estimated, this model cannot be used. A second statistical procedure would be to plot variances and consider their frequency distribution. Any variance above a preset standard deviation from the budgeted amount could be investigated. A third possibility is to plot variances on a control chart to observe whether a variance appears to be trending toward an upper or lower limit on the control chart.

- Judgment – a manager who is aware of events occurring during a period that affects variances for that period does not need to investigate variances. Managers use their knowledge of the production process and their intuition to determine whether or not to investigate variances.

- Prescribed dollar or percentage amount – often companies have a stated dollar amount or stated percentage deviation from the standard that is used to determine whether to investigate variances.

Criteria for Investigating Variances

Criteria to select variances to investigate:

Cost benefit: The benefits must outweigh the costs to investigate a variance. The expected value model described earlier can be used to determine whether the costs outweigh the benefits.

Materiality: If a variance is considered insignificant, it need not be investigated. Frequently, variances above the prescribed dollar amount or prescribed percentage deviations are investigated. Those below these levels are considered immaterial.

Consistency of occurrence: If a variance is approximately the same period after period, management may want to investigate. The variance may be below the prescribed dollar or percentage amount; however the repeat occurrence indicates a potential problem.

Ability to control:	A cost that is beyond a company's control, such as realty taxes, need not be investigated; however, the variance should be highlighted to management.
Nature of item:	Some costs require closer monitoring than other costs because of their importance. For example, marketing campaigns are important because they promote a company's image or product. Under spending, which produces a favourable variance, could have dire long-term consequences in terms of lost market share or lost sales.

Cost/Volume/Profit (CVP) Analysis and Breakeven Analysis

Skill Level:	R/U	A/A
3.1.4.4 Performs cost-volume-profit (CVP) analysis for a given organization		
a) Describes the assumptions and limitations underlying CVP analysis	✓	
b) Describes the information requirements to perform CVP analysis	✓	
c) Performs a CVP analysis for single product and multiple product situations		✓
3.1.4.5 Performs breakeven, relevant cost, contribution margin, linear programming, sensitivity and uncertainty analyses		
d) Breakeven analysis		
• Calculates breakeven using alternative approaches (e.g. graphical, equation, contribution method), including consideration of sales mix and income tax		✓
3.1.4.5 e) Sensitivity analysis		
• Explains and illustrates how sensitivity analyses can be applied to capital budgeting, CVP, relevant costing, contribution margin analysis and other planning tools	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

CVP analysis is a model describing the relationship between costs (variable and fixed), volume (units sold) and profit. Generally, it is used estimate income given sales activity levels. A common application is to identify the breakeven sales volume.

The CVP relationship can be depicted graphically, in equation form or through contribution margin analysis.

CVP Analysis – Methods of Calculating Breakeven Point

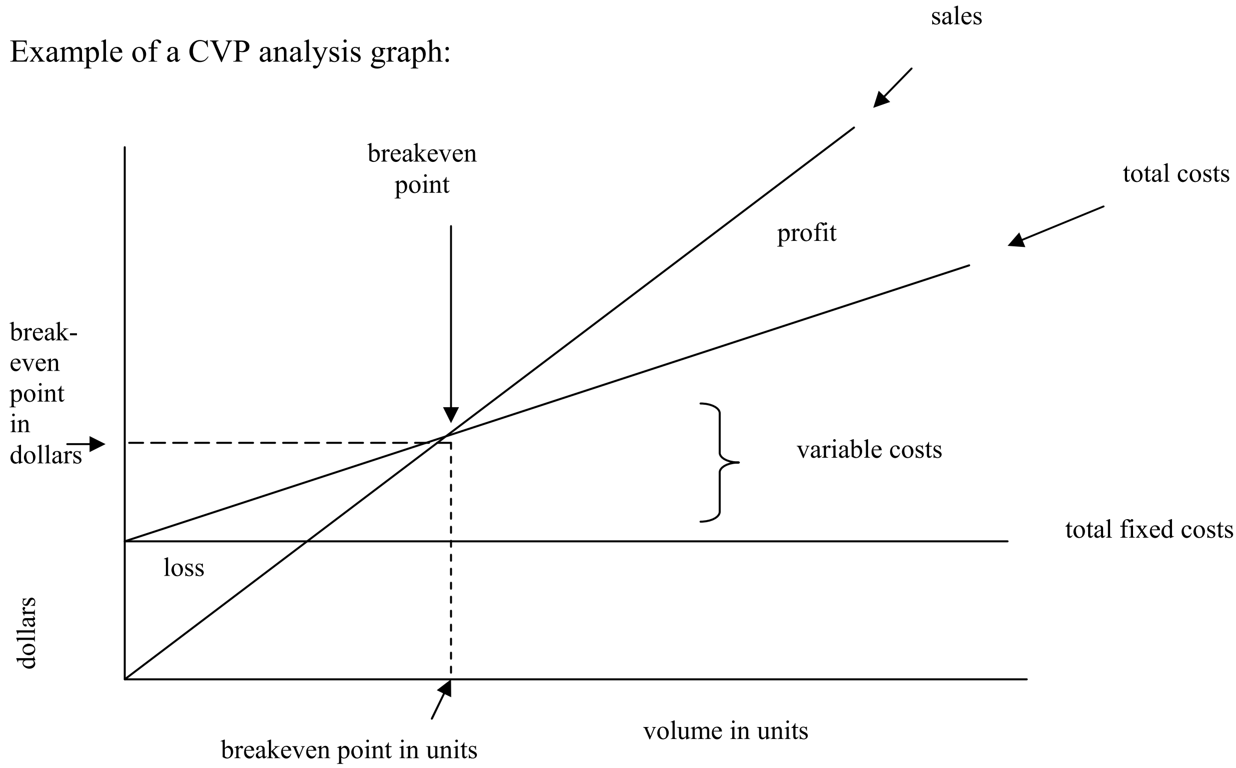
Three methods for calculating the breakeven points:

1. Graphical
2. Contribution margin
   - i) contribution margin per unit
   - ii) contribution margin ratio
3. Equation

1. Graphical

This method plots sales, variable costs and fixed costs. The relationship between these factors can be readily depicted from the graph.

Example of a CVP analysis graph:



This graph denotes the relationship over the relevant range. Once outside the relevant range this relationship is not valid.

<u>Description of graph:</u>

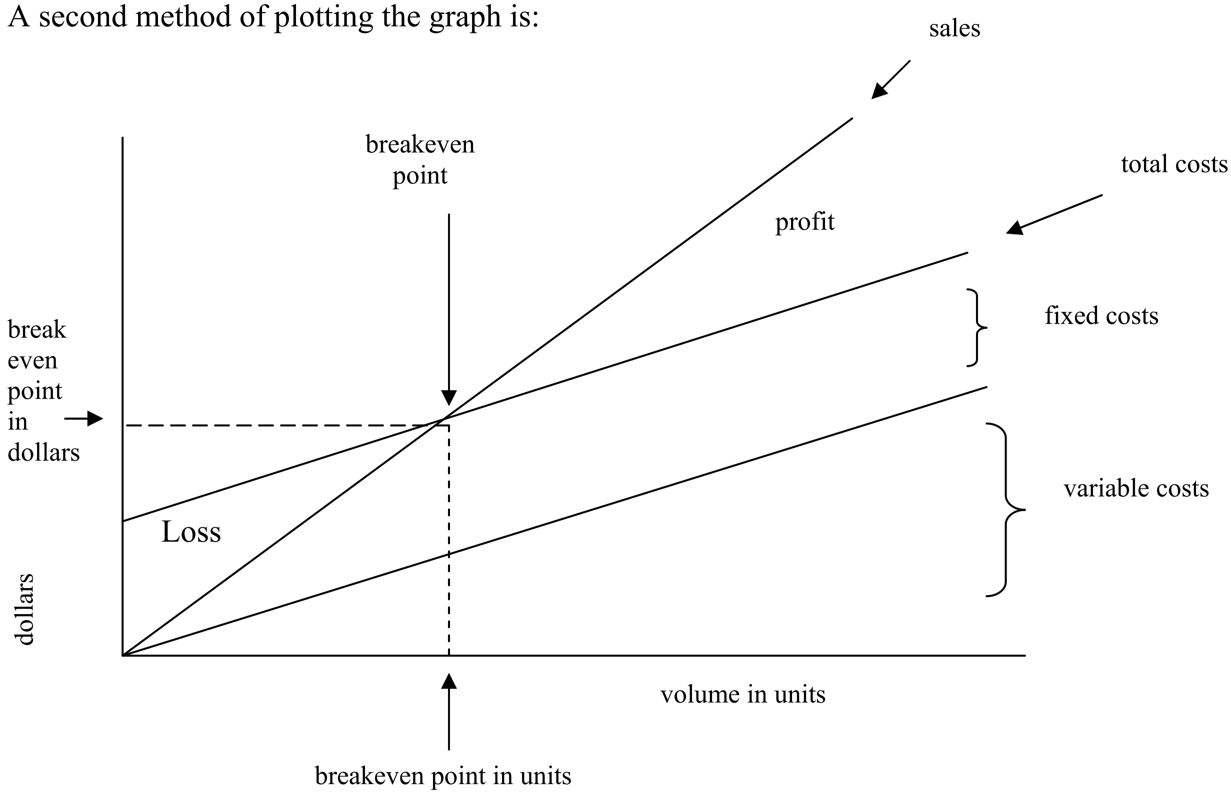
Total fixed costs are held constant over the relevant range.

Total costs include variable and fixed costs.

The difference between total costs and total fixed costs are variable costs. Note that total variable costs increase as volume increases.

Sales are total sales. The intersection of sales and total costs is the breakeven point. The area above this point represents profit and the area below represents losses.

A second method of plotting the graph is:



The only difference between this graph and the previous graph is the plotting of fixed costs. In this graph, fixed costs are plotted diagonally; however, the difference between total costs and variable costs is constant, which adheres to the underlying assumption that fixed costs are constant over the relevant range.

If a target profit were introduced, the total cost line would be increased to accommodate the target profit and would be called "total cost and target profit".

2. Contribution Margin (CM) Method

This method uses the contribution margin to calculate the breakeven point. This method can be applied using two approaches:

1. Contribution margin per unit
2. Contribution margin ratio

Contribution Margin per Unit

The formula for this approach:

$$\text{breakeven point in units} = \frac{\text{fixed costs}}{\text{CM per unit}}$$

CM per unit = selling price per unit – variable cost per unit

Introducing a target profit changes the formula as follows:

$$\text{Breakeven point in units} = \frac{\text{fixed costs + target profit}}{\text{CM per unit}}$$

Numerical example:

Selling price (SP) = \$31.25/unit
Variable costs (VC) = \$20.00/unit
Fixed costs (FC) = \$28,125
x = number of units required to breakeven

$$\text{Breakeven point in units} = \frac{\text{FC}}{\text{CM per unit}}$$

$$= \frac{\$28,125}{\$31.25/\text{unit} - \$20/\text{unit}}$$

$$= \frac{\$28,125}{\$11.25/\text{unit}}$$

$$= 2,500 \text{ units}$$

Therefore, 2,500 units must be sold to breakeven.

Introducing the target profit of $22,500, the solution changes as follows:

$$\text{Breakeven point in units} = \frac{\text{FC + target profit}}{\text{CM per unit}}$$

$$= \frac{\$28{,}125 + \$22{,}500}{\$31.25/\text{unit} - \$20/\text{unit}}$$

$$= \frac{\$50{,}625}{\$11.25/\text{unit}}$$

$$= 4{,}500 \text{ units}$$

Therefore, 4,500 units must be sold to yield a target profit of $22,500.

Contribution margin ratio

This approach uses the contribution margin as a percentage of sales to determine the breakeven point.

Formula:

$$\text{Breakeven point in sales dollars} = \frac{\text{fixed costs}}{\text{CM ratio}}$$

$$\text{CM ratio} = \frac{\text{CM per unit}}{\text{selling price per unit}}$$

OR

$$\text{CM ratio} = \frac{\text{total contribution margin}}{\text{total sales}}$$

With a target profit the formula changes as follows:

$$\text{Breakeven point in sales dollars} = \frac{\text{fixed costs + target profit}}{\text{CM ratio}}$$

Using the previous information, the breakeven calculations using the CM ratio approach are:

$$\text{Breakeven point in sales dollars} = \frac{\text{FC}}{\text{CM ratio}}$$

$$\text{CM ratio} = \frac{\text{SP-VC}}{\text{SP}}$$

$$= \frac{\$31.25 \text{ per unit} - \$20 \text{ per unit}}{\$31.25 \text{ per unit}}$$

$$= \frac{\$11.25}{\$31.25}$$

$$= 36\%$$

$$\text{BE point} = \frac{\$28,125}{36\%}$$

= $78,125 in sales dollars required to breakeven

Therefore, sales must equal $78,125 to breakeven or units sold to breakeven must equal 2500 ($78,125/$31.25 per unit).

Introducing the target profit of $22,500 results in the following:

$$\text{Breakeven point in sales dollars} = \frac{\text{FC + target profit}}{\text{CM ratio}}$$

$$= \frac{\$28,125 + \$22,500}{36\%}$$

$$= \frac{\$50,625}{36\%}$$

= $140,625 in sales dollars required to breakeven

Therefore, sales must equal $140,625 to earn a target profit of $22,500 or units sold to earn the target must equal 4500 ($140,625/$31.25 per unit).

3. Equation

This method uses an equation to calculate breakeven:

sales – variable costs – fixed costs = 0

If a target profit is introduced, the equation becomes:

sales – variable costs – fixed costs = target net income

Using the information in the preceding example, breakeven is calculated as follows:

Equation:

$$\begin{aligned} 31.25x - 20.00x - 28{,}125 &= 0 \\ 31.25x - 20.00x &= 28{,}125 \\ 11.25x &= 28{,}125 \\ x &= 2{,}500 \text{ units} \end{aligned}$$

Therefore, 2,500 units must be sold to breakeven.

Assuming a target profit of $22,500, the equation changes as follows:

$$\begin{aligned} 31.25x - 20.00x - 28{,}125 &= 22{,}500 \\ 31.25x - 20.00x &= 22{,}500 + 28{,}125 \\ 11.25x &= 50{,}625 \\ x &= 4{,}500 \text{ units} \end{aligned}$$

Therefore, to earn a target profit of $22,500, 4,500 units must be sold.

Single vs. Multi Product CVP Analysis

Single CVP analysis performs analysis on one product, whereas multi-product CVP analysis includes the impact of several products. Multi-product CVP analysis often uses an average contribution margin to compute the breakeven point for each product. The previous equations presented CVP for single product situations. Calculating CVP for multi-product situations is presented below.

Multi-product CVP - Impact of Sales Mix

Companies selling more than one product need to calculate the breakeven point incorporating all products. The sales mix refers to the percentage of each product's sales relative to the other products. There are three approaches to calculating the breakeven point in multi-product situations. These are:

1. Product bundle approach
2. Contribution approach
   i. contribution margin per unit
   ii. contribution ratio
3. Equation approach

Note to candidates: It usually is not necessary to learn all three approaches. All three approaches result in the same answer. It is recommended candidates learn one method well, but also review the other methods.

Each of these approaches are illustrated on the following pages based on this data:

	Product X			Product Y			Total	
	Unit $	Total	%	Unit $	Total	%	%	
Sales in units	-	150,000	75%	-	50,000	25%	100%	200,000
Sales	$10	$1,500,000	60%	$20	$1,000,000	40%	100%	$2,500,000
Variable costs	$4	600,000	-	$6	300,000	-	36%	900,000
Cont. margin	$6	900,000		$14	700,000		64%	1,600,000
Fixed costs								800,000
								$800,000

Multi-product CVP – The 'Product Bundle' Approach to Breakeven

This approach is another means of calculating breakeven without applying algebra. This approach considers the sales mix and contribution margin of the group of products together as a 'bundle'.

Using the previous example, the product bundle approach is calculated as follows:

	Product X	Product Y	Bundle
	Unit $	Unit $	
Selling price	$10	$20	
Variable costs	$4	$6	
Contribution margin	$6	$14	
Sales mix (three of X for every one of Y)	x 3	x 1	
	18.00	14.00	32.00 CM of the bundle

Number of bundles required to breakeven:

$$\text{Number of bundles required to breakeven} = \frac{\text{FC}}{\text{CM of product bundle}}$$

$$= \frac{\$800,000}{32}$$

$$= 25,000 \text{ bundles}$$

Application of sales mix to bundles:

	Product X	Product Y
Sales mix (three of X for every one of Y)	3	1
Number of bundles	25,000	25,000
Number of units of each product to BE	75,000	25,000

Multi-Product CVP - The Contribution Approach to Breakeven

- Contribution margin per unit approach

The first step is to calculate the average contribution margin per unit and then apply the formula. Once the total units are determined, calculate the number of units of each product that must be sold by applying the sales mix percentage.

Using the previous example, the average contribution margin per unit is:

$$\text{Average CM per unit} = \frac{\text{total contribution margin}}{\text{total sales in units}}$$

$$= \frac{\$1{,}600{,}000}{200{,}000}$$

$$= \$8/\text{unit}$$

$$\text{Total sales required to breakeven} = \frac{\text{fixed costs}}{\text{average CM per unit}}$$

$$= \frac{\$800{,}000}{\$8}$$

$$= 100{,}000 \text{ units}$$

The sales mix percentage in units is calculated as follows:

		Product X	Product Y
Sales in units	a	150,000	50,000
Total sales in units	b	200,000	200,000
	a ÷ b	75%	25%

Sales required to breakeven:

		Product X	Product Y
Total sales in units required to breakeven	a	100,000	100,000
Sales mix percentage	b	75%	25%
Sales of each product required to breakeven	a x b	75,000	25,000

Therefore, 75,000 units of X must be sold and 25,000 units of Y must be sold to breakeven.

- Contribution ratio approach

To apply this method in multi-product situations, calculate the average contribution margin ratio, use the formulas to calculate the total breakeven point, then use the sales mix for dollar sales to determine the amount of sales dollars of each product that must be sold to breakeven.

Using the numerical data in the previous example:

$$\text{Average CM ratio} = \frac{\text{total contribution margin}}{\text{total sales in dollars}}$$

$$= \frac{\$1{,}600{,}000}{2{,}500{,}000}$$

$$= 64\%$$

$$\text{BE in sales dollars} = \frac{\text{fixed costs}}{\text{CM ratio}}$$

$$= \frac{\$800{,}000}{64\%}$$

$$= \$1{,}250{,}000$$

		Product X		Product Y	
The sales mix percentage in sales dollars:					
Sales in dollars	a	$1,500,000		$1,000,000	
Total sales ($1,500,000 + $1,000,000)	b	$2,500,000		$2,500,000	
Sales mix percentage in sales dollars	a ÷ b	60%		40%	

Sales in dollar of each product required to breakeven:

		Product X		Product Y	
Total sales in dollars required to breakeven	a	$1,250,000		$1,250,000	
Sales mix percentage	b	60%		40%	
Sales in dollars of each product required to breakeven	a x b	$750,000	A	$500,000	A
Restated in units:					
Selling price per unit		$10	B	$20	B
Units that must be sold to breakeven		75,000	A ÷ B	25,000	A ÷ B

Introducing the target profit of $200,000 results in the following:

$$\text{BE in sales dollars} = \frac{\text{FC + target profit}}{\text{CM ratio}}$$

$$= \frac{\$800{,}000 + \$200{,}000}{64\%}$$

= $1,562,500 total sales dollars required to earn a target profit of $200,000.

Sales in dollars of each product required to earn the target profit of $200,000:

		Product X		Product Y	
Total sales in dollars required	a	$1,562,500		$1,562,500	
Sales mix percentage (calculated previously)	b	60%		40%	
Sales in dollars of each product required	a x b	$937,500	A	$625,000	A
Restated in units:					
Selling price per unit		$10	B	$20	B
Units that must be sold to earn target profit		93,750	A ÷ B	31,250	A ÷ B

Multi-Product CVP – The Equation Approach to Breakeven

This approach expresses a product's sales in units relative to other products.

There are two methods of applying the equation approach:

1. *Consider the sales mix within the equation:*

$$\underbrace{(10-4)}_{\text{CM of X}} \times \underbrace{.75x}_{\text{sales mix of X}} + \underbrace{(20-6)}_{\text{CM of Y}} \times \underbrace{.25x}_{\text{sales mix of Y}} = 800{,}000$$

$$4.5x + 3.5x = 800{,}000$$

$$x = 100{,}000$$

Application of the sales mix:

X	100,000	x	.75	=	75,000
Y	100,000	x	.25	=	25,000

Assuming a target profit of $200,000 changes the results as follows:

$$4.5x + 3.5x = 800{,}000 + 200{,}000$$
$$8x = 1{,}000{,}000$$
$$x = 125{,}000$$

Application of the sales mix:

X	125,000	x	.75	=	93,750
Y	125,000	x	.25	=	31,250

2. *Expressing each of the products in terms of one of the products:*

The sales mix can be expressed as three units of product X are sold for every one unit of product Y. Product X unit sales are 150,000 ($1,500,000 ÷ $10) and Product Y unit sales are 50,000 ($1,000,000 ÷ 20). Therefore, three units of X are sold for each unit of Y sold (150,000 ÷ 50,000).

Applying the equation approach results in the following:

Y = number of units of Product Y to breakeven
3Y = number of units of Product X to breakeven

sales – variable costs – fixed costs	=	0
((20Y + 10 (3Y)) – ((6Y + 4 (3Y)) – 800,000	=	0
(20Y + 30Y) – (6Y + 12Y)	=	800,000
50Y – 18Y	=	800,000
32Y	=	800,000
Y	=	25,000
	and	
3Y	=	25,000 X 3 = 75,000

Therefore, 25,000 units of Y must be sold and 75,000 units of X must be sold to breakeven.

Assuming a target profit of $200,000 changes the results as follows:

Sales – variable costs – fixed costs	=	target profit
((20Y + 10 (3Y)) – ((6Y + 4 (3Y)) – 800,000	=	200,000
(20Y + 30Y) – (6Y + 12Y)	=	800,000 + 200,000
50Y – 18Y	=	1,000,000
32Y	=	1,000,000
Y	=	31,250 units
	and	
3Y	=	31,250 X 3 = 93,750

Therefore, 31,250 units of Y must be sold and 93,750 units of X must be sold to earn a target profit of $200,000.

Recap of the Three Approaches and When to Use Each

The approach to use is dependent on the information available:

Approach	Useful when:
Equation	Sales volume is not available
Bundle	Sales volume is not available
Contribution margin – per unit and ratio	Sales volumes are necessary to calculate breakeven

Impact of Taxes on CVP

Taxes only impact breakeven calculations with a target profit. The target profit is adjusted for the effect of tax.

To determine the target profit, the following formula is applied:

$$\text{Pre-tax target profit} = \frac{\text{after tax target profit}}{(1 - \text{tax rate})}$$

For example, if the after-tax target profit is \$1,000 and the tax rate is 40%, the pre-tax target profit is:

$$\text{Pre-tax target profit} = \frac{\$1{,}000}{(1 - 0.4)}$$

$$= \frac{\$1{,}000}{0.6}$$

$$= \$1{,}667$$

Check:

Income	1,667
Taxes at 40%	667
Net income	1,000

Assumptions and Limitations of CVP Analysis

The CVP model is based on underlying assumptions regarding the interrelationship between revenue, costs and volume. In fact, profits will change due to other factors, besides volume. A few examples include efficiency improvements due to technological advances, strikes, unavailability of raw materials and market changes.

The assumptions and limitations can be summarized as:

1. The CVP model only considers volume as a driving factor of costs and revenue.
2. The behaviour of total costs and total sales is linear over the relevant range.
3. All costs can be defined as either fixed or variable.
4. Total fixed costs are constant over the relevant range.
5. Changes in variable costs are proportional to changes in volume.
6. Selling prices are constant.
7. Production costs (e.g. raw material costs, wage rates) are constant.
8. Efficiency and productivity are constant.
9. In multi-product CVP analysis, the sales mix remains constant, regardless of volume levels.
10. Production equals sales.

Sensitivity Analysis in CVP

To address uncertainty in the CVP model, sensitivity testing can be employed to determine the resulting profit or the breakeven level using different assumptions regarding selling prices, variable expenses, fixed costs and volumes. Although tedious to do manually, any spreadsheet can be used to do this analysis.

Relevant Costing

Skill Level:	R/U	A/A
3.1.4.5 a) Relevant costing • Applies the concept of relevant costs and relevant revenues to a wide range of decisions		✓
3.1.4.5 e) Sensitivity analysis • Explains and illustrates how sensitivity analyses can be applied to capital budgeting, CVP, relevant costing, contribution margin analysis and other planning tools	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Relevant costing is the process of identifying a decision's relevant costs. . The relevant costs are the future costs and revenues that differ among the alternatives. In other words, only the incremental or differential costs or revenues are relevant. Sunk costs are not relevant. Sunk costs are past costs that have already incurred. Relevant costing is also known as incremental or differential costing.

It should be noted that no competent decision maker would ever reach a decision considering only the decision's financial effects. There are often non-financial (usually strategic) considerations associated with a decision. For example, a decision to contract out production must consider the quality of the supplier's product and the supplier's ability to deliver on time. Therefore, in what follows the maintained assumption is there are no relevant qualitative factors that differ across alternatives so the focus is exclusively on the financial effects of decisions.

The steps to apply in any relevant costing decision are:

1. Determine all costs associated with each alternative.

2. Exclude sunk costs.

3. Exclude costs that do not differ among alternatives.

4. Select the best alternative after analyzing the remaining cost information.

In situations involving revenues, include revenues in the above four steps.

Relevant costing is typically applied in the following decisions:

Special orders	
Make or buy	
Adding or dropping a product line or organization unit	
Utilization of scarce resources	(addressed in the 'contribution margin analysis' section of this manual)
Sell or process further	(addressed in the 'joint costing section' of this manual)

Special Orders

Relevant costing can be applied to determine whether or not to accept a special order. If the incremental revenue from the special order is greater than incremental costs, the special order should be accepted. This applies in the following situations:

1. There is idle capacity. If there is no idle capacity, there is an opportunity cost of foregoing regular production to make capacity available.

2. A company is operating in a distress condition. In these instances, cash inflow can be crucial and accepting a special order can provide necessary cash.

3. There are no consequences of accepting or rejecting the order other than the immediate financial consequence of the decision.

Numerical example:

Basic data:

Capacity	200,000 units
Capacity utilized	180,000 units or 90%
Standard selling price	$4.00 per unit
Annual fixed cost	$90,000
Variable cost	$2.00 per unit

Special order:

Volume	10,000 units
Selling price	$2.40 per unit
Shipping expenses	$1.00 per unit paid by buyer

Should the special order be accepted?

Selling price	$2.40
Variable cost	$2.00
Contribution margin per unit	$0.40
Units	10,000
Total contribution margin	$4,000

The special order should be accepted because it results in additional contribution of $4,000.

In this example, capacity is available. If capacity were not available, the opportunity cost of foregoing regular production must be included. Assuming the company's capacity utilization is 200,000 units (i.e. there is no excess capacity), should the special order be accepted?

Selling price			$2.40
Variable cost of special order		$2.00	
CM of production foregone to produce the special order:			
Selling price	4.00		
Variable cost	2.00	2.00	4.00
Contribution margin per unit			($1.60)
Units			10,000
Total contribution margin			($16,000)

If excess capacity is not available the special order should not be accepted since doing so results in a loss of $1.60 per unit or $16,000 in total.

Make or Buy

This is the decision to either make a part internally or purchase externally. The costs of each alternative are compared and a decision is made. Note that qualitative factors must be considered in this decision. Producing internally ensures quality parts and a steady source of supply.

Therefore, quantitatively, it may be beneficial from a cost perspective for a company to purchase from an external source, control over quality and securing a steady source may outweigh the quantitative benefits. In addition, a decision to outsource could result in available capacity, which may or may not be idle. Available capacity due to purchasing externally could be rented out, used for other products or remain idle. The costs or revenues associated with these courses of action must be included in the quantitative analysis.

Numerical example:
Basic data:
Cost to produce internally:

	Per Unit	Total
Production in units	--	18,000
Costs:		
Direct materials	$4	$72,000
Direct labour	3	54,000
Variable factory overhead	3	54,000
Fixed factory overhead	6	108,000
Total cost	$16	$288,000

Cost to purchase externally:

External price	$12 per unit
Reduction in fixed overhead, if purchased externally	25%

To determine whether to make or buy, the company needs to consider the costs that change. In this situation, if the part is purchased externally, there will be idle capacity. Although a portion of the fixed overhead will be avoided by outsourcing, not all of the fixed costs can be avoided.

	Make 18,000 Units		Buy 18,000 nits	
	Per Unit	Total	Per Unit	Total
Purchase price	--	--	$12	$216,000
Direct materials	$4.00	$72,000		
Direct labour	3.00	54,000		
Variable factory overhead	3.00	54,000		
Fixed factory overhead that can be avoided $\frac{(\$108,000 \text{ X } 25\%)}{18,000}$	1.50	27,000		
Totals	$11.50	$207,000	$12	$216,000

Therefore, quantitatively, it is better to produce the part because this results in yearly savings of $9,000 ($216,000 - $207,000).

An alternative method to calculating the savings is:

	Make 18,000 Units		Buy 18,000 Units	
	Per Unit	Total	Per Unit	Total
Purchase price	--	--	$12.00	$216,000
Direct materials	$4	$72,000		
Direct labour	3	54,000		
Variable factory overhead	3	54,000		
Fixed factory overhead that can be avoided $\frac{(\$108,000 \text{ X } 25\%)}{18,000}$			(1.50)	(27,000)
Totals	$10	$180,000	$10.50	$189,000

In this instance, the fixed factory overhead that can be avoided is subtracted from the external purchase price. The net savings amount of $9,000 is the same ($189,000 - $180,000).

A third method for calculating the savings is:

	Make 18,000 Units		Buy 18,000 Units	
	Per Unit	Total	Per Unit	Total
Purchase price	--	--	$12.00	$216,000
Direct materials	$4	$72,000		
Direct labour	3	54,000		
Variable factory overhead	3	54,000		
Fixed factory overhead	6	108,000	4.50	81,000
Totals	$16	$288,000	$16.50	$297,000

In this instance, the cost of the fixed factory overhead for both make and buy is included. The net savings amount of $9,000 is the same ($297,000 - $288,000).

Candidates should use the method they are most comfortable with. All three methodologies were presented as various universities teach different methods.

Adding or Dropping a Product Line

The analysis for this decision must include only costs directly identifiable to the product lines. Common costs or fixed costs that will occur regardless of dropping or keeping the line must be removed from the analysis.

Example:

XYZ Company has three product lines: leisure books, textbooks and computer manuals. The company is considering dropping leisure books. The income statement for each product is:

	Computer Books	Leisure Books	Text Books	Total
Sales	$100,000	$150,000	$250,000	$500,000
Variable costs	60,000	80,000	120,000	260,000
Contribution margin	$40,000	$70,000	$130,000	$240,000
Less fixed costs:				
Direct fixed costs	20,000	65,000	40,000	125,000
Allocated fixed costs	10,000	15,000	25,000	50,000
Total fixed costs	30,000	80,000	65,000	175,000
Operating income	$10,000	($10,000)	$65,000	$65,000

To determine whether to drop leisure books, XYZ Company must remove the allocated fixed costs from net income. These costs will be incurred regardless of whether leisure books are dropped or retained.

	Leisure Books
Operating income, as given	($10,000)
Add: allocated fixed costs	15,000
Operating income directly attributable to leisure books	5,000

Therefore, XYZ Company should retain the leisure books product line.

Contribution Margin (CM) Analysis

Skill Level:	R/U	A/A
3.1.4.5 b) Contribution margin analysis		
• Computes contribution margin and gross margin and utilizes each appropriately in planning and decision making		✓
• Applies contribution margin analysis to short-term planning situations including those involving scarce resources		✓
3.1.4.5 e) Sensitivity analysis		
• Explains and illustrates how sensitivity analyses can be applied to capital budgeting, CVP, relevant costing, contribution margin analysis and other planning tools	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

CM Approach vs. Gross Margin (GM) Approach

The contribution margin approach is closely related to direct costing and is a method of presenting net income. Under this approach, all variable costs are deducted from sales to determine the contribution margin; all fixed costs including fixed manufacturing overhead, are then deducted to determine net income.

Under the gross margin (GM) approach, fixed manufacturing overhead is included in cost of goods sold.

Example:

Contribution margin (CM) approach:

		(in 000s)
Sales		$2,000
Less: variable expenses		
Manufacturing	$480	
Selling	200	
Administration	60	740
Contribution margin		$1,260
Less: fixed costs		
Manufacturing	$284	
Selling	96	
Administration	164	544
Net income		$716

Gross Margin (GM) approach:

		(in 000s)
Sales		$2,000
Less: manufacturing cost of goods sold		764
Gross margin		1,236
Less:		
Selling	$296	
Administration	224	520
Net income		$716

Reconciliation between CM approach and GM approach:

	(in 000s)
Contribution margin	$1,260
Gross margin	1,236
Difference	$24
Fixed manufacturing included in GM approach	$284
Variable selling and admin. included in CM approach	260
Difference	$24

When using the CM approach on a product basis, managers can easily see which products to emphasize. To enhance decisions, managers could use sensitivity analysis, whereby, scenarios using different assumptions regarding volume levels can be used. This allows managers to make better informed decisions about production levels, sales efforts, etc.

CM Analysis and Scarce Resources

The CM approach is a useful tool to evaluate the best use of scarce resources. When a manufacturing facility producing multiple products is operating at full capacity, managers must determine which products should utilize the scarce resources, such as direct labour hours or machine hours.

To make such a decision, managers should consider the CM per constraining factor, rather than CM per unit of product.

Example:

XYZ Company produces two products. The company is operating at capacity and the number of machine hours available is limited to 10,000 hours.

Total annual fixed costs for both products if $58,000

	Product X		Product Y	
	(per unit)		(per unit)	
Selling price	$12.00		$28.00	
Variable costs	$10.00		$24.00	
Contribution margin	$2.00	A	$4.00	A
Total annual fixed costs for all products is $58,000				
Machine hours required	2.0	B	5.0	B
CM per machine hours A ÷ B	$1.00		$0.80	
Maximum production:				
Machine hours available	10,000		10,000	
Machine hours required per unit	÷ 2		÷ 5	
Maximum total production in units	5,000		2,000	
CM per unit	x $2.00		x $4.00	
Total contribution margin	$10,000		$8,000	

Since Product X has a higher CM per constraining factor (machine hours), Product X should be produced and Product Y dropped. This enhances XYZ Company's contribution margin by $2,000 ($10,000 - $8,000). Note that Product Y has a higher CM per unit, but Product X has a higher CM per constraining factor.

In the foregoing example, we assumed unlimited demand. If XYZ Company anticipated maximum sales of 3,500 units of Product X, production levels would change as follows:

Total hours available	10,000	MH's
MH's utilized on Product X:		
3,500 units X 2 MH's/unit	7,000	
Remaining machine hours available	3,000	
MH's utilized on Product Y	3,000	
Machine hours available	0	

The number of units of Product Y produced equals 600 (3,000 MH's / 5 MH's per unit).

Total CM assuming limited demand for Product X:

	Product X	Product Y	Total
Units produced	3,500	600	
CM per unit	$2.00	$4.00	
	$7,000	$2,400	$9,400

Linear Programming

Skill Level:	R/U	A/A
3.1.4.5 c) Linear programming		
• Describes the assumptions underlying the use of linear programming	✓	
• Formulates simple and complex linear programming problems and solves simple problems (i.e. those with two variables)		✓
• Interprets linear programming solutions	✓	
3.1.4.5 e) Sensitivity analysis		
• Explains and illustrates how sensitivity analyses can be applied to capital budgeting, CVP, relevant costing, contribution margin analysis and other planning tools	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Linear programming is a method of allocating scarce resources in order to maximize revenue, contribution margin or profit, or to minimize costs.

Steps in Applying Linear Programming

1. Define the decision variables.
   These are the variables a manager needs to determine, such as the number of units to produce of each product.

2. Express the objective function in terms of the decision variables.
   The objective function, as the name implies, is a mathematical expression of the goal of the linear program, such as maximizing revenue or contribution margin or minimizing cost. Note that fixed costs and any fixed cost components in product costs should be excluded in this analysis since they will not change as a result of the decision.

3. Express the constraints in terms of the decision variable.
   The constraints are the limited resources. In addition, non-negativity constraints must be included. These are mathematical expressions, which state that the decision variables cannot fall below zero. The constraints are normally expressed as inequalities. (e.g. $<$ or $>$).

Linear Programming Example

XYZ Company produces two products, A and B. Both products must be processed in both the assembly and finishing departments. The hours available in each department are limited. The company would like to earn the highest contribution margin possible. Information on each product is:

Department	Products A	Products B	Hours Available
Assembly	4 hours	10 hours	100
Finishing	5 hours	3 hours	90
CM per unit	$32	$48	

Step 1: Define the decision variables:

A = number of units of Product A to produce
B = number of units of Product B to produce

Step 2: Express the objective function in terms of the decision variables.
The objective is to maximize contribution margin and is expressed as:

maximize = 32A + 48B

Step 3: Express the constraints in terms of the decision variables.
The constraints are the limited hours available in each department, as well as the non-negativity constraints:

Assembly: $4A + 10B \leq 100$ hours
Finishing: $5A + 3B \leq 90$ hours
Non-negativity constraint: $A, B \geq 0$

The linear programming model is then: maximize $32A + 48B$
subject to: $4A + 10B \leq 100$ hours
$5A + 3B \leq 90$ hours
$A, B \geq 0$

Methods to Solve Linear Programming Problems

To obtain the solution to a linear programming problem, there are two methods:

1. Simplex method – an iteration of various solutions are made until the optimal solution is found. This method is time consuming and tedious to perform manually; however, common computer software packages can perform the iterations quickly and easily.

3. Graphical method – corner points are plotted on a graph until a feasible region (an area representing feasible solutions) is determined. The graphical method can be used when there are two decision variables since a two-dimensional graph can only accommodate two decision variables.

   Steps in applying the graphical method:

   i. change inequality signs to equality signs
   ii. graph the equalities (see example below)
   iii. identify the feasible region
   iv. determine the CM at each corner in the feasible region. The highest CM is the optimum solution.

Graphical Method

Plotting graph:

Plotting assembly constraint:

Constraint: 4A + 10B = 100 hours

Substitute 0 for A:

$4(0) + 10B = 100$
$10B = 100$
$B = 10$
Point to graph = (A, B)
(0, 10)

Substitute 0 for B:

$4A + 10(0) = 100$ hours
$4A = 100$ hours
$A = 25$ hours
Point to graph = (A, B)
= (25, 0)

Plotting both points and drawing a line between the two is the assembly constraint function.

Plotting finishing constraint:

Constraint: 5A + 3B = 90 hours

Substitute 0 for A:

$5(0) + 3B = 90$
$3B = 90$
$B = 30$
Point to graph = (A, B)
= (0, 30)

Substitute 0 for B:

$5A + 3(0) = 90$ hours
$5A = 90$
$A = 18$
Point to graph = (A, B)
= (18, 0)

Plotting both points and drawing a line between the two is the finishing (machining) constraint function.

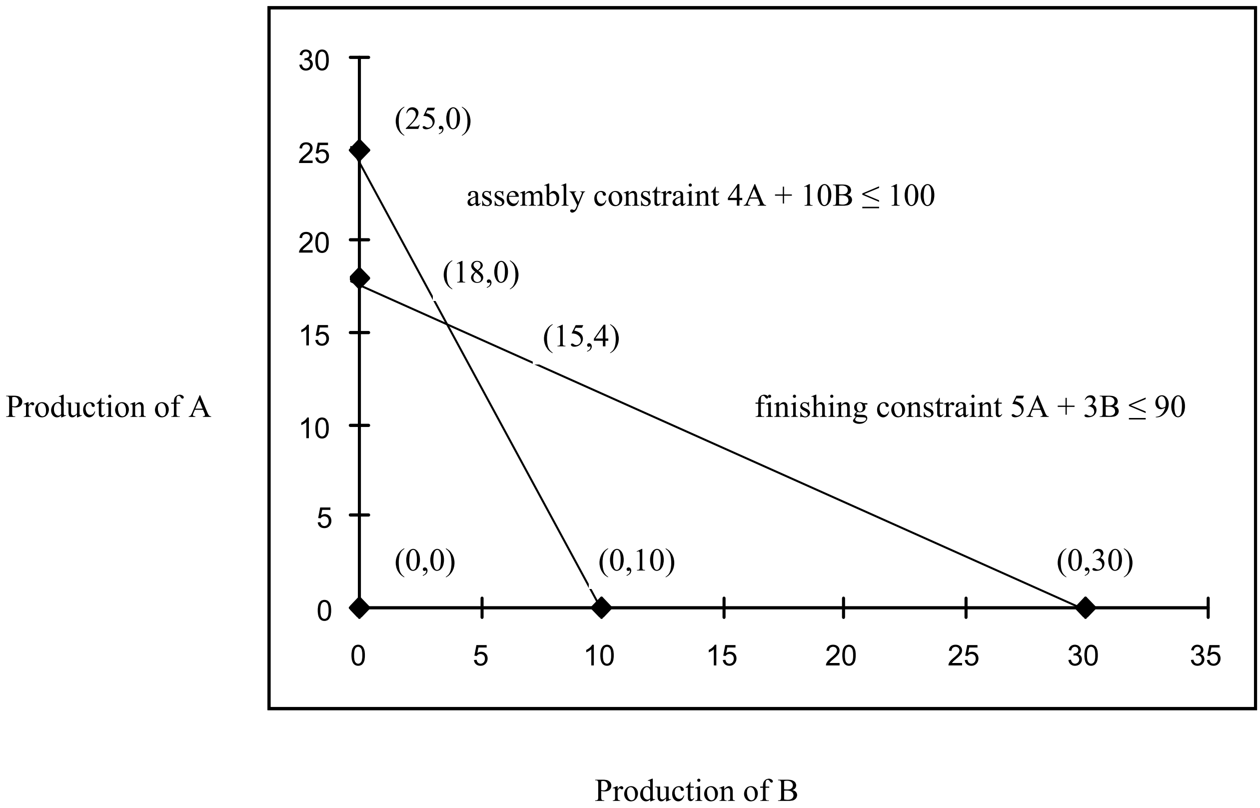
Plotting non-negativity constraint:

Constraint: A, B = 0
Point to graph = (A, B)
= (0, 0)

Summary of points to graph and resulting contribution margin:

	Point		Objective Function Contribution Margin
	A	B	32A + 48B
Assembly:	0	10	32(0) + 48(10) = $480
	25	0	32(25) + 48(0) = $800
Finishing:	0	30	32(0) + 48(30) = $1440
	18	0	32(18) + 48(0) = $576
Non-negativity:	0	0	32(0) + 48 (0) = 0

Plotting the Feasible Region



The feasible region is the portion of the graph in the bottom left corner (from 0 to 18 on the Y axis and from 0 to 10 on the x axis).

This region satisfies all the constraints. Since the problem is linear, there is no solution that will be better than best one at the corners of the feasible set. So, to determine the optimal solution, calculate the contribution margin at each corner point of the feasible region:

A	B	32A + 48B	
0	10	32(0) + 48(10) = \$480	(calculated previously)
18	0	32(18) + 48(0) = \$576	(calculated previously)
0	0	32(0) + 48 (0) = 0	
15	4	32(15) + 48(4) = \$672	(see below for calculation of intersection point)

The intersection point between the two constraint lines can be solved by solving the two constraints simultaneously:

$$\begin{array}{rcrl} 4A & + & 10B & = 100 \text{ hours} \\ \underline{5A} & \underline{+} & \underline{3B} & \underline{= \ \ 90 \text{ hours}} \\ -1A & + & 7B & = \ 10 \text{ hours} \end{array}$$

Since this equation cannot be solved, multiply each equation by a number, which will result in identical values for either A or B:

$$\begin{array}{rrcrl} & 4A\ (5) & + & 10B\ (5) & = 100\ (5) \\ = & 20A & + & 50B & = 500 \end{array}$$

$$\begin{array}{rrcrl} & 5A\ (4) & + & 3B\ (4) & = \ 90\ (4) \\ = & 20A & + & 12B & = 360 \end{array}$$

Simultaneous solution:

$$\begin{array}{rcrl} 20A & + & 50B & = 500 \\ \underline{20A} & \underline{+} & \underline{12B} & \underline{= 360} \\ & & 38B & = 140 \\ & & B & = 3.7 \quad \text{(rounded to 4)} \end{array}$$

Since B = 4, A can be calculated as:

$$\begin{array}{rcrl} 4A & + & 10B & = 100 \\ 4A & + & 10\ (4) & = 100 \\ & & 4A & = 100 - 40 \\ & & 4A & = 60 \\ & & A & = 15 \end{array}$$

Proof:

A = 15, B = 4

4A	+	10B	≤ 100
4(15)	+	10(4)	≤100
60	+	40	= 100
5A	+	3B	≤ 90
5(15)	+	3(4)	≤ 90
75	+	12	= 87

Decision Analysis Under Uncertainty

Skill Level:	R/U	A/A
3.1.4.5 f) Decision analysis and uncertainty • Explains and applies various tools for dealing with uncertainty in making decisions (e.g. decision tables, decision trees, expected value analysis, expected value of perfect information, etc.)	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Approaches have been developed to choose the best option when the decision maker has several alternatives and there is uncertainty with respect to future events. For example, in a new product launch, a retailer does not know the quantity to order, as consumer demand is unknown. If consumer demand is expected to be low, the retailer wants to buy low quantities; whereas, if consumer demand is expected to be high, the retailer would purchase high quantities. As the future event, consumer demand is uncertain, the manufacturer can use decision analysis models to assist in determining the quantity to order.

Types of Decision Models

Two types:
1. Payoff tables
2. Decision trees

Steps in constructing payoff tables or decision trees:
1. Identify alternative courses of action.
2. Identify possible future events.
   These events are not under the decision makers control (i.e. are uncertain). These future events are also known as states of nature.
3. Construct the payoff table or decision tree.
   This step results in a determination of the payoff associated with each alternative and future event.
4. Make a decision based on the results of the payoff table or decision tree.

Decision Making with Probabilities

If a decision maker can estimate the probabilities of the future events, these should be incorporated into the decision model. In the steps in constructing payoff tables or decision trees, probabilities are used in determining payoffs (Step 3). A common approach to decision making under uncertainty is the expected value criterion. The expected value (EV) of a decision alternative is calculated as follows:

EV (alternative) = (probability of first state of nature x outcome of that state of nature) + (probability of second state of nature) x (outcome of the second state of nature) + . . . for all states of nature

In essence, the EV represents a weighted average of the outcomes, using probabilities as weights. The alternative selected is the one with the highest EV for maximization problems and the lowest EV for minimization problems.

Example:

Doe Inc. owns land in Florida and intends to build a condominium development on the site. The company is deciding on whether to build a small, medium or large development. Demand is uncertain as the number of Canadian "snowbirds" fluctuates; demand could be low, medium or high. Management at Doe Inc. has determined profit payoffs will be: (all amounts in 000s)

Alternatives		Demand		
		Low	Medium	High
Small	d_1	1,400	1,400	1,400
Medium	d_2	1,100	1,600	1,600
Large	d_3	(1,300)	1,200	2,100

Management has determined the probabilities of demand to be:

Low	=	P (low)	=	.20
Medium	=	P (medium)	=	.35
High	=	P(high)	=	.45

Solution using information from the payoff table

The expected value of each alternative is calculated as:

Alternative									
Small	EV	=	.2(1400)	+	.35(1400)	+	.45(1400)	=	1,400
Medium	EV	=	.2(1100)	+	.35(1600)	+	.45(1600)	=	1,500
Large	EV	=	.2(-1300)	+	.35(1200)	+	.45(2100)	=	1,105

Conclusion

Using the expected value criterion and absent any qualitative considerations, the best alternative is to build a medium condominium complex as this provides the highest expected value.

Solution – Decision Tree Approach

Payoff table in decision tree format:

small (d_1)	low	P(low) = .2	1,400 x .2	=	280
					+
	medium	P(medium) = .35	1,400 x .35	=	490
					+
	high	P(high) = .45	1,400 x .45	=	630
			EV	=	1,400
medium (d_2)	low	P(low) = .2	1,100 x .2	=	220
					+
	medium	P(medium) = .35	1,600 x .35	=	560
					+
	high	P(high) = .45	1,600 x .45	=	720
			EV	=	1,500
large (d_3)	low	P(low) = .2	(1,300) x .2	=	(260)
					+
	medium	P(medium) = .35	1,200 x .35	=	420
					+
	high	P(high) = .45	2,100 x .45	=	945
			EV	=	1,105

Conclusion: Build a medium complex as this alternative provides the highest expected value.

Limitations of the Expected Value Model:

- not all future events are foreseeable and, therefore, may be omitted from the model
- the model assumes future events are independent of each other. There can be overlap between future events.
- it is difficult to accurately assess the probability of future events.
- the model ignores qualitative considerations in making a decision.
- the model ignores the decision maker's attitude towards risk. The expected value model assumes the decision maker is risk neutral. If the decision maker is risk seeking or risk averse, both the expected value of the decision and its dispersion become relevant in choosing the best decision.

Expected Value of Perfect Information (EVPI)

Companies can sometimes obtain information that reduces or eliminates the uncertainty associated with the different future events/states of nature of a problem. The EVPI refers to the maximum amount a company would pay to obtain this information.

Formula to calculate EVPI:

EVPI	=	EV of best alternative with perfect information	_	EV of best alternative without perfect information

Example:

In the previous example, the best alternative was to build a medium condominium complex as this resulted in the highest expected value (EV = 1,500). If perfect information were available, that is, the probabilities were known with certainty, the optimal decision strategy is:

If low demand occurs, build a small complex.
If medium demand occurs, build a medium complex.
If high demand occurs, build a large complex.

The expected value of this optimal decision strategy is:

$$
\begin{aligned}
& .20\,(1{,}400) + .35(1{,}600) + .45(2{,}100) \\
= \;& 280 + 560 + 945 \\
= \;& 1{,}785
\end{aligned}
$$

Therefore, the EVPI is:

EVPI	=	EV of best alternatives with perfect information	-	EV of best alternative without perfect information
	=	1,785		1,500
	=	285		

In other words, $285 represents the additional expected value that can be obtained if perfect information about the future events were known. Therefore, the company should be willing to pay $285 to obtain perfect information.

Limitations of EVPI

Perfect information is rarely, if ever, available. When determining whether to obtain additional information, the decision maker must weigh the additional expected value arising from perfect information against the costs of obtaining this information.

Information System Requirements for Cost Accumulation

Skill Level:	R/U	A/A
3.1.4.6 Describes information system requirements for cost accumulation		
a) Understands and explains the various activities comprising transaction cycles (e.g. revenue, expenditure, payroll, conversion, general ledger, etc.) in an accounting information system	✓	
b) Identifies appropriate source documents for determining resource consumption by activities (such as purchase of materials, use of labour, maintenance of equipment and other overhead activities) and describes the flow of documents in costing systems	✓	
c) Identifies cost elements obtainable from various source documents and accounts	✓	
d) Describes the flow of costs through the subsidiary ledgers and general ledger t-accounts in costing systems	✓	
e) Understands the differences in information system requirements for an ABC system vs. traditional job costing and process costing systems	✓	
f) Describes the components comprising an ABC relational data base	✓	
g) Understands and applies a variety of tools for systems documentation and analysis (e.g. document flow diagrams, process flow diagrams, process flowcharts, data flow diagrams, system flowcharts, etc.)	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Cost accumulation has two primary approaches (job order and process costing) within cost accounting systems. Job order costing is used when different types of products, jobs or batches are produced within a period. In a job order costing system, direct materials costs and direct labour costs are usually traced directly to jobs. Overhead is applied to jobs using a predetermined rate. Actual overhead costs are not traced to jobs. A process costing system is used when a single, homogeneous product or service is produced. In a process costing system, total manufacturing costs are divided by total number of units produced during a given period. The unit cost that results is a broad, average figure.

Operational AIS are basically transaction processing systems (TPS). They record and report the voluminous, routine and repetitive transactions that mirror the day-to-day operations of an organization. By computerizing these functions, organizations often eliminate the labour of manually recording endless details, usually reduce processing cost and frequently provide faster and better service to their customers. They also develop a massive database of information that management can use to support tactical decisions and strategic planning.

Computerized AIS is composed of a series of software modules or subsystems used either separately or in concert. When these systems are integrated, each subsystem receives data as input from other subsystems and provides information as output to other subsystems.

The general ledger sub-system ties all other financial accounting subsystems together, provides managers with periodic accounting reports and statements, such as an income statement and a balance sheet, and provides support for budgeting. It also permits creation of general ledger accounts and definition of the organization's fiscal period. Finally, it produces a list of accounts maintained by the financial accounting system.

The fixed assets sub-system maintains records of equipment, property and other long-term assets owned by an organization. These records include the original cost of the assets, the depreciation rate on each asset or group of assets, the accumulated depreciation to date and the book value of the asset. It also processes and maintains data on the gain or loss on the sale of fixed assets and may prepare special income tax forms for fixed assets, if required.

The sales order processing sub-system routinely records sales orders and provides the documents other sub-systems use to fill those orders, maintain inventory levels and bill the customer. It provides sales tax data to the general ledger sub-system for posting to tax agency accounts, stock data to the inventory sub-system for updating inventory balances and sales invoice data to the accounts receivable sub-system for posting to customer accounts.

The accounts receivable sub-system allows for entry, update and deletion of customer information, such as charge sales, credit terms, cash payments received, credit for returned or damaged merchandise and account balances. It produces aged accounts receivable reports, which classify accounts into several categories, such as more than 30 days, 60 days and 90 days overdue.

The accounts payable sub-system processes much of the same routine, repetitive information as the accounts receivable sub-system, except the information is about the organization's creditors rather than customers. It provides data directly to the general ledger sub-system and receives data from the purchase order sub-system.

The inventory control sub-system provides input to the general ledger sub-system and receives data from the purchase order and the sales order sub-systems. Its basic purpose is to keep track of inventory levels and inventory costs for the organization. It maintains information about each stock item, such as stock numbers and descriptions, receipts and issues of stocks, and stock balances. It may also trigger the purchase of stock when stock levels reach certain points, maintain information about stock item costs and maintain selling price data on each stock item.

The purchase order processing sub-system processes purchase orders and tracks which purchase orders have been filled, which stock items ordered are on back order, which stock items have been damaged or do not meet the specifications of the original order and when orders are expected to be received. It provides inputs to the accounts payable and inventory sub-systems.

The payroll sub-system processes wage and salary information, such as payments to employees, deductions from employee pay cheques and payments to federal, provincial and other taxing agencies. It produces weekly payroll summary reports, overtime reports and forms for tax agencies such as Revenue Canada, GST and PST (if applicable).

The starting point of collecting accounting data in most AIS is the source document. A source document is a record that captures the key data of a transaction (data, purpose, quantities, dollar amounts, etc). Source documents serve an important function in AIS as they provide the input data for the transaction to take place and the source document serves as part of the permanent audit trail. In some cases, source documents help business process flow. Once a source document is recorded and stored, it could trigger the next event. Such basic systems are often referred to as transaction processing systems (TPS – discussed more fully later).

Source documents form the inputs for recording transactions in ledgers and journals. The general ledger provides details for the entire set of accounts used in the organizational AIS. Transactions are summarized from the general journal and posted in the general ledger. Subsidiary ledgers maintain detailed information regarding routine transactions, with an account established for each entity.

In activity-based costing (ABC) systems, activities associated with overhead cost are identified and then records are kept on the costs and activities; activities are viewed as drivers of the overhead costs. This method treats overhead costs as more direct than traditional cost-accounting methods (job/process costing systems). ABC provides more accurate cost allocations by avoiding rough allocation procedures. ABC requires more bookkeeping than traditional costing methods because ABC requires keeping track of instances of activities, not just costs. Companies often use ABC for strategic purposes, while at the same time use traditional costing methods. Having AIS allows a company to do both kinds of cost accounting.

ABC works best within a company that uses an enterprise system (ES). The main role of an ES is to have a single database central to the organization and to ensure information can be shared across all functional levels and management hierarchies. ESs help eliminate the problem of information fragmentation caused by multiple information systems in an organization.

Most organizations acknowledge there isn't enough systems documentation. In most cases, the need to create a system that works overrides the need for a system that is well documented. Research has shown that insufficient documentation costs organizations time and money. Here are some tools to help document AIS.

Document flowcharts – traces the physical flow of documents through an organization using common symbols (these symbols have not been standardized through a common body). Constructing document flowcharts begins by identifying different departments/groups that handle documents of a particular system.

System flowcharts – concentrate on the computerized data flow on the AISs, where document flowcharts focus on tangible documents. System flowcharts typically depict the electronic flow of data and processing steps by using common symbols that have been standardized through a governing body. Some system flowcharts merely provide an overview of the system. Inputs and outputs are specified by general input/output symbols. More detailed system flowcharts illustrate more detail input/output processes.

Process maps – document business processes in easy-to-follow diagrams. A business process is a natural group of business activities that create value for an organization. Research has suggested that process maps are among the easiest to draw and among the easiest for novices to follow.

Data flow diagrams (DFD) – are primarily used in the system development process as a tool to help analyze existing systems or in planning a new system. DFDs are frequently used in documenting AIS.

Product Positioning and the Product Life Cycle

Skill Level:	R/U	A/A
3.2.1.1 Identifies the positioning of the organization's products/services within the product life cycle (see also F1.2.5)		
a) Describes the value proposition and identifies the products and services integral to the value proposition for a given organization	✓	
b) Describes the dimensions of the product life cycle and explains the characteristics of the various stages of the life cycle	✓	
c) Understands how products and services can be managed through the product life cycle in both domestic and international markets	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

An organization's value proposition distinguishes its product or service offering from that of other organizations. It must reflect how potential customers, not managers, value the product and/or service, thereby, positioning the organization's offering against its competition. Alternative bases for the expression of a value proposition, depending upon customer needs, are:

i. product/service attributes (i.e. Tide whitens whites);
ii. overall value (i.e. Budget saves you money);
iii. class of user (i.e. many clothing brands);
iv. product class (i.e. hotels targeting business segment)
v. end-use application (i.e. Gatorade quenches thirst)
vi. specific competitor (i.e. one credit card against another)

The product life cycle (PLC) describes the <u>industry</u> sales and profits cycle for a new product or service, from market entry to market exit. The PLC has four main stages:

<u>i. Market Introduction</u> – slow sales growth, combined with high expenditures on product development and promotion to build awareness, result in negative profits.

<u>ii. Market Growth – r</u>apid sales growth during this stage of market acceptance produce profits and attract new competitors to the market. Profits peak.

<u>iii. Market Maturity</u> – sales level, as the pool of potential customers, is exhausted. To grow, companies must now attract customers away from competitors.

<u>iv. Sales Decline – o</u>verall sales decline as new products are introduced to replace old products and profits erode.

As a product or service moves through the PLC, the four "P's of marketing (product, price, place and promotion) must be managed in consideration of the unique characteristics of each stage. The length of each stage can pass in weeks or last for years, depending on the product, market and strategic actions of the players.

Market Introduction
New idea introduced by a monopoly (one company); may move to monopolistic competition (more than one competitor, each with a unique offering). Introductory pricing can follow a skimming policy, to skim the cream off the market with a high price before competitors enter or, a penetration policy, to gain market share with a low price and discourage competitors from entering. Selective distribution through intermediaries willing to give the offer special attention. Pioneering advertising stimulates primary demand for a product category rather than for one particular brand. Informative advertising explains the benefits and uses.

Market Growth
The innovator profits and attracts competition, leading to monopolistic competition or an oligopoly (few competitors with similar offerings). To compete, some copy the innovator; some improve the offer; others target a narrower segment or sub-market. Competitive pricing, to match competitor's offer, is common in this stage. Intensive distribution now to sell through all suitable intermediaries. Persuasive advertising aims to develop a favourable attitude toward the company's particular offering, often by comparing the offering to that of a competitor.

Market Maturity
Industry sales level, industry profits go down, as the market moves toward pure competition, with many competitors offering a similar product or service. Companies that can't compete fall out during this stage, referred to as "industry shakeout". Most every day products are in the mature stage. Price cutting occurs as competitors fight for increasingly price-sensitive customers. Distribution still intensive, but some may move to exclusive distribution, through one intermediary in return for some other advantage, typically lower cost. Competitive advertising aggressively aims to develop specific demand for the company's offering. Promotion costs increase.

Sales Decline

Strong brands may still be profitable, often through production and marketing cost cuts.

Price competition is common.

Distribution still intensive, with pressure on intermediaries to lower cost.

Reminder advertising, when the market is already familiar with an offering, is necessary to keep customers from shifting to a competitor.

SWOT

Skill Level:	R/U	A/A
3.2.1.2 Identifies the organization's internal strengths and weaknesses and its external opportunities and threats (i.e. SWOT analysis) with respect to the value proposition (see also F1.2)		
a) Identifies the internal strengths and weaknesses of a given organization (leadership, resources, people, techniques/methods/practices, technology, processes, branding, etc.)		✓
b) Identifies the external opportunities and threats of a given organization (current and potential customers/markets, technology, cost structure, resources, suppliers, environmental forces, competition, industry trends, international trade, etc.)		✓
c) Analyzes the business models of rivals to identify the sources of their advantages (e.g. cost, differentiation, capabilities, culture, etc.)		✓
d) Assesses various market-product strategies (e.g. market penetration, product development, market development, diversification, etc.) for a given organization		✓
R/U = Remembering and Understanding A/A = Application and Analysis		

A common strategy applied in marketing planning is the analysis of an organization's **S**trengths, **W**eaknesses, **O**pportunities and **T**hreats, or SWOT analysis. A SWOT analysis supports an organization's value proposition by identifying critical strengths to build upon, weaknesses to address, opportunities to take advantage of and threats to avoid.

Strengths and weaknesses are internal factors an organization can control and include elements of the marketing mix and other functional areas, such as:

Examples of:	Strengths	Weaknesses
Product	Recognizable brand	No patent
Place	Exclusive distribution	Poor location
Price	Low price advantage	Non-competitive price
Promotion	Effective marketing	Low awareness
Production	Advanced techniques	High defect rate
People	Successful recruitment	Poor training
Finance	Able to secure capital	Limited capital

Opportunities and threats are external factors an organization cannot control. Environmental scanning of the organization's market to identify opportunities and threats includes the following PEST factors:

Examples of:	Opportunities	Threats
Political	Favourable trade regulations	Political instability
Economic	Rising incomes	Interest rate fluctuations
Social	Unfulfilled customer need	Shifts in consumer behaviour
Technological	Supportive systems	Outdated systems

Matching strengths with market opportunities help define an organization's competitive advantage. Additionally, a competitive analysis is required in order to assess the strengths and weaknesses of both current and potential market competitors.

First, the appropriate set of competitors must be identified. The set should include rivals, the closest competitors and, more broadly, any organization that offers a substitute good that meets similar customer needs. For example, a movie theatre likely considers other theatres as rivals, but also must compete with substitute providers, such as video stores and movies-on-demand TV.

Next, the competitors' strengths and weaknesses are assessed in order to identify each competitors' competitive advantage. A competitive advantage enables an organization to sustain profits within its industry. Positioning-based advantages are either cost-based (customer needs are satisfied at a lower cost) or differentiation-based (customer benefits exceed competing product benefits). An organization can use its cost advantage or differentiation to position itself in the market as a cost leader or differentiator.

Resource-based advantages are based on either an organization's assets (i.e. brand, management knowledge, organizational culture) or an organization's ability to use its assets more effectively than its competitors (i.e. product innovation process, manufacturing efficiency).

Supported by SWOT and competitive analysis, an organization must decide which market opportunities it will pursue. Broadly, there are four possibilities:

	Current Products	New Products
Current Markets	(i) market penetration	(iii) product development
New Markets	(ii) market development	(iv) diversification

(i) Market penetration – to sell more current product in current markets, by aggressively marketing, lowering price, increasing distribution or other market penetration strategies.

(ii) Market development – to sell more current product in new market(s), by advertising to new customers, distributing in new locations or other strategies to reach new markets. This is called duplication in the strategy literature.

(iii) Product development – to sell new product(s) in current markets to better satisfy current market needs. This is called scaling in the strategy literature.

(iv) Diversification – to sell new product(s) in new market(s) is the most challenging strategy as it represents a completely new line of business, thus, with higher risks, yet possibly higher returns. This is called granulation in the strategy literature.

Product Mix

Skill Level:	R/U	A/A
3.2.1.4 Identifies a profitable product mix consistent with the value proposition		
a) Describes the product mix of an organization in terms of the relevant dimensions (e.g. depth, breadth, consistency)	✓	
b) Describes various product mix strategies (e.g. product positioning, product line extension, product mix extension, trading up, trading down, product alteration, product mix contraction)	✓	
c) Computes product line sales and profits		
• Performs a contribution margin analysis in a multi-product setting to determine the appropriate product mix		✓
• Applies linear programming analysis to determine the most profitable product mix		✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Product Mix

Product mix refers to the variety of products or services offered by a seller (e.g. retailer, manufacturer) to a buyer.

The product mix must be strategically planned to maximize customer value. Dimensions of the product mix include breadth or how wide the product assortment is, including all product lines and individual products. A product mix extension adds a new product to the assortment (i.e. Starbucks ice cream). Depth refers to the number of products in a specific product line: a set of closely related individual products. A product line extension adds more variety to a line by introducing different sizes, flavours, packages or some other product alteration (i.e. Starbucks caramel coffee).

As products are added, it is important to consider consistency of the offer in terms of quality, dependability and whatever other features the customer associates with the organization. When there are many products in a product line, customers may trade up, to a higher value product (i.e. from a Starbucks house blend to a latte) or, customers may trade down, to a lower value product (i.e. from Starbucks house blend to the new $1 sampler coffer). A product mix contraction reduces the number of products in a line, when the logistical costs of having a deep product line outweigh the benefits of serving multiple customer segments.

Product Mix Strategies

There are five common product mix strategies:

- Product positioning
  This refers to how consumers perceive the product relative to competitors' products.
  Means of positioning:
  - relative to a competitor
  - relative to a product class or attribute
  - relative to a target market
  - price and quality

- Product mix expansion
  This includes:
  - adding similar items to an existing line
  - adding new product lines (e.g. clothes manufacturer adds new product line of handbags)

- Trading up and trading down
  - trading up: adding products that have a higher price
  - trading down: adding products that have a lower price

- Alteration of existing products
  - improving the current product and positioning it as "new and improved"

- Product mix contraction
  - eliminating products or a product line

Distribution and Supply Chain Management

Skill Level:	R/U	A/A
3.2.1.5 Explains distribution and supply chain management		
a) Describes the components of an organization's distribution and supply chain and explains the strategic and operational objectives of distribution and supply chain management (e.g. end customer satisfaction, efficiency, flexibility, agility, reliability, etc.)	✓	
b) Explains the internal and external factors that can influence the behaviour of the supply chain	✓	
c) Describes and understands the role of the various activities pertaining to distribution and supply chain management (e.g. customer order management, purchasing, supplier management, physical distribution management, inventory management, quality control, aggregate planning, logistics management, materials management, scheduling, etc.)	✓	
d) Explains the importance of matching the appropriate production process to the product in terms of aligning operations and corporate strategies	✓	
e) Explains the importance of lean (just-in-time) production and service systems	✓	
f) Explains the issues and factors relevant for establishing and maintaining sound supplier relationships and understands the various types of supplier relationships (e.g. partnerships, vertical integration, long- and short-term market relationships, etc.)	✓	
g) Explains the issues and factors relevant for establishing and maintaining sound relationships with distributors and understands the various types of distribution channels (e.g. direct, wholesale, retail, Internet, etc.)	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Components of the Supply Chain

Components of the supply chain (also known as the value chain):

1. Procurement (supplier selection, forecasting, production and customer information sharing, credit and cash transfers, inbound transportation, warehousing and inventory, accounts payable and receivable)
2. Production (order scheduling, production, materials and service requirements scheduling, order fulfillment, outbound transportation)
3. Distribution (distributors, delivery, warranty, after sales service)

The objective is to build a chain of suppliers that maximizes value to the end user. Customer satisfaction is multi-dimensional and includes many performance criteria beyond simple conformance to product or service specifications. Flexibility, agility, responsiveness, reliability, availability, price and payment terms vary in relative importance to different customers.

Flexibility is the ability of a supply chain to accommodate changes driven by the purchaser. These changes may involve product designs, delivery schedules, order size or other requirements.

Agility is the speed at which a supplier can make changes requested by the purchaser. This is particularly important in situations where demand fluctuates randomly and products are highly customized.

Reliability is based on trust that a supplier can provide a consistently good level of performance without exception over a long-term. This is important because it enables purchasers to minimize the inventory held as a buffer in cases of quality, quantity and delivery problems.

Responsiveness is evidence of a supplier's commitment to the purchaser's needs and an important component of the supplier relationship.

Availability involves both supplier inventory levels and manufacturing lead times. Products that are out of stock or require long production lead times to produce can pose difficulties in certain cases.

Price and payment terms are important components of a purchase agreement. Certain industries (such as grocery retailing) rely on suppliers to provide extended payment terms. For some organizations, payment terms may be more important than price, which can be passed on to the customer.

Factors that Influence the Supply Chain

Internal factors that influence the behaviour of the supply chain:

1. Outsourcing is a decision to make or buy a product based on some advantage to the company. Make or buy decisions are complex and not always related to price. Investment decisions, the ability to control the process, improved reliability and self-sufficiency play a role in whether to make or buy. An example is GM, who found it advantageous to purchase sub-assemblies, rather than assemble themselves.

2. Vertical integration refers to the extent a company invests in the ability to produce a product or service previously purchased from a supplier or by manufacturing a product for which they formerly supplied a part. Backward integration is when the company purchases its supplier or manufactures the product themselves. Forward integration is where the company that manufactures components decides to produce the end product. An example is Magna Steyr, the auto parts manufacturer that now assemble complete vehicles.

3. “Many suppliers” is a strategy that enables a company to obtain highly competitive bids and is most common when the product is a commodity. Suppliers aggressively compete with one another and are responsible for maintaining competitive technology, forecasting, cost, delivery and quality competence. Since the product is undifferentiated, the lowest price offered is the best choice. Credit arrangements tend to be a lump sum payment due shortly after delivery.

4. “Few suppliers” is a strategy that seeks a long-term relationship with a supplier who will become a partner in the supply chain. Long-term supplier relationships require agreement on goals, trust and compatible organizational cultures. Relatively few, long-term suppliers who invest in product design, manufacturing capacity and delivery schedules yield long-term planning advantages and economies of scale for both supplier and purchasing companies. These benefits are not available to organizations that participate in the “many suppliers” strategy. The downside to this strategy is it is difficult switching costs and time consuming to change suppliers. Companies that use just-in–time manufacturing systems and major retailers (such as Wal-Mart) are examples of organizations that use long-term supplier relationships.

<u>External factors that influence the behaviour of the supply chain</u>:

1. Currency fluctuations affect international transactions. Both buyers and sellers can use future currency contracts to hedge or secure gains and losses due to these fluctuations. Differences in currency also affect the choice of country where products will be sourced.

2. Inflation affects holding gains on inventories. During inflationary times, companies will expend surplus cash on expanded raw materials inventories to avoid losses on cash and inflationary price increases over time.

3. Political risk and corruption affects the supply chain. While prices in some countries may be lower, political instability can interfere with importation, production and shipment of goods. Illegal payments to “expedite” shipments through customs or obtain export permits are common in some countries.

4. Transportation costs affect the supply chain. Items that are heavy (steel, cement) are expensive to transport and, thus, local suppliers have a price advantage. In the case of smaller, high-value goods (such as consumer electronics), transportation affects the landed cost to a much lesser degree.

5. Interest rates affect the financial nature of large supplier contracts. High financing costs may result in milestone payments, pre-payments or other mechanisms, which shift the interest burden between supplier and purchaser. Discounts for prompt payment (2% discount net 10 days) are a common feature of many supply contracts.

Supply Chain Activities

1. Customer order management involves a number of steps, many of which occur simultaneously and must be coordinated to proceed efficiently and meet deadlines.
   a. Parts explosion is a process where parts and materials required to produce the product are identified. In the case of customized or special products, parts explosion and subsequent purchasing form important cornerstones of the cost estimation/price quotation process.
   b. Production scheduling involves finding a time period of sufficient duration and lead time in which the product will be made. Lead time is important in that any necessary materials or parts can be drawn from inventory or ordered from suppliers and be on-site at the time they are needed for production. In the case of some products, not all components are required at the same time. Knowledge of how much time is needed to manufacture the product is important in maintaining production efficiency. Customer delivery requirements also play an important role in scheduling production.

2. Purchasing Department
   a. Product specification involves working with the engineering department or standard product parts explosions to ensure the correct materials or parts are ordered.
   b. Supplier selection often involves more than finding a source of a raw material or component at a competitive price. Today, suppliers are often long-term supply chain partners who have an interest in what you do and work with the organization at every stage from product design to just-in-time delivery in order to contribute to value for the end user. In this case, supplier selection is an important long-term decision for both the supplier and the purchaser.
   c. Supplier management involves working with the supplier to ensure materials meet specifications, arrive on time and do not delay the production process. In many cases, purchasing companies work with suppliers to reduce their costs through redesign, long-term production scheduling and corresponding investments in more efficient production technology that would otherwise not be possible.

3. Inventory Management
   a. Inventory control includes order receiving, inspection, storage, issuances and control balances.
   b. Inventory costs such as use of capital, warehousing, handling, shrinkage and obsolescence are notorious for contributing little to end user value. Increasingly, manufacturing companies work at minimizing their inventories with their suppliers and customers.
   c. Just-in-time is an integrated supply chain system that optimizes value by reducing inventory at all stages of the supply chain by having small lots of materials and components delivered to the manufacturing floor at precisely the time they are needed.

d. Inventory costs can be justified in situations where customers require fast order turnaround, the materials have erratic delivery times, unreliable quality or can only be obtained in quantity. In the latter case, the economic order quantity (EOQ) is used to determine the order size that minimizes inventory holding cost.

e. Vendor managed inventories (VMI) are inventories belonging to the supplier that are stored on the purchaser's property and sold on a stock depletion basis. The shared advantage is that the inventory is located where it is needed, reducing the warehousing and shipping costs of the supplier and purchaser's cost of financing and managing the inventory.

4. Quality Assurance

   a. Materials that do not conform to quality specifications are a major source of expense and delay for any company.

   b. Sub-standard materials that arrive on schedule will delay production, resulting in idle machinery, labour and delay of future production schedules.

   c. Unreliable quality from suppliers results in the need for increased inventory to buffer inferior material shipments and safeguard the production schedule.

   d. Companies work with long-term suppliers to eliminate sub-standard materials and parts due to the extreme cost and disruption experienced due to poor quality

5. Aggregate Planning

   a. Aggregate planning deals with demand and production in aggregated, not specific order quantities.

   b. A company's plan on how to deal with demand using current resources (such as plant and equipment) over an intermediate period of time, typically 12-18 months.

   c. An aggregate plan deals with production rates, inventory levels, workforce deployment and capacity limits in relation to forecasted and known customer demand.

   d. The goal is to maximize production and minimize costs over the next operating period.

6. Logistics Management

   a. Managing material flows including the shipping, customs brokerage, warehousing and inventory activities of a supply chain

   b. Modern innovations include third-party logistics companies, containerized freight, international order tracking and expediting.

   c. Some organizations provide complete logistics services, including inventory management.

Matching Production Processes to the Product

Organizations compete for customers using one of three strategies: low cost, differentiation and focus. Meeting customer needs has the greatest effect on the characteristics of a particular supply chain.

Low cost producers compete by delivering products and services to customers whose main purchase criterion is the lowest price. This is done through a supply chain that features high rates of plant utilization and production efficiency, minimal inventory levels to reduce costs, short lead times and maximum performance at minimum cost. Examples of these kinds of organizations are utility companies (Union gas) and fast food chain restaurants (McDonald's).

Some customers require customized goods and services. Producers with a differentiation strategy build their supply chains with suppliers that have: strong product development skills; willingness to share market information and participate in product design; modular processes that lend themselves to mass customization; minimized inventory to avoid obsolescence; and have fast development/lead times. Examples of these organizations include fashion retailers such as Benetton and Victoria's Secret.

Producers with a focus strategy develop their supply chains to respond quickly to demand for customized products and fast delivery. Customers select these companies for their capacity, speed and flexibility to meet specialized demands. These organizations invest in buffer inventory to reduce production and delivery time and utilize product designs that have low set up and rapid production ramp-up times. They select transportation providers that deliver direct to the consumer in the shortest possible time. An example of this kind of organization is Dell computers.

Just in Time (JIT)

Standard products with long production runs and steady consumer demand lend themselves to supply chain efficiencies not available to other types of products. In these situations, the entire supply chain is integrated so every participant produces and delivers goods up the chain at the same rate. Perfect quality materials and parts move in small lots continuously through the chain, minimizing inventory, warehousing space and downtime. The capacity of each participant in the chain is fully utilized and great efficiency is achieved at every step (local optimization). The leading example of just-in-time manufacturing systems is the automobile industry.

Also known as "lean" production systems, JIT relies on a relatively small number of long-term partners (suppliers) who participate fully to maintain the even flow of the supply chain. In JIT, manufacturing everything is critical, otherwise the system stops. Minimal inventory of materials and parts are held and, thus, if one supplier fails to delivery on time, the chain stops within a short time period. Poor quality goods have the same effect – a rejected batch of parts stops the next stage of production because there is minimal inventory on hand to maintain production.

Batch production systems (customized products ordered in batches) require longer lead times, coordination of parts and materials purchasing. Special information technologies such as MRP (material resource planning) enable manufacturers to integrate production schedules with the delivery of parts and material to arrive exactly when they are needed, avoiding inventory and production disruptions.

Supplier Relationships

Relationship	Many Suppliers	Few suppliers
View of the suppliers	Contestants	Partners
Time horizon	Short-term, tactical	Long-term, strategic
Attitude	If they need the business, they will cut the price	Supplier is entitled to a reasonable profit
Procurement specification	Precise definition and terms	Supplier participates in collaborative solutions
Information sharing	Minimal, need-to-know basis	Maximal, help supplier understand all our needs
Helpfulness to supplier	Supplier left to solve their own problems	Help supplier solve our problems
Financial impact on supplier	Supplier only captures some orders	Supplier captures all the orders and has better capacity utilization
Development incentive	Risk of order volume reduces investment in equipment, training, etc.	Low risk of order volume encourages investment in equipment, training, etc.
Order of emphasis on supplier selection	1. Price 2. Quality 3. Delivery	1. Quality 2. Delivery 3. Price

Distributors and Distribution Channels

The final link in the supply chain is between the manufacturer and the end user. There are many ways (channels) by which products are sold to the end user:

- Retail is where an end user purchases the product from a reseller.
- Wholesale is where product is sold to a reseller.
- Direct selling is where the end user purchases direct from the manufacturer or their sales representative.
- Internet selling is when customers order a product though an Internet website for delivery to an address. (i.e. Dell computers).

- Catalogue marketing is a predecessor to Internet distribution; however, it remains popular because a printed catalogue has the capability to sell over a longer time period (i.e. L.L. Bean)
- Multi-level marketing is a direct selling organizational structure whose goal is to recruit a large number of direct sellers. This is accomplished by giving a portion of each direct sale individual's sales to their recruiter. An example is Amway.

Manufacturers may set up their own sales organization or seek strategic partnerships (sometimes known as a channel partner) to market and distribute products. It is often less costly to work with a distributor or a manufacturer's agent than to set up your own sales force. The importance of the distributor is to market, service and represent the manufacturer. This may include acting as a communications filter between consumers and the producer, warranty administration, replacement, repair work, parts supplier and product support.

Manufacturers seldom have the sales ability of distributors; however, some distributors use price discounting rather than other marketing techniques to achieve sales volumes. There is general agreement that building and maintaining good distributor relationships require the following:

1. Choose specialists who know the market and product space.
2. Integrate distributors into the supply chain as partners.
3. Create guidelines regarding price, warranty and other matters that make sense to both parties.
4. Provide distributors with the marketing support they need.
5. Enable distributors to make high potential incomes.
6. Do not sell direct (unless agreed to) or through competing distributors in the same area.
7. Maintain open and frequent communication.

Distributors operate in various levels or channels:

1. Retail is sale of the product to the end user (i.e. Wal-Mart).
2. Wholesale is the sale of the product to resellers (i.e. National Grocers).

Retailers stock and sell products to the end user, often in conjunction with competing or related products. Retailers may also provide return and warranty replacements or initial warranty contact with the end user. Retailers act as a communications filter between consumers and the producer, thereby, limiting the communication burden of the producer to the most essential inquiries.

Wholesalers are strategic partners who represent a manufacturer in a geographic area. Wholesalers communicate with retailers and keep them up-to-date with product, delivery, warranty and other information on behalf of the manufacturer. Wholesalers also are involved in sales forecasting and the exchange of market information.

Managing Inventory

Skill Level:			R/U	A/A
3.2.1.5	h)	Understands and applies various models and systems for managing inventories (e.g. EOQ, reorder point, MRP, JIT, etc.)	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis				

Inventory Management

Inventory must be managed to ensure inventory levels are kept to a minimum. There is a trade-off between inventory carrying costs and the benefits of holding inventory. High inventory levels result in high carrying costs and insufficient inventory levels result in potential lost sales due to stock outs and production slowdowns.

Common inventory management practices:

- use of models, such as EOQ, to ensure the optimum amount of inventory is ordered
- reduce lead time by introducing JIT or MRP
- sophisticated simulation models that estimate the inventory related costs under different inventory management practices
- dispose of obsolete items to reduce carrying costs
- monitor inventory levels carefully
- keep minimal levels of inventory for high risk items, such as computers, fashion items and perishables

Economic Order Quantity Model

This model calculates the optimum amount of goods to order.

Formulas:

Carrying cost (cost of holding inventory, including storage, handling, spoilage, opportunity cost etc.)

carrying cost = average inventory quantity x carrying cost per one unit

$$= \frac{Q}{2} \times CC$$

Q = number of units ordered each time an order is placed, Q/2 is the average

Ordering cost (cost to place an order and receive the merchandise, sometimes called restocking costs)

ordering cost = number of orders x ordering cost per one unit

$$= \frac{T}{Q} \times O$$

T = total sales per year or if raw material inventory total units used each year

Q = number of units ordered each time an order is placed

total inventory cost = carrying cost + ordering cost

$$= \left[\frac{Q}{2} \times CC\right] + \left[\frac{T}{Q} \times O\right]$$

Using simple calculus, we find the order quantity that minimizes total inventory cost is:

economic order quantity (EOQ):

$$EOQ = \sqrt{\frac{2TO}{CC}}$$

Safety Stock

To protect against potential stock outs, many companies carry extra stock. The extra amount carried depends on expected usage and estimated lead time. Lead time may be known or it might vary. If the lead time varies and there is too little safety stock, the organization will stock out. Uncertainty models can be used to choose the safety stock that minimizes the sum of the cost of holding safety stock and the expected cost of stocking out.

Stock out Cost:

# of orders	x	# of stock out units	x	unit stock out cost	x	probability of a stock out

Reorder Point

When inventory drops to a certain level, it is time to reorder. The amount ordered should be based on the amount calculated using the EOQ model.

$$\text{reorder point} = \left[\text{lead time in weeks} \times \text{weekly usage} \right] + \text{safety stock}$$

<u>Example of EOQ:</u>

Glass insulators (SKU 1341) have a relatively stable usage rate, averaging 1,000 items per year. RMP purchases these insulators from the manufacturer at a cost of $20 per unit delivered to the warehouse. The cost to process an order is $30, including receiving and redistribution to outlying service depots. An estimate of the holding costs for SKU 1341 is $6 per unit, representing a 30% opportunity cost of capital. The manufacturer requires 60 days to ship an order of SKU 1341.

Calculate the optimal order size and reorder point for SKU 1341.

Optimal order size:

$$\text{economic order quantity} = \frac{2 * \text{fixed cost per order} * \text{annual demand}}{\text{inventory carrying cost}}$$

$$= \sqrt{\frac{2*30*1000}{6}}$$

$$= 100 \text{ units}$$

Note: Freight – in cost and cost per unit purchased are not used as these costs are assumed to be the same irrespective of the order quantity.

Reorder point (ROP):

$$ROP = \text{demand per day} \times \text{lead time for a new order (days)}$$

$$= \frac{\text{D (annual demand of product)}}{\text{365 days}} \times \text{lead time (days)}$$

Using the same RMP example, calculate the reorder point:

$$ROP = \text{demand per day} \times \text{lead time for a new order (days)}$$

$$= \frac{1000 \text{ / year}}{365 \text{ days}} \times 60 \text{ days}$$

$$= 164.38 \sim 164 \text{ units}$$

When the inventory falls to 164 units, an order for 100 units should be placed.

MRP

MRP is a type of computer program that incorporates production requirements, changes in current conditions and updated delivery information for components or materials. It performs three important functions:

a) Purchase planning and control (order release dates and quantities)
b) Priority planning and control (expected delivery dates and date required)
c) Planning and capacity utilization (production scheduling and expansion)

Inputs to the MRP program:

a) Master production schedule
b) Bill of materials file
c) Inventory status file
    i) gross requirements
    ii) scheduled receipts
    iii) stock on hand
    iv) net requirements
    v) planned order releases

Outputs of the MRP program:

a) Order release notices
b) Future order release schedule
c) Order revision notices
d) Rescheduling notices
e) Order cancellation notices

MRP II (Manufacturing Resource Planning)

MRP II (Note substitution of "manufacturing" for "materials and "resource" for "requirements") expands MRP capabilities to include labour scheduling, payroll and financial requirements, including investment in inventory.

New Products and Services

Skill Level:	R/U	A/A
3.2.1.6 Describes innovative ways to improve the value proposition (e.g. new product development)		
a) Describes the stages in the new product/service development processes (e.g. idea generation/R&D, screening/evaluation, business analysis, design, market testing, commercialization, etc.)	✓	
b) Understands the new product adoption process and innovation characteristics affecting the adoption rate	✓	
c) Understands how the marketing function can be used to improve the value proposition for a given organization	✓	
d) Describes the impact of appropriate strategic cost management initiatives (e.g. target costing, lifecycle costing) on improvements to the value proposition	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Stages in the New Product Development Process

1. Idea generation
   Pursuit of new ideas for products. Sources include customer demand, the sales force, competition and suppliers.

2. Idea screening
   Screening of the ideas generated in Stage 1 to determine which are worthy of development

3. Concept development and testing
   This is filling in the details of the idea to create a concept. The concept is tested on target consumers to determine consumer reaction.

4. Marketing strategy development
   A strategy for the new product is developed.

5. Business analysis
   Forecasting sales and profit associated with the new product.

6. Product development
   If the product is physical, a prototype is developed.

7. Test marketing
   Products are often target tested in one or two geographic areas.

8. Commercialization
   Introduction of the product into the market.

Stages in the New Product Adoption Process

The new product adoption process refers to the way in which consumers accept a new product. This process occurs in six steps:

1. Awareness
   - consumer becomes aware of the product
2. Interest
   - consumer shows interest (i.e. collects information) on the product
3. Evaluation
   - pros and cons of the product are compared
4. Trial
   - customer purchases to try the product
5. Adoption
   - customer decides whether or not to continue buying the product
6. Confirmation
   - customer purchases the product and may also seek reassurance on the purchase decision

Characteristics Affecting the Adoption Rate of New Products

This refers to characteristics of the product itself. These characteristics affect the adoption rate. They are:

- Relative advantage
  - how is the product superior to current products?
- Compatibility
  - is the product compatible with the values, beliefs and experiences of the customers?
- Complexity
  - is the product difficult to understand and use? The more difficult, the less likely it will be accepted or acceptance will be slower.
- Trialability
  - is the product easily tested by the consumer? If not, acceptance is slower.
- Observability
  - is the product seen as being able to work?

Segment Profitability

Skill Level:	R/U	A/A
3.2.2.1 Prepares profitability reports by product, division, geographic location, etc. (see also F1.2.1.3, F3.1.4 and F3.2.1.4)		
a) Understands and applies revenue allocation methods (e.g. stand alone, incremental, etc.) to sales of bundled products/services for a given organization	✓	✓
b) Prepares profitability reports for appropriately defined segments for a given organization, (e.g. product, division, geographic location, demographic, gender, etc.)		✓
c) Prepares a customer profitability analysis for a given organization		✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Revenue Allocation Methods

A bundled product occurs whenever a company sells, for one selling price, a product bundle made up of several stand alone products. For example, you can purchase Microsoft Word for $200 individually or you can purchase Microsoft Office for $500, which includes Word, Excel and PowerPoint. The issue becomes one of how to allocate the bundled revenues to the individual products. There are two methods to do this – the stand alone and incremental revenue allocation methods.

The stand-alone revenue allocation method allocates the sales revenue based on individual prices. For example, assume Microsoft Office is made up of three products each selling for $200 individually, but when purchased in a bundle will cost $500. The stand alone revenue allocation method would allocate $500 x (200/600) = $166.67 of revenue to each product (the $200 is the stand alone revenue for each product and the $600 is the aggregate stand alone revenues for all three products combined).

The stand alone method is an application of the so called Shapley-Shubik allocation method and is often used in regulatory settings to allocate the costs of shared facilities among the users of those facilities.

The incremental revenue allocation method assumes that one product in a bundle is a primary product and all others are secondary. For example, assume we sell a bundle of three products for $300 and Product A is the primary product. The other two products are secondary (i.e. customers are really purchasing Product A and getting Products B and C for a little more). If the primary product generates revenues individually of $275, then we allocate $275 of the bundle revenue to the primary product. The remaining $25 gets allocated to the secondary products based on their relative sales price using the stand alone method.

Customer Profitability Analysis

Typically cost accounting systems accumulate all non-manufacturing costs into single selling, general and administrative accountants and, therefore, cannot identify product and service costs or distribution and delivery costs for individual customers. ABC can help identify customer activities and track costs allocated to specific customers. This can provide management with unique information about customers and customer segments. The benefits include:

- protecting existing highly profitable customers;
- re-pricing expensive services, based on cost-to-serve;
- discounting to gain business with low cost-to-serve customers;
- negotiating win-win relationships that lower service costs to cooperative customers;
- conceding permanent loss customers to competitors; and
- attempting to capture high profit customers from competitors

Customer profitability analysis has become an important new management accounting tool based on recognition that each customer is different and each dollar of revenue does not contribute equally to the organization's profitability. Customers utilize company resources differently; thus, customer related costs vary from one customer to another.

The following issues should be considered when analyzing customer profitability:

- how to develop reliable customer revenue and customer cost information.
- how to recognize future downstream costs of customers.
- how to incorporate a multi-period horizon in the analysis.
- how to recognize different drivers of customer costs.

This requires a broader examination of the costs associated with customer service. For example, post-sale customer service costs must be included in any analysis of customer costs. Some customers require substantially more post-sale service than others. In addition, future environmental liabilities related to the sale of current products are additional downstream costs that must be included. With management's increased focus on customers, this analysis can provide forward looking information about individual customers and customer segments and more broadly examine both the revenues and costs related to customer transactions. Revenues can vary among customers due to variations in volume levels and differences in price structures, products and services. Costs can also vary depending on how customers use the company's resources such as marketing, distribution and customer service. Unless a complete analysis of the benefits and costs of customer relationships is undertaken, companies will unknowingly continue to service unprofitable customers. Only after a thorough analysis of the costs and benefits can organizations decide which customers to service and strategically price its products and services.

There are many costs that are often hidden within the production, support, marketing and general administrative areas. To better understand customer profitability, these costs should be examined and assigned appropriately using ABC methods. These currently hidden customer costs may include items such as:

- inventory carrying costs;
- stocking and handling costs;
- quality control and inspection costs;
- customer order processing;
- order picking and order fulfillment;
- billing, collection and payment processing costs;
- accounts receivable and carrying costs;
- customer service costs;
- wholesale service and quality assurance costs; and
- selling and marketing costs.

Whether customer specific costs are necessary and/or can be determined depends on several factors, including the fragmentation of the customer base, the cost structure of the company and the existence of the necessary information infrastructure. Analysis can be crude and simple and even incomplete, yet still effective at providing valuable customer profitability information.

Forecasting

Skill Level:	R/U	A/A
3.2.2.2 Describes the information requirements for market analysis with respect to customer/client/member demand, buying patterns, market trends, etc.		
a) Describes and understands the advantages and disadvantages of various techniques for analyzing markets and forecasting demand (e.g. times series methods, linear regression, Delphi method, customer surveys)	✓	
b) Identifies the elements of a good forecast and the major factors to consider when selecting and evaluating a forecasting technique	✓	
c) Describes various methods of conducting market research and explains the advantages of each	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

To understand customer needs and assess market potential, an organization must undertake market research – procedures to obtain and analyze information to support marketing decisions. Market research involves the following steps:

i. problem definition
ii. situation analysis (including available secondary data)
iii. problem specific data collection (primary data)
iv. data interpretation
v. problem solving

To effectively plan marketing strategy, the market potential must be estimated, including a sales forecast – an estimate of sales to the targeted market segment. Two approaches are common.

I. Extending past behaviour (quantitative methods):

i. The trend extension method predicts future sales by extending past sales into the future. While relatively easy to calculate, this method assumes past trends will continue and cannot be applied to new product forecasts.
ii. The factor method considers the relationship of sales to an important factor(s), say industry sales, and adjusts sales forecasts by the factor. This method is effective only if an appropriate factor can be found.
iii. Time series analysis tracks historical fluctuations of economic variables (i.e. interest rates, exchange rates), to reflect the ups and downs of a market, given that most do not grow in a straight line.
iv. A leading series is one that changes ahead of sales, thus, can be used to forecast sales. For example, the number of households in a defined geographic area may be a good predictor of area retail sales. The challenge is finding an appropriate series.

II. Predicting future behaviour (qualitative methods):

i. The Delphi method surveys a jury of industry experts, asking each expert to forecast sales. The forecasts are shared in additional survey rounds, until a consensus is reached. The value of this method is it reflects expert judgments; however, the accuracy of results will vary.

ii. Surveys of customers, retailers, wholesalers, salespeople or other relevant parties can also provide sales forecasts. Again, the accuracy of results is dependent upon the knowledge and judgment of those surveyed.

Other methods commonly used to collect primary data specific to a research problem include:

i. Focus groups are a widely used method to gather qualitative data by means of group interviews with six to 10 people. While a relatively simple and inexpensive method to gain customer insights, results are not statistically valid.

ii. Mail surveys are also common and effective when a large number of questions are asked. While this method provides statistical data, response rates are often below 25%.

iii. Phone surveys are a relatively fast method to obtain statistical data. However, survey length is more limited.

iv. Personal interviews are relatively expensive and are better suited to questions that require more detailed explanation or probing.

The "best" research method is determined by the research problem to be solved, as well as budget and logistical factors. Scientific methods provide objective information as the basis for decision making. Results should be representative, meaning the sample surveyed is a part of the relevant population or total group of interest. To obtain representative data, random sampling is best, whereby each person in the population has the same chance of being selected for the research study (i.e. survey).

The Four P's of Marketing

Skill Level:	R/U	A/A
3.2.2.3 b) Explains the concept of the marketing mix and its key elements (product, price, promotion, place) and understands how to manage these elements to achieve an effecting marketing program	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

The Four P's of Marketing

- Product
  This consists of the product itself, along with its image (e.g. different beer brands appeal to different audiences) and other added features (such as warranties, packaging).

- Price
  Overpricing results in lost demand, under pricing can result in an image of lesser quality.

- Promotion
  Products and services must be promoted – consumers can't purchase if they do not know the product or service exists. The goals of promotion vary from informing to persuading to reminding.

- Place
  This includes both location and distribution. An example of location is placing a retail store in an area within easy reach of the target market. Distribution involves two aspects:

  1. Channel of distribution
  2. Logistics (i.e. the scheduling and arranging the means of distribution)

Services

Skill Level:	R/U	A/A
3.2.2.3 c) Understands the unique elements of services and the special nature of the marketing mix for services	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

The Nature and Scope of Services

A service is an activity or benefit that is intangible. It can be sold by itself (e.g. legal services) or with a physical product (e.g. photocopy maintenance and repair services are sold with the product, the photocopier).

Services	vs.	Products
Intangible		Tangible
Inseparable (provision and consumption of service is simultaneous)		Separable (goods are provided and are usually not consumed immediately)
Heterogeneity (each unit of service is different than other units)		Homogeneous (each unit of product is identical)
Perishable (non-inventoriable)		Inventoriable
Fluctuating demand Demand often fluctuates more than for products.		Stable demand Demand is more stable than in services.

The Strategic Marketing Process for Services

Selecting target markets:

It is important that segmentation is accurate and the consequent target marketing is properly carried out. This is because selling a service means selling something that is seen as having value in the eyes of the consumer.

Determining service mix strategies:

Similar to product lines, service companies must determine whether to add or drop 'product' lines.

Service features:

To remain competitive, companies often need to add features (e.g. sell your home and receive air miles). In addition, branding can be an effective means of marketing.

Managing service quality:

To ensure quality standards are being met, it is important to continually measure whether consumers needs are being met. In addition, it is crucial to ensure staff understand that poor customer service can be detrimental to the company. Services are an intangible that represents value to the consumer – part of that value is the customer-company relationship.

Channels of distribution:

There are various means of delivering services, such as:

- directly from provider to user (e.g. couriers)
- franchising (e.g. Pizza Pizza)
- through intermediaries (e.g. a doctor's patients may use medical labs)
- vending machines (e.g. bank machines)

Promotion:

Common techniques:

- personal selling (e.g. life insurance)
- advertising (e.g. car rentals)
- POP (point of purchase) displays
- sponsorship of community or charitable events (e.g. banks often sponsor charitable events)

Role of Promotion and Advertising

Skill Level:		R/U	A/A
3.2.2.3	d) Explains the role of promotion and advertising in revenue generation	e) ✓	f)
R/U = Remembering and Understanding A/A = Application and Analysis			

Nature and Purpose of Promotion

Promotion is the fourth P (of the four Ps – product, place, price, promotion) and is defined as all messages that:

- inform consumers about products
- persuade consumers to purchase the product
- remind consumers about the product or company

Promotion Methods

- Advertising
  Two types:
  - product advertising – non-personal selling of a product or service
  - institutional advertising – promoting a concept, idea or philosophy or the goodwill of an industry, company or organization

- Personal selling
  A seller's promotional presentation, which is conducted on a person-to-person basis with the buyer.

- Sales promotion
  Marketing activities, other than personal selling, mass media campaigns and publicity to stimulate sales. Often these promotions are short-term. Examples include contests, low interest rates for a limited time, two-for-one specials and coupons.

- Public relations
  This is a company's effort to create favourable attention, such as enhanced public image and word-of-mouth.

- Direct marketing
  Selling directly to the consumer through mail, telephone, email or facsimile.

Factors Affecting the Promotional Mix

The promotional mix is the blending of personal selling and non-personal selling (including advertising, sales promotion and public relations) to inform, persuade or remind consumers about the company and/or its products and services. Factors affecting the promotional mix are:

- Nature of the market (target audience)
  Target markets or consumers are in different stages with respect to what has been called "readiness to buy". The six stages are:
    1. Awareness – target market needs to be informed
    2. Knowledge – target market has little knowledge and, therefore, needs to be informed
    3. Liking – target market likes the product and, therefore, promotion is aimed at persuading or reminding
    4. Preference – target market prefers a company's brand. Promotion must be aimed at retaining these customers.
    5. Conviction – target market purchases the product. Promotion is aimed at reminding.
    6. Purchase – target market is ready to buy

- Stage in the product life cycle
    - introductory stage – goal is to inform
    - growth stage – goal is to persuade
    - maturity stage – goal is to remind
    - decline stage – goal is to remind

- Nature of the product
  Standardized products with minimal servicing requirements require less personal selling and more mass marketing. Higher priced custom products that are technically complex and require servicing require a high level of personal selling.

- Geographic scope
  Small local markets can be serviced through personal sales representatives, but it may not be feasible to service large widely dispersed markets through personal selling.

- Funds available
  The amount a company has to spend on promotion places an important role in the type of promotion used. Television advertising is expensive and, therefore, small organizations cannot afford to use television as a media outlet.

Nature and Scope of Advertising

Advertising is defined as paid non-personal communication through various media by companies, NPOs and individuals who are identified with the advertising message and who hope to inform, persuade or remind their selected target audience. Types of advertising include:

- personal (i.e. non-business) – advertising aimed at individuals
- business – advertising aimed at businesses
- product – advertising a particular product or service
- institutional – promoting a concept, idea, philosophy or goodwill of an industry, company or organization
- primary – aimed at increasing sales of a category or an industry, not a specific product (e.g. use steel instead of wood)
- selective – aimed at a particular product/brand within a category or industry
- comparative – a type of selective advertising in which competing brands are compared (e.g. detergent ads often engage in this)
- cooperative – sharing of advertising costs by the retailer and manufacturer or wholesaler (called vertical cooperative advertising) or by a group of retailers (e.g. all stores in a shopping mall may have a joint flyer or ad)

Nature and Scope of Sales Promotion and Public Relations

Types of sales promotion:

- Trade
  - aimed at distributors, retailers, wholesalers (intermediaries in the distribution channel)
- Consumers
  - aimed at the ultimate user

Public relations were defined earlier as a business's efforts to create favourable publicity and word of mouth. Public relations tools include:

- press releases
- public speeches, television appearances of senior executives
- holding special events, such as senior's lunches
- distributing audio visual tools (e.g. videos)
- corporate identity kits and materials

Branding, Packaging and Labelling

Skill Level:			R/U	A/A
3.2.2.3	e)	Understands brands and the branding decision	✓	
	f)	Explains the importance of packaging and labelling in creating customer value	✓	
R/U = Remembering and Understanding A/A = Application and Analysis				

Branding

Definition of Brand

A brand is a name, term, sign, symbols or design (or some combination thereof) used to identify the products of one business and to differentiate business or product from its competition.

Merits and Disadvantages of Branding

Merits

- easy recognition by consumers, therefore, less confusion when purchasing
- enhances brand loyalty
- can use branding for positioning – when in a leadership position, often will remain so for many years
- established brands can be used for new products
- assures purchasers with respect to quality
- can add prestige to products
- can use branding in a product differentiation strategy

Disadvantages

- brand must be promoted
- product quality must be maintained
- some products do not lend themselves to branding (e.g. books)

Branding Strategies

Why use a branding strategy?

If successful, a branding strategy can differentiate a company's products from that of its competition. Customers will purchase the brand that fulfills their needs. Without a branding strategy, customers may not recognize differences between products and will purchase based on price.

There are three ways of branding:

1. A company brands its own products (e.g. Nortel, Bell Canada). This is often extremely expensive and can take many years. On the other hand, the company controls the brand.
2. A company sells its products under another company's brand name. This can be advantageous for small or unknown manufacturers; however, there are often restrictions placed on the manufacturer, such as restrictions on selling under other brand names.
3. A mix of 1 and 2.

Common Branding Strategies:

- 'Family' brand names (the same brand name is used on all products)
  - advantages
    - less expensive because do not need to continually introduce new brands for new products
    - when introducing new products, the brand already has customer recognition
  - disadvantages
    - implementation of one product that is not well received tarnishes the image of the rest of the products in the family

- Separate brand names for each product
  - advantages
    - can create different brands for different target markets, thus, increasing overall sales
    - if a new product is poorly received, it will not impact the other products

- 'Family' brand names for groups of similar products
- Use of the company name with a brand name (e.g. Lotus Notes, Lotus Office Suite)

Packaging and Labelling

Packaging

Packaging is as critical as is having a high quality product – sometimes even more so. Packaging should have one or more of the following characteristics:

- be convenient
- ensures product is safe and/or clean (e.g. sealed lids on over-the-counter medicine)
- provide information (e.g. nutrition information, instructions)
- be easy to open or customers can see the product
- limit damage and theft

If packaging has these characteristics, it can be used as a marketing tool.

Labelling

A label is part of the product and is defined as information provided about the product or seller.

Types of labels:

- brand label – indicates the brand
- grade label – indicates quality
- descriptive labels – provides information (e.g. how to use, care for, information on component parts, such as 50% wool, 50% cotton on a sweater)
- eco-labelling – indicates is an environmentally friendly product. This labelling could be used as a marketing tool.

Pricing

Skill Level:	R/U	A/A
3.2.3 Calculates domestic and international prices for a given organization using various pricing strategies (e.g. value-based pricing, cost-plus pricing, reverse engineering, etc.)		
a) Describes various long- and short-term pricing objectives and the factors affecting the choice of a pricing objective (e.g. survival, revenue maximization, sales growth, market share, breakeven, social responsibility, etc.)	✓	
b) Identifies pricing constraints (e.g. stage in the product life cycle, demand, single product vs. product line, marketing and production costs, type of competitive markets, competitors' prices, sealed bid situations)	✓	
c) Understands the sensitivity of demand to price changes (i.e. the demand curve) and describes the factors that affect demand for a product or service (consumer tastes, consumer income, price and availability of substitute and complementary products, price elasticity of demand, potential reactions of rivals, marginal costs, shared costs, etc.)	✓	
d) Describes and applies various demand oriented methods of pricing (e.g. value-based, skimming, penetration, prestige, price lining, target, bundle, yield management, peak load)	✓	✓
e) Describes and applies various cost oriented methods of pricing (e.g. standard mark-up, cost-plus, experience curve)	✓	✓
f) Describes and applies various profit oriented methods of pricing (e.g. target profit, target return on sales, target return on investment)	✓	✓
g) Describes and applies various competition-oriented methods of pricing (e.g. customary, market, above or below market, loss leader)	✓	✓
h) Describes and applies a reverse engineering pricing strategy	✓	✓
i) Describes and applies adjustments to list or quoted prices (e.g. discounts, allowances, geographical adjustments, special orders)	✓	✓
j) Understands the legal and regulatory aspects of pricing (e.g. price fixing, price discrimination, deceptive pricing, predatory pricing)	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Pricing decisions begin with organizational objectives:

Survival – set prices at a short-term rate, typically low, in order to get the organization through a difficult period (i.e. recession).

Sales growth – adjust price or discount, in order to encourage current customers to buy more product or to attract new customers.

Market share – adjust price to either maintain current market share or to increase market share relative to the competition.

Revenue maximization – set price, typically high and control costs in order to maximize revenues.

Breakeven – identify the price sufficient to cover variable costs and breakeven in the short-term.

Social responsibility – set price to meet a social need (i.e. provide low income housing; maximize employment in a low employment area).

Price can range from a high “ceiling”, the maximum a customer would pay for a product, to a low “floor”, the minimum to cover costs. The price within the range is influenced by a host of market factors and pricing constraints:

Stage of product life cycle will influence price. A high price strategy may work in the introduction stage, when a product is novel and competition is minimal, may not work in the maturity stage, when competition is substantial and marketing is more aggressive.

Costs of incurred research and development, production, distribution and marketing, will influence price.

As the nature of competition moves from a monopoly (one company), to monopolistic competition (more than one competitor, each with a unique offering), to oligopoly (few competitors with similar offerings), to pure competition (many competitors offering a similar product or service), price becomes increasingly competitive.

Sealed bid pricing is common in some industries. Organizations submit prices for set jobs in confidence as “sealed bids”. Price setting requires consideration, not only of costs and desired profits, but also the probability of winning the bid.

Product line pricing is required if more than a single product is offered. Price points for low, medium and high quality products in a line are set to maximize profits for the line and to reflect customers’ perceived quality differences.

The sensitivity of customer demand to price changes is reflected in a demand curve – a graphical representation of the relationship between price and the quantity of product desired at any given price. Many factors affect demand:

> Customer characteristics – understanding customer tastes and how to satisfy their needs is key to effective marketing. Both personality factors and economic factors, such as income levels of potential customers, will affect demand.
>
> Availability of substitutes – if customers have many product choices, they may be more price sensitive.
>
> Availability of complementary products – if more than one product are sold together, the price of one product (i.e. razor) may influence the price and demand for the other product (i.e. blades).
>
> Price elasticity of demand refers to the change in demand as a result of a change in price. Price inelasticity exists when demand changes little in response to a price increase or decrease (i.e. change in the price of a prescribed medicine may have little influence on demand).
>
> Costs must be known in order to estimate demand and set price, including fixed and variable costs, shared costs that require allocation across products and marginal cost – the change in total cost of producing one additional unit of a product.
>
> Reaction of rivals must be anticipated. Typically, a price leader is the first to announce price changes, then others follow. Or, a company may undercut by setting prices lower to attract a competitor's customers. Keeping prices fairly equal can avoid a price war.

Cost-based methods of pricing are based on the seller's costs. Commonly used, relatively easy to calculate, yet market demand is not accounted for.

A standard mark-up is a simple method of adding a percentage mark-up to the selling price. For example:

Designer jeans cost	\$100
Retail price	\$150
Mark-up/retail price	= \$50/\$150 = 33.3% mark-up on selling price

A mark-up on cost, which is less common, is calculated as:

Mark-up/cost	= \$50/\$100 = 50% mark-up on cost

Cost plus is a similar method to mark-up. It begins with cost, then an amount (rather than a percentage) is added to arrive at price.

Experience curve pricing begins with the average cost of a product, obtained by dividing total cost by total quantity produced. Then, an average of future cost is estimated, based on the assumption that with time and experience, costs will decrease. A desired mark-up is then added to the expected cost to establish price.

Demand-based methods of pricing are based on the market demand for a product. Effectiveness of these pricing methods depends on the quality of the demand estimates.

Perceived value pricing bases price on customers' perceived value, requiring both an understanding of customer values and the ability to measure those values monetarily. For example:

Price of other designer jeans	\$125
Premium for superior quality	\$ 10
Premium for superior brand image	\$ 10
Perceived value price	\$145

Value pricing sets price fairly low for a good quality product to offer high value to customers. Wal-Mart's "everyday low pricing" is an example of value pricing.

Skimming strategy sets price high to "skim the cream" off the market. Skimming is implemented at the introduction stage of the PLC, when competition is minimal and the product is novel. It allows an innovative company to recover expenses and assumes demand is inelastic at this stage of the PLC.

Penetration strategy sets price low to break into a market, gain share and establish a strong customer base, knowing that competition is gaining. It assumes demand is elastic.

Price lining sets prices at strong price points based on consumer demand rather than cost. For example, a cost oriented method may calculate the price for suits in the range of \$185 to \$205. Price lining sets the price for all suits at \$199. The seller feels that lowering the price will not increase sales significantly, until the next price point is reached, say \$149.

Prestige pricing can be applied to luxury or status goods (i.e. fur coat, diamond ring) where a high price reflects a desired product image and actually increases demand.

Product-bundle pricing offers one price for a set bundle of products (i.e. McDonald's value meal) lower than the sum of the individual products to encourage customers to buy more.

Target pricing considers the demand price relationship for a particular target market, for a particular marketing mix. For example, a discount store targets a budget oriented clothes shopper and a higher end store sells higher priced clothes to a different target.

Profit-based methods of pricing set price in order to yield a target profit, a target rate of return on investment (ROI) or a target return on sales. For example, a designer jeans manufacturer invested \$1 million, unit cost is \$100, anticipated unit sales are 10,000 pairs of jeans and desired return is 20%. The target return price is calculated as follows:

$$\text{unit cost} + \frac{\text{desired return x invested capital}}{\text{unit sales}} = \text{Target-return price}$$

$$\$100 + \frac{.20 \text{ x } \$1{,}000{,}000}{10{,}000} = \$120$$

Competition-based methods of pricing are based on competitors' prices:

Market pricing strategy sets price about equal to the competitor's price to avoid a price war.

Above market pricing sets price as high as "the traffic will bear" to maximize revenue.

Below market pricing sets price on the low side to discourage competitors from entering the market.

Loss leader pricing sets a commonly purchased product (i.e. milk) below cost to attract customers, who will hopefully buy other goods that will maximize total revenue.

Reverse engineering pricing strategy is a different method of analyzing pricing structure, by taking it apart and redeveloping a new price. It begins with price and works back to an expected rate of return based on demand forecasts, rather than historical data.

Adjustments can be made to the list price – the base or starting price before adjustments based on the following:

Geographic distances: "free on board" (f.o.b.) factory or to a specific place, sets the geographic distance to which point the seller will cover shipping costs. Beyond that point, the buyer is responsible for the goods and shipping costs. Freight absorption to a specific place means the seller will absorb or cover costs to that point. Absorption of some shipping costs may be required if a competitor has a geographic advantage.

Discounts are reductions from list price in return for some action. A common discount is for payment made within a limited number of days. For example, 2/10 net 30 represents a 2% discount offer if payment is made within 10 days or, full payment is required within 30 days.

Quantity discounts are based on volume of an order and can be either non-cumulative (each order is discounted individually) or cumulative (discount increases with each order over a set period, say, one year).

Promotional allowances are discounts off the list price offered to intermediaries in a distribution chain in return for promotional assistance.

Special orders are temporary discounts from list price offered to clear inventory or to meet a competitor's price.

Legal and regulatory aspects of pricing include:

Price discrimination – involves charging different prices for the same offer without just cause. Just cause means the price difference is justified in terms of a real difference in volume, quality, etc. Discounts are not discriminatory if offered to any customer who meets the same terms.

Predatory pricing – while it is not illegal to compete on price, it is illegal for a company to attempt to destroy a competitor by charging an abnormally low price.

Price fixing or collusion – it is illegal for competing companies to agree to fix a price, typically at an artificially high level.

Deceptive pricing misleads the consumer. For example, bait pricing attracts customers by offering a low price, say a $299 dryer, when a higher priced dryer is really the sales objective. While bait pricing is not illegal, it can contravene the Competition Act if it is deemed misleading.

Information Technology as a Resource

Skill Level:	R/U	A/A
3.2.4.1 Identifies key performance indicators for IT		
a) Describes the characteristics of various types of information systems (e.g. transaction processing, management reporting, decision support, etc.) in terms of inputs, processing, outputs, users and uses of output	✓	
b) Describes the difference between accounting information systems and management information systems	✓	
c) Describes the role of information systems in managing the supply chain	✓	
d) Describes the concept and role of data warehousing	✓	
e) Explains the alignment/integration of information systems and key performance indicators for IT with business objectives and success factors, with respect to technology assessment, capacity planning, allocation of resources, management of technology diffusion, etc. in particular business settings	✓	✓
f) Explains the managerial tasks and practices pertaining to systems acquisition, development, analysis, implementation and post-implementation review	✓	
h) Explains various methods of evaluating IT (e.g. NPV, cost-benefit analysis, ROI, business case approach, value analysis, total cost of ownership, benchmarking, balanced scorecard, etc.)	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Note to candidates: Requirement 3.2.4.1 (g) is included elsewhere in this manual.

Types of Information Systems

Transaction processing system (*TPS*) supports the day-to-day business operating activities as represented by transactions and is usually the first and most important objective of an organizational information strategy (it collects the data upon which higher levels of aggregation depend). A TPS is focused at the operating level of a business. The information produced by a TPS usually consists of detailed reports of daily transactions (such as a list of items sold or all the accounting transactions that have been recorded in various ledgers and registers) or future transactions (such as a list of items that need to be ordered).

Management information systems (MIS) provide middle managers with reports that summarize and categorize information derived primarily from data gathered by the various TPS in the organization. The purpose of the reports is to allow managers to spot trends and to get an overview of current activities, as well as to monitor and control operations. The goal of an MIS is to support tactical (rather than strategic) decision making.

Executive information systems (EIS) provide information to executive level decision makers in a highly aggregated (summary or graphical) form so they can quickly scan information for trends and anomalies. Information is collected from both internal (TPS, MIS and other sources) and external data.

Decision support systems (DSS) are special purpose information systems to support decision making. A DSS augments human decision making performance and problem solving by using 'what if' analysis. A what if analysis allows for making hypothetical changes to data scenarios and observing how such changes would hypothetically influence outcomes.

Accounting information systems (AIS) is a collection of processes, procedures and systems to record, classify, summarize and consolidate accounting data for internal and external use. AIS intersect the two disciplines of accounting and information systems.

Supply Chain Management

Supply chain management (SCM) is the process of planning, implementing and controlling the movement of a product or service from supplier to customer. The primary objective of SCM is to fulfill customer demand through the most efficient use of resources, including distribution capacity, inventory and labour. Systems such as electronic data interchange (EDI) and the just-in-time (JIT) methodology require the extensive use of information systems and communication in order to optimize the supply chain.

Data Warehouse

A Data Warehouse is a repository of selected operational and analytical databases. Data is copied once into a centralized 'warehouse' (written once, read many times, but never updated) and used to analyze information. Data warehousing allows for on-line analytical processing (OLAP), thus, providing multidimensional data retrieval and analysis. The power of data warehousing lies in its sophisticated combination of data from various internal and external sources. They are costly and complex to implement and maintain.

Information Systems Alignment

Information Systems Alignment – information systems have no meaning unless they are connected to specific business outcomes. In this context, measurement should be a way to answer the question: What is the value of information systems to the business? Effective measurement programs must be rooted in both IS and the business in order to be effective. To reach the goal of a business-oriented measurement program, an organization goes through different phases:

1. The first phase is the development of an internal IS measurement program. In this phase, the informatics group (the IG are typically responsible for the acquisition, deployment and maintenance of the computing infrastructure in the organization) focuses on designing a meaningful measurement program from a technical vantage point. The IG develops operational definitions for IS performance at the organizational, application and project level. This phase helps the organization to define key measures for assessing its technical and software processes in terms of quality, productivity and impact on customer satisfaction. Typical measures in this phase include productivity oriented input/output ratios, defect and/or failure densities and intensities, software process maturity ratings and technical quality metrics.
2. In the second phase, the measurement program must be linked to business performance. For example, the organization should be able to make assessments about its performance in business terms, such as a percentage increase in productivity in a given period that will translate into lower unit production costs and/or the production of new products and/or enhancements to existing products. A shift in measurement occurs in this phase, going from output/input to outcome/input. A typical measure is functional quality.
3. In phase three, the program becomes a business oriented measurement program. The organization can directly express changes in its performance. The measurement focus shifts to outcome, such as business value, process improvement and yield.

Information Systems Integration

Information Systems Integration – IS must be integrated with corporate strategy. In the past, information systems modelled the basic processes through which business was conducted. Rather than transforming the processes to take advantage of new technology or ideas, they computerized only established processes. This yielded automated processes rather than leverage. Today, there is considerable evidence that IS can be the vehicle for radical transformation, yielding productivity improvement and competitive gains if those basic business processes are changed through business process re-engineering or BPR. Indeed a major objective of information strategy planning is the re-engineering of business processes. IS integration must occur at different levels.

1. At the lowest level of integration, there are isolated information systems that were designed to help operational units improve efficiency. These systems are not directly linked to any integrated strategic plan. A large number of IS fall into this category.

2. The second level of integration is characterized by policy formulation systems designed to aid the strategic planning process. In this case, the system helps formulate the plan, but it is not a part of an end product or service produced by the organization. A set of analytical tools helps select a course of action to maximize corporate performance over a multi-year planning horizon. In addition, econometric and risk analysis models are available. Here, technology itself becomes a part of the strategy, expanding the range of strategic alternatives considered by the organization.
3. At the third level, the technology itself becomes a part of policy execution. It expands the range of strategic alternatives considered. At this level, technology is integrally related to an organization's strategic thinking by helping to define the range of possibilities. At the same time, it provides a good portion of the means by which the strategy, once selected, is to be implemented.

Systems Development Life Cycle

Systems development life cycle (SDLC) is the most popular method of developing information systems. It is a formal, step-by-step process that many organizations follow during systems analysis and design. It is a method that breaks development into smaller, more manageable, pieces. Whether large or small, it is important to follow a clearly defined process. The number of steps or phases can vary, but always include more or less the same processes:

1. Planning – Identify the scope and boundary of the problem and plan the development strategy and goals. The goal of this phase is to evaluate its:
   - Organizational feasibility – how well the new system will support the strategic objectives of the organization.
   - Technical feasibility – hardware, software and network capability, reliability and availability.
   - Operational feasibility – end-user acceptance, management support, customer, supplier and government requirements.
   - Economic feasibility – cost savings, increased revenue, decreased investment and increased profits.
2. Analysis – Study and analyse the problem (or the business opportunity) causes and effects, then identify and analyse the requirements that must be fulfilled by any successful solution. Modelling tools include: data flow diagrams (DFDs), systems flowcharts diagram, entity relationship diagrams (ERDs). System's functional requirements:
   - User interface requirements – the end users' entry and exit boundaries to the system
   - Processing requirements – the required activities to transform input into output and response time needed for processing activities.
   - Storage requirements – organization, content and size of databases, types and frequency of updating and inquires and the rationale for and the length of, record retention.
   - Control requirements – accuracy, validity, safety, security and adaptability requirements for system input, processing, output and storage functions.

3. Design – If necessary, design the solution. The three major deliverables resulting from the design phase include:
    - User interface design – focuses on supporting the interactions between end-users and the system.
    - Data design – focuses on the design of data bases and files to be used by the system.
    - Process design – focuses on the design of software resources (i.e. the programs, procedures and algorithms needed by the system).
4. Implementation – This phase includes hardware and software acquisition, software development, testing of programs and procedures, development of documentation and operating manuals and a variety of installation activities. It also involves the education and training of end users and specialists who will operate the new system. There are four basic approaches to implementation:
    - Direct implementation – the new system is put in place all at once (low cost/high risk)
    - Parallel implementation – involves running the old system and the new system at the same time for a specified period of time (high cost/low risk)
    - Phased implementation – spreads the implementation over time in order to avoid the traumatic effects of trying to implement all the components at once (medium cost/medium risk)
    - Pilot implementation – is preferred if a system is to be implemented at many locations in a decentralized company (medium-high cost/medium-high risk)
5. Support – Analyse the implemented solution, refine the design and implement improvements to the solution. Different support solutions can thread back into the previous steps.

Notes:

- Some SDLC models might have more phases; what's important is to have manageable pieces.
- Although we mention five separate phases, one phase does not necessarily have to be completed before the next one is started. In other words, the phases often overlap.
- Three groups of people are usually involved in a SDLC project: users, managers and technical staff consisting of system analysts, designers and programmers.

Evaluating IT

Information systems are considered long-term capital investments. Six capital budgeting models may be used to evaluate capital projects: The pay back method, the accounting rate of return on investment (ROI), the cost-benefit ratio, the net present value, the profitability index and the internal rate or return (IRR). Many problems arise when financial analysis is applied to information systems. Most thorny among these is that financial models do not express the risk and uncertainty of their own cost and benefits estimates. Furthermore, costs and benefits do not occur in the same time frame, as costs tend to be up front and tangible (measurable); whereas, benefits tend to be back-loaded and intangible (difficult to quantify). In addition, inflation may affect costs and benefits differently. Finally, technology, especially information technology, can change during the course of the project, causing estimates to vary greatly. There is some reason to believe that investment in information technology requires special consideration in financial modelling. Computer-based information systems are similar to other capital investments in that they produce an immediate investment cost and are expected to produce cash benefits over a term greater than one year. The high rate of technological change in computer-based information systems means most systems are seriously out-of-date in five to eight years. A common tool used is a business case, which helps decision makers to proceed or abandon a project. Capital budgeting tools are one element that fits within a good business case. To better evaluate the IT impact, analysis in a complex environment requires good assumptions, judgment and data. Total cost of ownership assesses direct and indirect costs commonly associated with the life of the investment. Balanced scorecard (BSC) is another management tool to communicate the value of IT throughout the organization. The BSC helps link the metrics of effectiveness and efficiency of the IT project to the strategic goals of the organization.

Computer Operations and Traditional Control Activities

Skill Level:	R/U	A/A
3.2.4.1 g) Describes the management accounting issues relating to computer operations and the effects of computer-based information systems on traditional control activities, such as transaction authorization, segregation of duties, access control, independent verification, etc.	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Specific Computer Control Procedures

- Authorization
  Various authorization control techniques include:
  - use of passwords
  - limit access to specified records/files in each department
  - suspend a user ID if too many attempts are made to sign on
  - restrict certain transactions to specified terminals
  - restrict operation of terminals to a specified time during the day or week
  - 'time-outs', which force the terminal to sign off after a specified period of inactivity
  - logs of access or attempted access, which are reviewed on a regular basis
  - personnel policies restricting employee activities and tasks

- Separation of incompatible functions
  Procedures include:
  - Segregation of incompatible functions between users, developers, processing and support. Segregation between users and developers is necessary to ensure computer controls are not developed in such a way they can be circumvented by a user. This segregation also provides a cross check on the accuracy and appropriateness of new systems and program changes. Segregation between developers and processing is necessary to ensure only appropriately verified and approved programs are run by processing. Segregation between users and processing is needed to ensure programs or data cannot be accessed and modified by users. Segregation between support, which is responsible for security and database administration, is essential because security is ultimately responsible for the integrity of the data.

  Within user departments, it is also important to establish segregation of the following activities:
  - initiation and authorization of transactions
  - recording and approval of transactions
  - custody of assets
  - reconciliation of assets and liabilities to the financial records

In cases where segregation of incompatible functions cannot be met, the risk and cost of possible errors should be assessed and appropriate mitigating control procedures should be established. These procedures often consist of input validation controls or re-performance procedures.

- Adequacy of documentation and records
  Documentation is important in both systems development and processing. As part of the SDLC, it is important to prepare:
  - adequate operating documentation
  - adequate user documentation

  From a processing perspective, the following documentation is necessary:
  - procedures for data entry
  - procedures for production scheduling and control
  - procedures for computer operations

  It is also important to have a documented disaster recovery plan.

- Safeguarding of assets
  This refers to the physical security of the physical components of a system – hardware, data storage, mediums and the building housing the computer system. As mentioned previously, risks include:
  - fire, flood, earthquake
  - terrorism
  - theft
  - intentional damage by employees

  Methods of physically securing a location include:
  - controlling access through an identification method, such as finger print scans
  - locking doors
  - housing equipment in a building built to withstand natural disasters, such as earthquakes
  - installation of fire sprinklers (although sprinklers normally consist of a chemical substance, not water, because water can damage the system)

- Limitation of access (access controls)
  This refers to access controls to protect software and data. The most common means of providing security is through the use of passwords to prevent unauthorized access. Another method is through the requirement that two separate people log on, with separate passwords, to access a system.

- Independent checks on performance (also known as internal verification)
  This refers to a second independent person checking the work of the preparer. This can be achieved through two techniques, review of the output by a second person or use of the internal audit department to verify procedures are followed and output is timely, accurate, authorized and complete.

- Backup recovery
  Control procedures include:
    - include recovery and restart procedures in operations documentation
    - identify exposures and risks that may cause a disruption
    - prepare backup and recovery plans
    - review insurance coverage in the event of a business interruption
    - document and test backup recovery procedures

- Disaster planning
    - document and test emergency procedures to ensure protection of life and property
    - the same procedures as backup recovery above apply to disaster planning
    - conduct tests to:
        - verify that all data and programs are available in off-site storage
        - reconstruct systems from data held in off-site storage
        - verify that systems can be recovered at alternative sites
        - train employees in recovery procedures

Other Control Issues

- Data integrity
  Controls related to data integrity ensure data is accurate, complete, timely and authorized. Controls to ensure data integrity include:

    - standard operating procedures, which are enforced
    - monitoring to ensure compliance with standard operating procedures
    - written service level agreements between users and information processing defining the nature and level of service
    - appropriate maintenance
    - accepting only authorized, tested and documented program changes into production
    - input validation techniques, such as:
        - transaction validation
          Each transaction is scrutinized before processing to ensure it is acceptable, authorized and legitimate. Often, the location, site or person originating a processing activity may be a factor in determining transaction validity. A change to a budget may be permitted if an authorized person made the change.

        - sequence checks
          As processing takes place, the number sequence is examined to verify that each transaction is in the proper order and there are no missing or duplicated transactions.

- batch totals
  This ensures all transactions have been processed. A total of the numbers in a specific field in a file is determined before processing. After processing, a second total is calculated of the number in the field. The two totals are compared, which ensures no transactions are missing.

- hash totals
  Similar to batch totals, but totals the number of items, not the total of numerical values. This is useful when transactions contain non-numerical data.

- format checks
  Pre-established definitions for a field ensure data is not input incorrectly. For example, if a field is predefined to accept numerical values, alphabetic values are not accepted.

- reasonableness check
  Pre-defined ranges of numerical values help prevent large errors from occurring. Any value input above or below the pre-established limits could either be rejected or flagged on an exception report.

- check digits
  A check digit is an additional digit added to the end of a numeric value. An algorithm is applied to each of the digits preceding the last one. When an operator inputs a value, the processor calculates the check digit and compares it to the inputted value. If incorrect, the input is rejected.

- Privacy
  Privacy of data can be ensured through limiting access to appropriate individuals. Methods to do so include:
  - use of passwords
  - limit access to specified records/files in each department
  - suspend a user ID if too many attempts are made to sign on
  - restrict certain transactions to specified terminals
  - restrict operation of terminals to a specified time during the day or week
  - ‘time-outs’, which force the terminal to sign off after a specified period of inactivity
  - logs of access or attempted access, which are reviewed on a regular basis

- Continuity of processing
  Controls to ensure continuity of processing, include:
    - forecast computer capacity and user needs and make adjustments where necessary
    - monitor system performance to ensure problems are identified and corrected in a timely manner
    - schedule information processing so users needs can be met
    - maintain hardware and software
    - require users to notify information processing of changes in their processing needs in advance of the required changes

- Disaster recovery
  This is a contingency plan in the event of a disaster. It ensures an organization can continue to process essential data in the event of a disaster. Key items in a disaster recovery plan are:
    - off-site storage of data, programs, operating systems and documentation
    - a planning document containing the detailed steps to follow in the event of a disaster
    - backup agreements and alternative sites

  To be effective, the disaster recovery plan must be up-to-date and tested.

Segregation of Duties Revisited

Segregation of duties ("SoD") is a key element among internal controls. SoD enforces a level of checks and balances upon the activities of individuals. The prevention of fraud and innocent error is the primary objective of enforcing SoD. The objective of SoD is achieved by distributing the tasks and associated privileges for a specific business process among multiple users. With the concept of SoD, business duties can be categorized into four types of functions: authorization, custody, record keeping and reconciliation. In a perfect system, no one person should handle more than one type of function. While SoD is well established in AIS, it is fairly new to the IS department. In information systems, segregation of duties helps reduce the potential damage from the actions of one person. When duties cannot be separated, compensating internal controls to reduce the risk of an existing or potential control weakness should be put in place.

Enterprise Resource Planning

Skill Level:	R/U	A/A
3.2.4.2 Describes the role of an enterprise resource planning (ERP) system		
a) Describes enterprise resource planning (ERP) and contrasts ERP systems with traditional information systems	✓	
b) Explains the role and objectives of ERP systems in terms of integrating business processes across organizational boundaries and functions	✓	
c) Identifies and explains the capabilities, benefits and challenges of ERP systems facing an organization	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

<u>Enterprise resource planning</u> (ERP) are incredibly complex and broad software packages must be configured to meet the needs of a company. ERPs help manage organization-wide processes, using a common database and shared management reporting tools. ERP helps 'tear down' the traditional walls between finance, sales, production and distribution by integrating all facets of a business. ERPs, with the support of a single central database, help eliminate the problems of data fragmentation caused by multiple systems that share information easily.

<u>Business process</u> is a collection of activities that take one or more kinds of input and create an output that is of value to the customer. ERP software supports the efficient operation of organizational processes by integrating activities throughout an organization (sales, marketing, manufacturing). Business process re-engineering (BPR) is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements. It allows an organization to review its business processes with the intent of eliminating work that does not add value to the customer. As ERPs touch every area in a company, including the outer left (suppliers) and outer right (customers), implementing and using ERPs will almost certainly involve a business process re-engineering (BPR) initiative. BPR is a long and, sometimes painful, undertaking.

<u>ERP capabilities</u> attempt to cover all basic functions of an enterprise, regardless of the organization's business or charter. Non-manufacturing businesses, non-profit organizations and governments all now utilize ERP systems. To be considered an ERP system, a software package must provide the function of at least two systems (payroll and accounting). ERPs are invaluable in the enforcement of SoD as they feature role-based access to data and function, as well as enforcing industry best practices such as SOX and its Canadian equivalent. Main characteristics of an ERP system:

- single database
- consistent information
- management control
- global integration
- easier maintenance due to system consolidation

Benefits of ERP

- Streamlined data handling results in higher accuracy, faster internal data handling and fewer data entry errors.
- Better data sharing (through common data base) leads to more efficient operations and resulting cost savings.
- Having integrated information system promotes cooperation between functional areas, for example, between marketing and manufacturing.
- Improved management reporting leads to better top management operational control.
- Leads employees to think about corporate goals, not merely functional area goals.
- Integrated organizational information system helps overcome the effects of geographical dispersion.
- ERP system replaces legacy systems, which now no longer require maintenance, leading to cost savings. Furthermore, less home grown software need be written in future.
- ERP system serves as a platform for software applications that are difficult to implement without an integrated information system: CRM, SCM, data mining, e-commerce.

Challenges of ERP

- Many problems organizations experience with ERP systems are due to inadequate investment in ongoing training for involved personnel, including those implementing and testing changes, as well as a lack of corporate policy protecting the integrity of the data in the ERP systems and how it is used.
- Customization of the ERP software is limited by design – ERPs reflect best practices.
- Re-engineering of business processes to fit the "industry standard" prescribed by the ERP system may lead to a loss of competitive advantage.
- ERP systems can be extremely expensive.
- ERPs are often seen as too rigid and too difficult to adapt to the specific workflow and business process of some companies—this is cited as one of the main causes of their failure.
- Many of the integrated links need high accuracy in other applications to work effectively. A company can achieve minimum standards, then, over time, "dirty data" will reduce the reliability of some applications.
- Once a system is established, switching costs are high for any one of the partners (reducing flexibility and strategic control at the corporate level).
- The blurring of company boundaries can cause problems in accountability, lines of responsibility and employee morale.
- Resistance to sharing sensitive internal information between departments can reduce the effectiveness of the software.
- Some large organizations may have multiple departments with separate, independent resources, missions, chains of command, etc. and consolidation into a single enterprise may yield limited benefits.
- The system may be too complex when measured against the actual needs of the organization.

Customer Relationship Management

Skill Level:	R/U	A/A
3.2.4.3 Describes the role of a customer relationship management (CRM) system		
a) Describes role, objectives and deliverables of customer relationship management (CRM) systems	✓	
b) Describes the types of CRM (e.g. operational, analytical, collaborative) and CRM applications (e.g. sales, marketing, customer service, customer-centric intelligence, online networking, etc.)	✓	
c) Identifies and explains the capabilities, benefits and challenges of CRM systems facing an organization	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Customer relationship management (CRM) is a system used to learn more about customers' needs and behaviours in order to develop stronger relationships with them. Good customer relationships are at the heart of business success. There are many technical components to CRM, but it's a mistake to think about CRM exclusively in technical terms. Rather, consider CRM as a strategic process that will help you better understand customers' needs and how you can meet those needs while simultaneously enhancing the bottom line. This strategy depends on bringing together multiple pieces of information about customers and market trends so you can sell and market your products and services more effectively.

Types of CRMs:
Functional/operational CRM – used at a functional area only, support front office processes.
Collaborative CRM – builds a single view of the customer across all contact channels in order to distribute customer intelligence to all customer facing functions. This view stresses the importance of coordinating information across time and across contact channels in order to systematically manage the entire customer relationship.
Analytical CRM – analyses customer data to target marketing and customer campaigns. Makes use of data mining to aid decisions.

CRM applications
Customer facing applications – these include all the areas where customers interact with the company: call centers, including help desks; sales force automation; and field service automation. Such CRM applications basically automate the information flow or they support employees in these areas.
Customer-touching applications – in this category, customers interact directly with the applications. Notable are self-service, campaign management and general purpose, e-commerce applications.
Customer-centric intelligence applications – These applications are intended to analyze the results of operational processing and use the results of the analysis to improve CRM applications. Data reporting and warehousing and data mining are the prime topics here.

CRM Benefits

- Improve the organization's ability to retain and acquire customers
- Maximize the lifetime value of each customer (share of wallet)
- Providing products and services that are exactly what customers want
- Offering better customer service
- Cross selling products more effectively
- Helping sales staff close deals faster

Challenges of CRMs

- CRM initiative launched without a strategy.
- CRM is considered an IT project, not business initiatives leveraging technology.
- Lack of communication between individuals in the customer relationship chain, leading to an incomplete picture of the customer.
- Lack of proper support or buy-in from users.

Performance Management Problems

MA1 Problem: Cost Classification and Behaviour - MCQ

1. Consider a single hard copy of this study guide as a cost object. What would be the best three labels to classify the relation between this cost object and the following two costs of producing the cost object respectively: (1) the paper; and (2) the one time fees paid to the authors (i.e. not royalties)?
   a. (1) direct cost (2) variable cost
   b. (1) variable cost (2) unavoidable cost
   c. (1) fixed cost (2) variable cost
   d. (1) direct cost (2) fixed cost
   e. (1) avoidable cost (2) variable cost

2. Given a cost has already been identified as a variable cost, which of the following additional descriptions of the cost is incompatible with that identification?
   a. The cost, in total, does not change with changes in the volume of the cost driver.
   b. The cost can be traced directly to the cost object.
   c. The cost, in total, does change with changes in the volume of the cost driver.
   d. The cost cannot be traced directly to the cost object.
   e. The cost is not a prime cost.

3. The total direct labour cost of producing 100 units of Product X is $50. The direct material cost of producing the 100 units is perfectly variable and the cost driver is the number of units produced. The cost of the direct material traced to each unit is $1.25. Indirect costs are completely fixed at $75 for the production of the 100 units. What are the total conversion costs for the 100 units of Product X?
   a. $275
   b. $250
   c. $200
   d. $175
   e. $125

MA2 Problem: Cost Classification and Behaviour - SMA

A portion of the costs incurred by business organizations is designated as direct labour cost. As used in practice, the term 'direct labour cost' has a wide variety of meanings. Unless the meaning intended in a given context is clear, misunderstanding and confusion are likely to ensue. If a user does not understand the elements included in direct labour cost, erroneous interpretations of the numbers may occur and could result in poor management decisions.

The National Association of Accountants has issued Statement on Management Accounting (SMA) Number 4C, 'Definition and Measurement of Direct Labour Cost,' to assist management accountants in dealing with problems that may arise in interpreting and understanding direct labour costs. Along with providing a conceptual definition of direct labour cost, this Statement describes how direct labour costs should be measured. Measurement of direct labour costs involves two aspects: (1) the quantity of labour effort to be included, that is, the types of hours or other units of time to be counted; and (2) the unit price by which each of these quantities is multiplied to arrive at a monetary cost.

Required:

a. Distinguish between direct labour and indirect labour.
b. Explain why some non-productive labour (e.g., coffee breaks, personal time) is treated as direct labour while other non-productive labour (e.g., down time, training) is treated as indirect labour.

MA3 Problem: Cost Classification and Behaviour – XDATA Limited

The following information was available about supplies cost for the first four months of the year for XDATA Limited.

Month	Production Volume	Supplies Cost
January	1,400	$ 5,400
February	3,200	14,200
March	1,200	6,200
April	3,000	14,800

1. Using the high-low method, an estimate of supplies cost at 2,000 units of production would be:

   a. $9,200
   b. $8,925
   c. $13,950
   d. $9,400
   e. Inappropriate to determine from the information given.

2. Using the same data and the high-low method, an estimate of supplies cost at 4,000 units of production would be:
   a. $9,200
   b. $8,925
   c. $13,950
   d. $9,400
   e. Inappropriate to determine from the information given.

MA4 Problem: Cost Classification and Behaviour – Vettor Company

Vettor Company manufactures electrical components. Plant management has experienced difficulties with fluctuating monthly overhead costs. Management wants to be able to estimate overhead costs to plan its operations and financial needs. A trade association publication reports that for companies manufacturing electrical components, overhead tends to vary with machine hours.

Monthly data was gathered on machine-hours and overhead costs for the past two years. There were no major changes in operations over this period of time. The raw data is:

Month Number	Machine-Hours	Overhead Costs
1	20,000	$84,000
2	25,000	99,000
3	22,000	89,500
4	23,000	90,000
5	20,000	81,500
6	19,000	75,500
7	14,000	70,500
8	10,000	64,500
9	12,000	69,000
10	17,000	75,000
11	16,000	71,500
12	19,000	78,000
13	21,000	86,000
14	24,000	93,000
15	23,000	93,000
16	22,000	87,000
17	20,000	80,000
18	18,000	76,500
19	12,000	67,500
20	13,000	71,000
21	15,000	73,500
22	17,000	72,500
23	15,000	71,000
24	18,000	75,000

The data was entered into Excel and a regression was run on the data. The following output was obtained:

R-square	0.91
T-value of the independent variable	15.00
Coefficients of the equation:	
Intercept	39,859
Independent variable (slope)	2.15

Required:

a. Use the high-low method to estimate the overhead costs.
b. Are the regression analysis results acceptable?
c. Use the results of both the high-low method and the regression to prepare the cost estimation equation and to prepare a cost estimate for 22,000 machine hours.

MA5 Problem: Cost Estimation – High-Low Method – Alex Limited

The following report for Alex Limited details direct labour costs and output levels for the twelve months ended December 31, 2000.

	Units Produced	Direct Labour Costs
January	21,560	$336,336
February	19,710	300,975
March	24,300	346,275
April	23,190	320,022
May	18,690	256,980
June	18,460	258,440
July	18,420	257,880
August	16,120	256,120
September	17,950	278,225
October	31,040	450,080
November	26,190	390,231
December	23,430	325,677

Required:

Estimate the cost function using the high-low method.

MA6 Problem: Manufacturing Cost– Crites Manufacturing

The following information is available for the Crites Manufacturing Company for the year ended December 31, 2005:

Sales	$325,000
Work-in-process, January 1	19,000
Work-in-process, December 31	15,600
Direct materials inventory, January 1	21,400
Direct materials inventory, December 31	19,800
Finished goods inventory, January	36,700
Finished goods inventory, December 31	13,600
Direct materials purchased	32,400
Direct labour	52,000
Supervisory and indirect labour	27,300
Administrative salaries	43,000
Supplies and indirect materials	5,400
Heat, light and power (70% for manufacturing plant)	31,600
Amortization (80% for manufacturing plant)	37,500
Property taxes (75% for manufacturing plant)	9,900
Administrative costs	10,950
Marketing costs	42,600

<u>Required:</u>

Prepare an income statement with a supporting schedule of cost of goods manufactured.

MA7 Problem: Manufacturing Cost – Stoney Manufacturing

The following information pertains to Stoney Manufacturing for 2006:

Direct labour	$ 30,000
Sales	400,000
Selling expenses	50,000
Raw (direct) materials on hand:	
January 1	8,000
December 31	4,000
General and administrative expenses	18,000
Finished goods:	
January 1	25,000
Work-in-process:	
January 1	19,000
December 31	18,000
Direct material purchases	47,000
Depreciation: factory	20,000
Indirect labour	3,000
Indirect materials used	7,000
Marketing promotions	1,500
Factory taxes	11,000
Utilities	20,000
Courier costs (office)	900
Miscellaneous plant overhead	4,000
Plant repairs and maintenance	9,000
Customer service costs	3,000
Fire insurance: factory equipment	3,000
Materials handling costs	8,000

Additional Information:

a. The gross profit margin is 73.25%

b. Depreciation is charged to production at 70%

c. Utilities are charged to production at 90%

<u>Required:</u>

1. Prepare a schedule of cost of goods manufactured for the year ended December 31.
2. Prepare a schedule of cost of goods sold.
3. Prepare an income statement for the year ended December 31.

MA8 Problem: Activity-Based Costing – Madcap Manufacturing

Madcap Manufacturing produces 80 different types of hats and caps. Lately, sales and profits have been declining, although the overall market for hats and caps has actually been growing. The company has, in the past, used a job order costing system for each production run. Under this system, factory overhead was allocated on the basis of direct labour hours. However, direct labour is now a relatively small part of production costs as the company has automated its factory in the past two years.

You were hired as a consultant to the plant manager last November. You have analyzed the budgeted costs and activities for 2007 and broken them down as:

Direct materials (100,000 meters)	$75,000
Direct labour (10,000 hours)	160,000
Set up costs (750 set ups)	22,500
Maintenance (20,000 machine hours)	40,000
Production scheduling (500 batches)	7,500
Inspection (800 inspections)	16,000
Material handling (100,000 meters)	6,000
Depreciation (20,000 machine hours)	200,000
Power (20,000 machine hours)	8,000

The company has been asked to bid on an order for 1,000 caps with a special design. This order is forecast to require:

Direct materials	500 meters
Direct labour	60 hours
Set ups	2
Inspections	2
Machine hours	100 hours

The order would be produced in one production run (batch). The company normally sets its selling price at 40% above full manufacturing cost.

Required:

How much would Madcap Manufacturing bid on this special order using direct labour hours to apply factory overhead?

Repeat requirement (1), but use ABC to apply the factory overhead.

Performance Management - Problems

MA9 Problem: Activity-Based Costing – Alaire Corporation

Alaire Corporation manufactures several different types of printed circuit boards; however, two of the boards account for the majority of the company's sales. The first board, a television circuit board, has been a standard in the industry for several years. The market for this type of board is competitive and, therefore, price sensitive. Alaire plans to sell 65,000 of the TV boards in 2000 at a price of $150 per unit. The second high-volume product, a personal computer (PC) circuit board, is a recent addition to Alaire's product line. Because the PC board incorporates the latest technology, it can be sold at a premium price; the 2000 plans include the sale of 40,000 PC boards at $300 per unit.

Alaire's management group is meeting to discuss strategies for 2000 and the current topic of conversation is how to spend the sales and promotion dollars for next year. The sales manager believes the market share for the TV board could be expanded by concentrating Alaire's promotional efforts in this area. In response to this suggestion, the production manager said, "Why don't you go after a bigger market for the PC board? The cost sheets I get show the contribution from the PC board is more than double the contribution from the TV board. I know we get a premium price for the PC board, so selling it should help overall profitability."

Alaire uses a standard cost system and the following data apply to the TV and PC boards.

	TV Board	PC Board
Direct material	$80	$140
Direct labour	1.5 hours	4 hours
Machine time	.5 hours	1.5 hours

Variable factory overhead is applied on the basis of direct labour hours. For 2000, variable factory overhead is budgeted at $1,120,000 and direct labour hours are estimated at $280,000. The hourly rates for machine time and direct labour are $10 and $14, respectively. Alaire applies a material handling charge at 10% of material cost. This material handling charge is not included in variable factory overhead. Total 2000 expenditures for material are budgeted at $10,600,000.

Ed Welch, Alaire's controller, believes that before management proceed with the discussion about allocating sales and promotional dollars to individual products, it might be worthwhile to look at the products on the basis of the activities involved in their production. As Welch explained to the group, "Activity-based costing integrates the cost of all activities, known as cost drivers, into individual product costs rather than including these costs in overhead pools." Welch has prepared the schedule shown below to help management understand this concept.

	Budgeted Cost	Cost Driver	Annual Activity for Cost Driver
Material overhead:			
Procurement	$ 400,000	Number of parts	4,000,000 parts
Production scheduling	220,000	Number of is	110,000 boards
Packaging and shipping	440,000	Number of boards	110,000 boards
	$1,060,000		
Variable overhead:			
Machine set up	$ 446,000	Number of set ups	278,750 set ups
Hazardous waste disposal	48,000	Pounds of waste	16,000 pounds
Quality control	560,000	Number of inspections	160,000 inspections
General supplies	66,000	Number of boards	110,000 boards
	$1,120,000		
Manufacturing:			
Machine insertion	$1,200,000	Number of parts	3,000,000 parts
Manual insertion	4,000,000	Number of parts	1,000,000 parts
Wave soldering	132,000	Number of boards	110,000 boards
	$5,332,000		

Required Per Unit	TV Board	PC Board
Parts	25	55
Machine insertions	24	35
Manual insertions	1	20
Machine set ups	2	3
Hazardous waste	.02 lb.	.35 lb.
Inspections	1	2

"Using this information," Welch explained, "we can calculate an activity-based cost for each TV and PC board and then compare it to the standard cost we have been using. The only cost that remains the same for both cost methods is the cost of direct material. The cost drivers will replace the direct labour, machine time and overhead costs in the standard cost."

Required:

a. Identify at least four general advantages associated with activity-based costing.

b. On the basis of standard costs, calculate the total gross profit expected in 2000 for Alaire Corporation's
   1. TV board.
   2. PC board.

c. On the basis of activity-based costs, calculate the total gross profit expected in 2000 for Alaire Corporation's
   1. TV board.
   2. PC board.

d. Explain how the comparison of the results of the two costing methods may impact the decisions made by Alaire Corporation's management.

MA10 Problem: Activity-Based Costing – Johannes Incorporated

Johannes Incorporated manufactures two types of mattresses, premium and regular. There are two direct cost categories, direct materials and direct manufacturing labour and three indirect cost pools (activity cost pools). The three indirect (activity) cost pools are materials handling, cutting and assembly. There are no other cost pools associated with the production of the mattresses.

Information related to the indirect (activity) cost pools is:

Manufacturing Activity Area	Budgeted Costs for 2007	Cost Driver Used as Allocation Base (or activity measure)	Cost Allocation Rate (or activity rates)
Materials-handling	1,120,000	Parts	1.40
Cutting	2,560,000	Parts	3.20
Assembly	2,240,000	direct manufacturing labour hours	28.00

Data for September 2007 with respect to quantities, direct material, parts and labour are:

	Units Produced	Direct Material Costs	Number of Parts	Direct Manufacturing Labour Hours
Regular	2,000	624,000	40,000	6,000
Premium	500	210,000	20,000	2,000

The direct manufacturing labour rate is $25 per hour. There is no beginning or ending inventories.

The upstream activities to manufacturing (research and design) and the downstream activities (marketing, distribution, logistics and customer service) were budgeted per unit as:

	Upstream activities	Downstream activities
Regular	$40	$87
Premium	$83	$104

Required:

Compute the full product costs per unit for both the regular and premium mattress lines.

MA11 Problem: Activity-Based Costing – Uppervale Health Centre

Uppervale Health Centre runs four programs: (1) alcoholic rehabilitation, (2) drug addict rehabilitation, (3) children's services, and (4) after-care (counselling and support of patients following release from a mental hospital).

The Centre's budget for 2005 is:

Professional salaries:		
Six physicians x $100,000	$600,000	
19 psychologists x $50,000	950,000	
23 nurses x $25,000	575,000	$2,125,000
Medical supplies		300,000
General overhead (administrative salaries, rent, utilities, etc.)		1,275,000
		$3,700,000

The staff completed surveys indicating the time devoted to each of the four programs. Employee allocations to individual programs are:

	Alcohol	Drug	Children	After-care	Total Employees
Physicians	--	2	4	--	6
Psychologists	6	4	--	9	19
Nurses	4	6	4	9	23

Eighty (80) patients are in residence in the alcohol program, each staying about half a year. Thus, the clinic provided 40 patient years of service in the alcohol program. Similarly, 100 patients were involved in the drug program for about half a year each. Thus, the clinic provided 50 patient years of service in the drug program. The clinic provided 50 and 60 patient years of service to children's services and after-care respectively.

Other information gathered by the Centre:

1. Administrative costs and consumption of medical supplies depend on the number of patients in each department and the length of their stay (that is, patient years).
2. Rent and clinic maintenance depend on the square metres of space occupied by each program.
3. Laboratory service costs are driven by the number of laboratory tests performed.
4. General overhead costs consist of:

Rent and clinic maintenance	$ 200,000
Administrative costs to manage patient charts, food, laundry	800,000
Laboratory services	275,000
	$1,275,000

5. Other information about individual departments:

	Alcohol	Drug	Children	After-care	Total
Square metres of space occupied by each program	9,000	9,000	10,000	12,000	40,000
Number of patients	80	100	100	120	400
Number of laboratory tests	400	1,400	3,000	700	5,500

<u>Required:</u>

1a. Calculate the indirect cost rates for medical supplies, rent and clinic maintenance, administrative cost rate for patient charts, food, laundry and laboratory services using an activity-based costing approach.

b. What are the total costs of each program and the cost per patient year using an activity-based costing approach?

MA12 Problem: Job Order Costing – Redro Limited

Redro Limited is a custom manufacturer and uses a job order costing system. Information relating to production for the month of August is:

Job orders completed	$400,000
Cost of job orders shipped to customers	$360,000
Selling price	cost + 25%
Direct materials issued	$110,000
Beginning WIP	$85,000
Direct labour	$180,000
Direct labour hours	12,000
Actual manufacturing overhead	$129,000
Beginning finished goods	0

Manufacturing overhead is applied based on direct labour hours. The manufacturing overhead rate is calculated at the beginning of the year. Estimated annual manufacturing overhead is $2,400,000 and budgeted labour hours are 240,000.

Required:

1. What is the balance in WIP at the end of August?

2. What is the under- or over-applied overhead for the month of August (assume no under- or over-applied balance carried forward)?

MA13 Problem: Job Order Costing – Tapem Limited

Tapem Limited has two departments, Department I and Department II. Tapem uses a job order system and applies manufacturing overhead to products on the basis of direct labour hours for Department I and machine hours for Department II. At the beginning of the year, Tapem Limited estimated the following:

	Department I	Department II
Direct labour hours	26,000	8,000
Machine hours	5,000	32,000
Manufacturing overhead	$403,000	$352,000

Job 1368, which produced 65 units, required the following:

	Department I	Department II
Direct materials	$845	$468
Direct labour	$1,335	$132
Direct labour hours	89	8
Machine hours	4	96

At the end of the year, actual manufacturing overhead was $463,105 for Department I and $347,600 for Department II.

In addition, actual direct labour hours and machine hours for Department I and II for the year are:

	Department I	Department II
Direct labour hours	28,510	8,200
Machine hours	6,150	33,400

Required:

1. What is the overhead cost applied to job 1368?

2. What is the under- or over-applied manufacturing overhead for Department I and II for the year?

MA14 Problem: Job Order Costing – Valani Corporation

Valani Corporation manufactures made-to-order widgets and uses a normal job order cost costing system. During the month of August, the following jobs were worked on and the following costs incurred.

	Job A4	Job A5	Job A6	Job A7	Total
Balance in opening Work-in-process	$5,600	$7,800	-	-	$13,400
Costs added during August -					
Direct materials	10,000	20,000	$16,000	$4,000	50,000
Direct labour	5,000	4,000	3,000	1,500	13,500
Job status at end of August	Sold	Complete In FG Inventory	Complete In FG Inventory	In WIP Inventory	

Valani's controller budgeted total overhead costs to be $600,000 and budgeted direct labour cost to be $150,000. Overhead is allocated on the basis of direct labour cost. The company marks up their jobs at 40% over cost. There were no opening finished goods inventories.

Required:

Prepare all journal entries relative to these jobs for the month of August.

MA15 Problem: Job Order Costing – Devoe Company

Devoe Company uses a job order costing system and started the 2005 year with the following inventory balances:

Raw materials inventory	$160,000
Work-in-process inventory	87,000
Finished goods inventory	265,000

The following transactions took place during 2005:

1. Raw material purchases amounted to $450,000.
2. Raw materials issued to production were:

Direct materials	$475,000
Indirect materials	20,000

3. Direct labour hours incurred totalled 19,500 at an average rate of $30. The company estimated total overhead to be $500,000 and direct labour hours incurred to be 20,000. The company allocates overhead on the basis of direct labour hours.
4. Total manufacturing overhead (excluding indirect materials) incurred was $485,000.
5. The work-in-process at December 31, 2005 consisted of the following two jobs:

	Job A650	Job A652
Direct materials	$45,000	$26,500
Direct labour hours	560	125

6. Ending finished goods inventory totalled $247,000.

<u>Required:</u>

a. Prepare journal entries to record the above transactions.
b. Prepare a schedule of cost of goods manufactured and cost of goods sold.
c. Prepare the journal entry to dispose of over/under applied overhead on the following assumptions:
   i. the balance is written-off against cost of goods sold, and
   ii. the balance is prorated between the balances containing overhead that was applied this year.

Performance Management - Problems

MA16 Problem: Job Order Costing – Duench Incorporated

Duench Inc. is a manufacturer of furnishings for infants and children. The company uses a normal job order costing system. Duench's WIP inventory at April 30, 2004, consisted of the following jobs:

Job Number	Items	Units	Accumulated Cost
CBS1O2	Cribs	20,000	$ 900,000
PLPO86	Playpens	15,000	420,000
DRS 114	Dressers	25,000	250,000
			$1,570,000

The company's finished goods inventory, using the FIFO method, consisted of five items:

Item	Quantity And Unit Cost	Accumulated Cost
Cribs	7,500 units @ $64 each	$ 480,000
Strollers	13,000 units @ $23 each	299,000
Carriages	11,200 units @ $102 each	1,142,400
Dressers	21,000 units @ $55 each	1,155,000
Playpens	19,400 units @ $35 each	679,000
		$3,755,400

Duench applies factory overhead on the basis of direct labour hours. The company's factory overhead budget for the fiscal year ending May 31, 2004, totalled $4,500,000 and the company plans to expend 600,000 direct labour hours during this period. Through the first 11 months of the year, a total of 555,000 direct labour hours were worked and total factory overhead amounted to $4,273,500.

At the end of April, the balance in Duench's raw materials inventory account, which includes both raw materials and purchased parts, was $668,000. Additions to and requisitions from raw materials inventory during the month of May included:

	Raw Materials	Purchased Parts
Additions	$242,000	$396,000
Requisitions:		
Job CBS102	51,000	104,000
Job PLP086	3,000	10,800
Job DRS 114	124,000	87,000
Job STRO77 (10,000 strollers)	2,000	81,000
Job CRGO98 (5,000 carriages)	65,000	187,000

During the month of May, Duench's factory payroll consisted of the following:

Account	Hours	Cost
CBS102	12,000	$122,400
PLP086	4,400	43,200
DRS114	19,500	200,500
STR077	3,500	30,000
CRG098	14,000	138,000
Indirect	3,000	29,400
Supervision		57,600
		$621,100

The following jobs were completed and the unit sales for the month of May:

Job number	Items	Quantity
CBS102	Cribs	20,000
PLPO86	Playpens	15,000
STRO77	Strollers	10,000
CRGO98	Carriages	5,000

Items	Quantity Shipped
Cribs	17,500
Playpens	21,000
Strollers	14,000
Dressers	18,000
Carriages	6,000

Required:

a. Describe when it is appropriate for a company to use a job order cost system.

b. Calculate the dollar balance in Duench's WIP inventory account as of May 31, 2004

c. Calculate the dollar amount related to the playpens in Duench 's finished goods inventory as of May 31, 2004

d. Explain the proper accounting treatment for over- or under-applied overhead balances when using a job order cost system.

Performance Management - Problems

MA17 Problem: Job Order Costing – Eagleson Company

Eagleson Company employs a normal job order costing system. Manufacturing overhead is applied on the basis of machine hours using estimated manufacturing overhead costs of $1,200,000 and an estimated activity level of 80,000 machine hours. Eagleson's policy is to close the over/under application of manufacturing overhead to cost of goods sold.

Operations for the year ended November 30, 2005, have been completed and all accounting entries have been made for the year except the application of manufacturing overhead to the jobs worked on during November, the transfer of costs from WIP to finished goods for the jobs completed in November and the transfer of costs from finished goods to cost of goods sold for the jobs sold during November. Jobs N11-007, N11-013 and N11-015 were completed during November 2005. All completed jobs except job N11-013 had been turned over to customers by the close of business on November 30, 2005.

Summarized data accumulated from the accounting records as of October 31, 2005 and November 2005 is:

Job #	WIP Balance 10/31/05	November 2005 Activity Direct Materials	Direct Labour	Machine Hours
N11-007	$ 87,000	$ 1,500	$ 4,500	300
N11-013	55,000	4,000	12,000	1,000
N11-015	-0-	25,600	26,700	1,400
D12-002	-0-	37,900	20,000	2,500
D12-003	-0-	26,000	16,800	800
Totals	$142,000	$95,000	80,000	6,000

Operating Activity	Activity Through Oct. 31, 2005	November 2005 Activity
Manufacturing overhead incurred		
Indirect materials	$ 125,000	$ 9,000
Indirect labour	345,000	30,000
Utilities	245,000	22,000
Depreciation	385,000	35,000
Total incurred overhead	$1,100,000	$96,000
Other items		
Material purchases*	$965,000	$98,000
Direct labour costs	$845,000	$80,000
Machine hours	73,000	6,000

Account balances at beginning of fiscal year	
Materials inventory*	$105,000
Work-in-process inventory	60,000
Finished goods inventory	125,000

* Material purchases and materials inventory consist of both direct and indirect materials. The balance of the materials inventory account as of November 30, 2005, is $85,000.

Required:

a. Eagleson Company uses a predetermined overhead rate to apply manufacturing overhead to its jobs. When overhead is accounted for in this manner, there may be over- or under-applied overhead.

   1. Explain why a business uses a predetermined overhead rate to apply manufacturing overhead to its jobs.
   2. How much manufacturing overhead would Eagleson have applied to jobs through October 31, 2005?
   3. How much manufacturing overhead would Eagleson apply to jobs during November 2005?
   4. Determine the amount by which manufacturing overhead is over- or under-applied as of November 30, 2005.
   5. Over- or under-applied overhead must be eliminated at the end of the accounting period. Explain why Eagleson's method of closing over- or under-applied overhead to the cost of goods sold is acceptable in this case.

b. Determine the balance in Eagleson Company's finished goods inventory at November 30, 2005.

c. Prepare a schedule of cost of goods manufactured for Eagleson Company for the year ended November 30, 2005.

MA18 Problem: Process Costing – Equivalent Units – ABC Company

Compute the equivalent units of production for each element of cost (material, labour and overhead) in each of the following unrelated situations using (a) FIFO and (b) weighted average flow:

A. Started 13,000 units into production; finished and transferred 10,000 units. There was no beginning work-in-process. Ending work-in-process is 40% complete with respect to conversion costs (i.e. direct labour and overhead) and 100% complete with respect to direct materials.

B. Beginning work-in-process was 8,000 units, 100% complete with respect to materials and 25% complete with respect to labour and overhead. Started 20,000 units into production; finished and transferred 22,000 units. The ending work-in-process is 80% complete with respect to materials and 70% complete with respect to conversion costs.

C. Beginning work-in-process was 6,000 units, 75% complete with respect to materials and 50% complete with respect to labour and overhead. Started 40,000 units into production; finished and transferred 30,000 units. The ending work-in-process is 25% complete with respect to materials and 30% complete with respect to conversion costs.

MA19 Problem: Process Costing – Equivalent Units – Satarelli Corporation

Satarelli Corporation is a manufacturer that uses process costing to account for costs of production. Satarelli manufactures a product in three separate departments: moulding, assembly and finishing. The following information was obtained for the assembling department for the month of June:

Work-in-process, June 1 – 1,000 units made up of:

	Amount	Degree of Completion
Moulding department costs transferred in	$32,000	100%
Costs added by the assembly department		
Direct materials	20,000	100
Direct labour	7,200	60
Manufacturing overhead	5,500	50
Work-in-process, June 1	$64,700	

During the month of June, 5,000 units were transferred in from the moulding department at a cost of $160,000. The assembly department added the following $150,000 of costs:

Direct materials	$ 96,000
Direct labour	36,000
Manufacturing overhead	18,000
	$150,000

Four thousand units were completed and transferred to the finishing department.

At June 30, 2,000 units were still in WIP. The degree of completion of WIP at June 30 was:

Direct materials	90%
Direct labour	70
Manufacturing overhead	35

Required:

Calculate the cost of the units transferred out to the Finishing department and the value of the ending WIP assuming that the Sartarelli Corporation used (a) the weighted average method and (b) the FIFO method.

MA20 Problem: Process Costing – Equivalent Units – Tsizis Corporation

Tsizis Corporation makes a product called Turbulence in one department of the company. Direct materials are added at the beginning of the process. Labour and overhead are added continuously throughout the process. Spoilage, if any, occurs at the beginning of the process just after materials have been added, but before any conversion costs have been incurred.

The following information relates to production during November:

1. Work-in-process inventory, November 1 (4,000 kg – 75% complete):

Direct materials	$22,800
Direct labour	24,650
Manufacturing overhead	21,860

2. Direct materials:

Inventory, November 1 - 2,000 kg	$10,000
Purchases, November 3 - 10,000 kg	51,000
Purchases, November 18 - 10,000 kg	51,500

   Sent to production during November - 16,000 kg

3. Direct labour costs - $103,350.

4. Manufacturing overhead costs - $93,340

5. Transferred out to finished goods inventory – 15,000 kg

6. Work-in-process inventory November 30, 3,000 kg, 33 1/3% complete as to conversion costs.

The FIFO method is used for both materials inventory valuation and for WIP inventories.

The controller has determined any spoilage in excess of 1,300 units is abnormal spoilage.

Required:

Calculate the cost of the units transferred out to finished goods inventory and the value of the ending WIP. Calculate the value of abnormal spoilage.

MA21 Problem: Process Costing – Equivalent Units – Gagnon Company

Gagnon Company uses a process costing system for its three production departments: initiation, assembly and finishing. The following data is available for the assembly department for the month of September:

Opening WIP	
Units	15,000
Costs:	
Transferred in	$97,650
Direct materials	186,450
Conversion costs (60% complete)	77,670
Units transferred in from the initiation department	46,000
Units transferred out to the finishing department	48,500
Costs added during month	
Transferred in	$298,540
Direct materials	460,650
Conversion costs	382,956
Units in ending WIP (25% completed as to conversion costs)	9,000

The assembly department adds direct materials when the process if 40% complete. Inspection takes place when the process is 75% complete, at which time all spoiled units are detected. The engineering department has concluded any spoiled units in excess of 1,500 for the month of September can be considered abnormal spoilage.

<u>Required:</u>

Calculate the cost of the units transferred out to finished goods inventory, the value of the ending WIP and the value of abnormal spoilage under (a) the FIFO method and (b) the weighted average method.

Performance Management - Problems

MA22 Problem: Process Costing – Fortis Manufacturing Limited

Fortis Manufacturing Limited uses FIFO based process costing. Direct materials are added at the beginning of the production process and conversion costs are added evenly during production. Inspection occurs when production is 100% complete. Normal spoilage is 8% of good units completed and transferred out to finished goods during the period. There was both normal and abnormal spoilage during the period. Data for March is:

	Units	Direct Material	Conversion Costs
WIP, beginning (25% complete)	4,000	$ 76,000	$11,000
Started	60,000		
Good units completed and transferred out	52,000		
WIP, ending (80% complete)	6,500		
Current period costs		$1,080,000	$617,000
Costs per equivalent unit for work done in March		$18	$10

<u>Required:</u>

Calculate the cost of:
- (a) Ending inventory
- (b) Goods transferred to finished goods inventory
- (c) Normal spoilage
- (d) Abnormal spoilage

MA23 Problem: Process Costing – Transferred In, No Spoilage - MCI

This is a straight forward problem, which provides an overview of process costing, including transferred in costs. There are no complicating factors such as spoilage.

ABC Manufacturing Incorporated ("MCI") uses a process costing system in each of its two departments. Once units have been processed in Department A, they are transferred to Department B for further processing. Material is applied at the beginning of the process in Department A and at 95% completion in Department B. Labour and overhead costs occurs evenly throughout production in both Department A and B.

In the current period, beginning WIP in Department A was 200 units (65% completed). This inventory incurred direct material costs of $2,000 and conversion costs of $6,240. The beginning WIP in Department B was 400 units (90% complete). Department B's beginning WIP cost $24,800 for transfer in cost and $6,000 in conversion.

During the current period, in Department A 10,000 units were started, 8,000 units were transferred out of Department A to Department B and ending WIP in Department A was 2,200 units (75% complete). In Department B, 8,000 units were transferred in, 7,000 units were transferred to finished goods and ending WIP inventory was 1,400 units (1,000 units 75% completed and 400 units 95% completed).

Costs incurred in each of the departments during the current period are:

	Department A	Department B
Material	$120,400	$ 14,800
Labour and overhead	$476,000	$127,950

Required:

1. Using first in first out (FIFO) costing methodology, calculate for both Department A and B the:
   - cost of goods transferred
   - cost of ending WIP

   Round the cost per equivalent unit to four decimal places and round all other cost calculations to the nearest dollar

2. Recalculate Part 1 using the weighted average costing methodology.

   Round the cost per equivalent unit to four decimal places and round all other cost calculations to the nearest dollar

Performance Management - Problems

MA24 Problem: Process Costing - Transferred In Costs and Spoilage – Wargo Limited

Wargo Limited ("WL") uses a process costing system in each of its two departments. Once units have been processed in Department A, they are transferred to Department B for further processing. Material is applied at the beginning of the process in Department A and at 96% completion in Department B. Labour and overhead costs occur evenly throughout production in both Department A and B. The units are inspected at 80% completion in Department A and at 95% completion in Department B. Normal spoilage is 2% for Department A and 5% for Department B.

In the current period, beginning WIP inventory in Department A was 25,000 units (60% complete). This inventory incurred direct material costs of $97,500 and conversion costs of $85,000. The beginning WIP in Department B was 15,000 units (90% completed). Department B's beginning WIP cost $135,900 in transferred in costs and $162,000 in conversion cost.

During the current period in Department A, 175,000 units were started, 165,000 units were transferred out of Department A to Department B and ending WIP in Department A was 30,000 units (75% completed). In Department B, 160,000 units were transferred to finished goods and ending WIP inventory was 10,000 units (50% completed).

Costs incurred in each of the departments during the current period are:

	Department A	Department B
Material	$612,500	$ 384,000
Labour and overhead	$970,750	$2,704,750

Required:

Using weighted average, calculate for both Department A and B the:
- cost of goods transferred
- cost of ending WIP
- spoiled units

Round the cost per equivalent unit to five decimal places and round all other cost calculations to the nearest dollar

MA25 Problem: Process Costing – Transferred In Costs and Spoilage – Jerdi's Manufacturing Limited

Jerdi's Manufacturing Limited ("JML") uses process costing in each of its two manufacturing departments, Department A and Department B. Once units have been processed in Department A, they are transferred to Department B for finishing.

Material is added at the beginning of the process in Department A and at 98% completion in Department B. Labour and overhead costs occur evenly throughout the process in both Department A and B. Normal spoilage is 5% of good units in Department A and 4% in Department B. The units are inspected at 90% completion in Department A and at 95% in Department B.

In the current period, beginning WIP in Department A was 4,000 units (75% completed). This inventory incurred direct material costs of $42,000 and conversion costs of $21,000. The beginning WIP in Department B was 2500 units (70% complete). Department B's beginning WIP cost consists of transferred in costs of $45,500 and conversion costs of $26,250.

During the current period, in Department A 20,000 units were started, 19,000 units were transferred out of Department A to Department B and ending WIP in Department A was 3,500 units (80% completed). In Department B, 17,500 units were transferred to finished goods and ending WIP inventory was 3,000 units (85% completed).

Costs incurred in each of the departments during the current period are:

	Department A	Department B
Material	$200,000	$42,875
Labour and overhead	$165,230	$271,250

Required:

1. Using FIFO, calculate for both Department A and B the:
   - cost of goods transferred
   - spoiled units
   - cost of Ending WIP
2. Using weighted average calculate for both Department A and B the:
   - cost of goods transferred
   - spoiled units
   - cost of ending WIP

Round the cost per equivalent unit to five decimal places

Performance Management - Problems

MA26 Problem: Process Costing – Transferred In Costs and Spoilage – Rauz Incorporated

Rauz Incorporated ("RI") uses process costing in each of its two manufacturing departments, Department A and Department B. Once units have been processed in Department A, they are transferred to Department B for finishing.

Material is added at the beginning of the process in Department A and at 75% completion in Department B. Labour and overhead costs occur evenly throughout the process in both Department A and B. Normal spoilage is 5% of good units in Department A and 8% in Department B. The units are inspected at 85% completion in Department A and at 95% completion in Department B.

In the current period, beginning WIP in Department A was 3,100 units (70% complete). This inventory incurred direct material costs of $21,700 and conversion costs of $11,935. The beginning WIP in Department B was 4,500 units (60% completed). Department B's beginning WIP transferred in cost was $24,000 and $46,000 in conversion.

During the current period in Department A, 64,400 units were started, 60,000 units were transferred out of Department A to Department B and ending WIP in Department A was 4,000 units (35% completed). In Department B, 60,000 units were transferred in and 52,000 units were transferred to finished goods and ending WIP inventory was 6,500 units (80% completed).

Costs incurred in each of the departments during the current period are:

	Department A	Department B
Material	$183,300	$1,080,000
Labour and overhead	$131,675	$617,000

<u>Required</u>

Using FIFO costing method, calculate for both Department A and B the:
- costs of goods manufactured
- spoiled units
- cost of ending WIP

Round the cost per equivalent unit to five decimal places

MA27 Problem: Process Costing Multiple Choice – Oma Inc.

Oma Inc. uses process costing FIFO method to cost its products. The following data is available for the month of November.

Beginning work-in-process (75% complete for direct materials and 40% complete for conversion costs)	3,000	units
Units completed and transferred to finished goods	14,000	units
Ending work-in-process (35% complete for direct materials and 20% complete for conversion costs)	1,000	units
Beginning work-in-process Consisting of $40,500 for direct materials and $60,000 for conversion costs.	$100,500	
Equivalent unit cost of direct materials for November		$20.00
Equivalent unit cost of conversion for November		$52.50

1. Direct material cost incurred during the current period is:
   (a) $287,000
   (b) $280,000
   (c) $300,000
   (d) $242,000
   (e) $282,500

2. Conversion cost incurred during the current period is:
   (a) $735,000
   (b) $682,500
   (c) $742,500
   (d) $787,500
   (e) $745,500

3. Total cost of goods completed and transferred out is:
   (a) $907,000
   (b) $898,000
   (c) $1,007,500
   (d) $1,025,000
   (e) $1,087,500

Performance Management - Problems

MA28 Problem: Process Costing – Normal and Abnormal Spoilage – Oil Lite Ltd.

Oil Lite Ltd. uses actual costs and applies process cost accounting. The following data is available for the month of October.

Beginning WIP (100% complete for direct materials and 50% complete for labour and overhead)	4,000	units
Beginning WIP Consisting of $48,000 for direct materials and $11,000 for labour and overhead	$59,000	
Good units completed and transferred out	20,000	units
Ending WIP (100% complete for direct materials and 40% complete for labour and overhead)	3,000	units
Direct material costs incurred during the month	$262,600	
Labour and conversion costs incurred during the month	$121,800	

Direct materials are added at the beginning of the process and labour and overhead is applied throughout the process.

Inspection occurs at the end of the process.

Normal spoilage for the month was 700 units.

Abnormal spoilage for the month was 500 units. The abnormal spoilage was due to a machine malfunction that occurred when the units were 80% complete for conversion.

<u>Required:</u>

1. How many units were started during the month?

2. Under the FIFO method, what is:
   (a) the cost of the abnormal spoilage
   (b) the value of ending WIP
   (c) the number of equivalent units for both direct materials and conversion
   (d) the cost of units completed and transferred out

3. Answer 2. (a) through (d) using the weighted average method.

MA29 Problem: Direct vs. Absorption Costing – Broadcast Inc.

Broadcast Inc. manufactures and sells a single product.

Current year sales volume was 50,000 units at a selling price of $86 per unit. Direct material and direct labour amount to $28 per unit. Variable manufacturing overhead costs were $13 per unit plus fixed costs of $455,000 per year. There were no beginning inventories and 65,000 units were produced during the year. Variable selling and general and administrative costs were $4.50 per unit sold plus fixed costs of $765,000 for the year.

<u>Required:</u>

(a) Prepare an absorption costing income statement for the year.

(b) Prepare a contribution costing income statement for the year.

(c) Reconcile the difference between the two statements, absorption and contribution and explain why net income is different between the two costing approaches.

MA30 Problem: Direct vs. Absorption Costing – Aristotle Inc.

Aristotle Inc. manufactures and sells a single product. Current year sales volume is 130,000 units at a selling price of $24 per unit. Aristotle Inc. uses a standard costing system. The standard cost of direct material and direct labour amount to $9 per unit. Variable manufacturing overhead costs were $3 per unit plus fixed costs of $405,000 per year. The standard level of production is 135,000 units per year. Beginning inventories were 12,000 units and 135,000 units were produced during the year. Variable selling and general and administrative costs were $2.20 per unit sold plus fixed cost of $156,000 for the year. The income tax rate is 40%.

Assume the standard cost is constant year-over-year.

Required:

(a) Prepare an absorption costing income statement for the year.

(b) Prepare a contribution costing income statement for the year.

(c) Reconcile the difference between the two statements, absorption and contribution, and explain why net income is different between the two costing approaches

MA31 Problem: Direct vs. Absorption Costing – Hoeley Ltd.

Hoeley Ltd. manufactures and sells a single product. Hoeley Ltd. utilizes a standard costing system. Select information for the past year is:

Sales volume	52,000 units
Selling price	$46 per unit
Standard costs:	
Direct material and direct labour	$14.25 per unit
Budgeted manufacturing overhead	$3.25 per unit plus fixed costs of $267,750 per year
Budgeted level of production	59,500 units per year
Beginning inventory	11,000 units
Ending inventory	15,000 units
Selling, general and administrative	$2.30 per unit sold plus fixed costs $560,000
Income tax rate	40%
Actual production during year	56,000

Variances for variable manufacturing costs amounted to $6,924 unfavourable. Actual expenditures for fixed manufacturing costs were $257,300. All product cost variances are expensed directly to cost of goods sold. There were no variances with respect to any of the selling and general and administrative costs.

Standard costs are constant year-over-year.

Required:

(a) Prepare an absorption costing income statement for the year.

(b) Prepare a contribution costing income statement for the year.

(c) Reconcile the difference between the absorption and contribution income statements.

MA32 Problem: Direct vs. Absorption Costing – HRL Inc.

HRL Inc. produces a single product and uses a standard absorption costing system. Standard costs for the current year, at an expected annual sales and production level of 144,000 units and at an expected selling price of $34 are:

	Cost Per Unit
Direct material	$6.00
Direct labour	5.50
Variable manufacturing overhead	3.00
Fixed manufacturing overhead	7.00
Standard cost of manufacturing	21.50
Variable selling expenses	1.50
Fixed selling expenses	4.00
Full cost per unit	$27.00

Actual fixed monthly expenses of $84,000 for manufacturing overhead and $48,000 for selling and administration.

Production is budgeted to occur evenly throughout the year.

Financial results for January are:

	Original January Budget	January Actual
Sales (@ $34 per unit)	$476,000	$340,000
Standard cost of sales	144,000	215,000
Gross profit at standard	332,000	125,000
Production variances*	--	14,000
Adjusted gross profit	346,000	139,000
Selling and administration	69,000	63,000
Income (loss) before tax	$277,000	$76,000

* No spending or efficiency variances, only production volume/denominator variances.

January sales, which were expected to be greater than normal, were 4,000 units less than planned. There is no inventory on January 1.

<u>Required:</u>

Recalculate the actual net income for January using a contribution approach. Reconcile the difference between the two statements, absorption and contribution.

MA33 Problem: Direct vs. Absorption Costing – Oma Company

Oma Company uses a standard cost system. The following information represents Oma's results for the year ended December 31, 2000:

Direct materials standard rate	$5/unit
Direct labour rate	$12/hour
Direct labour inputs per unit	3 hours
Budgeted manufacturing fixed overhead at the beginning of the year	$810,000

Fixed manufacturing overhead is applied on the basis of direct labour hours

Estimated direct labour hours at the beginning of the year	540,000
Selling price	$55/unit
Variable selling and administration	$1.50/unit
Fixed selling and administration	$450,000
Beginning finished goods inventory	50,000 units
Cost of beginning finished goods inventory	$2,400,000
Ending finished goods inventory	63,000 units
Sales	160,000 units
Actual fixed manufacturing overhead for the year	$795,000
Variable overhead	$2.50/unit

Make the following assumptions:
- over- or under-applied overhead is expensed to cost of sales
- there were no price, spending or efficiency variances
- there were no beginning or ending WIP or direct materials inventory
- Variable costs per unit are consistent year-over-year

<u>Required:</u>

1. What is the under- or over-applied overhead for the year? Show the components of the under- or over-applied overhead.
2. Prepare an income statement using the direct costing approach.
3. Prepare an income statement using the absorption costing approach.
4. Explain the difference in the operating income calculated in Parts 2 and 3.

MA34 Problem: Direct vs. Absorption Costing– Butron Company

Butron Company uses variable costing for internal management purposes and full absorption costing for external reporting purposes. Thus, at the end of each year, financial information must be converted from variable costing to full absorption costing for external reports.

At the end of last year, management anticipated sales would rise 20% this year. Therefore, production was increased from 20,000 units to 24,000 units. However, economic conditions kept sales volume at 20,000 units for both years.

The following data pertain to the two years:

	Last Year	This Year
Selling price per unit	$60	$60
Sales (units)	20,000	20,000
Beginning inventory (units)	2,000	2,000
Production (units)	20,000	24,000
Ending inventory (units)	2,000	6,000

Variable cost per unit for both years was composed of:

Labour	$15
Materials	9
Variable overhead	6
	$30

Estimated and actual fixed costs for each year were:

Production	$180,000
Selling and administrative	200,000
	$380,000

<u>Required:</u>

a. Present the income statement based on variable costing for this year.
b. Present the income statement based on full absorption costing for this year.
c. Explain the difference, if any, in the operating profit figures.

MA35 Problem: Direct vs. Absorption Costing – Northway Corporation

Northway Corporation is a manufacturer of a synthetic element. Jim Northway, president of the company, has been eager to get the operating results for the just completed fiscal year. He was surprised when the income statement revealed income before taxes had dropped to $360,000 from $750,000, even though sales volume had increased 100,000 kilograms. This drop in net income had occurred even though Northway had implemented the following changes during the past 12 months to improve the profitability of the company:

- In response to a 10% increase in production costs, the sales price of the company's product was increased by 12%. This action took place on December 1, 2003.
- The management of the selling and administrative departments were given strict instructions to spend no more in fiscal 2004 than in fiscal 2003.

Northway's accounting department prepared and distributed to top management the comparative income statements presented below. The accounting staff also prepared related financial information in the accompanying schedule to assist management in evaluating the company's performance. Northway uses the FIFO inventory method for finished goods.

Northway Corporation
Statements of Operating Income
for the years ended November 30, 2003 and 2004 ($000 omitted)

	2003	2004
Sales revenue	$9,000	$11,200
Cost of goods sold	6,750	9,340
Gross margin	2,250	1,860
Selling and administrative expenses	1,500	1,500
Operating Income	$ 750	$ 360

Performance Management - Problems

Northway Corporation
Selected Operating and Financial Data
for 2003 and 2004

	2003	2004
Sales price	$10/kg	$11.20/kg
Material cost	$1.50/kg	$1.65/kg
Direct labour cost	$2.50/kg	$2.75/kg
Variable overhead cost	$1.00/kg	$1.10/kg
Total fixed overhead costs	$3,000,000	$3,300,000
Selling and administrative costs (all fixed)	$1,500,000	$1,500,000
Sales volume	900,000 kg	1,000,000 kg
Beginning inventory	300,000 kg	600,000 kg
Units produced	1,200,000 kg	500,000 kg

Required:

a Explain to Jim Northway why Northway Corporation's operating income decreased in the current fiscal year despite the sales price and sales volume increases.

b A member of the Northway's accounting department has suggested the company adopt variable (direct) costing for internal reporting purposes.

i. Prepare an operating income statement through income before taxes for the year ended November 30, 2004, for Northway Corporation using the variable (direct) costing method.

ii. Present a numerical reconciliation of the difference in operating income using the absorption costing method as currently employed by Northway and the variable (direct) costing method as proposed.

MA36 Problem: Joint Costing and By-Products – Copper Co.

Copper Company mines one mineral, which is processed into three separate products, X, Y and Z. Joint costs are $1,800,000. To complete X and Y, further processing is required at costs of $1,900,000 and $2,480,000, respectively. Product Z does not required further processing. The following production and sales information is available for the current year:

	Tonnes Started	Tonnes Completed	Tonnes Sold	Selling Price after Processing
X	10,000	10,000	10,000	$1,190/tonne
Y	12,000	12,000	8,000	$1,540/tonne
Z	28,000	28,000	21,000	$1,170/tonne

There is no shrinkage during any part of the manufacturing process.

Required:

1. Allocate the joint costs under the following methods:
    a) Physical measure method (assume the input is on a tonne basis and for every one tonne started, the input is one tonne of raw material)
    b) Sale value (assume selling price per tonne at split-off is: $595 for X, $462 for Y and $1,170 for Z)
    c) Net realizable value

2. Assume there is a by-product from production, which can be sold for a nominal amount. One thousand tonnes of this by-product was produced and can be sold for $30 per tonne. There are no separable costs associated with this by-product. Eight hundred tonnes were sold during the year. Explain the methods of accounting for this by-product.

MA37 Problem: Joint Costing and Sell or Process Further – Alcove Ltd.

The Mantine Division of Canadian Alcov Ltd. produces two products: Mantine A (M-A) and Mantine B (M-B) and a by-product, Ceta, from a single material, Koron. Koron is placed in a centrifuge and separated into three intermediate products: K-1, K-2 and K-3. K-1 is processed further to produce Mantine A and K-2 is further processed to produce Mantine B. K-3 is packaged, with packaging costs totalling $3.50 per kilogram and is sold as Ceta.

Mantine production and sales statistics for March were:

	Produced (000s)	Sold (000s)	Selling Price
K-1	4,000 kg		
K-2	2,000 kg		
K-3 (Ceta)	1,000 kg	950 kg	$5.00/kg
M-A	4,000 kg	4,010 kg	$9.50/kg
M-B	1,800 kg	1,90 kg	$18.00/kg

On March 1, the Mantine Division had inventories on hand of 100,000 kg of Mantine A valued at $720,000 and 150,000 kg of Mantine B valued at $2,175,000.

The company uses a first-in, first-out (FIFO) cost flow assumption to determine inventory and cost of goods sold valuation. There is no waste, spoilage, evaporation or shrinkage in any of the processes.

Total costs (in thousands) of the Mantine processes for March were:

Koron	$10,000
Centrifuge process	6,000
M-A process	20,000
M-B process	21,600
Total	$57,600

All finishing costs in the M-A and M-B processes are variable costs. Any units that are in progress for the month of March have not incurred any separable costs.

Ceta is treated as a miscellaneous revenue item for income purposes. Any by-product inventory is carried at net realizable value. No joint costs are allocated to the by-product.

Required:

Using the net realizable value method to allocate joint costs, determine the amount that would be shown on the balance sheet or income statement for March for the following items:

a)

i) Cost of goods sold.

ii) Inventories for K-2, Ceta, M-A and M-B.

b)

i) Mantine Division has an offer from another company to buy all the K-1 it can produce at a price of $4.75 per kilogram. Should Mantine accept the offer? Show calculations.

ii) What is the minimum intermediate market price Mantine should accept for K-l? Why?

MA38 Problem: Sell or Process Further – Smits Ltd.

Smits Ltd. produces three chemicals, A, B and C. Processing begins with one substance, ogg. Subsequent processing occurs to produce B and C. A does not require further processing. Joint costs are $100,000. Other production and sales information is:

	Production	Selling Price Per Tonne at Completion	Selling Price Per Tonne at Split-Off
A	800 tonnes	$50	$50.00
B	600 tonnes	$300	$200.00
C	400 tonnes	$420	$287.50

Further processing costs for B and C are $40,000 and $60,000, respectively.

Required:

Should Smits sell at the split off point or process further?

MA39 Problem: Sell or Process Further – Luna Company

Luna Company (LMC) develops mineral deposits in Canada's north.

During 2003, the company removed 1,200,000 tonnes of ore from the mine; this level of production is expected to continue for the next 25 years.

The process of extracting valuable minerals begins with the removal of ore from the ground and crushing it. The crushed ore is then ready to enter the refining process. The total cost of mining and crushing the ore amounts to $30.65 per tonne.

In order to extract the usable minerals, the crushed ore is passed through three distinct processes: amalgamation, electrolysis and purification (see Exhibit 1). In the first stage, called amalgamation, mercury is added to the unrefined ore. The mercury combined with the valuable minerals forms a compound, which is drawn off. This compound is then heated, causing the mercury to vaporize, leaving a residue, which is 30% gold, 60% silver and 10% platinum. One ounce of residue is obtained for every three tonnes of ore placed in the process. The vaporized mercury is condensed and reused the next day. The total cost of the amalgamation process is $13.51 per ounce of residue recovered. Each year the company must invest an additional $280,000 to replace mercury lost during the recovery process.

The second process is called electrolysis. In this process, the residue from the amalgamation process is cast into thick slabs, which are hung in large vats of acid. When an electric current is passed through the vat, pure gold is transferred to separate plates. When the gold plates and acid are removed from the vat, silver is recovered from the bottom of the vat. When the acid is filtered for reuse the next day, platinum is removed. The total cost of the electrolysis process is $9.60 per ounce of residue placed in the vat.

At this point, the gold plates are 99.9% pure and can be sold on world markets. The current market price for gold is $400 per ounce, but mine officials are aware that future prices may rise or fall from this level, depending on the state of the world economy. During the past three months, the price has ranged from $350 to $420 per ounce.

The silver can be sold after electrolysis for $4.60 per ounce or it can be further purified. Purification costs are $1.30 per ounce of pure silver, which can be sold for $6 per ounce (both the $6 and $4.60 prices have remained relatively stable during the past year and management expects no significant changes during the next year). This purification process reduces the volume of the silver product by 20%.

The platinum can be sold after electrolysis for $430 per ounce or further purified and sold for $550 per ounce. Purification results in a 10% reduction in the volume of platinum. The total cost of purification is $48.60 per ounce of pure platinum.

Exhibit 1
Luna Mining Company Inc.
Summary of Mineral Processing

PROCESS	INPUT	OUTPUT	PROCESS COST	MARKET PRICE OF OUTPUT
1. Amalgamation	3 tonnes ore mercury	1 oz. residue mercury	$13.51/oz. of residue $280,000/year for mercury	N/A N/A
2. Electrolysis	1 oz. residue	.3 oz. pure gold .6 oz. raw silver .1 oz. raw platinum	$9.60/oz. of input	$400/oz. pure gold $4.60/oz. raw silver $430/oz. raw platinum
3. Purification	1 oz. raw silver	.8 oz. pure silver	$1.30/oz. of output	$6/oz. of pure silver
4. Purification	1 oz. raw platinum	.9 oz. pure platinum	$48.60/oz. of output	$550/oz. of pure platinum

<u>Required:</u>

Determine the optimal yearly production plan for the ore processed by LMC

MA40 Problem: Joint Costing – Roye Company

Roye Company buys zeon for $0.80 a litre. At the end of distilling in Department 1, zeon splits off into three products: argon, xeon and neon. Argon is sold at the split-off point, with no further processing; xeon and neon require further processing before they can be sold. Xeon is fused in Department 2 and neon is solidified in Department 3. The following is a summary of costs and other related data for the year ended December 31.

	Department		
	Distilling (1)	Fusing (2)	Solidifying (3)
Cost of zeon	$96,000		
Direct labour	24,000	$45,000	$65,000
Manufacturing overhead	20,000	1,000	54,000

	Products		
	Argon	Xeon	Neon
Litres sold	15,000	30,000	45,000
Litres on hand at year-end	10,000	-	15,000
Sales in dollars	$30,000	$96,000	$141,750

There were no beginning inventories on hand at January 1 and there was no zeon on hand at the end of the year on December 31. All litres on hand on December 31 were complete as to processing.

Required:

a. Assume the Roye Company uses the net realizable value method for allocating joint costs, calculate the cost of goods sold and the cost of ending inventories of each of the three products.

b. Assume the Roye Company uses the physical units method for allocating joint costs, calculate the cost of goods sold and the cost of ending inventories of each of the three products.

MA41 Problem: Joint Costing – Mirza Inc.

Mirza Inc. makes a candy bar called Rey, which sells for $50 per kilogram. The manufacturing process also yields a product known as Nagu. Without further processing, Nagu sells for $0.10 per kg. With further processing, Nagu sells for $0.30 per kg. During the month of April, total joint manufacturing costs up to the point of separation consisted of the following charges to work-in-process inventory:

Direct materials	$150,000
Direct labour	120,000
Factory overhead	30,000

Production for the month aggregated 394,000 kg of Rey and 30,000 kg of Nagu. To complete Nagu during the month of April and obtain a selling price of $0.30 per kg, further processing of Nagu during April would entail the following additional costs:

Direct materials	$2,000
Direct labour	1,500
Factory overhead	500

Required:

Prepare the April journal entries for Nagu, if Nagu is:

a. Transferred as a by-product at sales value to the warehouse without further processing, with a corresponding reduction of Rey's manufacturing costs.

b Further processed as a by-product and transferred to the warehouse at net realizable value, with a corresponding reduction of Rey's manufacturing costs.

c Further processed and transferred to finished goods inventory, with joint costs being allocated between Rey and Nagu on the basis of their net realizable value.

MA42 Problem: Departmental Costing and Cost Allocation – Peters Ltd.

Peters Ltd. consists of four departments: personnel and purchasing, which are service departments; and machining and painting, which are production departments. Budgeted data for the year consisted of the following:

Item	Personnel	Purchasing	Machining	Painting
Overhead costs	$40,000	$35,000	$128,000	$48,000
# of employees	10	15	25	138
Machine hours	0	0	23,500	29
Direct labour costs	0	0	$32,000	$147,000
Purchase requisitions	6	0	2,650	450

Required:

a) Allocate the two service departments' costs using the step-down allocation method and develop departmental overhead rates for each of the production departments using the most logical base for each department.

b) Calculate and give the journal entry to record the total amount of under- or over-applied overhead for the company, assuming the following actual results for the year:

	Machining	Painting
Overhead costs	$173,000	$78,540
Direct labour costs	$38,300	$139,750
Machine hours	24,150	29

c) Briefly discuss reasons for allocating service department costs.

MA43 Problem: Department Cost Allocation – Danny Ltd.

Danny Ltd. has three service departments: corporate wide advertising; legal; and human resources that are respectively allocated based on revenue, usage and number of employees. Allocation information regarding all the departments is:

	Service Departments			Operating Departments			
	Advertising	Human Resources	Legal	A	B	C	Total
Revenue	-	-	-	$3,766,000	$4,635,000	$3,970,000	$12,371,000
Usage of legal services	5%	10%	-	10%	30%	45%	100%
Employees	16	22	12	140	175	35	400
Costs, before allocation	$1,450,000	$1,885,000	$950,000	$2,690,000	$3,434,000	$2,835,000	

<u>Required:</u>

1. Using the direct method, compute the costs allocated to the operating departments, A, B and C.

2. Using the step-down method, compute the costs allocated to each operating department. Assume human resource costs are allocated to the advertising and legal departments, along with departments A, B and C and, subsequently, legal costs are allocated to advertising and departments A, B and C. Advertising is not allocated to any other service department.

MA44 Problem: Cash Budget – Splash Inc.

Splash Inc., a distributor of fashion items, normally collects its receivables 50% in month of sale, 30% the subsequent month and 18% in the third month. Historically, 2% is not collected (is a bad debt). Splash Inc. attempts to match its payments of payables closely to its receivables and pays for its purchases 40% in the month of purchase, 25% in the next month and 35% in the third month. Sales during February, March and April were $150,000, $193,000 and $162,000, respectively. Purchases during these three months were $196,000, $178,000 and $225,000 for February, March and April. The company pays income tax instalments of $4,000 each month. Assuming the beginning balance of cash as at February 1 is $39,800 and the company wishes to maintain a cash balance of $30,000, prepare a cash budget for February, March and April. Splash Inc. has a line of credit available at a rate of 10%. Interest is paid when the loan is repaid. December and January sales were $240,000 and $182,000, respectively. December and January purchases were $210,000 and $180,000, respectively.

Required:

Prepare a cash budget for February, March and April.

MA45 Problem: Budgeting – City of Jimmytown

The City of Jimmytown had the following sales of water for the last half of 2009.

Month	Sales Revenue
July	$100,000
August	90,000
September	120,000
October	85,000
November	140,000
December	100,000

- All sales are on credit. Historically, 50% is collected in the month of the sale, 35% during the first month following the sale and 15% in the second month following the sale.

- Cost of water averages 75% of sales revenue. Water is purchased in month of sale. All purchases are paid during the month following the purchase.

- Operating costs of $20,000 are paid each month.

- The September 1 cash balance is expected to be the minimum balance of $10,000.

- The minimum acceptable cash balance at the end of any month is $10,000. Money can be borrowed from a local bank in increments of $1,000. (Do not include interest charges in your budget.)

Required:

Prepare monthly a cash budget for September, October and November 2009 and an overall cash budget for the three months together.

MA46 Problem: Budgeting – Moore Company

The following performance report is for the Moore Company bottling department for the month ending December 31, 2006.

	Actual	Budget	Variance	
Volume (units)	75,000	90,000		
Manufacturing costs:				
Direct materials	$156,000	$180,000	$24,000	(F)
Direct labour	835,000	900,000	65,000	(F)
Variable overhead	360,000	450,000	90,000	(F)
Fixed overhead	60,000	54,000	6,000	(U)
Total	$1,411,000	$1,584,000	$173,000	(F)

Required:

1. Evaluate the performance report.
2. Using a flexible budgeting approach, prepare a more appropriate

   performance report (i.e. produce a flexible budget and indicate planning and flexible budget variances).

MA47 Problem: Budgeting - Storey Manufacturing Company

Storey Manufacturing Company makes two basic products, Cee and Dee. Data assembled by the managers is:

	Cee	Dee
Requirements for finished unit:		
Raw material 1	10 kg	8 kg
Raw material 2		4 kg
Raw material 3	2 units	1 unit
Direct labour	5 hours	8 hours
Sales price	$100	$150
Sales units	12,000	9,000
Estimated beginning inventory	400	150
Desired ending inventory	300	200

	Raw Materials		
	1	2	3
Cost	$2.00 per kg	2.50 per kg	$0.50 per unit
Estimated beginning inventory	3,000	1,500	1,000
Desired ending inventory	4,000	1,000	1,500

The direct labour wage rate is $4 per hour. Overhead is applied on the basis of direct labour hours. The tax rate is 40%.

The budgeted sales level is divided into quarters. Storey estimated 20% of the annual sales will be in the first quarter, 30% in the second and 25% in the third and fourth quarters. The beginning inventory of finished products has the same cost per unit as the ending inventory. The work-in-process inventory is negligible.

Storey Manufacturing Company
Sales Forecasts By Products 2001

	Cee		Dee		Total
	Units	Dollars	Units	Dollars	Dollars
First quarter	2,400	$ 240,000	1,800	$ 270,000	$ 510,000
Second quarter	3,600	360,000	2,700	405,000	765,000
Third quarter	3,000	300,000	2,250	337,500	637,500
Fourth quarter	3,000	300,000	2,250	337,500	637,500
Total	12,000	1,200,000	9,000	1,350,000	$2,550,000

Factory Overhead Costs

Indirect materials	$ 10,000
Miscellaneous supplies and tools	5,000
Indirect labour	40,000
Supervision	20,000
Payroll taxes and fringe benefits	75,000
Maintenance costs – fixed	20,000
Maintenance costs – variable	10,000
Depreciation	70,000
Heat, light and power – fixed	8,710
Heat, light and power – variable	5,090
	$263,800

Selling And Administrative Expenses

Advertising	$ 60,000
Sales salaries	200,000
Travel and entertainment	60,000
Depreciation – warehouse	5,000
Office salaries	20,000
Executive salaries	250,000
Supplies	4,000
Depreciation – office	6,000
	$605,000

Required:

Prepare the following:

a. Production budget
b. Direct materials purchase budget
c. Direct labour budget
d. Cost of goods sold budget
e. Budgeted income statement

Note: Because you are given inventory values for the beginning and the end of the year, it is impossible to construct budgets by quarter. The budgets should be presented for the whole year.

MA48 Problem: Budgeting - Gowan Corporation

Gowan Corporation manufactures and distributes wooden baseball bats. This is a seasonal business with a large portion of its sales occurring in late winter and early spring. The production schedule for the last quarter of the year is heavy in order to build up inventory to meet expected sales volume.

The company experiences a temporary cash strain during this heavy production period. Payroll costs rise during the last quarter because overtime is scheduled to meet the increased production needs. Collections from customers are low because the fall season produces only modest sales. This year, the company's concern is intensified because prices are increasing during the current inflationary period. In addition, the sales department forecasts sales of fewer than one million bats for the first time in three years. This decrease in sales appears to be caused by the popularity of aluminum bats.

The cash account builds up during the first and second quarters as sales exceed production. The excess cash is invested in treasury bills and other commercial paper. During the last half of the year, the temporary investments are liquidated to meet the cash needs. In the early years of the company, short-term borrowing was used to supplement the funds released by selling investments, but this has not been necessary in recent years. Because costs are higher this year, the treasurer asks for a forecast for December to judge if the $40,000 in temporary investments will be adequate to carry the company through the month with a minimum balance of $10,000. Should this amount ($40,000) be insufficient, she wants to begin negotiations for a short-term loan.

The unit sales volume for the past two months and the estimate for the next four months are:

October (actual)	70,000
November (actual)	50,000
December (estimated)	50,000
January (estimated)	90,000
February (estimated)	90,000
March (estimated)	120,000

The bats are sold for $5 each. All sales are made on account. Half of the accounts are collected in the month of the sale, 40% are collected in the month following the sale and the remaining 10% in the second month following the sale. Customers who pay in the month of the sale receive a 2% cash discount.

The production schedule for the six month period beginning with October reflects the company's policy of maintaining a stable year-round work force by scheduling overtime to meet the following production schedules:

October (actual)	90,000
November (actual)	90,000
December (estimated)	90,000
January (estimated)	90,000
February (estimated)	100,000
March (estimated)	100,000

The bats are made from wooden blocks that cost $6 each. Ten bats can be produced from each block. The blocks are acquired one year in advance so they can be properly aged. Gowan pays the supplier one-twelfth of the cost of this material each month until the obligation is retired. The monthly payment is $60,000.

The plant is normally scheduled for a 40-hour, five-day work week. During the busy production season, however, the work week may be increased to six 10-hour days. Workers can produce 7.5 bats per hour. Normal monthly output is 75,000 bats. Factory employees are paid $15 per hour for regular time and time and one-half for overtime.

Other manufacturing costs include variable overhead of $0.30 per unit and annual fixed overhead of $280,000. Depreciation charges totalling $40,000 are included among the fixed overhead. Selling expenses include variable costs of $0.20 per unit and annual fixed costs of $60,000. Fixed administrative costs are $120,000 annually. All fixed costs are incurred uniformly throughout the year.

The controller has accumulated the following additional information:

1. The balances of selected accounts as of November 30, 2004 are:

Cash	$12,000
Marketable securities, at market value	40,000
Accounts receivable	96,000
Prepaid expenses	4,800
Accounts payable (arising from raw material purchases)	300,000
Accrued vacation pay	9,500
Equipment note payable	102,000
Accrued income taxes payable	50,000

2. Interest to be received from the company's temporary investments is estimated at $500 for December.

3. Prepaid expenses of $3,600 will expire during December and the balance of the prepaid account is estimated at $4,200 for the end of December.

4. Gowan purchased new machinery in 2004 as part of a plant modernization program. The machinery was financed by a 24-month note of $144,000. The terms call for equal principal payments over the next 24 months with interest paid at the rate of 1% per month on the unpaid balance at the first of the month. The first payment was made on May 1, 2004.

5. Old equipment, which has a book value of $8,000, is to be sold during December for $7,500.

6. Each month the company accrues $1,700 for vacation pay by charging vacation pay Expense and crediting accrued vacation pay. The plant closes for two weeks in June when all plant employees take a vacation.

7. Quarterly dividends of $0.20 per share will be paid on December 15 to stockholders of record. Gowan Corporation has authorized 10,000 shares. The company has issued 7,500 shares and 500 of these are classified as treasury stock.

8. The quarterly income taxes payment of $50,000 is due on December 15, 2004.

Required:

Prepare a schedule that forecasts the cash position at December 31, 2004. What action, if any, will be required to maintain a $10,000 cash balance?

MA49 Problem: Budgeting - Martin Company

The following forecasted variable costing income statement was prepared for Martin Company.

Sales	$100,000
Variable costs	45,000
Contribution margin	$55,000
Fixed costs	25,000
Net income	$30,000

The President of Martin knows there is uncertainty associated with all these estimates. Currently, the pro forma statement represents the most likely outcome. The President, however, wants to conduct a sensitivity analysis to examine the worst case and best cases scenarios as well. After consultation with his managers, the following additional information was determined:

- The worst case and best case scenarios for sales represent a +/- change of 25% of the most likely levels.
- The worst case and best case scenarios for fixed costs represent a +/- change of 20% of the most likely levels.
- Variable costs are always proportional to sales. The worst case for the behaviour of variable costs is they climb to 60% of sales. The best case scenario for variable costs is they fall to 40% of sales.

Required:

Calculate the net income for Martin Company using all variables at their worst case levels. Repeat this process and calculate the net income with all variables assuming their best case levels. How likely do you think these ends points are?

MA50 Problem: Flexible Budget Variances - Funnie Flexible Inc.

Funnie Flexible Inc. has developed standard costs of $25 per unit for variable costs and budgeted annual fixed costs to be $210,000. The budgeted sales price per unit is $58 and, at this price, management estimated sales to be 15,000 units. Actual results were disappointing, as only 11,000 units were sold. Actual variable costs were $264,000 and fixed costs were $202,000. There was no beginning or ending inventory. The actual average selling price per unit was $56.50.

Required:

Compute the flexible budget variance, sales volume variance and static budget variance.

MA51 Problem: Flexible Budget Variances - Appleby Inc.

The controller of Appleby Inc. created standards for variable costs for one of its products as:

	Per Unit
Direct material	$2.00
Direct labour	5.60
Variable overhead	1.25

At the beginning of the year, Appleby Inc. estimated the average selling price to be $15 per unit and, at this price, estimated sales to be 70,000 units. Annual fixed costs were estimated to be $180,000.

Subsequent to year-end, the controller determined actual results to be sales of 75,000 units at an average price of $13.50 per unit. Total variable costs were $660,000 and total fixed costs were $192,000. There was no beginning or ending inventory.

Required:

Calculate the flexible budget, sales volume and static budget variances.

MA52 Problem: Variances - Copper Bottom Pot Company Ltd.

Copper Bottom Pot Company Ltd. (CBPC), manufactures one product, The Big Pot. The company uses a standard cost system and has established the following standards per unit of The Big Pot.

	Standard Quantity	Standard Price	Standard Cost
Direct materials	6.0 kilograms	$14 per kilogram	$84
Direct labour	1.5 hours	$20 per hour	$30

The following activities were recorded by CBPC for the production of The Big Pot in January 2000:

- The company produced 600 units during the month.
- A total of 4,000 kilograms of material were purchased at a cost of $52,000.
- On January 1, 2000, there was no beginning inventory of materials on hand; 200 kilograms of materials remained in the warehouse unused at the end of the month.
- The company employs 12 people to produce The Big Pot. In January, each worked an average of 65 hours at an average of $21 per hour.

Required:

a. For direct materials used in the production of The Big Pot:

  i. Compute the direct materials purchase price variance and the direct materials usage variance.

  ii The direct materials were purchased from a new supplier who is anxious to enter into a long-term purchase contract. Would you recommend the company sign the contract? Explain.

b. For the direct labour employed in the production of The Big Pot:

  i. Compute the direct labour rate variance and the direct labour efficiency variance.

  ii. In the past, the 12 people employed in the production of The Big Pot consisted of four experienced workers and eight inexperienced assistants. During January, the company experimented with shifting the labour mix to six experienced workers and six inexperienced assistants. Would you recommend the new labour mix be continued? Explain.

MA53 Problem: Variances – Addy Company

Addy Company's direct labour costs are:

Standard direct labour hours allowed for actual output	30,000
Actual direct labour hours	29,000
Direct labour efficiency variance, favourable	\$4,000
Direct labour rate variance, favourable	\$5,800
Total gross wages	\$110,200

Required:

a. What was Addy's standard direct labour rate?
b. What was Addy's actual direct labour rate?

MA54 Problem: Variances - Andres Industries

Andres Industries employs a standard cost system. Andres has established the following standards for the prime costs of its Hunters' Bow product line:

	Standard Quantity	Standard Price	Standard Cost
Direct materials	8 kg	$1.80/kg	$14.40
Direct labour	0.25 DLH	$8/DLH	2.00
			$16.40

During November, Andres purchased 160,000 kg of direct materials at a total cost of $304,000. The total factory wages for November were $42,000, 90% of which were for direct labour. Andres manufactured 19,000 Hunters' Bows during November using 142,500 kg of direct materials and 5,000 direct labour hours.

Required:

a. What was the direct materials purchase price variance for November?
b. What was the direct materials usage variance for November?
c. What was the direct labour rate variance for November?
d. What was the direct labour efficiency variance for November?

MA55 Problem: Variances - Brien Manufacturing Company

Brien Manufacturing Company has a process cost accounting system. A monthly analysis compares actual results with both a monthly plan and a flexible budget. Standard direct labour rates used in the flexible budget are established at the time the annual plan is formulated and held constant for the entire year. Standard direct labour rates in effect for the fiscal year ending June 30 and standard hours allowed for the output in April are:

	Standard Rate Per Hour	Standard DLH Allowed For Output
Labour class III	$8	500
Labour class II	$7	500
Labour class I	$5	500

The wage rates for each labour class increased on January 1 under the terms of a new union contract negotiated in December of the previous fiscal year. The standard wage rates were not revised to reflect the new contract. The actual direct labour hours worked and the actual direct labour rates per hour experienced for the month of April were:

	Actual Direct Labour Rate Per Hour	Actual Direct Labour Hours
Labour class III	$8.50	550
Labour class II	$7.50	650
Labour class I	$5.40	375

Required:

a. What is the total direct labour variance?
b. What is the direct labour rate variance?
c. What is the direct labour efficiency variance?
d. What is the direct labour yield variance? (Round all standard prices to four decimal places)
e. What is the direct labour mix variance for April?

Performance Management - Problems

MA56 Problem: Variances - Boutin Glass Works

Boutin Glass Works production budget for the year ended November 30, 2004 in Department C was based on 200,000 units. Each unit requires two standard hours of labour for completion. Total overhead was budgeted at $900,000 for the year and the fixed overhead rate was estimated to be $3 per unit. Both fixed and variable overhead are applied to the product on the basis of direct labour hours. The actual data for the year ended November 30, 2004 are:

Actual production in units	198,000
Actual direct labour hours	440,000
Actual variable overhead	$352,000
Actual fixed overhead	$575,000

<u>Required:</u>

a. What were the standard hours allowed for actual production for the year ended November 30, 2004?
b. What was the VOH efficiency variance for the year?
c. What was the VOH spending variance for the year?
d. What was the FOH spending variance for the year?
e. What was the FOH applied to Boutin's production for the year?
f. What was the FOH production volume variance for the year?

MA57 Problem: Variances – Ferguson Foundry Ltd.

Mark Ferguson, the president of Ferguson Foundry Limited (FFL), sat in his office early on June 2, 2005, reviewing the financial statements of FFL for the fiscal year ended May 31, 2005. The results for the year were both a shock and a disappointment.

Mr. Ferguson had called Carl Holitzner, CMA, an independent consultant, to meet him in his office. When Carl arrived, Mr. Ferguson described his concerns.

"I don't know what went wrong last year. Everybody kept telling me we were selling more woodstoves than we thought we would and I knew from attending the trade shows the sales of woodstoves throughout the province were rising. When I saw the statements for last year, I couldn't believe the drop in profits.

"This company began in 1905. My grandfather used to make farm implements and sled runners; my father produced mostly trailers. I've dabbled in a few product lines like sewer grates and staircase railings but, for the past five years, we've concentrated solely on woodstoves. Sales were slow at first and there were many producers in the market. But we have a good sales force and things have been steadily improving for the past two years. In 2004, we achieved record profits.

"In addition to profits dropping, we have lost our management team. The sales manager took early retirement last month, the production manager is in the hospital for major surgery and the accountant quit after we discussed the kind of information I felt he should be providing. He kept telling me everything was running smoothly. Boy, was he wrong!

"I called you here because I need some help in understanding what went wrong last year. I want to be sure similar mistakes are not made in the future. I'll be hiring new people, but I need some answers quickly. Here is the statement of budgeted and actual results (Exhibit 1). I was also able to dig up a statement of standard costs (Exhibit 2) that was prepared last year, plus market and job cost data, which the accountant had prepared before he left (Exhibit 3). The standard costs are an accurate reflection of what it should cost to make either of the woodstove models."

<u>Required:</u>

Assume the role of Carl Holitzner and provide an explanation for FFL's lower than budgeted profit for the fiscal year ended May 31, 2005. Support your explanation with a detailed variance analysis.

Exhibit 1

Ferguson Foundry Limited

Static Budget and Actual Results

for the year ended May 31, 2005

Static budget

	Basic	Deluxe	Total
Sales volume (in units)	4,500	5,500	10,000
Sales revenue	$1,350,000	$4,400,000	$5,750,000
Variable costs			
Direct materials	315,000	1,045,000	1,360,000
Direct labour	405,000	1,320,000	1,725,000
Overhead	202,500	660,000	862,500
Selling and administration	67,500	220,000	287,500
	990,000	3,245,000	4,235,000
Contribution margin	$ 360,000	$1,155,000	1,515,000
Fixed costs:			
Manufacturing			750,000
Selling and administration			132,500
			882,500
Operating income			$ 632,500

Actual Results

	Basic	Deluxe	Total
Sales volume (in units)	7,200	4,800	12,000
Sales revenue	$2,340,000	$3,360,000	$5,700,000
Variable costs			
Direct materials	860,000	820,800	1,306,800
Direct labour	748,800	1,190,400	1,939,200
Overhead	374,400	595,200	969,600
Selling and administration	108,000	192,000	300,000
	1,717,200	2,798,400	4,515,600
Contribution margin	$622,800	$ 561,600	1,184,400
Fixed costs			
Manufacturing			780,000
Selling and administration			139,500
			919,500
Operating income			$264,900

Exhibit 2
Ferguson Foundry Limited
Unit Cost Standards
for the year ended May 31, 2005

	Basic Woodstove	Deluxe Woodstove	
Direct materials:			
Standard quantity per unit	70 kg	190 kg	Standard price
per kilogram	$1	$1	
Direct labour:			
Standard quantity per unit	6 hrs.	16 hrs.	
Standard rate per hour	$15	$15	
Variable overhead:			
Standard quantity per unit	6 hrs.	16 hrs.	
Standard rate per hour	$7.50	$7.50	
Variable selling and administrative rate per unit	$15	$40	

Exhibit 3
Ferguson Foundry Limited
Market and Job-Cost Data
for the year ended May 31, 2005

Market data:

Expected total market sales of woodstoves	100,000 units
Actual total market sales of woodstoves	133,333 units

Summary of job cost sheets:

	Basic	Deluxe	Total
Units of woodstoves produced	7,200	4,800	12,000
Direct materials:			
Actual quantity used in kilograms	540,000	912,000	1,452,000
Actual price per kilogram			$0.90
Direct labour:			
Actual direct labour hours worked	46,800	74,400	121,200
Actual rate per hour			$16.00
Actual variable overhead allocated on the basis of direct labour hours	$374,400	$595,200	$969,600

MA58 Problem: Variances, Breakeven and Pricing - PFC

Peterborough Furniture Company (PFC) produces pine furniture. The company keeps its costs down by only producing two products: pine tables and pine chairs.

The budget prepared for Year 7 was:

Peterborough Furniture Company
Master Budget
for the year ending December 31, Year 7

	Pine Chair	Pine Table	Year Total
Sales Revenue:			
Quantity	5,000	2,500	7,500
Price	$ 225	$ 485	
Total revenue	$1,125,000	$1,212,500	$2,337,500
Cost of goods sold:			
Variable costs:			
Direct material	$200,000	$200,000	$400,000
Direct labour	500,000	200,000	700,000
Overhead	250,000	100,000	350,000
Total variable cost	$950,000	$500,000	$1,450,000
Contribution margin	$175,000	$712,500	$887,500
Fixed cost:			
Manufacturing			$550,000
Selling and administration			125,000
Total fixed costs			$675,000
Net income before taxes			$212,500

 Please report errors or omissions to studymanual_errata@cmaontario.org

The unit prices and quantities used by PFC to construct this budget were:

	Pine Chair	Pine Table
Direct material:		
Standard quantity (board feet)	40	80
Standard price/board foot	x $ 1	x $ 1
Total	$40	$80
Direct labour:		
Standard quantity (hours)	10	8
Standard rate/hour	x $ 10	x $ 10
Total	$100	$ 80
Variable overhead:		
Standard quantity (hours)	10	8
Standard rate/hour	x $ 5	x $ 5
Total	$50	$40
Total unit cost	$190	$200

The labour employed in the plant was moderately skilled with wages per hour varying among workers in the range of $6 to $14 per hour. Variable overhead includes indirect labour, sanding equipment, glue, small tools and other assorted materials. It has been established that variable overhead varies directly with direct labour hours. Fixed costs (manufacturing and selling and administrative) are not applied to products.

The actual amount of profit earned in Year 7 was only $54,165, much lower than budgeted. Although the number of pieces sold was greater than expected and the industry volume of unit sales had actually grown to about 99,817 pieces during the year, PFC's income was lower than expected. Budgeted industry volume for the year was 93,750 pieces. Actual results are:

Peterborough Furniture Company
Actual Results
for the year ending December 31, Year 7

	Pine Chair	Pine Table	Year Total
Sales revenue:			
Quantity	5,985	2,200	8,185
Price	$ 235	$ 475	
Total revenue	$1,406,475	$1,045,000	$2,451,475
Cost of goods sold			
Variable costs:			
Direct material	$245,385	$180,400	$425,785
Direct labour	658,350	165,000	823,350
Overhead	329,175	99,000	428,175
Total variable cost	$1,232,910	$444,400	$1,677,310
Contribution margin	$173,565	$600,600	$774,165
Fixed cost:			
Manufacturing			$590,000
Selling and administration			130,000
Total fixed costs			$720,000
Net income before taxes			$54,165

A new supplier of wood had been selected during the year. While some lower quality wood was obtained, the price per board foot was definitely better. Also, a new mill had opened up in town during the year. Mr. Odette was forced to increase his wages to keep his good workers. The following list of unit costs has been prepared by the PFC bookkeeper.

Actual Costs for Year 7 Per Unit

	Pine Chair	Pine Table
Direct material:		
Actual quantity	45	90
Actual price	$0.91111	$0.91111
Total actual	$41.00	$82.00
Direct labour:		
Actual quantity	10.00	6.25
Actual rate	$11.00	$12.00
Total actual	$110.00	$75.00
Variable overhead:		
Actual quantity	10.00	6.25
Actual rate	$5.50	$7.20
Total actual	$55.00	$45.00
Total	$206.00	$202.00

<u>Required:</u>

a) Prepare a flexible budget report.

b) Calculate the following cost variances for both the chairs and tables:
Direct material
Direct labour
Variable overhead
Fixed manufacturing
Fixed selling and administrative

c) Calculate the following revenue variances:
Sales revenue price
Sales volume
Sales mix
Sales quantity
Market share
Market size (industry volume)

d) Reconcile the total variances calculated in b) and c) to the master budget vs. actual variance.

e) Assuming the net assets, fixed manufacturing expenses and fixed selling and administrative expenses for Year 8 could be allocated to the products produced as follows, what should the price for a pine table and a pine chair be, using the return on assets method of pricing and full costing? Assume the required return on assets is 10% for both products and use the actual costs incurred for Year 7.

	Pine Chair	Pine Table
Fixed manufacturing	$220,000	$370,000
Fixed selling and administration	$110,000	$20,000
Net assets employed	$1,436,000	$1,012,000

f) Using the data in the master budget for Year 7, determine the breakeven point in unit sales and dollar sales for PFC.

MA59 Problem: Variance Analysis - F&G Inc.

The controller for F&G Inc. developed the following standards per unit:

	Input Required	Standard Price or Rate
Direct materials	2 kgs	$2.90 per kg
Direct labour	3.5 hours	$12.50 per hour
Manufacturing overhead:		
Variable	--	$2.20 per DLH
Fixed	--	$4.10 per DLH

Normal volume for the month of August, based on historical results, was estimated to be 8,000 units. Actual production results for August was 8,800 units, using the following inputs:

Direct materials purchased	18,000 kgs @ $2.60/kg
Direct materials issued to production	19,800 kgs
Direct labour	32,200 hours @ a total cost of $425,040
Actual manufacturing overhead	
Variable	$68,360
Fixed	$112,100

Required:

Calculate the following variances:

a) Direct material price and quantity variance
b) Direct labour rate and efficiency variance
c) Variable overhead spending and efficiency variance
d) Under- or over-applied fixed overhead, fixed flexible budget variance and production volume variance

Performance Management - Problems

MA60 Problem: Variance Analysis - Trombone Ltd.

Trombone Ltd. (TL) uses standard costing. At the beginning of the year, TL budgeted variable overhead to be $341,000, based on total direct labour hours of 110,000. Total direct labour costs were estimated to be $1,485,000.

Other standard information is:

Direct material cost per kilogram	$5.20
Direct material inputs required for each unit of output	3 kgs
Direct labour inputs required for each unit of output	2.5 hours

During the month of October, actual results were:

Units produced	5,680
Direct material purchased	19,060

The controller for TL calculated variances for October as:

Direct material efficiency variance	$3,640 F
Direct labour efficiency variance	$4,995 U
Variable overhead spending variance	$2,167 F
Actual fixed overhead cost	$44,860
Total under-applied fixed overhead	$3,680
Fixed overhead flexible budget variance	$5,040 U

The unfavourable direct material price variance was $.40 per kilogram and, due to significant overtime premiums required due to a machine break down, actual direct labour costs exceeded budgeted costs by $1.25 per hour. Fixed overhead is applied based on direct labour hours.

Required:

Calculate the following for the month of October

a) Actual price paid per kilogram of material
b) Total direct material price variance
c) Total kgs of direct material issued to production
d) Actual total direct labour hours
e) Total direct labour rate variance
f) Flexible budget variance for direct labour
g) Variable overhead efficiency variance
h) Actual variable overhead costs
i) Variable overhead flexible budget variance
j) Fixed overhead rate
k) Total budgeted fixed overhead for the month of October
l) Fixed overhead production volume variance

MA61 Problem: Revenue Variances - New Look Jacket Inc.

New Look Jacket Inc.(NLJ) produces and sells two lines of jackets: nylon and leather. The market for nylon jackets is large and competitive, but the leather jacket market has traditionally been small with only a few competing manufacturers.

The operating budget for NLJ for the year 2007 was:

	Nylon Jackets	Leather Jackets	Total
Sales volume	95,000	5,000	100,000
Sales revenue	$3,325,000	$750,000	$4,075,000
Total variable costs	2,161,250	517,500	2,678,750
Contribution margin	$1,163,750	$232,500	$1,396,250

The actual results for the year 2007 are:

	Nylon Jackets	Leather Jackets	Total
Sales volume	93,500	16,500	110,000
Sales revenue	$3,366,000	$2,442,000	$5,808,000
Total variable costs	2,127,125	1,707,750	3,834,875
Contribution margin	$1,238,875	$ 734,250	$1,973,125

Additional information:

	Nylon Jackets	Leather Jackets
Market size (units):		
2007 budget	475,000	12,500
2007 actual	425,000	125,000

Required:

Calculate all relevant revenue variances and comment on the performance of the marketing department.

Performance Management - Problems

MA62 Problem: Revenue Variances - Sleepy Hollow Hotels, Ltd.

Sleepy Hollow Hotels, Ltd. (SHHL) operates two hotels in the metro region. Each hotel has two grades of rooms: standard and deluxe. SHHL has a total of 300 deluxe rooms and 700 standard rooms in the region.

On June 17, 2006, the: executive committee of SHHL met to review its second-quarter results. The following are excerpts from the meeting.

Brian Grant, President: "Preliminary results from our second quarter indicate that Suzie Paquin, our new Vice-President of Sales, should be recognized for a job well done. It seems clear to me our new incentive bonus program, consisting of a sales commission based on total sales in addition to a base salary, is working. As you will see in Exhibit 1, revenues exceeded those projected for the period. Overall occupancy was up slightly despite a decrease in the overall market demand. In particular, the market responded enthusiastically to our deluxe rooms, on which Suzie placed particular emphasis."

Ann Tait, Controller: "Excuse me, Brian, but your description of last quarter's performance may be overly optimistic. There were several occasions when our regular customers had to be turned away because all deluxe rooms were occupied. Also, the contribution margins for both types of rooms were down. I'll need to prepare a variance analysis before I can make any conclusions."

After the meeting, Brian Grant directed Ann Tait to do the following:

1. Analyze the second quarter results, including a detailed variance analysis. Comment on the overall performance of SHHL and explain the significance of the variances from budget.
2. Comment on the performance evaluation of Suzie Paquin, Vice-President, Sales.

<u>Required:</u>

As Ann Tait, the Controller for Sleepy Hollow Hotels Ltd., prepare a report to the president, Brian Grant.

Exhibit 1

Sleepy Hollow Hotels Ltd.
Sales and Operating Data
for the quarter ended May 31, 2006

A. Sales revenue for 92 days in the quarter:

Budgeted revenue	$8,721,600
Actual revenue	8,825,100
Revenue variance	$ 103,500 F

B. Average daily occupancy rates:

	Standard		Deluxe		Total	
	# of Rooms	%	# of Rooms	%	# of Rooms	%
Budgeted	490	70%	240	80%	730	73%
Actual	455	65%	285	95%	740	74%

C. Industry data:

	Budget	Actual
Total average daily demand for hotel rooms in the region	14,600 rooms	13,455 rooms
SHHL's market share	5%	5.5%

D. Operating budget:

	Standard	Deluxe
Daily room rate	$120	$150
Variable costs per room per day	40	61
Contribution margin per unit	$ 80	$ 89
Average daily number of rooms occupied	490	240
Total rooms for the quarter (92 days)	45,080	22,080
Fixed costs for the quarter	$2,000,000	$1,500,000

E. Actual operating results:

	Standard	Deluxe
Daily room rate	$120	$145
Variable costs per room per day	41	63
Contribution margin per unit	$ 79	$ 82
Average daily number of rooms occupied	455	285
Total rooms for the quarter (92 days)	41,860	26,220
Fixed costs for the quarter	$2,000,000	$1,500,000

MA63 Problem: Cost Volume Profit Analysis - ABC Company

The following information pertains to ABC Company and its product, Product A.

Selling price per unit		$45.00
Direct material cost per kg		$2.00
Direct labour cost per unit		$1.20
Variable overhead cost per unit		$0.80
Material required per unit		2 kgs
Other variable expenses per unit		$0.60
Annual fixed costs:		
Advertising	$15,000	
Fixed manufacturing	60,000	
Other fixed expenses	8,000	$83,000

Required:

1. What is the breakeven point in both units and sales dollars?

2. Assume ABC has a target net profit of $240,000 and a tax rate of 40%. What is the breakeven point in both units and sales dollars?

3. If ABC Company chose to discontinue advertising and instead pay $3 per unit as a commission, what would the breakeven point be in both units and sales dollars?

MA64 Problem: Cost Volume Profit Analysis – Konrad Inc.

Konrad Inc. has three product lines, X, Y and Z. The contribution margin of X, Y and Z is $45, $25 and $28 respectively. Historically, the annual unit sales of X, Y and Z have been 3,000, 5,000 and 1,000. Konrad's annual fixed costs are $249,600.

<ins>Required:</ins>

What is Konrad Inc.'s breakeven point in units, assuming the sales mix remains constant? How many units of X, Y and Z need to be sold to breakeven?

MA65 Problem: Cost Volume Profit Analysis – Excellent Textbook Company

Excellent Textbook Company produces an accounting text book used by many universities and colleges. The company sells the book to book stores at the price of $43.50 each. The costs of manufacturing and marketing the text at the company's normal volume of 3,000 units per month are:

Unit manufacturing costs:		
Variable materials	$5.50	
Variable labour	8.25	
Variable overhead	4.20	
Fixed overhead	6.60	
Total unit manufacturing costs		$24.55
Unit marketing cost:		
Variable	2.75	
Fixed	7.70	
Total unit marketing costs		10.45
Total unit costs		$35.00

Required:

a. What is the breakeven volume in units? In sales dollars?

b. Market research indicates monthly volume could increase to 3,500 units, which is well within production capacity limitations if the price were cut from $43.50 to $38.50 per unit. Would you recommend this action be taken? Support your response by showing your calculations.

MA66 Problem: Cost Volume Profit Analysis - Nixon Company

The estimates made for Nixon Company, a one product company are:

Nixon Company
Projected Income Statement
for the year ended December 31, 1995

Sales revenue (100 units x $100 per unit)		$10,000
Manufacturing cost of goods sold:		
Direct materials	$1,400	
Direct labour	1,500	
Variable overhead	1,000	
Fixed overhead	500	4,400
Gross margin		5,600
Selling and administrative expenses:		
Variable	1,100	
Fixed	2,000	3,100
Operating income		$ 2,500

Required:

a. How many units of the product must Nixon sell to breakeven?
b. What would be the operating income if projected units increased by 25%?
c. What would dollar sales be at the breakeven point if fixed overhead increased by $1,700.

MA67 Problem: Cost Volume Profit Analysis - All-Day Candy Company

All-Day Candy Company is a wholesale distributor of candy. The company services grocery, convenience and drug stores in a large metropolitan area. All-Day has achieved small but steady growth in sales over the past few years, while candy prices have been increasing. The company is formulating its plans for the coming fiscal year. Following is the data used to project the current year's after-tax net income of $110,400.

Average selling price	$4.00	per box
Average variable costs:		
Cost of candy	$2.00	per box
Selling expenses	0.40	per box
	$2.40	per box
Annual fixed costs:		
Selling	$ 160,000	
Administrative	280,000	
	$ 440,000	
Expected annual sales volume (390,000 boxes)	$1,560,000	
Tax rate	40%	

Manufacturers of candy have announced they will increase prices of their products an average of 15% in the coming year due to increases in raw materials (sugar, cocoa, peanuts, etc.) and labour costs. All-Day Candy Company expects all other costs will remain at the same rates or levels as the current year.

Required:

a. How was the $110,400 net income figure calculated?
b. What is All-Day Candy Company's breakeven in boxes of candy for the current year?
c. What selling price per box must All-Day Candy Company charge to cover the 15% increase in the cost of candy and still maintain the current CM ratio?
d. What volume of sales in dollars must the All-Day Candy Company achieve in the coming year to maintain the same net income after taxes as projected for the current year if the selling price of candy remains at $4 per box and the cost of candy increases 15%?
e. How many units would have to be sold next year to generate a net income equal to 10% of revenue?

MA68 Problem: Cost Volume Profit Analysis - Mistry Company

Mistry Company manufactures a line of electric garden tools that are sold in general hardware stores. The company's controller, Sylvia Harlow, has just received the sales forecast for the coming year for Mistry's three products: weeders, hedge clippers and leaf blowers. Mistry has experienced considerable variations in sales volumes and variable costs over the past two years and Harlow believes the forecast should be carefully evaluated from a CVP viewpoint. The preliminary budget information for 2008 is presented as:

	Weeders	Hedge Clippers	Leaf Blowers
Unit sales	50,000	50,000	100,000
Unit selling price	$28	$36	$48
Variable manufacturing cost per unit	$13	$12	$25
Variable selling cost per unit	$5	$4	$6

For 2008, Mistry's fixed factory overhead is budgeted at $2,000,000 and the company's fixed selling and administrative expenses are forecasted to be $600,000. Mistry has an effective tax rate of 40%.

Required:

a. Determine Mistry Company's budgeted net income for 2008.
b. Assuming the sales mix remains as budgeted, determine how many units of each product Mistry Company must sell in order to breakeven in 2008.
c. Determine the total dollar sales Mistry Company must sell in 2008 in order to earn an after-tax net income of $450,000.
d. After preparing the original estimates, Mistry Company determined its variable manufacturing cost of leaf blowers would increase 20% and the variable selling cost of hedge clippers could be expected to increase $1 per unit. However, Mistry has decided not to change the selling price of either product. In addition, Mistry has learned its leaf blower has been perceived as the best value on the market and it can expect to sell three times as many leaf blowers as any other product. Under these circumstances, determine how many units of each product Mistry Company would have to sell in order to breakeven in 2008.

MA69 Problem: Relevant Costing – Special Orders - CBA Inc.

CBA Inc., a manufacturer, has received a special request for 1,000 units of its product, widgets, at a price of $52.50 per unit. The normal selling price for widgets is $60 per unit. CBA Inc.'s annual capacity is 25,000 units and its current sales are 22,000 units per annum. To analyze this special order, Jim Blum, the sales manager, gathered the following budgeted information:

Direct materials per unit	$2.10
Direct labour per unit	$1.75
Variable overhead per unit	$0.96
Fixed manufacturing overhead per unit	$1.10
Variable selling and administration per unit	$10.96

The variable selling and administration costs per unit represent commissions and would not be incurred on this order.

<u>Required:</u>

1. Should CBA Inc. accept this special order?

2. Assume CBA Inc.'s annual sales are 25,000 units. Should CBA Inc. accept this special order?

MA70 Problem: Relevant Costing – Special Orders - Kimco Inc.

Kimco Inc. produces a single product. The cost of producing and selling a single unit of this product at the company's normal activity level of 8,000 units per month is:

Direct materials	$2.50
Direct labour	3.00
Variable overhead	0.50
Fixed overhead	4.25
Variable selling and administrative expense	1.50
Fixed selling and administrative expense	2.00

The normal selling price is $15 per unit. The company's capacity is 10,000 units per month. An order has been received from an overseas source for 2,000 units at a price of $12 per unit. There are variable selling and administrative costs related to this order. This order would not disturb regular sales.

Required:

1. If the order were accepted, by how much would monthly profits be increased or decreased? (The order would not change the company's total fixed costs.)
2. Assume the company has 500 units of this product, which are inferior to the current model, left over from last year. The units must be sold through regular channels at reduced prices. What unit cost figure is relevant for establishing a minimum selling price for these units? Explain.

MA71 Problem: Relevant Costing – Special Orders - George Jackson

George Jackson operates a small machine shop. He manufactures one standard product available from many other similar businesses and also manufactures products to customer order. His accountant prepared the following annual income statement:

	Custom Sales	Standard Sales	Total
Sales	$50,000	$25,000	$75,000
Material	10,000	8,000	18,000
Labour	20,000	9,000	29,000
Depreciation	6,300	3,600	9,900
Power	700	400	1,100
Rent	6,000	1,000	7,000
Heat and light	600	100	700
Other	400	900	1,300
	44,000	23,000	67,000
	$ 6,000	$ 2,000	$ 8,000

The depreciation charges are for machines used in the respective product lines. The power charge is apportioned on the estimate of power consumed. The rent is for the building space, which has been leased for 10 years at $7,000 per year. The rent, heat and light are apportioned to the product lines based on the amount of floor space occupied. All other costs are current fixed expenses identified with the product line incurring them.

A valued custom parts customer has asked Jackson to manufacture 5,000 special units for him. Jackson is working at capacity and would have to give up some other business to take this order. He cannot renege on custom orders already agreed on, but he could reduce the output of his standard product by about one-half for a year while producing the specially requested custom part. The customer is willing to pay $7 for each part. The material cost will be about $2 per unit and the labour will be $3.60 per unit. Jackson will have to spend $2,000 for a special device that will be discarded when the job is completed.

Required:

What is the net gain or loss from the special order?

MA72 Problem: Relevant Costing – Special Orders - Strutt Company

Strutt Company, which manufactures robes, has enough idle capacity available to accept a special order of 10,000 robes at $8 a robe. A predicted income statement for the year, without this special order is:

	Per Unit	Total
Sales revenue	$12.50	$1,250,000
Manufacturing costs:		
Variable	6.25	625,000
Fixed	1.75	175,000
	8.00	800,000
Gross profit	4.50	450,000
Marketing costs:		
Variable	1.80	180,000
Fixed	1.45	145,000
	3.25	325,000
Operating profit	$ 1.25	$125,000

If the order is accepted, variable marketing costs on the special order would be reduced by 25% because all of the robes would be packed and shipped in one lot. However, if the offer is accepted, management estimates it will lose sales of 2,000 robes at regular prices.

Required:

What is the net gain or loss from the special order?

MA73 Problem: Relevant Costing – Make or Buy - Todders Ltd.

Todders Ltd. currently purchases a part required in its manufacturing process for $17 per unit. In addition to the purchase price of $17, Todders Ltd. incurs ordering, receiving and inspection costs of $2.50/unit. Todders is considering making the part and, to that end, has estimated costs per unit as:

Direct materials	$5.75 per unit
Direct labour	$10.00 per unit
Variable overhead	$1.50 per unit
Increase in fixed manufacturing overhead	$30,000

Todders Ltd.'s annual requirement of this part is 30,000 units.

Required:

Should Todders produce this unit or purchase externally? What is the net benefit to Todders Ltd.?

MA74 Problem: Relevant Costing – Make or Buy - Surtel Company

When you completed your audit of the Surtel Company, management asked for your assistance in deciding whether to continue manufacturing a part or to buy it from an outside supplier. The part, which is named Faktron, is a component used in some of the finished products of the company. From your audit working papers and from further investigation, you develop the following data as being typical of the company's operations:

- The annual requirement for Faktrons is 5,000 units. The lowest quotation from a supplier was $8 per unit.

- Faktrons have been manufactured in the precision machinery department. If Faktrons are purchased from an outside supplier, certain machinery will be sold and would realize its net book value.

- Following are the total costs of the precision machinery department during the year under audit when 5,000 Faktrons were made:

Direct materials	$67,500
Direct labour	50,000
Indirect labour	20,000
Light and heat	5,500
Power	3,000
Depreciation	10,000
Property taxes and insurance	8,000
Payroll taxes and other benefits	2,800
Other	5,000

- The following precision machinery department costs apply to the manufacture of Faktrons: direct materials $17,500; direct labour $28,000; indirect labour $6,000; power $300; and other $500. The sale of the equipment used for Faktrons would reduce the following costs by the amounts indicated: depreciation, $2,000; and property taxes and insurance $1,000.

- The following additional precision machinery department costs would be incurred if Faktrons were purchased from an outside supplier: freight $0.50 per unit; and indirect labour for receiving, materials handling and inspection $5,000. The cost of the purchased Faktrons would be considered a precision machinery department cost.

Required:

a. Prepare a schedule comparing the total costs of the precision machinery department (1) when Faktrons are made and, (2) when Faktrons are bought from an outsider supplier.

b. Discuss the considerations in addition to the cost factors you would bring to the attention of managers in assisting them in deciding whether to make or buy Faktrons. Include in your discussion the considerations that might be applied to the evaluation of the outside supplier.

MA75 Problem: Relevant Costing – Buying Decision - Tsui Company

Tsui Company needs a total of 125 tons of sheet steel, 50 tons of 2-inch width and 75 tons of 4-inch width, for a customer's job. Tsui can purchase the sheet steel in these widths directly from Jensteel Corporation, a steel manufacturer or it can purchase sheet steel from Jensteel that is 24 inches wide and have it slit into the desired widths by Precut, Inc. Both vendors are local and have previously supplied materials to Tsui.

Precut specializes in slitting sheet steel provided by a customer into any desired width. When negotiating a contract, Precut tells its customers there is a scrap loss in the slitting operation, but this loss has never exceeded 2.5% of input tons. Precut recommends if a customer has a specific tonnage requirement, it should supply an adequate amount of steel to yield the desired quantity. Precut's charges for steel slitting are based on good output, not input handled.

The 24-inch wide sheet steel is a regular stock item of Jensteel and can be shipped to Precut within five days after receipt of Tsui's purchase order. If Jensteel is to do the slitting, shipment to Tsui would be scheduled for 15 days after receipt of Tsui's purchase order. Precut has quoted delivery at 10 days after receipt of the sheet steel. In prior dealings, Tsui has found both Jensteel and Precut to be reliable vendors with high quality products.

Tsui has received the following price quotations from Jensteel and Precut:

Jensteel Corporation Rates

Size	Gauge	Quantity	Cost Per Ton
2-inch	14	50 tons	$210
4-inch	14	75 tons	200
24-inch	14	125 tons	180

Precut, Inc. Steel Slitting Rates

Size	Gauge	Quantity	Price Per Ton Of Output
2-inch	14	50 tons	$18
4-inch	14	75 tons	$15

Freight And Handling Charges

Destination	Cost Per Ton
Jensteel to Tsui	$10.00
Jensteel to Precut	$ 5.00
Precut to Tsui	$ 7.50

In addition, Precut informed Tsui that if it purchases 100 output tons of each width, the per ton slitting rates would be reduced 12%. Tsui knows the same customer will be placing a new order in the near future for the same material and estimates it would have to store the additional tonnage for an average of two months at a carrying cost of $1.50 per month for each ton. There would be no change in Jensteel's prices for additional tons delivered to Precut.

<u>Required:</u>

a. Prepare an analysis that will show whether Tsui Company should:
   1. Purchase the required slit steel directly from Jensteel Corporation.
   2. Purchase the 24-inch wide sheet steel from Jensteel and have it slit by Precut into 50 output tons two inches wide and 75 output tons four inches wide.
   3. Take advantage of Precut's reduced slitting rates by purchasing 100 output tons of each width.

b. Without prejudice to your answer to Required (a), present qualitative arguments why Tsui Company may favour the purchase of the slit steel directly from Jensteel Corporation.

Performance Management - Problems

MA76 Problem: Relevant Costing – Drop a Product Line - Licnep Ltd.

Licnep Ltd. has three major product lines, soda, juice and ice cream. Licnep is considering discontinuing producing ice cream because the divisional income statement indicates it is being sold at a loss. The most recent annual income statement is outlined below:

	Soda (000s)	Juice (000s)	Ice Cream (000s)
Sales	$48,330	$44,980	$26,230
Variable costs	16,500	19,600	12,700
Fixed costs	21,800	24,400	18,300
Operating income	$10,030	$ 980	($4,770)

The fixed costs include fixed costs directly attributable to each product line as well as allocated common costs. The portion of directly attributable fixed costs included in total fixed costs is 40% for soda, 75% for juice and 55% for ice cream.

Required:

Should Licnep Ltd. discontinue making ice cream?

MA77 Problem: Relevant Costing – Drop a Product Line - Andres Company

Andres Company manufactures and sells three different products: Ex, Why and Zee. Projected income statements by product line for the year are presented below:

	Ex	Why	Zee	Total
Unit sales	10,000	500,000	125,000	635,000
Sales revenue	$925,000	$1,000,000	$575,000	$2,500,000
Variable cost of units sold	285,000	350,000	150,000	785,000
Fixed cost of units sold	304,200	289,000	166,800	760,000
Gross margin	335,800	361,000	258,200	955,000
Variable non-manufacturing costs	270,000	200,000	80,000	550,000
Fixed non-manufacturing costs	125,800	136,000	78,200	340,000
Operating profit	$(60,000)	$ 25,000	$100,000	$ 65,000

Production costs are similar for all three products. Fixed non-manufacturing costs are allocated to products in proportion to revenues. The fixed cost of units sold is allocated to products by various allocation bases, such as square feet for factory rent and machine hours for repairs.

Andres management is concerned about the loss on product Ex and is considering two alternative courses of corrective action.

Alternative A. Andres would lease new machinery for the production of product Ex. Management expects the new machinery would reduce variable production costs so total variable costs (cost of units sold and non-manufacturing costs) for product Ex would be 52% of product Ex revenues. The new machinery would increase total fixed costs allocated to product Ex from $430,000 to $480,000 per year. No additional fixed costs would be allocated to products Why or Zee.

Alternative B. Andres would discontinue the manufacture of product Ex. Selling prices of products Why and Zee would remain constant. Management expects product Zee production and revenues would increase by 50%. The machinery devoted to product Ex could be sold at scrap value that equals its removal costs. Removal of this machinery would reduce total fixed costs by $30,000 per year. The remaining fixed costs allocated to product Ex include $155,000 of rent expense per year. The space previously used for product Ex can be rented to an outside organization for $157,500 per year.

Required:

Prepare a schedule analyzing the effect of Alternative A and Alternative B on projected total operating profit.

MA78 Problem: CM Analysis and Scarce Resources - John's Company

John's Company has two products, X and Y. Both X and Y are produced on the same machine. The maximum operating capacity of the machine is 5,500 hours. X requires three hours of machine time, while Y requires five hours of machine time. Other information regarding X and Y:

	X	Y
Selling price per unit	$128.00	$98.00
Direct materials per unit	6.00	3.50
Direct labour per hour	15.00	15.00
Variable manufacturing overhead per direct labour hour	5.50	6.60
Predetermined fixed overhead rate per machine hour	4.00	4.00
Variable selling and administrative	$25.00	$20.00

Product X requires 2.5 direct labour hours and product Y requires 1.5 direct labour hours. Total fixed manufacturing costs for the year are $22,000. The demand for Product X is 600 units and the demand for Product Y is unlimited. Fixed selling and administration costs are $8,000.

<u>Required:</u>

What is the optimum production quantity of Product X and Product Y?

MA79 Problem: CM Analysis and Scarce Resources - Paulie Limited

The controller of Paulie Limited provided the following data regarding product A and B.

	A	B
Selling price	$11.30	$19.25
Direct materials required per unit	2 kgs	3 kgs
Direct material cost per kilo	$1.00	$0.80
Direct labour cost per hour	$12.00	$12.00
Direct labour hours required per unit	.25	.75
Machine hours required per unit	4.0	6.0
Variable manufacturing overhead per unit	$1.50	$1.75
Annual demand	4,000	5,000

Other information:

Total fixed selling and administrative costs are $19,380, allocated as:	
A: $7,880 B: $11,500	
Total fixed manufacturing overhead for the year	$660,000
Available machine hours	49,600

<u>Required:</u>

What is the optimum production quantity of Product A and B?

Performance Management - Problems

MA80 Problem: CM Analysis and Scarce Resources - Ronson Electric

Ronson Electric produces three products, X, Y and Z. Cost and revenue characteristics of the three products are: (per unit)

	Product X	Product Y	Product Z
Selling price	$40	$40	$36
Less: variable expenses			
Direct materials	15	5	10
Labour and overhead	7	23	17
Contribution margin	$18	$12	$9
Contribution margin ratio	45%	30%	25%

Demand for the company's products is strong with far more orders on hand each month than the company has raw material available to produce. The same kind of raw material is used in each product. The raw material costs $2.50 per kilogram, with a maximum of 5,000 kilograms available each month. Which orders would you advise the company accept first, those for product X, Y or Z? Which orders second? Third? Explain and show your computations.

MA81 Problem: CM Analysis and Scarce Resources - Lam Company

Lam Company manufactures a line of carpeting that includes a commercial carpet and a residential carpet. Two grades of fibre – heavy duty and regular – are used in manufacturing both types of carpeting. The mix of the two grades of fibre differs in each type of carpeting, with the commercial grade using a greater amount of heavy duty fibre.

Lam will introduce a new line of carpeting in two months to replace the current line. The present fibre in stock will not be used in the new line. Management wants to exhaust the present stock of regular and heavy duty fibre during the last month of production.

Data regarding the current line of commercial and residential carpeting are:

	Commercial	Residential
Selling price per roll	$1,000	$800
Production specifications per roll of carpet:		
Heavy duty fibre	80 kg	40 kg
Regular fibre	20 kg	40 kg
Direct labour hours	5 hours	5 hours
Standard cost per roll of carpet:		
Heavy-duty fibre ($3 per kg)	$240	$120
Regular fibre ($2 per lb.)	40	80
Direct labour ($30 per DLH)	150	150
Variable manufacturing overhead (60% of direct labour cost)	90	90
Fixed manufacturing overhead (120% of direct labour cost)	180	180
Total standard cost per roll	$700	$620

Lam has 42,000 kg of heavy duty fibre and 20,000 kg of regular fibre in stock. There are a maximum of 4,000 direct labour hours available during the month. The labour force can work on either type of carpeting.

Sufficient demand exists to sell 250 rolls of commercial carpets and 500 rolls of residential carpets.

Required:

Calculate the number of rolls of commercial carpet and residential carpet Lam Company must manufacture during the last month of production to maximize overall profitability.

Performance Management - Problems

MA82 Problem: Linear Programming - Tranta Company

Tranta Company produces two products, A and B. Product A require 10 hours of assembly time and four hours of finishing time. Product B requires six hours of assembly time and three hours of finishing time. Both Product A and B require 10 kilograms of direct material input. The available hours of assembly time and finishing time are 144 and 100, respectively. There are currently 16,000 kilograms of direct material available. Due to a strike by the only supplier of this material, no material can be purchased. The contribution margin on Product A is $450 per unit and the contribution margin on Product B is $375.

<u>Required:</u>

Formulate the objective function and the constraints.

MA83 Problem: Linear Programming – XYZ Inc.

XYZ Inc. produces two products, X and Y. The following data is available regarding X and Y:

	X	Y
Direct material required	3.5 kgs	2.0 kgs
Direct labour required	.75 hours	.25 hours
Machine 1 time required	1.50 hours	.50 hours
Machine 2 time required	.50 hours	.50 hours
Contribution margin per unit	$8	$5

The available capacity is:

Direct material	2,400 kgs
Direct labour	800 hours
Machine 1 hours	220 hours
Machine 2 hours	244 hours

<u>Required:</u>

Assuming XYZ Inc. wants to maximize total contribution margin, prepare the linear programming model to meet this objective.

MA84 Problem: Linear Programming - The Fluffy Toy Company

The Fluffy Toy Company makes two types of stuffed animals: Bob the Rat and Bob the Cat. The equipment in the plant is a highly automated, flexible manufacturing system. While both Bob the Rat and Bob the Cat are produced on the same machinery, the two use different settings. For the coming quarter, there is only 2,000 machine hours available for production of the two stuffed animals. Fluffy would like to settle on the product mix that would be the most advantageous for the organization. The following data applies to the manufacture of the two stuffed animals.

	Bob the Rat	Bob the Cat
FMS machine hours per unit	1.00	0.50
Unit selling price	\$2.50	\$3.00
Unit variable cost	1.50	2.25

<u>Required:</u>

a. Assume the market will absorb as many of either product the organization can manufacture. Determine the product mix that maximizes profit.

b. Assume market conditions have changed. Now, Fluffy Toy can sell no more that 1,500 Bob the Rat stuffed animals and no more than 3,000 Bob the Cat stuffed animals. Formulate this problem as a linear programming problem. Produce the objective function and all supporting equations.

MA85 Problem: Linear Programming - Harrington Corporation

Harrington Corporation manufactures and sells three products: anchor bolts (A); bearings; (B); and casters (C). There are 150 direct labour hours available. Machine hour capacity allows 100 anchor bolts only; 50 bearings only; 40 casters only; or any combination of the three that does not exceed the capacity. Data associated with the products follow:

Product	Selling Price	Variable Cost Per Unit	Fixed Cost Per Unit	Direct Labour Hours Per Unit
A	$4.00	$1.00	$2.00	2
B	3.50	0.50	2.00	2
C	6.00	2.00	3.00	3

<u>Required:</u>

a. Develop the objective function to maximize the total contribution margin from Harrington's three products.

b. Develop the direct labour hour constraint.

c. Develop the machine hour constraint.

Performance Management - Problems

MA86 Problem: Linear Programming - Pools and Things Ltd.

Pools and Things Ltd. (PATL) currently manufactures swimming pools and pool-related accessories. Recently, a new division, incorporated as a wholly-owned subsidiary, was established under the name Outdoor Furniture Ltd. (OFL). OFL will produce two types of lawn chairs, regular and lounge.

OFL consists of two departments, each requiring specialized equipment and labour skills. Both types of chairs will require processing in each department. The necessary equipment has been purchased and the labour is being hired. Machine time and labour time will not be interchangeable between the two departments. Annual machine and labour time constraints for each department are:

	Machine Hours	Labour Hours
Department 1	40,000	25,000
Department 2	35,000	20,000

Both the regular and lounge chairs are expected to have life cycles of five years with maximum annual sales demands of 32,000 regular chairs and 20,700 lounge chairs. Other available information for these chairs is:

	Regular Chairs	Lounge Chairs
Selling price per unit	\$42	\$79
Direct materials per unit	\$5	\$8
Other variable production costs per unit (including labour and overhead)	\$20	\$41
Variable selling costs	\$2	\$3
Fixed production costs – allocated 50% to each product (excluding depreciation)	\$70,000	\$70,000
Fixed administration costs per year – allocated 50% to each product (excluding bank loan interest)	\$130,000	\$130,000
Machine time per unit:		
Department 1	1/2hour	1 hour
Department 2	1/2hour	1 hour
Direct labour time per unit:		
Department 1	1/2 hour	1/2 hour
Department 2	1/4 hour	1/2 hour

The beginning balance sheet of OFL consists of :

- cash in the amount of \$100,000
- new production equipment costing \$1,500,000 (straight-line depreciation, expected salvage value of \$300,000 at the end of five years)
- term loan from the bank in the amount of \$1,200,000, requiring quarterly principal payments of \$90,000 plus interest, payable at the rate of 1.75% per quarter
- common shares issued to PATL at a value of \$400,000

Additional information is provided in Appendix 1.

The controller of PATL, G. Johnson, has arranged an operating line of credit for OFL. The bank's terms are:

1. A maximum of 85% of the projected accounts receivable balance at the end of each quarter will be advanced by the bank.
2. Funds are to be advanced on the first day of a quarter and repaid on the last day of a quarter. Advances and repayments must be in units of $10,000.
3. A minimum cash on hand balance of $25,000 must be maintained.
4. Interest will be based on an annual rate of 8% and will be payable at the end of each quarter, based on the quarter's opening balance.
5. OFL must immediately submit to the bank the following information for OFL's first year of operations: a cash flow budget for each quarter; a pro forma income statement for the year; a pro forma year-end balance sheet.

Exhibit 1
Information Gathered by Brooks

Cash inflows:
- sales will occur evenly over the year
- 20% of cash from sales will be received in the month of sale, 70% in the following month and 8% in the third month
- 2% of sales will be uncollectible

Cash outflows:
- variable production and selling costs, excluding direct materials, will be paid in the month of production
- direct materials will be received on a just-in-time basis and will be paid 30 days after receipt
- fixed production and administration costs will be paid evenly throughout the year
- no finished goods inventory will be maintained
- no income tax instalment payments will be required during OFL's first year of operations

Other data:
- OFL's effective tax rate is 40%
- assets are class 8 at a 20% CCA rate
- OFL uses the percentage of sales basis to estimate bad debts

Performance Management - Problems

Required:

a. What is the objective function and the constraints in this problem?
b. Assume the linear program provides you with the following optimal solution:
   Regular chairs – 30,000
   Lounge chairs – 20,000
   Prepare a cash flow budget for the four quarters of the first year of operations.
c. Prepare a budgeted income statement for the first year of operations.
d. Prepare a budgeted balance sheet at the end of the first year of operations.

MA87 Problem: Decision Analysis Under Uncertainty – Slick Ltd.

Slick Ltd. produces a product called Zap. The president of Slick Ltd. is currently attempting to decide on an appropriate selling price for each unit of Zap for the upcoming year. He realized a higher price would naturally result in lower demand, but he also felt the actual final demand would depend on whether the state of the economy next year is weak or strong.

His situation is further complicated because he must purchase his entire material requirement for next year's production of Zap in a single lot of either 200,000 units or 240,000 units and the unit price of these materials will depend on the size of the lot he orders, 200,000 or 240,000. The sole supplier of the material will accept no additional orders during the year. Therefore, if Slick Ltd. does not purchase enough material to meet actual demand, some orders will be left unfilled. On the other hand, if more material is purchased than required to fill demand, the excess material will become spoiled at the end of the year and Slick Ltd. will have to scrap the spoiled material.

The president has summarized the cost of material data and his expected overall demand situation for the next year is:

Quantity of Materials Ordered	Cost per Unit
200,000 units	$3.00
240,000 units	2.90

Note: Each unit of Zap requires one unit of materials.

Expected Demand for Zap:

	State of Economy	
Unit Selling Price	Weak (p = .6)	Strong (p = .4)
$5.25	180,000	200,000
$5.00	200,000	240,000

<u>Required:</u>

Determine the quantity of material that should be ordered for next year's production of Zap and the selling price for one unit of Zap that will provide Slick Ltd. with the highest expected contribution next year. Assume all other costs in the production of Zap remain constant regardless of the quantity produced. Show all supporting calculations.

MA88 Problem: Decision Analysis under Uncertainty - Dynaco Company

Dynaco Company produces a particular product from a process consisting of operations of five machines. The probability distribution of the number of machines, which will break down in a week is:

Number of machines that will break down each week	Probability
0	.10
1	.10
2	.20
3	.25
4	.30
5	.05

Every time a machines breaks down at the Dynaco Manufacturing Company, it requires one, two or three hours to fix it according to the following probability distribution.

Repair Time (hours)	Probability
1	.30
2	.50
3	.20

<u>Required:</u>

If it costs $72 per hour to repair a machine (which includes lost productivity) when it breaks down, determine the average weekly break down cost.

MA89 Problem: Payoff Tables (Expected Values) and EVPI - Germain Ltd.

Germain Ltd. manufactures and sells machine tools.

Currently, Germain is considering whether to implement a computerized direct ordering service for its customers. The existing average contribution margin per order is $140 and Germain's total fixed costs are $26 million per year. The company believe if it implements the new service without any loss of clients, it could charge an additional $10 per order. The incremental costs of the ordering service would be $3 per order plus $1,500,000 per year to lease the required equipment.

The marketing manager has estimated two probable levels of production and sales for the coming year. She believes there is a 70% chance Germain will have 200,000 orders and a 30% chance of having 300,000 orders. A marketing research firm has offered to do a survey that can determine, with certainty, which level of orders Germain will have in the coming year.

The company executive has to decide how much (if anything) it should pay for the market research information.

<u>Required:</u>

a) Calculate the amount Germain would be willing to pay (if anything) for the perfect information about orders in the coming year.

b) Explain the limitations of your method of analysis in Part a).

Source: CMA Adapted

MA90 Problem: Expected Values (Payoff Tables) - AMC Corporation

AMC Corporation is introducing a new product and must decide on a selling price. The variable cost per unit is $5.60. Senior management has narrowed the pricing alternatives to two choices: $14.50 or $8.20 per unit. Management estimates sales levels and the probability of attaining these levels as:

Selling price of $8.20:

Units	Probability
15,000	5%
10,000	85%
8,000	10%

Selling price of $14.50:

Units	Probability
4,700	5%
3,800	65%
2,600	30%

As the volume levels noted above are in the relevant range, fixed costs remain constant regardless of the selling price chosen.

Required:

1. Using a payoff table, calculate the optimal price AMC Corporation should charge.

2. Restate Part 1 using a decision tree.

MA91 Problem: Payoff Tables (Expected Values) and EVPI - Etam Repap Inc.

Etam Repap Inc. is considering rearranging its plant to increase efficiency. If the rearrangement is completely successful, anticipated operating costs will be $200,000 per annum. If the rearrangement is partially successful, anticipated operating costs are expected to be $310,000. If unsuccessful, operating costs are anticipated to be $510,000. The probability of complete success is 50%, partial success 30% and failure 20%. If the company does not rearrange, operating costs will be $400,000.

<u>Required:</u>

1. Prepare a payoff table (alternatives are rearrange or do not rearrange).

2. Restate requirement 1 in a decision tree format.

3. Etam Repap Inc. has an opportunity to hire a consultant who could predict the success rate with certainty. How much should Etam be willing to pay for such a report?

MA92 Problem: Expected Values (Payoff Tables) – HotDogs

You own the rights to sell hot dogs at the local ball park. The weather network predicts the probability of rain at 60% for the game coming up tomorrow. You have to decide today whether you will set up your hot dog stand inside or outside. If you set up outside and it does not rain, you expect to sell 800 hot dogs, but if it rains you will only sell 200 hot dogs. If you set up inside and it does not rain, you will sell 300 hot dogs, but, if it rains, you will sell 700 hot dogs. Each hot dog generates a contribution margin of $2.

<u>Required:</u>

a. Where should you set up, inside or outside?
b. What is the most you would pay someone to predict (with 100% accuracy) tomorrow's weather?
c. At what rain probability would you be indifferent between setting up inside or outside?

MA93 Problem: Expected Values (Payoff Tables) - Propeller Inc.

Propeller Inc. is considering three alternative machines to produce a new product. The cost structures (unit variable costs plus avoidable fixed costs) for the three machines are shown below. The selling price is unaffected by the machine used.

Single purpose machine	$0.60 + $20,000
Semi-automatic machine	$0.40 + $50,000
Automatic machine	$0.20 + $120,000

The demand for units of the new product is described by the following probability distribution:

Demand	Probability
200,000	0.4
300,000	0.3
400,000	0.2
500,000	0.1

<u>Required:</u>

Calculate expected demand. Calculate the expected costs of using the semi-automatic machine. Which machine should be selected?

MA94 Problem: Expected Values (Payoff Tables) - QTI Ltd.

Your client, QTI Ltd., wants your advice on which of two alternatives he should choose. One alternative is to sell an investment now for $10,000. Another alternative is to hold the investment three days, after which he can sell it for a certain selling price based on the following probabilities:

Selling Price	Probability
$ 5,000	0.4
8,000	0.2
12,000	0.3
30,000	0.1

<u>Required:</u>

Would you recommend selling the investment now or hold the investment for three days?

MA95 Problem: Expected Values (Payoff Tables) - The Elwood Company

The Elwood Company is considering hiring several new employees to handle an overload from a new contract. If the new people are not hired, there will be delays in the contract work. The following payoff matrix has been prepared for analyzing whether new people are needed:

	Hire New People	Do Not Hire New People
Retain new customers	$100,000	$75,000
Lose new customers	25,000	50,000

Based on past experience, the company expects to retain 75% of the new customers with no new hires.

Required:

Calculate the expected profit for the "no hire" decision.

MA96 Problem: Expected Values (Payoff Tables) - The Gallant Company

The Gallant Company manufactures a unique thermostat that yields dramatic cost savings from effective climatic control of large buildings. The efficiency of the thermostat is dependent upon the quality of a specialized thermocoupler. These thermocouplers are purchased from Braun Company for $15 each.

Since early 2003, an average of 10% of thermocouplers purchased from Braun have not met Gallant's quality requirements. The number of unusable thermocouplers has ranged from 5% to 25% of the total number purchased and has resulted in failures to meet production schedules. In addition, Gallant has incurred additional costs to replace the defective units because the rejection rate of the units is within the range agreed upon in the contract.

Gallant is considering a proposal to manufacture the thermocouplers. The company has the facilities and equipment to produce the components. The engineering department has designed a manufacturing system that will produce the thermocouplers with a defective rate of 4% of the number of units produced. The following schedule presents the engineer's estimates of the probabilities that different levels of variable manufacturing cost per thermocoupler will be incurred under this system. Additional annual fixed costs incurred by Gallant if it manufactures the thermocoupler will amount to $32,500.

Estimated Variable Manufacturing Cost Per Thermocoupler Unit	Probability Of Occurrence
$10	0.1
12	0.3
14	0.4
16	0.2

Gallant Company will need 18,000 thermocouplers to meet its annual demand requirements.

Required:

Prepare an expected value analysis to determine whether Gallant Company should manufacture the thermocouplers.

Performance Management - Problems

MA97 Problem: Expected Values (Payoff Tables) - The Finch Company

The Finch Company manufactures modular furniture for the home and uses a monthly variance system to control costs of the manufacturing departments. Peter Carter is the supervisor of the assembly department and is reviewing the monthly variance analysis for November:

Standard cost of production materials	$275,000
Materials price variance	-0-
Materials quantity variance, unfavourable	19,000
	$294,000

Carter has gathered the following information to assist him in deciding whether or not to investigate the unfavourable materials quantity variance:

Estimated cost to investigate the variance	$ 4,000
Estimated probability the assembly department is operating properly	90%
If the assembly department is operating improperly:	
Estimated cost to make the necessary changes	$ 8,000
Estimated present value of future unfavourable variances that would be saved by making the necessary changes	$40,000

Required:

a. Recommend whether or not Finch Company should investigate the unfavourable materials quantity variance.

b. Peter Carter is uncertain about the probability estimate of 90% for proper operation of the assembly department. Determine the probability estimate of the assembly department operating properly that would cause Collins to be indifferent between the two possible actions.

MA98 Problem: Pricing - Katz Inc.

Bob Katz, the owner of Katz, Inc., is preparing a bid on a job that requires $1,200 of direct materials, $600 of direct labour and $250 of overhead. Bob normally applies a standard mark-up based on cost of goods sold to arrive at an initial bid price. He then adjusts the price as necessary in light of other factors (e.g. competitive pressures). Last year's income statement is:

Sales	$100,000
Cost of goods sold	45,000
Gross margin	55,000
Selling and administrative expenses	24,500
Net income	$ 30,500

Required:

1. Bill's standard mark-up is unchanged from last year. Calculate it as a percentage of sales.

2. What is Bob's initial bid price?

Performance Management - Problems

MA99 Problem: Pricing - Classic Corporation

The following data relate to a year's budgeted activity (100,000 units) for Classic Corporation, a single product company:

	Per Unit
Selling price	5.00
Variable manufacturing costs	1.00
Variable marketing costs	2.00
Fixed manufacturing costs (based on 100,000 units)	0.25
Fixed marketing costs (based on 100,000 units)	0.65

Total fixed costs remain unchanged between 25,000 units and total capacity of 160,000 units. An order is received for 10,000 units to be used in an unrelated market. The sale would require production of 10,000 extra units.

<u>Required:</u>

What price per unit should be charged on the special order to increase operating profit by $15,000?

Performance Management Solutions

MA1 Solution: Cost Classification and Behaviour - MCQ

1. d
2. a
3. e

MA2 Solution: Cost Classification and Behaviour – SMA

a. Direct labour can be directly traced to a cost object such as a product or service This is accomplished through a source document, such as a time ticket or through automated tracking systems, such as touch screens or bar code scanners at a workstation. An example of direct labour is the hours spent by an artist in creating a painting.

Indirect labour cannot be easily traced to a particular product or service (or management chooses not to trace it directly because of the cost involved in attempting direct tracing and/or the insignificance of the labour cost involved). Often, indirect labour is a common cost applicable to many products. For example, the time involved by an artist in obtaining supplies is an indirect labour cost because the supplies are used on more than one painting.

b. Non-productive labour included in direct labour:

Some types of non-productive labour are normal, unavoidable and/or required by law. Examples include break time and bathroom time. Thus, the amount of time is budgeted (and must be paid for) as direct labour includes both productive time directly working on a product or service plus an allocation of this non-productive time.

Non-productive labour classified as indirect labour:

Other types of labour time, such as down time and training time, are classified as indirect labour costs because these activities are (potentially) avoidable and not attributable to an individual product.

MA3 Solution: Cost Classification and Behaviour– XDATA Limited

1.d

- Determine slope: ($14,200-$6,200) / (3,200 units – 1,200 units) = $4/unit
- Determine intercept: ($14,200) – (3,200 units * $4/unit) = $1,400
- Establish cost function: ($1,400) + (# of units * $4/unit) = total cost
- Apply cost function: ($1,400) + (2,000 units * $4/unit) = $9,400

2.e (outside relevant range).

MA4 Solution: Cost Classification and Behaviour – Vettor Company

a.

	Machine-Hours	Overhead Costs
High	25,000	99,000
Low	10,000	64,500
Change	15,000	34,500

Variable cost = $34,500 / 15,000 = $2.30
Fixed cost = $99,000 – (25,000 x $2.30) = $41,500

b. Economic plausibility criteria – is it reasonable to expect overhead costs would vary with machine hours? Yes.

Goodness of fit criteria – the r^2 = 91%. This means 91% of the variation in overhead costs is explained by the variation in machine hours.

Significance of slope coefficient – the t-value of 15 is greater than 2, making the slope coefficient significantly different from zero.

Conclusion: the regression is acceptable.

c. Using the high-low method, the overhead equation is:
Overhead = $41,500 + 2.30*MH

The estimate of overhead costs at 22,000 machine hours is:
$41,500 + 2.30(22,000) = $92,100

Using regression analysis, the overhead equation is:
Overhead = $39,859 + 2.15*MH

The estimate of overhead costs at 22,000 machine hours is:
$39,859 + 2.15(22,000) = $87,159

MA5 Solution: Cost Estimation – High-Low Method – Alex Limited

The units produced at Alex Limited are the independent variable. Therefore, the costs associated with the high and low values for units produced are used to calculate the cost function.

	Units Produced (x)	Direct Labour Cost (y)
High	31,040	$450,080
Low	16,120	256,120
Difference	14,920	$193,960

$$b = \text{slope (variable rate)} = \frac{\$193{,}960}{14{,}920} = \$13 \text{ per unit}$$

a = constant = y – bx

= $450,080 - $13 (31,040)
= $46,560

OR

a = constant = y – bx

= $256,120 - $13 (16,120)
= $46,560

y = $46,560 + $13x

Performance Management - Solutions

MA6 Problem: Manufacturing Cost – Crites Manufacturing

Crites Manufacturing Company
Schedule of Cost of Goods Manufactured
for the year ended December 31, 2005

Direct materials used		
Direct materials inventory, January 1, 2005	$21,400	
Direct materials purchased	32,400	
Direct materials inventory, December 31, 2005	(19,800)	$34,000
Direct labour		52,000
Manufacturing overhead		
Supervisory and indirect labour	27,300	
Supplies and indirect materials	5,400	
Heat light and power ($31,600 x 70%)	22,120	
Amortization ($37,500 x 80%)	30,000	
Property taxes ($9,900 x 75%)	7,425	92,245
Total manufacturing costs		178,245
Work-in-process, January 1, 2005		19,000
Work-in-process, December 31, 2005		(15,600)
Cost of goods manufactured		$181,645

Crites Manufacturing Company
Income Statement
for the year ended December 31, 2005

Sales		$325,000
Cost of goods sold		
Finished goods inventory, January 1, 2005	$36,700	
Cost of goods manufactured	181,645	
Finished goods inventory, December 31, 2005	(13,600)	204,745
Gross margin		120,255
Operating expenses		
Administrative costs	10,950	
Administrative salaries	43,000	
Marketing costs	42,600	
Heat light and power ($31,600 x 30%)	9,480	
Amortization ($37,500 x 20%)	7,500	
Property taxes ($9,900 x 25%)	2,475	116,005
Operating income		$4,250

MA7 Solution: Manufacturing Cost – Stoney Manufacturing

1.

Stoney Manufacturing
Schedule of cost of goods manufactured
for the year ending December 31, 2006

Direct materials:		
Beginning raw materials inventory, January 1	$ 8,000	
Plus: net purchases of raw materials	47,000	
Raw materials available	$55,000	
Less: ending raw materials inventory, Dec. 31	4,000	
Raw materials used		$ 51,000
Direct labour		30,000
Factory overhead		
Indirect materials	$ 7,000	
Indirect labour	3,000	
Factory depreciation (20,000 x .70)	14,000	
Factory taxes	11,000	
Utilities (20,000 x .90)	18,000	
Miscellaneous plant overhead	4,000	
Plant repairs and maintenance	9,000	
Fire Insurance: factory equipment	3,000	
Materials handling costs	8,000	77,000
Total manufacturing costs		$158,000
Beginning work-in-process inventory, January 1		19,000
		$177,000
Less: ending work-in-process inventory, Dec. 31		18,000
Cost of goods manufactured		$159,000

Performance Management - Solutions

2.

Stoney Manufacturing
Schedule of cost of goods sold
for the year ending December 31, 2006

Beginning finished goods inventory, January 1	$ 25,000
Plus: cost of goods manufactured	159,000
Goods available for sale	$184,000
Less: ending finished goods inventory, December 31[1]	77,000
Cost of goods sold[1]	$107,000

1. Ending finished goods inventory and cost of goods sold:

Gross profit:

Sales x 73.25%

400,000 x .7325 293,000

Cost of goods sold:

Sales – gross profit

400,000 – 293,000 107,000

Ending inventory:

Goods available for sale – cost of goods sold

184,000 – 107,000 77,000

 Please report errors or omissions to studymanual_errata@cmaontario.org

3.

Stoney Manufacturing
Income Statement
for the year ending December 31, 2006

Sales		$400,000
Cost of goods sold		107,000
Gross profit		$ 293,000
Operating expenses		
Selling expenses	$50,000	
General and administrative	18,000	
Depreciation (20,000 x .30)	6,000	
Marketing promotions	1,500	
Utilities (20,000 x .10)	2,000	
Courier costs (office)	900	
Customer service costs	3,000	81,400
Net income		$ 211,600

MA8 Solution: Activity Based Costing – Madcap Manufacturing

Using DLH to apply factory overhead at Madcap:

Direct materials:		
Cost per meter ($75,000 / 100,000m)	$0.75	
Cost for special order ($0.75 x 500m)		$375
Direct labour:		
Cost per hour ($160,000 / 10,000h)	16.00	
Cost for special order ($16 x 60h)		960
Overhead:		
Rate per DLH ($300,000 / 10,000h)	30.00	
Cost for special order ($30 x 60h)		1,800
Total manufacturing costs		3,135
Bid mark-up (40% of full manufacturing cost)		1,254
Bid price for special order		$4,389

Using ABC to apply factory overhead:

Direct materials:		
Cost per meter ($75,000 / 100,000m)	$0.75	
Cost for special order ($0.75 x 500m)		$375
Direct labour:		
Cost per hour ($160,000 / 10,000h)	16.00	
Cost for special order ($16 x 60h)		960
Unit level overheads:		
Pool 1: Material handling		
Pool rate ($6,000 / 100,000m)	0.06	
Applied OH ($0.06 x 500m)		30
Pool 2: Depreciation and Power		
Pool rate ([$200K+$8K] / 20,000MH)	10.40	
Applied OH ($10.40 x 100MH)		1,040
Batch level overheads:		
Pool 3: Set ups		
Pool rate ($22,500 / 750SU	30.00	
Applied OH ($30 x 2SU)		60

Pool 4: Production scheduling		
Pool rate ($7,500 / 500 batches)	15.00	
Applied OH ($15 x 1 batch)		15
Pool 5: Inspections		
Pool rate ($16,000/800 inspections)	20.00	
Applied OH ($20 x 2 inspections)		40
Product level overheads:		
Pool 6: Maintenance		
Pool rate ($40,000 / 20,000MH)	2.00	
Applied OH ($2 x 100MH)		200
Total manufacturing costs		2,720
Bid mark-up (40% of full manufacturing cost)		1,088
Bid price for special order		$3,808

Performance Management - Solutions

MA9 Solution: Activity Based Costing – Alaire Corporation

a. At least four general advantages associated with activity based costing for Alaire Corporation include:

- Provides management with a thorough understanding of complex product costs and product profitability for improved resource management and pricing decisions.
- Allows management to focus on value-added and non-value-added activities so non-value-added activities can be controlled or eliminated, thus streamlining production processes.
- Highlights the inter-relationship (cause and effect) of activities, which identifies opportunities to reduce costs (i.e. designing products with fewer parts in order to reduce the cost of the manufacturing process).
- Provides more appropriate means of charging overhead costs to products.

b. Variable overhead POR = $1,120,000 ÷ 280,000 = $4 per DLH

	TV	PC
Direct materials	$80	$140
Materials handling @ 10% of DM	8	14
Direct labour: 1.5 hours x $14 | 4 hours x $14	21	56
Machine time: .5 hours x $10 | 1.5 hours x $10	5	15
Variable OH: 1.5 hours x $4 | 4 hours x $4	6	16
	120	241
Selling price	$150	$300
Gross profit per unit	$30	$59
Volume	65,000	40,000
Total gross profit	$1,950,000	$2,360,000

c. Cost driver calculations:

Material overhead:	
Procurement: $400,000 / 4,000,000	$0.10 per part
Production scheduling: $220,000 / 110,000	$2 per board
Packaging and shipping : $440,000 / 110,000	$4 per board
Variable overhead:	
Machine set ups : $446,000 / 278,750	$1.60 per set up
Hazardous waste disposal: $48,000 / 16,000	$3 per pound
Quality control: $560,000 / 160,000	$3.50 per inspection
General supplies: $66,000 / 110,000	$0.60 per board

Manufacturing:	
Machine insertion: $1,200,000 / 3,000,000	$0.40 per part
Manual insertion: $4,000,000 / 1,000,000	$4.00 per part
Wave soldering: $132,000 / 110,000	$1.20 per board

	TV	PC
Direct materials	$80.00	$140.00
Material overhead:		
Procurement: $0.10 x 25 | 55	2.50	5.50
Production scheduling	2.00	2.00
Packaging and shipping : $440,000 / 110,000	4.00	4.00
Variable overhead:		
Machine set ups : $1.60 x 2 | 3	3.20	4.80
Hazardous waste disposal: $3 x .02 | .35	0.06	1.05
Quality control: $3.50 x 1 | 2	3.50	7.00
General supplies	0.60	0.60
Manufacturing:		
Machine insertion: $0.40 x 24 | 35	9.60	14.00
Manual insertion: $4 x 1 | 20	4.00	80.00
Wave soldering	1.20	1.20
	110.66	260.15
Selling price	150.00	300.00
Gross profit per unit	$39.34	$39.85
Volume	65,000	40,000
Total gross profit	$2,557,100	$1,594,000

d. The analysis, using standard costs, shows the unit gross profit of the PC board is almost double that of the TV board. On this basis, Alaire's management is likely to accept the production manager’s suggestion and concentrate promotional efforts on expanding the market for the PC boards.

However, the analysis, using activity based costs, does not support this decision. This analysis shows the unit dollar gross profit from each board is almost equal and the total gross profit from the TV board exceeds that of the PC board by almost $1,000,000. As a percentage of selling price, the contribution from the TV board is double that of the PC board (e.g. 26% vs. 13%).

MA10 Solution: Activity Based Costing – Johannes Incorporated

Regular mattress:

	Calculation		Per unit
Direct materials	624,000 ÷ 2,000	=	312
Direct labour	6,000 x 25 = 150,000		
	150,000 ÷ 2,000	=	75
Activity level cost			
Materials handling	40,000 x 1.40 = 56,000		
	56,000 ÷ 2,000	=	28
Cutting	40,000 x 3.20 = 128,000		
	128,000 ÷ 2,000	=	64
Assembly	6,000 x 28 = 168,000		
	168,000 ÷ 2,000	=	84
Product level cost:			
Upstream activities	given in question	=	40
Downstream activities	given in question	=	87
	Cost per unit		690

Premium mattress:

	Calculation		Per unit
Direct materials	210,000 ÷ 500	=	420
Direct labour	2,000 x 25 = 50,000		
	50,000 ÷ 500	=	100
Activity level cost			
Materials handling	20,000 x 1.40 = 28,000		
	28,000 ÷ 500	=	56
Cutting	20,000 x 3.20 = 64,000		
	64,000 ÷ 500	=	128
Assembly	2,000 x 28 = 56,000		
	56,000 ÷ 500	=	112
Product level cost:			
Upstream activities	given in question		83
Downstream activities	given in question		104
	Cost per unit		1,003

MA11 Solution: Activity Based Costing – Uppervale Health Centre

1a. The activity based approach would allocate costs using the appropriate cost drivers and cost driver rates.

Calculation of allocation base: patient years of service = ½ X number of patients

	Alcohol	Drug	Children	After-Care	Total
Patient years of service	40	50	50	60	200
Number of patients	80	100	100	120	400

Medical supplies rate $= \dfrac{\text{medical supplies costs}}{\text{total number of patient-years}} = \dfrac{\$300{,}000}{200} =$ \$1,500/patient year

Rent and clinic maintenance rate $= \dfrac{\text{rent and clinic maintenance costs}}{\text{total amount of square feet of space}} = \dfrac{\$200{,}000}{40{,}000} =$ \$5 per square metre

Admin. cost rate for patient charts, food and laundry $= \dfrac{\text{administration costs to manage patient charts, food, laundry}}{\text{total number of patient years}} = \dfrac{\$800{,}000}{200} =$ \$4,000 per patient year

Laboratory service rate $= \dfrac{\text{laboratory services costs}}{\text{total number of laboratory tests}} = \dfrac{\$275{,}000}{5{,}500} =$ \$50 per test

1b. Activity based costs for each program and cost per patient year of the four programs follow:

	Alcohol	Drug	Children	After-care
Direct labour:				
Physicians at \$100,000 x 0; 2; 4; 0	--	\$200,000	\$400,000	--
Psychologists at \$50,000 x 6; 4; 0; 9	\$300,000	200,000	--	\$450,000
Nurses at \$25,000 x 4; 6; 4; 9	100,000	150,000	100,000	225,000
Direct labour costs	400,000	550,000	500,000	675,000
Medical supplies[1] \$1,500 x 40; 50; 50; 60	60,000	75,000	75,000	90,000
Rent and clinic maintenance[2]				
\$5 x 9,000; 9,000; 10,000; 12,000	45,000	45,000	50,000	60,000
Administrative costs to manage patient charts, food and laundry[3]				
\$4,000 x 40; 50; 50; 60	160,000	200,000	200,000	240,000
Laboratory services[4]				
\$50 x 400; 1,400; 3,000; 700	20,000	70,000	150,000	35,000
Total costs	\$685,000	\$940,000	\$975,000	\$1,100,000
Divided by number of patient years	÷ 40	÷ 50	÷ 50	÷ 60
Cost per patient year	\$ 17,125	\$ 18,800	\$ 19,500	\$ 18,333

[1]Allocated using patient years
[2]Allocated using square metres of space
[3]Allocated using patient years
[4]Allocated using number of laboratory tests

Performance Management - Solutions

MA12 Solution: Job Order Costing – Redro Limited

1. Balance of WIP:

Beginning balance	$85,000
Add:	
Direct materials	$110,000
Direct labour	$180,000
Applied overhead (Note 1)	$120,000
Less:	
Job orders completed (transferred to finished goods)	($400,000)
Ending balance	$95,000

Note 1: Predetermined overhead rate:

$$\frac{\$2{,}400{,}000}{240{,}000 \text{ D.L. hours}} = \$10/\text{DLH}$$

$$\$10/\text{DLH} \times 12{,}000 \text{ hours} = \$120{,}000$$

2. Under- or over-applied overhead:

Actual overhead incurred	$129,000
Overhead applied to product	120,000
Under-applied overhead	$9,000

MA13 Solution: Job Order Costing– Tapem Limited

1. Predetermined overhead rates:

	Dept. I		Dept. II	
Estimated manufacturing overhead	$403,000		$352,000	
Divisor (DLH for Dept. I and MH for Dept. II)	÷ 26,000		÷ 32,000	
	$15.50	/DLH	$11.00	/DLH

Overhead applied to Job 1368:

Dept. I	89 DLH's x $15.50/DLH	=	$1,379.50
Dept. II	96 MH's x $11/MH	=	$1,056.00
			$2,435.50

2. Calculation of under- or over-applied overhead:

	Dept. I	Dept. II
Actual overhead	$463,105	$347,600
Applied overhead		
Dept. I: 28,510 x $15.50/DLH	$441,905	
Dept. II: 33,400 x $11/MH		$367,400
	$21,200	$19,800
	under-applied	over-applied

Performance Management - Solutions

MA14 Solution: Job Order Costing – Valani Corporation

WIP	$50,000	
Direct materials inventory		$50,000
To record the issue of direct materials to production.		
WIP	13,500	
Wages payable or Cash		13,500
To record direct labour.		
WIP ($13,500 x 4)	54,000	
Manufacturing overhead		54,000
To record the application of manufacturing overhead.		
POR = $600,000 / $150,000 = 4		
Finished goods inventory	119,400	
WIP		119,400
To record the completion of Jobs A4, A5 and A6.		
Job A4: $5,600 $^{\text{OP WIP}}$ + 10,000 $^{\text{DM}}$ + 5,000 $^{\text{DL}}$ + 5,000*4 $^{\text{OH}}$		$40,600
Job A5: $7,800 $^{\text{OP WIP}}$ + 20,000 $^{\text{DM}}$ + 4,000 $^{\text{DL}}$ + 4,000*4 $^{\text{OH}}$		47,800
Job A6: $16,000 $^{\text{DM}}$ + 3,000 $^{\text{DL}}$ + 3,000*4 $^{\text{OH}}$		31,000
		$119,400
Cost of goods sold	40,600	
Finished goods inventory		40,600
To record the sale of Job A4		
Accounts receivable (or cash)	56,840	
Sales		56,840
To record the sale of Job A4: $40,600 x 1.4		
Note: ending WIP balance should be:		
Opening balance		$13,400
Direct materials		50,000
Direct labour		13,500
Manufacturing overhead applied		54,000
Less: cost of goods manufactured		(119,400)
		$11,500
Proof: Job A7: $4,000 $^{\text{DM}}$ + 1,500 $^{\text{DL}}$ + 1,500*4 $^{\text{OH}}$		$11,500

 Please report errors or omissions to studymanual_errata@cmaontario.org

MA15 Solution: Job Order Costing – Devoe Company

a.	Raw materials inventory	$450,000	
	Cash or accounts payable		$450,000
	To record the purchase of raw materials.		
	WIP	475,000	
	Manufacturing overhead	20,000	
	Raw materials inventory		495,000
	To record the issue of direct materials to production and the use of indirect materials.		
	WIP (19,500 x $30)	585,000	
	Wages payable or cash		585,000
	To record direct labour.		
	WIP (19,500 x $25*)	487,500	
	Manufacturing overhead		487,500
	To record the application of manufacturing overhead.		
	* POR = $500,000 / 20,000 = $25		
	Manufacturing overhead	485,000	
	Accounts payable or cash		485,000
	To record the incurrence of manufacturing overhead costs.		
	Finished goods inventory	1,525,325	
	WIP		1,525,325
	To record cost of goods manufactured (see Section b)		
	Cost of goods sold	1,543,325	
	Finished goods inventory		1,543,325
	To record the cost of goods sold (see Section b).		

b.

Devoe Company
Schedule of cost of goods manufactured
for the year ended December 2005

Direct materials used	$475,000
Direct labour	585,000
Manufacturing overhead applied	487,500
Total manufacturing costs	1,547,500
WIP – beginning	87,000
WIP – end (schedule)	(109,175)
Cost of goods manufactured	$1,525,325

Devoe Company
Schedule of cost of goods sold
for the year ended December 2005

Finished goods inventory, beginning	$ 265,000
Cost of goods manufactured	1,525,325
Finished goods inventory, ending	(247,000)
Cost of goods sold	$1,543,325

Schedule – ending WIP

	Job A650	Job A652
Direct materials	$45,000	$26,500
Direct labour: 560 x $30 | 125 x $30	16,800	3,750
Manufacturing overhead: 560 x $25 125 x $25	14,000	3,125
	$75,800	$33,375

Total = 75,800 + 33,375 = 109,175

c. Actual manufacturing overhead
($20,000 indirect materials + 485,000 other) $505,000
Manufacturing overhead applied 487,500
Under-applied overhead $ 17,500

i. Cost of goods sold	17,500	
Manufacturing overhead		17,500

Alternate calculation:

Recall that under this approach, the allocation of current year over- or under-applied overhead is prorated against the accounts that have current year overhead applied to them. This means, it is necessary to isolate the accounts and the associated amounts that represent the current year's manufacturing costs.

		%	Allocation
Total manufacturing cost spent this year (see Part b)	$1,547,500		
This cost resides in:			
Ending FG	247,000	16%	$13,475
Ending WIP	109,175	7%	1,225
COGS [1,547,500-247,000-109175]	1,191,325	77%	2,800
	1,547,500	100%	17,500

ii.

	Balance	%	Allocation
COGS ($1,543,325 - 87,000 WIP-OP - 265,000 FG - OP)	$1,191,325	77%	$13,475
WIP	109,175	7%	1,225
FG	247,000	16%	2,800
	$1,547,500		$17,500

Cost of goods sold	13,475	
Work-in-process	1,225	
Finished goods inventory	2,800	
Manufacturing overhead		17,500

Performance Management - Solutions

MA16 Solution: Job Order Costing – Duench Incorporated

a. A job order cost system is appropriate for manufacturing, merchandising and service companies that provide individual products or services or products or services in unique batches. The process characteristic that makes a job order costing desirable is the ability to trace materials and labour directly to the unit or batch.

b. POR = $4,500,000 I 600,000 direct labour hours = $7.50 per DLH

The only job in process at May 31, 2004 is Job DRS114:

Costs in opening WIP	$250,000
Direct materials added in May	124,000
Purchased parts added in May	87,000
Direct labour added in May	200,500
Manufacturing overhead applied: 19,500 hours x $7.50	146,250
	$807,750

c.

	Cost /Unit	Units	Total
Beginning inventory, finished goods	$35	19,400	$679,000
Playpens manufactured in May			
WIP – opening			420,000
Direct materials added in May			3,000
Purchased parts added in May			10,800
Direct labour added in May			43,200
Manufacturing overhead applied: 4,400 hours x $7.50			33,000
	34	15,000	510,000
Less: sales			
Beginning inventory	35	19,400	(679,000)
Manufactured in May	34	1,600	(54,400)
Ending inventory, finished goods	$34	13,400	$455,600

d. If the ending overhead balance at the end of the year is significant, it should be prorated over COGS and the balances in WIP, FG and COGS. If it is insignificant, the ending balance can be closed to COGS or carried forward to the following year.

MA17 Solution: Job Order Costing – Eagleson Company

a. 1. PORs are used rather than actual overhead rates for four related purposes:
- To calculate an appropriate amount of overhead to be included in the cost of products or services.

- To enable overhead allocation to be made in a timely manner, rather than waiting until total actual overhead costs and hours worked become known at the end of the year.

- To provide timely product cost information for journal entries transferring completed products from WIP to FG and from FG to COGS.

- To normalize the overhead charge: PORs smooth out uncontrollable fluctuations in actual overhead costs that are unrelated to activity or volume levels. Actual overhead rates, if calculated monthly for example, often vary due to seasonal factors.

2. POR = $1,200,000 / 80,000 = $15 per MH

Applied overhead to October 31 = 73,000 MH x $15 = $1,095,000

3. 6,000 MH x $15 = $90,000

4.

Actual manufacturing overhead:	
$1,100,000 + 96,000	$1,196,000
Manufacturing overhead applied:	
$1,095,000 + 90,000	1,185,000
Under-applied overhead	$ 11,000

5. The ending overhead balance at the end of the fiscal year is $11,000 under-applied. This is less than 1% of the actual overhead costs incurred. Theoretically, proper product costing requires any ending balance, regardless of its significance, to be prorated over all the jobs worked on throughout the year. Insignificant amounts such as this will not distort net income or the ending WIP and FG balances. Thus, from a practical perspective, Eagleson Company is justified in closing the ending overhead balance to COGS.

b.

	Job N11-013
WIP balance, October 31, 2005	$55,000
Costs added in November	
Direct materials	4,000
Direct labour	12,000
Manufacturing overhead: 1,000 MH x $15	15,000
	$86,000

Performance Management - Solutions

c. Ending WIP:

	Job D12-002	Job D12-003
Direct materials	$37,900	$26,000
Direct labour	20,000	16,800
Manufacturing overhead:		
2,500 MH x $15 | 800 MH x $15	37,500	12,000
	$95,400	$54,800

Eagleson Company
Schedule of cost of goods manufactured
for the year ended November 30, 2005

Direct materials used:		
Raw materials inventory, beginning	$105,000	
Raw material purchases	1,063,000	
Raw materials inventory, ending	(85,000)	
Raw materials used	1,083,000	
Less indirect materials used	(134,000)	$ 949,000
Direct labour		925,000
Manufacturing overhead applied		1,185,000
Total manufacturing cost		3,059,000
WIP, beginning		60,000
WIP, end		(150,200)
Cost of goods manufactured		$2,968,800

MA18 Solution: Process Costing – Equivalent Units – ABC Company

Part A:

	Physical Units	Equivalent Units: Direct Material	Equivalent Units: Conversion Costs
Beginning WIP inventory	0		
+ units started	13,000		
= physical units to account for	13,000		
Completed	10,000	10,000	10,000
WIP, ending (at percentage complete for DM and conversion costs)	3,000	3,000	1,200 (3000 x .4)
= physical units accounted for	13,000		
Work done to date (equivalent units under weighted average method)		13,000	11,200
Less: equivalent units for work done on beginning inventory in prior period (at percentage complete in prior year for DM and conversion costs)		(0)	(0)
Work done in current period only (equivalent units under FIFO method)		13,000	11,200

Performance Management - Solutions

Part B:

	Physical Units	Equivalent Units Direct Material	Equivalent Units Conversion Costs
Beginning WIP inventory	8,000		
+ units started	20,000		
= physical units to account for	28,000		
Completed	22,000	22,000	22,000
WIP, ending (at percentage complete for DM and conversion costs)	6,000	4,800 (6000 x .8)	4,200 (6000 x .7)
= physical units accounted for	28,000		
Work done to date (equivalent units under weighted average method)		26,800	26,200
Less: equivalent units for work done on beginning inventory in prior period (at percentage complete in prior year for DM and conversion costs)		(8,000)	(2,000) 8,000 x .25
Work done in current period only (equivalent units under FIFO method)		18,800	24,200

Part C:

	Physical Units	Equivalent Units Direct Material	Conversion Costs
Beginning WIP inventory	6,000		
+ units started	40,000		
= physical units to account for	46,000		
Completed	30,000	30,000	30,000
WIP, ending (at percentage complete for DM and conversion costs)	16,000	4,000 (16000 x 25%)	4,800 (16000 x 30%)
= physical units accounted for	46,000		
Work done to date (equivalent units under weighted average method)		34,000	34,800
Less: equivalent units for work done on beginning inventory in prior period (at percentage complete in prior year for DM and conversion costs)		(4,500) (6000 x 75%)	(3,000) (6000 x 50%)
Work done in current period only (equivalent units under FIFO method)		29,500	31,800

Performance Management - Solutions

MA19 Solution: Process Costing – Satarelli Corporation

a)

	Transferred In Costs	Direct Materials	Direct Labour	Mfg Overhead
Equivalent units				
Units transferred out	4,000	4,000	4,000	4,000
Ending WIP				
2,000 x 100%	2,000			
2,000 x 90%		1,800		
2,000 x 70%			1,400	
2,000 x 35%				700
	6,000	5,800	5,400	4,700
Costs in opening WIP	$32,000	$ 20,000	$ 7,200	$ 5,500
Costs added	160,000	96,000	36,000	18,000
	$192,000	$116,000	$43,200	$23,500
Cost per unit	$32	$20	$8	$5

Total cost/unit = $65

Cost of goods transferred out	
Units transferred out: 4,000 x $65	$260,000
Cost of ending inventory	
Transferred in costs: 2,000 x $32	$64,000
Direct materials: 1,800 x $20	36,000
Direct labour: 1,400 x $8	11,200
Manufacturing overhead: 700 x $5	3,500
	$114,700

T-account perspective:

WIP – Assembly

B	$64,700	260,000 TO
TI	160,000	
CA	150,000	
E	114,700	

WIP – Finishing

TI 260,000	

b)

	Transferred In Costs	Direct Materials	Direct Labour	Mfg Overhead
Equivalent units				
Units in opening WIP				
1,000 x 0%	-0-			
1,000 x 0%		-0-		
1,000 x 40%			400	
1,000 x 50%				500
Units started and Completed	3,000	3,000	3,000	3,000
Ending WIP				
2,000 x 100%	2,000			
2,000 x 90%		1,800		
2,000 x 70%			1,400	
2,000 x 35%				700
	5,000	4,800	4,800	4,200
Costs added	$160,000	$96,000	$36,000	$18,000
Cost per unit	$32.00	$20.00	$7.50	$4.2857

Total cost/unit = $63.7857

Cost of goods transferred out	
Costs in opening WIP	$64,700
Cost to complete opening WIP	
Direct labour: 400 x $7.50	3,000
Manufacturing overhead: 500 x $4.2857	2,143
	69,843
Units started and completed: 3,000 x $63.7857	191,357
	$261,200

Cost of ending inventory	
Transferred in costs: 2,000 x $32	$64,000
Direct materials: 1,800 x $20	36,000
Direct labour: 1,400 x $7.50	10,500
Manufacturing overhead: 700 x $4.2857	3,000
	$113,500

T-account perspective:

WIP – Assembly			WIP – Finishing	
B $64,700	261,200 TO		TI 261,200	
TI 160,000				
CA 150,000				
E 113,500				

MA20 Solution: Process Costing – Tsizis Corporation

Total spoilage =		
WIP – beginning	4,000	
Started	16,000	
Transferred out	(15,000)	
WIP – ending	(3,000)	
	2,000	
Less: normal spoilage	1,300	
Abnormal spoilage	700	

	Direct Materials	Conversion Costs
Equivalent Units		
To complete opening WIP: 4,000 x 25%		1,000
Good units started and completed	11,000	11,000
Normal spoilage	1,300	-0-
Abnormal spoilage	700	-0-
Ending WIP: 3,000 x 100% | 3,000 x 33 1/3 %	3,000	1,000
	16,000	13,000
Costs added*	$81,600	$196,690
Cost per unit	$5.10	$15.13

Total cost = $20.23

* Materials used:		
From opening inventory: 2,000 kg	$10,000	
From November 3 purchase: 10,000 kg	51,000	
From November 18 purchase		
4,000 kg x $51,500 / 10,000	20,600	
	$81,600	

Cost of units transferred out to finished goods inventory:		
Cost in opening WIP	$69,310	
Cost to complete opening WIP		
1,000 x $15.13	15,130	$84,440
Cost of units started and completed		
11,000 x $20.23		222,530
Cost of normal spoilage		
1,300 x $5.10		6,630
		$313,600

Cost of ending WIP

Direct materials: 3,000 x $5.10	$15,300
Conversion costs: 1,000 x $15.13	15,130
	$30,430

Cost of abnormal spoilage

700 x $5.10	$3,570

T-account perspective:

WIP			
B	$69,310	313,600	TO
DM	81,600	3,570	AS
OH	196,690		
E	30460		

Finished Goods		
TI	313,600	

Performance Management - Solutions

MA21 Solution: Process Costing – Gagnon Company

<u>Part (a)</u>

Total spoilage =	
WIP – beginning	15,000
Started	46,000
Transferred out	(48,500)
WIP – ending	(9,000)
	3,500
Less: normal spoilage	1,500
Abnormal spoilage	2,000

	Transferred in Costs	Direct Materials	Conversion Costs
Equivalent units			
To complete opening WIP:			
9,000 x 40%			6,000
Good units started and completed	33,500	33,500	33,500
Normal spoilage	1,500	1,500	1,125
Abnormal spoilage	2,000	2,000	1,500
Ending WIP:			
9,000 x 100% | 9,000 x 25%	9,000	-	2,250
	46,000	37,000	44,375
Costs added	$298,540	$460,650	$382,956
Cost per unit	$6.49	$12.45	$8.63

Total cost = $27.57

Cost of units transferred out to finished goods inventory:		
Cost in opening WIP	$361,770	
Cost to complete opening WIP		
CC: 6,000 x $8.63	51,780	$413,550
Cost of units started and completed		
33,500 x $27.57		923,595
Cost of normal spoilage		
TI: 1,500 x $6.49	$ 9,735	
DM: 1,500 x $12.45	18,675	
CC: 1,125 x $8.63	9,709	38,119
		$1,375,264

Cost of ending WIP

TI: 9,000 x \$6.49	\$58,410
CC: 2,250 x \$8.63	19,417
	\$77,827

Cost of abnormal spoilage

TI: 2,000 x \$6.49	\$12,980
DM: 2,000 x \$12.45	24,900
CC: 1,500 x \$8.63	12,945
	\$50,825

T-account perspective:

WIP – Assembly

B	\$361,770	1,375,264	TO
	TI	50,825	AS
	298,540		
DM	460,650		
CC	382,956		
E	77,826		

WIP – Finishing

TI	1,375,264	

Performance Management - Solutions

Part (b)

	Transfer in Costs	Direct Materials	Conversion Costs
Equivalent units			
Units transferred out	48,500	48,500	48,500
Normal spoilage	1,500	1,500	1,125
Abnormal spoilage	2,000	2,000	1,500
Ending WIP:			
9,000 x 100% | 9,000 x 25%	9,000	-	2,250
	61,000	52,000	53,375
Costs in OP WIP + costs added	$396,190	$647,100	$460,626
Cost per unit	$6.49492	$12.44423	$8.63000

Total cost = $27.56915

Cost of units transferred out to finished goods inventory:		
Cost of units transferred out		
48,500 x $27.56915		$1,337,104
Cost of normal spoilage		
TI: 1,500 x $6.49492	$ 9,742	
DM: 1,500 x $12.44423	18,666	
CC: 1,125 x $8.63000	9,709	38,117
		$1,375,221

Cost of ending WIP	
TI: 9,000 x $6.49492	$58,455
CC: 2,250 x $8.63000	19,417
	$77,872

Cost of abnormal spoilage	
TI: 2,000 x $6.49492	$12,990
DM: 2,000 x $12.44423	24,888
CC: 1,500 x $8.63000	12,945
	$50,823

T-account perspective:

WIP – Assembly

	Debit	Credit	
B	$361,770	1,375,221	TO
TI	298,540	50,823	AS
DM	460,650		
CC	382,956		
E	77,872		

WIP – Finishing

	Debit	Credit
TI	1,375,221	

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MA22 Solution: Process Costing – Fortis Manufacturing Limited

Production costs are:

(a)	Ending inventory	$169,000
(b)	Goods transferred to finished goods inventory	$1,577,480
(c)	Normal spoilage	$116,480
(d)	Abnormal spoilage	$37,520

See the following page for a complete production cost schedule. The bolded items in the schedule are calculated values.

Physical Flow of Production		Equivalent Units		
	Physical Units	DM	Conversion	
WIP, beginning	4,000			
Units started	60,000			
To account for	64,000			
Total spoiled units (normal and abnormal)	**5,500**	**5,500**	**5,500**	Calculated value: 64,000 – 52,000-6,500. equiv units at 100% b/c inspection is at 100%.
Good units completed	52,000	52,000	52,000	
WIP, ending	6,500	6,500	**5,200**	calculated value
Accounted for	64,000		(6500x 80%)	
Work done to date		64,000	62,700	calculated value
Less: work done on beginning inv. in prior periods:				
DM (4,000 x 100%)		(4,000)		
Conversion (4,000 x 25%)			(1,000)	
Work done during current periood only		60,000	**61,700**	calculated value

Performance Management - Solutions

Financial Flow of Production	Total		Cost of Production DM	Conversion	
WIP, beginning (76 + 11)	$ 7,000		-	-	
Current costs	1,697,000		$1,080,000	$617,000	
To account for	$1,784,000		$1,080,000	$617,000	
Divide by equivalent units			÷ 60,000	**÷ 61,700**	calculated value
Cost per equivalent unit	$28.00		$18.00	$10.00	
Application of total costs:					
Units completed and trfrd to FG inv.:					
WIP, beginning	87,000		76,000	11,000	
Cost to complete beg WIP:	30,000		-	30,000 (4,000-1000) x $10	
Good units started and completed (52,000-4,000)	1,344,000		864,000 (48,000 x 18)	480,000 (48,000 x 10)	
Normal spoilage 52,000 x 8% = 4,160	116,480		74,880 (4,160 x 18)	41,600 (4,160 x 10)	
Total transferred to FG inv.	1,577,480				
Abnormal spoilage (write-off) (5,500 – 4,160=1,340)	37,520		24,120 (1,340 x 18)	13,400 (1,340 x 10)	
Ending WIP	169,000		117,000 (6,500 x 18)	52,000 (5,200 x 10)	
Total costs accounted for	1,784,000				
			1,156,000	628,000	
DM and conversion cost check:					
Current period costs			1,080,000	617,000	
Beg inventory costs			76,000	11,000	
All costs accounted for			1,156,000	628,000	

Note to candidates:

When doing problems, consider how the problem could be asked in a MCQ format. This question could easily be stated as:

The cost of abnormal spoilage for March is:

(a) $24,120 incorrect – 1,340 x 18 -> calculated abnormal spoilage using only the DM rate of $18
(b) $37,520 correct – 5,500 – 4,160 = 1,340 x 28
(c) $74,880 incorrect – 4,160 x 18 -> calculated normal spoilage using the DM rate
(d) $116,480 incorrect – 4,160 x 28 -> calculated normal spoilage
(e) $154,000 incorrect – 5,500 x 28 -> calculated total spoilage

Each incorrect solution contains common errors candidates make. This MCQ is the level of difficulty to expect on the Entrance Exam. A MCQ such as this should take a maximum of two minutes. If a candidate understands process costing well, this question could easily be done in less than two minutes.

MA23 Solution: Process Costing – Transferred In, No Spoilage - MCI

Part 1 – FIFO

Department A – FIFO

Physical Flow of Production	Physical Units	DM	Conversion
		Equivalent Units	
WIP, beginning (65% complete)	200		
Units started	10,000		
To account for	10,200		
Units completed and transferred	8,000	8,000	8,000
WIP, ending (75% complete)	2,200	2,200	1,650 (2,200 × 75%)
Total units accounted for	10,200		
Work done to date		10,200	9,650
Less: work done on beginning inventory in prior period:			
DM (100% applied)		(200)	
Conversion (65% applied)			(130) (200 × 65%)
Work done during current period		10,000	9,520 See Note 1 below

Financial Flow of Production		Cost of Production	
WIP, beginning (DM 2,000 + ConC 6,240)	$ 8,240	-	-
Current costs	596,400	$120,400	$476,000
To account for	$604,640		
Divide by equivalent units		10,000	9,520
Cost per equivalent unit	**$62.04000**	**$12.0400**	**$50.00000**
Application of total costs (see Note 2 below):			
Units started and completed (8,000 - 200 = 7,800)	$483,912	$ 93,912	$390,000
Cost to complete beginning inventory:			
Beginning inventory – carry forward	8,240	2,000	6,240
Material added to complete (0% added)	0	0	-
Conversion cost added to complete (35% to complete)	3,500	-	3,500 (200 x 35% x 50.0000)
Total cost of goods transferred to Dept. B	$495,652		
Ending WIP	108,988	26,488 (2,200 × 12.0400)	82,500 (1,650 × 50.00000)
Total costs accounted for	$604,640		
		$122,400	$482,240
DM and conversion cost reconciliation			
	Current costs	$120,400	$476,000
	Beginning inventory costs	2,000	6,240
	All costs accounted for	$122,400	$482,240

Performance Management - Solutions

Note 1: Candidates should note that applying logic will quickly and easily yield the answer (as opposed to memorization, which will fail you on the Entrance Exam). As an example, using logic to calculate the equivalent units for conversion results in the following:

Since FIFO isolates the work done during the month, the question is "What conversion was added this month?"

Solution, using logic and not memorization:

Note that conversion is added evenly throughout the process and that beginning WIP was 65% complete with respect to conversion and ending WIP is 75% complete with respect to conversion.

Conversion added to units that were in beginning WIP → the beginning WIP was 65% complete and conversion occurs evenly, therefore, conversion that would be added to the units this month is 200 x 35% → last month, 65% of conversion was added, which means, this month the remainder, 35% (calculated as 100% - 65%), must be added		70
Conversion added to units that were started and completed →first it is necessary to calculate how many units were started and completed:		
Units started	10,000	
Units in ending WIP	(2,200)	
Therefore, units started and completed	7,800	
→ since the units were completed, conversion must have been added to all of them		7,800
Conversion added to units that are in ending WIP: In ending WIP there are 2,200 units that are 75% complete with respect to conversion → since conversion occurs evenly and the units are 75% complete, these units have 2,200 x 75% conversion applied to them. This is the EU with respect to conversion for ending WIP.		1,650
Total units that have conversion in them where the conversion was applied this month – this is the total EU for conversion in Department A under FIFO		9,520

Note 2: Often candidates have difficulty understanding the application of total costs using FIFO. These costs can be determined using logic. Recall that under FIFO, the cost per equivalent unit ("EU") is calculated based on costs incurred this month. The question then is "what happens to the cost of beginning WIP?" These costs are added to the cost of the units started and completed this month. The table below shows how to think this through logically:

Application of total costs:

1. Units started and completed this month: Since these units were started and completed, all costs (DM and conversion) related to these units are applied to them. →first, it is necessary to determine the units that were started and completed this month:		
Units started	10,000	
Units in ending WIP inventory	(2,200)	
Units started and completed this month	7,800	
Cost of the units started and completed:		
7,800 x 62.040		$483,912
2. Since FIFO isolates the work and cost that was done this month, it is necessary to determine the cost incurred this month to finish the units that were in beginning WIP inventory		
→ beginning WIP inventory was 100% complete with respect to DM. Therefore, the DM cost incurred this month to finish WIP inventory is zero	0	
→beginning WIP inventory was 65% complete with respect to conversion. This means that this month 35% of conversion on the beginning WIP units of 200 took place or 70 EU (200 x 35%). Therefore, the conversion cost incurred this month to finish beginning WIP inventory is 70 x $50 per EU	3,500	3,500
3. Cost of beginning WIP →at the beginning of this month, there was $8,240 in beginning WIP. The question posed earlier was "what happens to this cost?". This cost is carried forward and added to the costs incurred this month, so the total cost of the units transferred to Department B can be determined.		8,240
Total cost transferred		$495,652

Performance Management - Solutions

Department B – FIFO

Physical Flow of Production	Physical Units	Transferred In	DM	Conversion
		Equivalent Units		
WIP, beginning (90% complete)	400			
Units transferred in	8,000			
To account for	8,400			
Good units completed and transferred to FG	7,000	7,000	7,000	7,000
WIP ending :				
1,000 units 75% completed	1,000	1,000	0 (1,000 × 0%)	750 (1,000 × 75%)
400 units 95% completed	400	400	400 (400 × 100%)	380 (400 × 95%)
Accounted for	8,400			
Work done to date		8,400	7,400	8,130
Less: work done on beginning inventory in prior period:				
DM (DM added at 95% completion)		(400)	--	
Conversion (400 x 90%)				(360)
Work done during current period		8,000	7,400 See Note 1 below	7,770

Financial Flow of Production		Transferred In	DM	Conversion
		Cost of Production		
WIP, beginning (Con $6,000 + Tran $24,800)	$ 30,800	--	--	--
Current costs	638,402	495,652	14,800	127,950
To account for	$669,202	$495,652	$14,800	$127,950
Divide by equivalent units		8,000	7,400	7,770
Cost per equivalent unit	$80.4236	$61.9565	$2.00	$16.4671
Application of total costs:				
Units started and completed (7,000 – 400)	$530,796	$408,913	$13,200	$108,683
Cost to complete beginning inventory:				
Beginning inventory – completed	30,800	24,800	--	6,000
Material (100% added)	800		800 (400 x 2)	
Conversion cost (10% added)	659			659 (400 x 10% x 16.4671)
Total cost of goods transferred to FG	563,055			
Ending WIP:				
1,000 units 75% completed DM added after 95% completion	74,307	61,957 (1,000 × 61.9565)	0 (1,000 × 0% × 2)	12,350 (1,000 × 75% × 16.4671)
400 units 95% completed	31,840	24,783 (400 × 61.9565)	800 (400 × 100% × 2)	6,257 (400 × 95% × 16.4671)
Total ending WIP	106,147			
Total costs accounted for	$669,202			
(minor differences due to rounding)		$520,453	$14,800	$133,949

Note 1: Candidates should note that applying logic will quickly and easily yield the answer (as opposed to memorization, which will fail you on the Entrance Exam). As an example, using logic to calculate the equivalent units for DM results in the following:

Department B – FIFO

Since FIFO isolates the work done during the month, the question is "What DM was added this month?"

Solution, using logic and not memorization:

Note that DM is added at 95% complete in Department B.

DM added to units that were in beginning WIP → the beginning WIP was 90% complete and DM is added at 95% complete, therefore, DM would be added to the units this month		400
DM added to units that were started and completed →first, it is necessary to calculate how many units were started and completed:		
Units started (these are the units transferred from A)	8,000	
Units in ending WIP	(1,400)	
Therefore, units started and completed	6,600	
→ since the units were completed, DM must have been added to all of them		6,600
DM added to units that are in ending WIP: 1. 1,000 units are 75% complete → since DM is added at 95% these units have no DM in them		0
2. 400 units are 95% complete → since DM is added at 95% these units have DM in them		400
Total units that have DM in them – this is the EU for DM in Dept B under FIFO		7,400

Performance Management - Solutions

Part 2 – Weighted average

Department A – weighted average

Physical Flow of Production	Physical Units	Equivalent Units: DM	Equivalent Units: Conversion
WIP, beginning	200		
Units started	10,000		
To account for	10,200		
Units completed and transferred	8,000	8,000	8,000
WIP, ending	2,200	2,200	1,650 (2,200 × 75%)
Total units accounted for	10,200		
Work done to date		10,200	9,650

Financial Flow of Production		Cost of Production: DM	Cost of Production: Conversion
WIP, beginning	$ 8,240	$ 2,000	$ 6,240
Current costs	596,400	120,400	476,000
To account for	$604,640	$122,400	$482,240
Divide by equivalent units		10,200	9,650
Cost per equivalent unit	$61.97306	$12.0000	$49.97306
Application of total costs:			
Units completed and transferred to Dept. B	$495,784	$ 96,000 (8,000 × 12)	$399,784 (8,000 × 49.97306)
Ending WIP	108,856	26,400 (2,200 × 12)	82,456 (1,650 × 49.97306)
	$604,640	$122,400	$482,240

DM and conversion cost reconciliation	DM	Conversion
Current costs	$120,400	$476,000
Beginning inventory costs	2,000	6,240
All costs accounted for	$122,400	$482,240

Department B – weighted average

Physical Flow of Production	Physical Units	Transferred In	DM	Conversion
		Equivalent Units		
WIP, beginning	400			
Units transferred in	8,000			
To account for	8,400			
Good units completed and transferred	7,000	7,000	7,000	7,000
WIP ending				
1,000 units 75% completed	1,000	1,000	0	750
DM added after 95% completion			(1,000 × 0%)	(1,000 × 75%)
400 units 95% completed	400	400	400	380
			(400 × 100%)	(400 × 95%)
Accounted for	8,400			
Work done to date		8,400	7,400	8,130

Financial Flow of Production		Transferred In	DM	Conversion
		Cost of Production		
WIP, beginning (Con $6,000 + Tran $24,800)	$ 30,800	$ 24,800	$ 0	$ 6,000
Current costs	638,534	495,784	14,800	127,950
To account for	$669,334	$ 520,584	$14,800	$133,950
Divide by equivalent units		8,400	7,400	8,130
Cost per equivalent unit	$80.45021	$61.9742	$2.00	$16.47601
Application of total costs:				
Units completed and transferred to FG (7000)	$563,151	$433,819	$14,000	$115,332
Ending WIP:				
1,000 units 75% completed	74,331	61,974 (1,000 × 61.9742)	0 (1,000 × 0% × 2)	12,357 (1,000 × 75% × 16.4760)
400 units 95% completed	31,851	24,790 (400 × 61.9742)	800 (400 × 100% × 2)	6,261 (400 × 95% × 16.4760)
Total ending WIP	106,182			
Total costs accounted for	$669,333			
(minor differences due to rounding)		$520,583	$14,800	$133,950

Performance Management - Solutions

MA24 Solution: Process Costing - Transferred In Costs and Spoilage – Wargo Limited

Department A

Physical Flow of Production	Physical Units	Equivalent Units DM	Equivalent Units Conversion
WIP, beginning (60% complete)	25,000		
Units started	175,000		
To account for	200,000		
Good units completed and transferred	165,000	165,000	165,000
WIP, ending (75% complete)	30,000	30,000	22,500 (30,000 × 75%)
Total spoilage (normal and abnormal) (200,000 - 165,000 - 30,000)	5,000	5,000	4,000 (5,000 × 80%)
Total units accounted for	200,000		
Work done to date		200,000	191,500

Financial Flow of Production		Cost of Production DM	Cost of Production Conversion
WIP, beginning	$ 182,500	$ 97,500	$ 85,000
Current costs	1,583,250	612,500	970,750
To account for	$1,765,750	$710,000	$1,055,750
Divide by equivalent units		200,000	191,500
Cost per equivalent unit	$ 9.06	$3.55000	$5.51305
Application of total costs:			
Good units completed and transferred (165,000)	$1,495,403	$585,750 (165,000 × 3.55)	$909,653 (165,000 × 5.51305)
Normal spoilage (165,000 × 2% = 3,300)	26,269	11,715 (3,300 × 3.55)	14,554 (3,300 × 80% × 5.51305)
Total cost of goods transferred to Dept. B	$1,521,672		
Abnormal spoilage (5,000 - 3,300 = 1,700)	13,533	6,035 (1,700 × 3.5500)	7,498 (1,700 × 80% × 5.51305)
Ending WIP	230,544	106,500 (30,000 x 3.5500)	124,044 (30,000 × 75% × 5.51305)
Total costs accounted for (difference of $1 due to rounding)	$1,765,749	$710,000	$1,055,749

DM and conversion cost reconciliation

	DM	Conversion
Current costs	$612,500	$ 970,750
Beginning inventory costs	97,500	85,000
All costs accounted for	$710,000	$1,055,750

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Department B

Physical Flow of Production		Equivalent Units		
	Physical Units	Transferred In	DM	Conversion
WIP, beginning (90% complete)	15,000			
Units transferred in	165,000			
To account for	180,000			
Good units completed and transferred	160,000	160,000	160,000	160,000
WIP ending (50% complete)	10,000	10,000	0	5,000 (10,000 × 50%)
Total spoilage (normal and abnormal) (180,000 - 160,000 - 10,000)	10,000	10,000	0	9,500 (10,000 × 95%)
Accounted for	180,000			
Work done to date		180,000	160,000	174,500

Financial Flow of Production		Cost of Production		
WIP, beginning	$ 297,900	$ 135,900	$ 0	$ 162,000
Current costs	4,610,424	1,521,672	384,000	2,704,750
To account for	$4,908,324	$1,657,572	$384,000	$2,866,750
Divide by equivalent units		180,000	160,000	174,500
Cost per equivalent unit	$28.04	$9.20873	$2.40	$16.42837
Application of total costs:				
Good units completed and trfrd (160,000 units)	$4,485,936	$1,473,397	$384,000	$2,628,539
Normal spoilage (160,000 × 5% = 8,000)	198,526	73,670	0	124,856 (8,000 × 95% × 16.42837)
Total cost of goods transferred to FG	$4,684,462			
Abnormal spoilage write-off (10,000-8,000 = 2,000)	49,631	18,417 (2,000 × 9.20873)	0	31,214 (2,000 × 95% × 16.42837)
Ending WIP	174,229	92,087 (10,000 × 9.20873)	0	82,142 (5,000 × 16.42837)
Total costs accounted for (difference of $2 due to rounding)	$4,908,322	$1,657,571	$384,000	$2,866,751

Performance Management - Solutions

MA25 Solution: Process Costing – Transferred In Costs and Spoilage – Jerdi's Manufacturing Limited

Department A – FIFO

Physical Flow of Production		Equivalent Units	
	Physical Units	DM	Conversion
WIP, beginning (75% complete)	4,000		
Units started	20,000		
To account for	24,000		
Good units completed and transferred	19,000	19,000	19,000
WIP, ending (80% complete)	3,500	3,500	2,800 (3,500 × 80%)
	22,500		
Spoilage, inspection at 90%_ (24,000 - 22,500 = 1,500):			
Normal spoilage (19,000 × 5% = 950)	950	950	855 (950 x .90)
Abnormal spoilage (1,500 - 950 = 550) (only 90% of conversion cost applied to spoilage b/c inspection at 90%)	550	550	495 (550 x 90%)
Total units accounted for	24,000		
Work done to date		24,000	23,150
Less: work done on beginning inventory in prior period:			
DM (100% applied)		(4,000)	
Conversion (75% applied)			(3,000) (4,000 × 75%)
Work done during current period		20,000	20,150

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Financial Flow of Production		Cost of Production	
WIP, beginning (DM 42,000 + ConC 21,000)	$ 63,000	-	-
Current costs	365,230	$200,000	$165,230
To account for	$428,230		
Divide by equivalent units		20,000	20,150
Cost per equivalent unit	$8.20	$10.00	$8.20
Application of total costs:			
Good units started and completed (19,000 – 4,000)	$273,000	$150,000 (15,000 x 10)	$123,000 (15,000 x 8.20)
Beginning inventory costs:			
Beginning inventory – previously completed	63,000	42,000	21,000
Material (0% added b/c added last period)	0	0	-
Conversion cost (25% added b/c 75% done last period)	8,200	-	8,200 (4,000 x 25% x 8.20)
Cost of normal spoilage	16,511	9,500 (950 x 10)	7,011 (855 x 8.20)
Total cost of goods transferred to Department B	$360,711	$201,500	$159,211
Abnormal cost (write-off)	9,559	5,500 (550 × 10)	4,059 (495 × 8.20)
Ending WIP	57,960	35,000 (3,500 × 10)	22,960 (2,625 × 8.20)
Total costs accounted for	$428,230		
		$242,000	$186,230
DM and conversion cost reconciliation			
	Current costs	$200,000	$165,230
	Beginning inventory costs	42,000	21,000
	All costs accounted for	$242,000	$186,230

Performance Management - Solutions

Department B – FIFO

Physical Flow of Production	Physical Units	Transferred In	DM	Conversion
		Equivalent Units		
WIP, beginning (70% complete)	2,500			
Units transferred in	19,000			
To account for	21,500			
Good units completed and transferred	17,500	17,500	17,500	17,500
WIP ending (85% complete); DM added at 98%	3000	3,000	0 (3000 × 0%)	2,550 (3,000 × 85%)
Spoilage (total = 1,000 units):				
Normal spoilage (17,500 × 4%)	700	700	0	665 (700 x 95%)
Abnormal spoilage (1,000 - 700) (no DM added and 95% conv. applied) (no DM added and 95% conversion applied)	300	300	0	285 (300 x 95%)
Work done to date	21,500	21,500	17,500	21,000
Less: work done on beginning inventory in prior period No material (added this period), all transfer in, conversion at 70%		(2,500) (2,500 x 100%)	0	(1750) (2,500 x 70%)
Work done during current period		19,000	17,500	19,250

Financial Flow of Production		Transferred In	DM	Conversion
		Cost of Production		
WIP, beginning (Con $26,250 + Tran $45,500)	$ 71,750	--	--	--
Current costs	674,836	$360,711	$42,875	$271,250
To account for	$746,586	$360,711	$42,875	$271,250
Divide by equivalent units		19,000	17,500	19,250
Cost per equivalent unit	$35.53	$ 18.98479	$2.45	$14.09091
Application of total costs:				
Units started and completed (17,500 - 2,500 = 15,000)	$532,886	$284,772 (15,000 x 18.98479)	$36,750 (15,000 x 2.45)	$211,364 (15,000 x 14.09)
Beginning inventory costs:				
Beginning inventory – previously completed	71,750	45,500	0	26,250
Transfer in (0% added)	0	0	-	-
Material (100% added this period)	6,125	-	6,125 (2,500 x 2.45)	-
Conversion cost (30% added this period)	10,568	-	-	10,568 (2,500 x 30% x 14.09091)
Normal spoilage	22,659	13,289 (700 x 18.98479)	0	9,370 (700 x 95% x 14.09)
Total cost of goods transferred to FG	$643,988			
Abnormal spoilage	9,711	5,695 (300 x 18.98479)	0	4,016 (300 x 95% x 14.09091)
Ending WIP – 85% completed	92,886	56,954 (3,000 x 18.98479)	0	35,932 (3,000 x 85% x 14.09091)
Total costs accounted for	$746,585			
(difference of $1 due to rounding)		$406,210	$42,875	$297,500

Department A - weighted average method

Physical Flow of Production	Physical Units	Equivalent Units DM	Equivalent Units Conversion
WIP, beginning (75% complete)	4,000		
Units started	20,000		
To account for	24,000		
Units completed and transferred	19,000	19,000	19,000
WIP, ending (80% complete)	3,500	3,500	2,800
			(3,500 × 80%)
Spoilage (24,000 - 22,500 = 1,500):			
Normal spoilage (19,000 × 5% = 950)	950	950	855
			(950 x 90%)
Abnormal spoilage (1,500 - 950 = 550)	550	550	495
(only 90% of conversion cost applied to spoilage)			(550 x 90%
Total units accounted for	24,000		
Work done to date		24,000	23,150

Financial Flow of Production		Cost of Production DM	Cost of Production Conversion
WIP, beginning	$ 63,000	$ 42,000	$ 21,000
Current costs	365,230	200,000	165,230
To account for	$428,230	$242,000	$186,230
Divide by equivalent units		24,000	23,150
Cost per equivalent unit	$18.12782	$10.08333	$8.04449
Application of total costs:			
Good units completed and transferred (19,000)	$344,428	$191,583	$152,845
		(19,000 x 10.08333)	(19,000 x 8.04449)
Cost of normal spoilage	16,457	9,579	6,878
		(950 x 10.08333)	(855 x 8.04449)
Total cost of goods transferred to Dept. B	$360,885		
Abnormal cost (write-off)	9,528	5,546	3,982
		(550 x 10.08333)	(455 x 8.04449)
Ending WIP	57,817	35,292	22,525
		(3,500 × 10.08333)	(2,800 × 8.04449)
Total costs accounted for	$428,231		
(difference of $1 due to rounding)		$242,000	$186,230
DM and conversion cost reconciliation			
Current costs		$200,000	$165,230
Beginning inventory costs		42,000	21,000
All costs accounted for		$242,000	$186,230

Department B – weighted average method

Physical Flow of Production	Physical Units	Equivalent Units: Transferred In	DM	Conversion
WIP, beginning	2,500			
Units Transferred in	19,000			
To account for	21,500			
Good units completed and transferred	17,500	17,500	17,500	17,500
WIP ending (85% complete); DM added at 98%	3,000	3,000	0 (3,000 × 0%)	2,550 (3,000 × 85%)
Spoilage (1,000 units):				
Normal spoilage (17,500 × 4%)	700	700	0	665 (700 x 95%)
Abnormal spoilage (1,000 - 700) (no DM added and 95% conversion applied)	300	300	0	285 (300 x 95%)
Accounted for	21,500			
Work done to date		21,500	17,500	21,000

Financial Flow of Production		Cost of Production: Transferred In	DM	Conversion
WIP, beginning	$ 71,750	$ 45,500	$ 0	$ 26,250
Current costs	675,010	360,885	42,875	271,250
To account for	$746,760	$406,385	$42,875	$297,500
Divide by equivalent units		21,500	17,500	21,000
Cost per equivalent unit	$35.51829	$18.90162	$2.45	$14.16667
Application of total costs:				
Good units completed and transferred (17,500)	$621,570	$330,778 (17,500 x 18.90162)	$42,875 (17,500 x 2.45)	$247,917 (17,500 x 14.16667)
Normal spoilage	22,652	13,231 (700 x 18.90162)	0	9,421 (665 x 14.16667)
Total cost of goods transferred to FG	$644,222			
Abnormal spoilage	9,708	5,670 (300 x 18.90162)	0	4,038 (285 x 14.16667)
Ending WIP – 85% completed	92,830	56,705 (3,000 x 18.90162)	0	36,125 (2,550 x 14.16667)
Total costs accounted for	$746,760			
		$406,384	$42,875	$297,501

MA26 Solution: Process Costing – Transferred In Costs and Spoilage – Rauz Incorporated

Department A

Physical Flow of Production	Physical Units	Equivalent Units: DM	Equivalent Units: Conversion
WIP, beginning	3,100		
Units started	64,400		
To account for	67,500		
Units completed and transferred	60,000	60,000	60,000
WIP, ending	4,000	4,000	1,400 (4,000 × 35%)
Spoilage (67,500 - 64,000 = 3,500):			
Normal spoilage (60,000 × 5% = 3,000)	3,000	3,000	2,550 (3,000 X 85%)
Abnormal spoilage (3,500 - 3,000 = 500) (only 85% of conversion applied to spoilage)	500	500	425 (500 X 85%)
Total units accounted for	67,500		
Work done to date		67,500	64,375
Less: work done on beginning inventory in prior period:			
DM (100% applied b/c DM added last period)		(3,100)	
Conversion (70% applied b/c 70% added last period)			(2,170) (3,100 × 70%)
Work done during current period		64,400	62,205

Financial Flow of Production		Cost of Production: DM	Cost of Production: Conversion
WIP, beginning (DM 21,700 + conv. 11,935)	$ 33,635	-	-
Current costs	314,975	$183,300	$131,675
To account for	$348,610		
Divide by equivalent units		64,400	62,205
Cost per equivalent unit	$4.96306	$2.84627	$2.11679
Application of total costs:			
Units started and completed (60,000 – 3,100)	$282,398	$161,953 (56,900 x 2.84627)	$120,445 (56,900 x 2.11679)
Cost of beginning inventory:			
Beg. Inventory – previously completed	33,635	21,700	11,935
Material (0% added b/c added last period)	0	0	-
Conversion cost (30% added this period)	1,969	-	1,969 (3,100 x 30% x 2.11679)
Cost of normal spoilage	13,937	8,539 (3,000 x 2.84627)	5,398 (2,550 x 2.11679)
Total cost of goods transferred to Dept. B	$331,939		
Abnormal cost (write-off)	$ 2,323	$ 1,423 (500 x 2.84627)	$ 900 (425 x 2.11679)
Ending WIP	14,349	11,385 (4,000 x 2.84627)	2,964 (1,400 x 2.11679)
Total costs accounted for (difference of $1 due to rounding)	$348,611	$205,000	$143,611
DM and conversion cost reconciliation			
Current costs		$183,300	$131,675
Beginning inventory costs		21,700	11,935
All costs accounted for		$205,000	$143,610

Department B

Physical Flow of Production	Physical Units	Equivalent Units: Transf. In	DM	Conversion
WIP, beginning (60% complete)	4,500			
Units transferred in	60,000			
To account for	64,500			
Good units completed and transferred	52,000	52,000	52,000	52,000
WIP, ending (80% complete) DM added @ 75% and CC evenly	6,500	6,500	6,500	5,200 (6,500 × 80%)
Spoilage (64,500 - 58,500 = 6,000):				
Normal spoilage (52,000 × 8%)	4,160	4,160	4,160	3,952 (4,160 x 95%)
Abnormal spoilage (6,000 – 4,160)	1,840	1,840	1,840	1,748 (1,840 x 95%)
Work done to date	64,500	64,500	64,500	62,900
Less: work done on beginning inv. in prior period:				
No material added b/c added last perid, all trnsfrd in completed last period		(4,500)	0	0
Conversion (60% complete in prior period)		0	0	(2,700) (4,500 x 60%)
Work done during current period		60,000	64,500	60,200

Financial Flow of Production		Cost of Production: Transf. In	DM	Conversion
WIP, beginning (con $46,000 + tran. $24,000)	$ 0,000	--	--	--
Current costs	2,028,939	$331,939	$1,080,000	$617,000
To account for	$2,098,939	$331,939	$1,080,000	$617,000
Divide by equivalent units		60,000	64,500	60,200
Cost per equivalent unit	$32.5268	$5.53232	$16.74419	$10.24917
Application of total costs:				
Good units started and completed (52,000 - 4,500 = 47,500)	$1,544,970	$262,785 (47,500 x 5.53232)	$795,349 (47,500 x 16.74419)	$486,836 (47,500 x 10.24917)
Cost of beginning inventory:				
Beginning inventory – completed in prior period	70,000	24,000	0	46,000
Additional costs to complete beg inventory this period:				
Beginning inventory – transfer in (0% added)	0	0	0	0
Material (100% added)	75,349	0	75,349 (4,500 x 16.74419)	0
Conversion cost (40% added)	18,449	-	-	18,449 (4,500 x 40% x 10.24917)
Normal spoilage	133,175	23,014 (4,160 x 5.53232)	69,656 (4,160 x 16.74419)	40,505 (3,952 x 10.24917)
Total goods transferred to FG	$1,841,943			
Abnormal spoilage (write-off)	58,904	10,179 (1,840 x 5.53232)	30,809 (1,840 x 16.74419)	17,916 (1,748 x 10.24917)
Ending – 80% completed	198,093	35,960 (6,500 x 5.53232)	108,837 (6,500 x 16.74419)	53,296 (5,200 x 10.24917)
Total costs accted for (difference of $1 due to rounding)	$2,098,940			
		$355,938	$1,080,000	$663,002
DM and conversion cost reconciliation				
Current period costs		$331,939	$1,080,000	$617,000
Beginning inventory costs		24,000	0	46,000
All costs accounted for		$355,939	$1,080,000	$663,000

MA27 Solution: Process Costing Multiple Choice – Oma Inc.

1. (d) $242,000

2. (b) $682,500

3. (c) $1,007,500

Supporting calculations are on the next page.

Supporting calculations:

Note: Bolded items are calculated values (i.e. not given in the question)

Oma Inc.
Production Cost Report
for the month of November 2000

	Physical Units	Equivalent Units: Direct Materials	Equivalent Units: Conversion Costs
Flow of Production			
Beginning WIP	3,000		
Started	12,000		
To account for	15,000		
Completed and transferred out	14,000	14,000	14,000
WIP, ending	1,000	350	200
		(1,000 @ 35%)	(1,000 @ 20%)
Accounted for:	15,000		
Equivalent units for work done in prior period		(2,250) [3,000 (75%)]	(1,200) [3,000 (40%)]
Work done during current period only		12,100	13,000

		Production Cost: Direct Materials	Production Cost: Conversion Costs
Beginning WIP	$100,500	N/A[1]	N/A[1]
Current costs	$924,500	**$242,000**	**$682,500**
To account for	$1,025,000		
Divide by equivalent units		÷ 12,100	÷ 13,000
Cost per equivalent unit		$20.00	$52.50
Application of costs:			
WIP, ending			
Direct materials	$7,000	350 ($20)	
Conversion	10,500		200 ($52.50)
	$17,500		
Completed and transferred out:			
Beginning WIP	$100,500		
Costs to complete beginning WIP	109,500	750 ($20)	1800 ($52.50)
Started and completed in current period (12,000 - 1,000) = 11,000	797,500	11,000 ($20)	11,000 ($52.50)
	$1,007,500		
Accounted for	$1,025,000		

[1] Not applicable because incurred in prior period (FIFO isolates costs and production to current period only).

 Please report errors or omissions to studymanual_errata@cmaontario.org

MA28 Solution: Process Costing – Normal and Abnormal Spoilage – Oil Lite Ltd.

1. 20,200 units (see production cost report on next page)

2. a) $8,900
   b) $46,200
   c) 20,200 and 20,300
   d) $388,300

See production cost report on following pages for detailed calculations.

3. a) $8,799.39
   b) $45,650.22
   c) 24,200 and 22,300
   d) $388,948.86

See production cost report on following pages for detailed calculations.

Oil Lite Ltd.
Production Cost Report – FIFO
October 31

	Physical Units	Equivalent Units: Direct Materials	Equivalent Units: Conversion Costs
WIP, beginning	4,000		
Started	20,200		
To account for	24,200		
Abnormal spoilage	500	500	400 (500 x 80%)
Normal spoilage	700	700	700
Completed and transferred out	20,000	20,000	20,000
WIP, ending	3,000	3,000 (3000 x 100%)	1,200 (3000 x 40%)
Units accounted for	24,200		
Work done to date		24,200	22,300
Less: work done in previous period on beginning inventory		(4,000) [4000 x 100%]	(2,000) [4000 x 50%]
Work done in current period only		20,200	20,300

	Total Costs	Production Cost: Direct Materials	Production Cost: Conversion Costs
WIP, beginning	$59,000	N/A	N/A
Current costs	384,400	$262,600	$121,800
Total costs to account for	$443,400	$262,600	$121,800
Divide by equivalent units		÷ 20,200	÷ 20,300
Cost per equivalent unit		$13.00	$6.00
Application of costs:			
Abnormal spoilage	$8,900	500 ($13)	400 ($6)
WIP, ending:			
Direct materials	$39,000	3000 ($13)	
Conversion	7,200		1,200 ($6)
	$46,200		
Completed and transferred out:			
WIP, beginning	$59,000	$48,000	$11,000
Cost to complete beginning inventory	12,000	0	2,000 ($6)
Good units started and completed during current period	304,000 [1]	16,000 ($13)	16,000 ($6)
Normal spoilage	13,300	700 ($13)	700 ($6)
	$388,300		
Costs accounted for:	$443,400		

[1] Good units started and completed during current period:

Units started	20,200
Less: normal spoilage	(700)
Less: abnormal spoilage	(500)
Less: ending WIP	(3,000)
	16,000

Oil Lite Ltd.
Production Cost Report – Weighted Average
October 31

	Physical Units	Equivalent Units Direct Materials	Conversion Costs
WIP, beginning	4,000		
Started	20,200		
To account for	24,200		
Abnormal spoilage	500	500	400 (500 x 80%)
Normal spoilage	700	700	700
Completed and transferred out	20,000	20,000	20,000
WIP, ending	3,000	3,000 (3000 x 100%)	1,200 (3000 x 40%)
Units accounted for	24,200		
Work done to date		24,200	22,300

	Total Costs	Production Cost Direct Materials	Conversion Costs
WIP, beginning	$59,000	48,000	11,000
Current costs	384,400	$262,600	$121,800
Total costs to account for	$443,400	$310,600	$132,800
Divide by equivalent units		÷ 24,200	÷ 22,300
Cost per equivalent unit		$12.8347	$5.9551
Application of costs:			
Abnormal spoilage	$8,799.39	500 ($12.8347)	400 ($5.9551)
WIP, ending:			
Direct materials	$38,504.10	3000 ($12.8347)	
Conversion	7,146.12		1,200 ($5.9551)
	$45,650.22		
Completed and transferred out to FG:			
Good units 20,000 x $18.7898	$375,796.00		
Normal spoilage 700 x $18.7898	13,152.86		
	$388,948.86		
Costs accounted for:	$443,398.47 [1]		

1. Minor difference of $1.53 due to rounding.

Performance Management - Solutions

MA29 Solution: Direct vs. Absorption Costing – Broadcast Inc.

(a) Absorption Costing Income Statement:

	Per Unit		Volume	Total
Revenue	$86		50,000	$4,300,000
Cost of goods sold:				
Production costs	$48	(i)	65,000	$3120,000
Less: ending inventory	$48		(15,000)	(720,000)
Cost of goods sold	$48		50,000	$2,400,000
Gross margin				$1,900,000
Selling, general and administrative expenses			(ii)	990,000
Net income before tax				$910,000

(i) Fixed overhead cost per unit = $455,000/ 65,000= $7
Total product cost per unit
= direct material and direct labour + variable overhead + fixed overhead
= $28 + $13 + $7 = $48
(ii) Total selling, general and administrative cost = $765,000+ ($4.50) (50,000 units sold)
= $990,000

(b) Contribution Income Statement:

	Per Unit		Volume	Total
Revenue	$86.00		50,000	$4,300,000
Variable production costs:				
Cost of goods sold:				
Variable production costs	$41.00	(i)	65,000	$2665,000
Variable ending inventory	$41.00		(15,000)	(615,000)
Variable cost of goods sold	$41.00		50,000	2,050,000
Variable selling, general and administrative	$4.50		50,000	225,000
Total variable costs				$2.275,000
Contribution margin				$2,025,000
Fixed costs:				
Manufacturing				$455,000
Selling, general and administrative				765,000
Total fixed costs				$1,220,000
Net income before tax				$805,000

(i) Variable product cost per unit
= direct material and direct labour + variable overhead
= $28 + $13 = $41

(c) Reconciliation of Absorption and Contribution Net Incomes

Net income absorption before tax	$910,000
Net income contribution before tax	805,000
Difference	$105,000
Units in ending inventory	15,000
Units in beginning inventory	0
Change [increase/(decrease)]	15,000
Fixed overhead cost/unit ($455,000 ÷ 65,000 units)	x $7.00
Change in inventory x fixed cost/unit	$105,000

Net income is higher under absorption costing because an additional $105,000 of the fixed manufacturing overhead resides in inventory at the end of the period. Any costs assigned to inventory are held on the balance sheet and are not expensed on the income statement until the units are sold.

Alternative Solutions:

Formula #1

Absorption costing income	–	variable costing income	=	fixed manufacturing in ending inventory	–	fixed manufacturing in beginning inv.
			=	(7 x 15,000)	–	(7 x 0)
			=	105,000		

Formula #2

Absorption costing income	–	variable costing income	=	(units produced – units sold)	x	budgeted fixed manufac. O/H rate
			=	(65,000-50,000)	x	7
			=	105,000		

Formula #3

Absorption costing income	–	variable costing income	=	(ending inv. – beginning inv.)	x	budgeted fixed manufac. O/H rate
			=	(15,000-0)	x	7
			=	105,000		

MA30 Solution: Direct vs. Absorption Costing – Aristotle Inc.

(a) Absorption Costing Income Statement:

	Per Unit		Volume		Total
Revenue	$24		130,000		$3,120,000
Cost of goods sold:					
Beginning inventory	$15	(i)	12,000		$180,000
Production costs	$15		135,000		2,025,000
Cost of goods available for sale	$15		147,000		2,205,000
Less: ending inventory	$15		(17,000)		(255,000)
Cost of goods sold	$15		130,000		$1,950,000
Gross margin					$1,170,000
Selling, general and administrative expenses				(ii)	442,000
Net income before tax					728,000
Income tax (40%)					291,200
Net income after tax					$436,800

(i) Since Aristotle utilizes a standard cost system, all costs are at standard.
Calculation:
Fixed overhead cost per unit = $405,000/135,000= $3
Total product cost per unit @ standard:
= direct material and direct labour + variable manufacturing overhead
= $9 + $3 + $3 = $15

(ii) Total selling, general and administration cost = $156,000 + ($2.20) (130,000 units sold)

(b) Contribution Income Statement:

	Per Unit		Volume	Total
Revenue	$24.00		130,000	$3,120,000
Variable production costs:				
Cost of goods sold:				
Variable beginning inventory	$12.00	(i)	12,000	$144,000
Variable production costs	$12.00		135,000	1,620,000
Cost of goods available for sale	$12.00		147,000	1,764,000
Less: variable ending inventory	$12.00		(17,000)	(204,000)
Variable cost of goods sold	$12.00		130,000	1560,000
Variable selling, general and administrative	$2.20		130,000	286,000
Total variable costs				$1,846,000
Contribution margin				$1,274,000
Fixed costs:				
Manufacturing				$405,000
Selling, general and administrative expenses				156,000
Total fixed costs				$561,000
Net income before tax				713,000
Income tax (40%)				285,200
Net income after tax				$427,800

(i) Variable product cost per unit
= direct material and direct labour + variable manufacturing overhead
= $9 + $3 = $12

Performance Management - Solutions

(c) Reconciliation of Absorption and Contribution Net Incomes

Net income absorption before tax		$728,000
Net income contribution before tax		713,000
Difference		15,000
Units in ending inventory		17,000
Units in beginning inventory		12,000
Change [increase/(decrease)]		5,000
Fixed overhead cost/unit	($405,000 / 135,000 units)	$3.00
Change in inventory x fixed cost/unit		$15,000

Net income is higher under absorption costing because an additional $15,000 of fixed manufacturing overhead resides in inventory at the end of the period as compared to the beginning of the period. Whatever costs are placed in inventory are held on the balance sheet and are not expensed on the income statement until the units are sold.

Alternative solutions:

Formula #1

Absorption costing income	–	variable costing income	=	fixed manufacturing in ending inv	–	fixed manufacturing in beginning inv.
			=	(3 x 17,000)	–	(3 x 12,000)
			=	15,000		

Formula #2

Absorption costing income	–	variable costing income	=	(units produced – units sold)	x	budgeted fixed manufac. O/H rate
			=	(135,000-130,000)	x	3
			=	15,000		

Formula #3

Absorption costing income	–	variable costing income	=	(ending inv. – beginning inv.)	x	budgeted fixed manufac. O/H rate
			=	(17,000-12,000)	x	3
			=	15,000		

MA31 Solution: Direct vs. Absorption Costing – Hoeley Ltd.

(a) Absorption Costing Income Statement:

	Per Unit		Volume		Total
Revenue	$46		52,000		$2,392,000
Cost of goods sold:					
Beginning inventory @ standard	$22	(i)	11,000		$242,000
Production costs @ standard	$22		56,000		1,232,000
Cost of goods available @ standard	$22		67,000		1,474,000
Less: ending inventory @ standard	$22		(15,000)		(330,000)
Cost of goods sold @ standard	$22		52,000		1,144,000
Variances:					
Variable cost variances (given)			(ii)	U	6,924
Fixed overhead spending (see next page)			(ii)	F	(10,450)
Fixed overhead volume (see next page)			(ii)	U	15,750
Cost of goods sold					$1,156,224
			Net to 5300 U		
Gross margin					$1,235,776
Selling, general and administrative expenses				(iii)	679,600
Income before tax					556,176
Income tax (40%)					222,470
Net income after tax					$333,706

(i) Fixed overhead cost per unit = $267,750 ÷ 59,500 = $4.50
Total product cost per unit
= direct material and direct labour + variable overhead + fixed overhead
= $14.25 + $3.25 + $4.50 = $22

(ii) Unfavourable variances increase cost and favourable variances decrease cost.

(iii)Total cost = $560,000 + ($2.30)(52,000 units sold)

Variance calculations:
Predetermined fixed manufacturing overhead rate
= budgeted fixed overhead/estimated volume
= $267,750 / 59,500
= $4.50/unit

Applied fixed overhead
= predetermined overhead rate x actual volume
= $4.50 x 56,000
= $252,000

Actual fixed overhead	Budgeted fixed overhead	Applied fixed overhead
$257,300	$267,750	$252,000

Spending variance	Production volume variance
$10,450 favourable	$15,750 unfavourable

Total = 5,300 U; under-applied = 5,300

(b) Contribution Income Statement:

	Per Unit		Volume		Total
Revenue	$46.00		52,000		$2,392,000
Variable costs:					
Cost of goods sold:					
Beginning inventory @ standard	$17.50	(i)	11,000		$192,500
Production costs @ standard	$17.50		56,000		980,000
Cost of goods available @ standard	$17.50		67,000		1,172,500
Less: ending inventory @ standard	$17.50		(15,000)		(262,500)
Cost of goods sold @ standard	$17.50		52,000		910,000
Variable variances			(ii)	U	6,924
Costs of goods sold					916,924
Variable selling, general and administrative	$2.30		52,000		119,600
Total variable costs					$1,036,524
Contribution margin					$1,355,476
Fixed costs:					
Manufacturing					$257,300
Selling, general and administrative expenses					560,000
Total fixed costs					$817,300
Income before tax					$538,176
Income tax (40%)					215,270
Net income after tax					$322,906

(i) Variable product cost per unit
= direct material and direct labour + variable overhead
= $14.25 + $3.25 = $17.50

(ii) Unfavourable variances increase cost and favourable variances decrease cost.

(c) Reconciliation of Absorption and Contribution Net Incomes

Income before tax – absorption		$556,176
Income before tax – contribution		$538,176
Difference		$18,000
Units in ending inventory		15,000
Units in beginning inventory		11,000
Change [increase/(decrease)]		4,000
Fixed cost/unit	($267,750 ÷ 59,500 units)	$4.50
Change in inventory x fixed cost per unit		$18,000

Alternative solutions:

<u>Formula #1</u>

Absorption costing income	–	variable costing income	=	fixed manufacturing in ending inv	–	fixed manufacturing in beginning inv.
			=	(4.50 x 15,000)	–	(4.50 x 11,000)
			=	18,000		

<u>Formula #2</u>

Absorption costing income	–	variable costing income	=	(units produced – units sold)	x	budgeted fixed manufac. O/H rate
			=	(56,000-52,000)	x	4.50
			=	18,000		

<u>Formula #3</u>

Absorption costing income	–	variable costing income	=	(ending inv. – beginning inv.)	x	budgeted fixed manufac. O/H rate
			=	(15,000-11,000)	x	4.50
			=	18,000		

MA32 Solution: Direct vs. Absorption Costing – HRL Inc.

Fixed overhead :

Note that the question states there is no spending variance, but a production volume variance of \$14,000 favourable. This can be depicted as:

Actual	Flexible Budget	Applied
\$84,000 given	\$84,000 [\$84,000 + 0 = \$84,000]	84,000 + 14,000 98,000

spending variance = 0 (given)

production volume variance = 14,000 F (given)

Over-applied = \$14,000 (favourable variance) [calculation: 0 + 14,000]

Units in beginning inventory	Given in question	0
Units produced	Applied OH ÷ POR = \$98,000 ÷ 7 =	14,000
Units sold	sales ÷ SP per unit = \$340,000 ÷ 34 =	10,000
Units in ending inventory	BI + production - EI	4,000

(a) Contribution Income Statement

Sales (10,000 units x $34 per unit)		$340,000
Variable costs:		
Direct material (10,000 units x $6)	$60,000	
Direct labour (10,000 units x $5.50)	55,000	
Variable overhead (10,000 units x $3)	30,000	
Variable selling (10,000 units x $1.50)	15,000	
Total variable costs (10,000 units x 16)		160,000
Contribution margin		180,000
Fixed costs:		
Manufacturing	$84,000	
Selling	48,000	
Total fixed costs		132,000
Income (loss) before tax		$ 48,000

Reported net income (absorption)	$76,000
Recalculated net income (contribution)	48,000
Difference	$28,000

Absorption income statement

Sales (10,000 units x $34 per unit)		$340,000
Cost of sales:		
Direct material (10,000 units x $6)	$60,000	
Direct labour (10,000 units x $5.50)	55,000	
Variable overhead (10,000 units x $3)	30,000	
	145,000	
Fixed O/H (10,000 x $7)	70,000	215,000
Gross margin @ standard		125,000
Production volume variance favourable		14,000
Gross margin @ actual		139,000
Selling, general and administration		63,000
Income (loss) before tax		$76,000

Reported net income (absorption)	$76,000
Recalculated net income (contribution)	48,000
Difference	$28,000

Reconciliation:

Volume calculations:

Actual sales volume		
$340,000 ÷ 34		10,000
Budgeted sales volume		
$476,000 ÷ 34		14,000
Budgeted monthly production volume		
144,000 ÷ 12 months		12,000
Actual production volume		
Budgeted monthly production volume	12,000	
Production volume variance		
= $14,000 ÷ predetermined mftg. OH rate (given)		
= $14,000 ÷ 7	2,000	14,000

Change in inventory:		
Beginning inventory		0
Ending inventory:		
Actual production	14,000	
Less: sales	10,000	4,000
Increase (decrease) in inventory		4,000
Predetermined manufacturing OH rate (given)		7.00
Change in inventory x fixed cost/unit		$28,000

Alternative Solutions:

Formula #1

Absorption costing income	–	variable costing income	=	fixed manufacturing in ending inventory	–	fixed manufacturing in beginning inv.
			=	(7 x 4,000)	–	(7 x 0)
			=	28,000		

Formula #2

Absorption costing income	–	variable costing income	=	(units produced – units sold)	x	budgeted fixed manufac. O/H rate
			=	(14,000 - 10,000)	x	7
			=	28,000		

Formula #3

Absorption costing income	–	variable costing income	=	(ending inv. – beginning inv.)	x	budgeted fixed manufac. O/H rate
			=	(14,000 - 10,000)	x	7
			=	28,000		

MA33 Solution: Direct vs. Absorption Costing – Oma Company

1.

Predetermined overhead rate $= \dfrac{\$810{,}000}{540{,}000 \text{ hours}}$

$= \$1.50/\text{DLH}$

Conversion of rate to a per unit cost = $1.50/DLH x 3 hours required per unit

= $4.50/unit

Manufacturing overhead applied:

Units manufactured:	
Units sold	160,000
Units in beginning inventory	(50,000)
Units in ending inventory	63,000
Units manufactured	173,000
Predetermined overhead rate per unit	x $4.50
	$778,500

Calculation of over- or under-applied overhead:

Actual overhead	$795,000
Applied overhead	778,500
Under-applied overhead	$16,500

Components of the under-applied overhead:

Difference in the numerator (estimated overhead vs. actual overhead)

Estimated overhead	$810,000		
Actual overhead	795,000	$15,000	over

Difference in the denominator:

Estimated production:			
(540,000 hours ÷ 3 hrs/unit)	180,000		
Actual production	173,000		
	7,000		
Predetermined overhead rate	x $4.50	$31,500	under
		$16,500	under

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2.

Oma Company
Direct Costing Income Statement
for the year ended December 31, 2000

	Unit	Total (160,000 units) [2]
Sales	$55.00	$8,800,000
Variable expenses:		
Direct materials	$5.00	
Direct labour ($12 x 3 hrs)	$36.00	
Variable overhead	$2.50	
Variable selling and admin.	$1.50	
Total variable expenses	$45.00	$7,200,000
Contribution margin	$10.00	$1,600,000
Fixed expenses:		
Manufacturing		$795,000 [1]
Selling and administrative		450,000
Total fixed expenses		$1,245,000
Pre-tax operating income		$355,000

[1] Since fixed manufacturing costs are not applied to products, the actual manufacturing overhead cost is used to calculate income. There will not be any under- or over-applied overhead.
[2.] Units sold = 160,000, which is given in the question. Note that the conventional method of calculating units sold is:

Beginning inventory	50,000	Given in question
Manufactured	173,000	Calculated: 160,000 + 63,000 – 50,000
Ending inventory	(63,000)	Given in question
Units sold	160,000	Given in question

However, since the question provides the units sold, it is not necessary to go through this calculation. In addition, the question indicates that variable costs per unit are consistent year-over-year, which means the unit cost of beginning inventory is the same as the unit cost of the current year's production. Since the variable cost per unit is identical year-over-year, it is not necessary to calculate costs separately for beginning inventory, manufactured and ending inventory.

3.

Oma Company
Absorption Costing Income Statement
for the year ended December 31, 2000

		Total (160,000 units)[2]
Sales		$8,800,000
Cost of goods sold:		
Finished goods, beginning	$2,400,000	
Cost of goods manufactured	8,304,000	
Cost of goods available for sale	$10,704,000	
Finished goods, ending	(3,024,000) [1]	
	$7,680,000	
Under (over) applied overhead	16,500	7,696,500
		$1,103,500
Less:		
Variable selling and administration	$240,000	
Fixed selling and administration	450,000	690,000
Pre-tax operating income		$413,500

[1] Finished goods, ending:
63,000 units x ($5 (DM) + $36 (DL) + $2.50 (VOH) + $4.50 (Fixed OH))
= $3,024,000

[2.] Units sold = 173,000 manufactured minus 63,000 in ending inventory = 160,000

Oma Company
Schedule of Cost of Goods Manufactured
for the year ended December 31, 2002

Direct materials (173,000 units x $5)	$865,000
Direct labour (173,000 units x $36)	6,228,000
Variable overhead (173,000 units x $2.50)	432,500
Fixed overhead (173,000 units x $4.50)	778,500
	$8,304,000

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4.

Operating income under direct costing		$355,000
Operating income under absorption costing		$413,500
	Difference	$58,500

The difference can be explained as:

Units in ending inventory	63,000
Units in beginning inventory	50,000
Increase in inventory	13,000
Fixed overhead rate	x $4.50
	$58,500

Performance Management - Solutions

MA34 Solution: Direct vs. Absorption Costing – Butron Company

a.

Sales (20,000 x $60)		$1,200,000
Variable costs (20,000 x $30)		600,000
Contribution margin		600,000
Fixed costs		380,000
Operating income		$220,000

b.

Sales (20,000 x $60)		$1,200,000
Cost of goods sold		
Opening inventory: 2,000 x (30 + 9*)	$ 78,000	
Cost of goods manufactured		
Variable costs – 24,000 x $30	720,000	
Fixed costs	180,000	
Ending inventory		
6,000 x (30 + 7.50**)	(225,000)	753,000
Gross margin		447,000
Selling and administrative expenses		200,000
Operating income		$247,000

c.

Difference in income	
Fixed costs in opening inventory: 2,000 x $9	($18,000)
Fixed costs in ending inventory: 6,000 x $7.50	45,000
	$27,000

* $180,000 / 20,000 units produced last year
** $180,000 / 24,000 units produced this year

MA35 Solution: Direct vs. Absorption Costing – Northway Corporation

a. Although sales volume increased by 100,000 kg causing an increase in contribution margin, because inventories went down significantly since last year, much of the fixed costs that had accumulated in the opening inventories were released to cost of goods sold during the year.

b. i.

Sales		$11,200,000
Variable costs		
Opening inventory: 600,000 x $5	$3,000,000	
Cost of goods manufactured: 500,000 x $5.50	2,750,000	
Less: ending inventory: 100,000 x $5.50	(550,000)	5,200,000
Contribution margin		6,000,000
Fixed costs		
Manufacturing	3,300,000	
Selling and administrative	1,500,000	4,800,000
Operating Income		$1,200,000

ii.

Fixed costs in opening inventory: 600,000 x $2.50*	(1,500,000)
Fixed costs in ending inventory: 100,000 x $6.60**	660,000
	$840,000

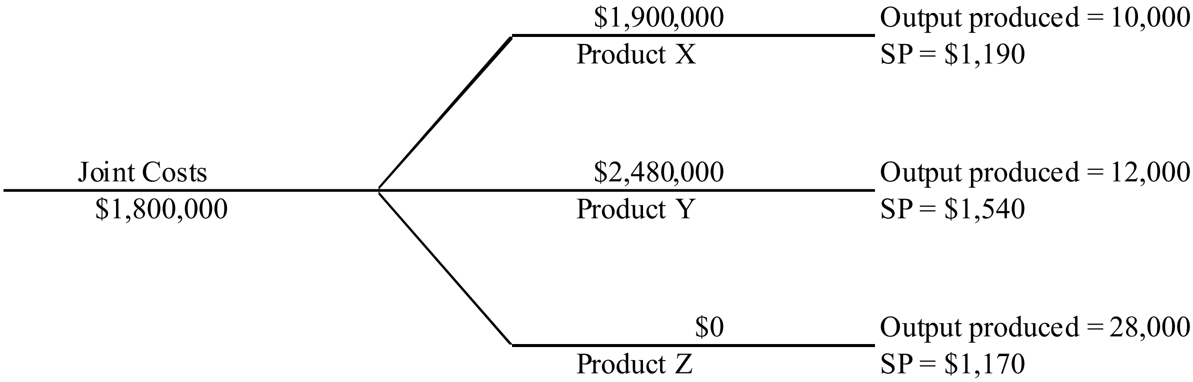
Equals the difference in income between variable and absorption costing of: $1,200,000 - $360,000

* $3,000,000 / 1,200,000 kg produced in 2003
** $3,300,000 / 500,000 kg produced in 2004

Performance Management - Solutions

MA36 Solution: Joint Costing and Byproducts – Copper Co.

Production process:



1. a) Allocation using physical measure method:

	X	Y	Z	Total
Input in tonnes (equals production (in tonnes) because one tonne of output requires one tonne of input)	10,000	12,000	28,000	50,000
Proportion of total	$\frac{10,000}{50,000}$	$\frac{12,000}{50,000}$	$\frac{28,000}{50,000}$	
	= 20%	= 24%	= 56%	
Allocation of joint costs (in 000s)	$360 ($1,800 x 20%)	$432 ($1,800 x 24%)	$1,008 ($1,800 x 56%)	$1,800

b) Allocation using sales value:

	X	Y	Z	Total (in 000s)
Sales value at split-off	10,000	12,000	28,000	
	x $595	x $462	x $1,170	
in 000s	5,950	5,544	32,760	$44,254
Proportion of sales value at split-off (in 000s):	$5,950 / $44,254	$5,544 / $44,254	$32,760 / $44,254	
	= 13.5%	= 12.5%	= 74.0%	
Allocation of joint costs (in 000s)	$1,800	$1,800	$1,800	
	x 13.5%	x 12.5%	x 74.0%	
	= $243	= $225	= $1,332	$1,800

c) Allocation using net realizable value

	X	Y	Z	Total (in 000s)
Sales value at completion (in 000s)	$11,900 ($1190 x 10,000)	$18,480 ($1540 x 12,000)	$32,760 ($1,170 x 28,000)	$63,140
Less: separable costs	1,900	2,480	0	4,380
NRV at completion	$10,000	$16,000	$32,760	$58,760
Proportions	= 17.0%	= 27.2%	= 55.8%	100%
Allocation of joint costs (in 000s)	$306 ($1,800 x 17%)	$489.60 ($1,800 x 27.2%)	$1004.40 ($1,800 x 55.8%)	$1,800

2. There are two methods of accounting for by-product.

Method 1: Recognition of the by-product inventory at NRV when produced:
By-product inventory:
By-product inventory at NRV:
1000 x NRV
1000 x (SP/unit – separable cost per unit) =
1000 x (30 – 0) = 30,000

Cost of main product inventory:

Product X inventory		$
Product Y inventory		$
Product Z inventory		$
Less: by-product inventory value (1,000 x (30-0))	(Note 1)	(30,000)
(reduces the cost of the main product(s))		
Total cost of main product(s) inventory		$

Note 1:

Note that by-product inventory value of $30,000 could be allocated against all three of the main products (prorated on a reasonable basis) or adjusted against the main product with the largest inventory value.

When the by-product inventory is sold, the following would be recorded:

Accounts receivable (or cash)	24,000	
By-product inventory		24,000
800 x $30/00/unit		

Method 2: Recognition of by-product revenue, by-product inventory not recorded

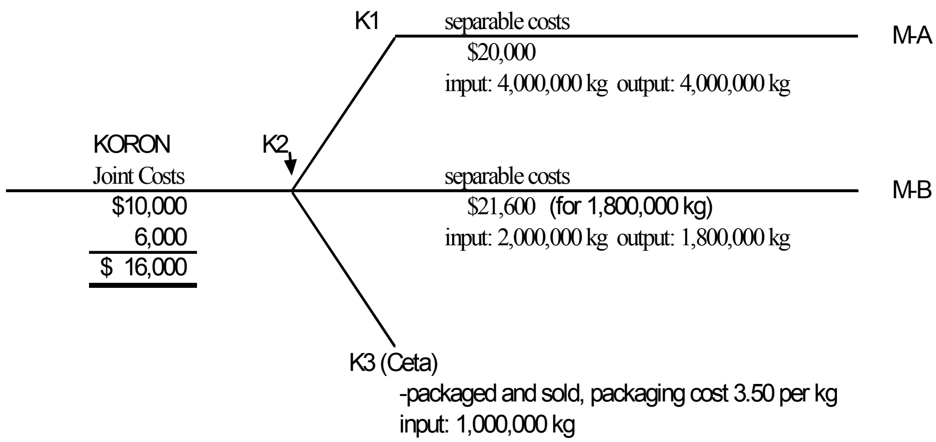
When the by-product is sold, the following entry would be recorded:

Accounts receivable (or cash)	24,000	
Revenue		24,000
800 x $30/00/unit		

By-product inventory is not recorded under this method.

MA37 Solution: Joint costing and sell or process further – Alcove Ltd.

a) The process can be drawn pictorially as:



Allocation of joint costs based on NRV:

		K-1 (processed into M-A)	K-2 Processed into M-B)	
Kilos produced/to be produced	A	4,000,000	2,000,000	Note that since ultimately there will be 2,000,000 of M-B to sell, under the NRV method 2,000,000 kgs should be used and not 1,800,000 kgs. The question clearly stated there was no spoilage or evaporation. This means of the 2,000 put into production, 1,800 were converted during March and 200 kg were still on the production line.
Selling price		$9.50	$18.00	
Sales value		$38,000,000	$36,000,000	
Separable costs		(20,000,000)	(24,000,000)	(Note 1)
NRV at split-off		18,000,000	12,000,000	30,000,000
Allocation of joint costs:				
Percentage:		18/30 = 60%	12/30 = 40%	
Joint costs		16,000,000	16,000,000	
Allocation:	B	9,600,000	6,400,000	
JC per unit	B ÷ A	$2.40	$3.20	

Note 1:

Costs to process K-2 into M-B:
$21,600,000 ÷ 1,800,000 kg = $12/kg – unit processing cost M-B
2,000,000 kg x $12/kg = $24,000,000 – applied cost for total March K-2 production, process into M-B

Explanation of costs to process K-2 into M-B (students have difficulty with this):
Number of kilos started into production:

K-1	4,000 kg
K-2	2,000 kg
K-3 (Ceta)	1,000 kg
Total kilos put into production	7,000 kg

Since there is no waste, shrinkage or evaporation, you know the ultimate production output for Ceta, M-A and M-B is:

Ceta	1,000 kg	given
M-A	4,000 kg	given
M-B	2,000 kg	PLUG
Total kilos put into production	7,000 kg	

This means that since 1,800,000 of M-B was produced, there is 200,000 still in process (i.e. still on the production line). To allocate joint costs using the NRV method, consider the total amount to be produced, which is 2,000,000 and not 1,800,000. The separable cost to produce the 2,000,000 kilos can be calculated as
:

Separable cost to product 1,800,000 kilos	21,600,000
Divided by 1,800,000 kilos	1,800,000
Cost per kilo	12.00
Cost for 2,000,000 kilos:	
Cost per kilo	12.00
x total kilos to be produced	2,000,000
Separable cost to produce 2,000,000 kilos	24,000,000

Costs per unit:

	M-A / K-1	M-B / K-2
Joint costs (calculated above)	2.40	3.20
Separable costs (given)	5.00	12.00
	7.40	15.20

Schedule of inventory quantities (000 kg):

	K-1	K-2	K-3	M-A	M-B
Opening inventory	0	0	0	100	150
Produced/transferred in	4,000	2,000	1,000	4,000	1,800
Sold/transferred out	(4,000)	(1,800)	(950)	(4,010)	(1,900)
Closing inventory	0	200	50	90	50

i) Cost of goods sold

M-A		
Beg. inv. (100,000 kg)	$ 720,000	
Produced (4,010,000 kg – 100,000 kg) @ $7.40	28,934,000	$29,654,000
M-B		
Beg. inv. (150,000 kg)	2,175,000	
Produced (1,900,000 kg – 150,000 kg) @ $15.20	26,600,000	28,775,000
		$58,429,000

Alternate presentation of COGS:

M-A	
Beginning inventory (100,000 kg)	$ 720,000
Cost of goods manufactured (4,000,000 x 7.40)	29,600,000
Ending inventory (90,000 kg) @ $7.40	(666,000)
	$29,654,000
M-B	
Beginning inventory (150,000 kg)	$ 2,175,000
Cost of goods manufactured (1,800,000 kg @ $15.20)	27,360,000
Ending inventory (50,000 kg) @ $15.20	(760,000)
	28,775,000
	$58,429,000

ii) Inventory

K-3 (Ceta) 50,000 kg @ ($5 - $3.50)	$75,000
K-2 200,000 kg @ $3.20	640,000
M-A 90,000 kg @ $7.40 (Note)	666,000
M-B 50,000 kg @ $15.20 (Note)	760,000
	$2,141,000

b) i) Assuming the same amount of Koron is produced, there will be an opportunity cost of selling K-1 instead of processing it further and selling it as M-A:

Separable revenue for M-A ($9.50 - $5)	$4.50
Offer	4.75
Increase in unit profit	$0.25

Accept the offer because profit will increase by $0.25 per unit or $1,000,000 on 4,000,000 kilograms of K-1.

ii) $4.50. This is the opportunity cost for not processing K-1 further. At this price, the net income for the company will be precisely the same regardless of whether they process K-1 into M-A or sell K-1 at split-off. Thus, the company is indifferent at this point.

Note: Joint cost is not relevant to the decision, since it will be incurred regardless of whether K-1 is sold at split-off or processed further

Source: CMA Adapted

MA38 Solution: Sell or Process Further – Smits Ltd.

Products B and C must be analyzed to determine whether to sell at the split-off point or process further. Since Product A does not require further processing, it is sold at the split-off point for $50 per tonne.

	Product B	Product C
Sales value at completion		
B: 600 tonnes x $300/tonne	$180,000	-
C: 400 tonnes x $420/tonne	-	$168,000
Less: separable costs	$40,000	$60,000
	$140,000	$108,000
Sales value at split-off		
B: 600 tonnes x $200/tonne	$120,000	
C: 400 tonnes x $287.50/tonne		$115,000

Conclusion:
To maximize net income, Product B should be processed further and Product C should be sold at split-off (i.e. not processed further).

Performance Management - Solutions

MA39 Solution: Sell or Process Further – Luna Company

Optimal yearly production plan:		
Tonnes of ore mined and crushed in 2003	1,200,000	tons
Ratio of tonnes of ore to ounces of gold/silver/platinum	3:1	
Quantity of gold/silver/platinum recovered in 2003	400,000	ounces
Quantities of individual minerals after electrolysis:		
Gold 30%	120,000	ounces (pure)
Silver 60%	240,000	ounces (impure)
Platinum 10%	40,000	ounces (impure)
	400,000	ounces

Note that all costs incurred up to the end of the electrolysis process are joint costs. Only after the electrolysis process is completed are separate and identified products recovered. Therefore, the cost of mining and crushing the raw ore, the cost of amalgamation including the yearly expenditure on mercury and the cost of the electrolysis process are all joint costs.

The primary concern is whether silver and platinum be sold "as is" or processed further. All costs incurred up to and including the electrolysis stage are sunk and, therefore, irrelevant.

	Silver	Platinum
Ounces recovered after electrolysis	240,000	40,000
Selling price as "impure" (per ounce)	\$4.60	\$430.00
Cost of purifying (per ounce of output)	\$1.30	\$48.60
Selling price as "pure" mineral (per ounce)	\$6.00	\$550.00
Amount recovered of "pure" product (240,000 x .8)	192,000	
(40,000 x .9)		36,000

Silver	Sell "As Is"	Purify
Volume of silver	240,000	192,000
Selling price	\$4.60	\$6.00
Revenue	\$1,104,000	\$1,152,000
Separable processing costs (\$1.30 x 192,000)		249,600
Relevant contribution	\$1,104,000	\$902,400

Platinum	Sell "As Is"	Purify
Volume of platinum	40,000	36,000
Selling price	\$430.00	\$550.00
Revenue	\$17,200,000	\$19,800,000
Separable processing costs (\$48.60 x 36,000)		1,749,600
Relevant contribution	\$17,200,000	\$18,050,400

The best decision is to sell the silver as is ("impure") and purify the platinum.

MA40 Solution: Joint Costing – Roye Company

a.

	Net Realizable Value	%	Allocation
Argon (25,000 x $2)	$50,000	29.41%	$41,174
Xeon ($96,000 – 45,000 – 1,000)	50,000	29.41%	41,174
Neon (60,000 x $3.15) – 65,000 – 54,000	70,000	41.18%	57,652
	$170,000		$140,000

	Argon	*Xeon*	*Neon*
Allocated costs	$41,174	$41,174	$57,652
Direct costs	-	46,000	119,000
	41,174	87,174	176,652
Units produced	25,000	30,000	60,000
Cost per unit	$1.6470	$2.9058	$2.9442
Cost of goods sold			
15,000 x $1.6470	$24,705		
30,000 x $2.9058		$87,174	
45,000 x $2.9442			$132,489
Cost of ending inventories			
10,000 x $1.6470	$16,470		
15,000 x $2.9442			$44,163

b.

	Physical Quantities	%	Allocation
Argon	25,000	21.74%	$30,436
Xeon	30,000	26.09%	36,526
Neon	60,000	52.17%	73,038
	115,000		$140,000

	Argon	*Xeon*	*Neon*
Allocated costs	$30,436	$36,526	$73,038
Direct costs	-	46,000	119,000
	30,436	82,526	192,038
Units produced	25,000	30,000	60,000
Cost per unit	$1.2174	$2.7509	$3.2006
Cost of goods sold			
15,000 x $1.2174	$18,261		
30,000 x $2.7509		$85,527	
45,000 x $3.2006			$144,027
Cost of ending inventories			
10,000 x $1.2174	$12,174		
15,000 x $3.2006			$48,009

MA41 Solution: Joint Costing – Mirza Inc.

a.	Inventory (30,000 x $0.10)	$3,000	
	Factory overhead – Rey		$3,000
b.	Inventory (30,000 x $0.30) – $4,000	$5,000	
	Direct materials inventory		2,000
	Labour payable or Cash		1,500
	Factory overhead or cash		500
	Factory overhead – Rey		1,000

c.

	Net Realizable Value	%	Allocation of joint Costs
Rey (394,000 x $50)	$19,700,000	99.9746%	$299,924
Nagu	5,000	0.0254%	76
	$19,705,000		$300,000

Inventory – Nagu ($4,000 + 76)	$4,076	
Direct materials inventory		2,000
Labour payable or Cash		1,500
Factory overhead or cash		500
Factory overhead – Rey		76

Performance Management - Solutions

MA42 Solution: Departmental Costing and Cost Allocation – Peters Ltd.

a) Use the appropriate cost drivers as follows on which to base the cost allocation:

Department	Cost Driver
Personnel	# of employees
Purchasing	Purchase requisitions
Machining	Machine hours
Painting	Direct labour costs

Personnel department cost allocated first because it has the highest cost among the service departments.

	Personnel	Purchasing	Machining	Painting
Overhead	$40,000	$35,000	$128,000	$48,000
Personnel (# of employees)	-40,000	3,371 [1]	5,618 [2]	31,011 [3]
	0	38,371		
Purchasing (# of requisitions)		-38,371	32,801 [4]	5,570 [5]
		0		
Total overhead cost			$166,419	$84,581

[1] (15/178) × $40,000
[2] (25/178) × $40,000
[3] (138/178) × $40,000
[4] (2,650/3,100) × $38,371
[5] (450/3,100) × $38,371

Overhead rates:
Machining = $166,419 ÷ 23,500 machine hours = $7.0817 per machine hour
Painting = $84,581 ÷ $147,000 direct labour dollars = $0.5754 per direct labour dollar

b)

Actual overhead ($173,000 + $78,540)		$251,540
Applied overhead:		
Machining (24,150 hrs × $7.0817)	$171,023	
Painting ($139,750 direct labour × $0.5754)	80,412	251,435
Under-applied overhead		$ 105

Journal Entry

Applied overhead account (s)	$251,435	
Under-applied overhead	105	
Actual overhead control account		$251,540

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c) Reasons for allocating service department costs include:
   1) Economic – to provide information for economic decisions (e.g. how to allocate available capacity among products)
   2) Motivation – to motivate managers and employees (e.g. to discourage using shared services unwisely)
   3) Income and asset measurement for external parties – to cost products for financial reporting purposes.
   4) Cost justification – to establish a “fair” price.

MA43 Solution: Department Cost Allocation – Danny Ltd.

1. Direct method
   Allocation of costs:

				Advertising
				$1,450,000
Allocated to:				
Dept. A	3,766 / 12,371	=	30.442163%	441,411
Dept. B	4,635 / 12,371	=	37.466656%	543,267
Dept. C	3,970 / 12,371	=	32.091181%	465,322
			Unallocated	0

				Human Resources
				$1,885,000
Allocated to:				
Dept. A	140 / (140 + 175 + 35)	=	40.0%	754,000
Dept. B	175 / (140 + 175 + 35)	=	50.0%	942,500
Dept. C	35 / (140 + 175 + 35)	=	10.0%	188,500
			Unallocated	0

				Legal
				$950,000
Allocated to:				
Dept. A	10% / 10% + 30% + 45%	=	11.764705%	111,765
Dept. B	30% / 10% + 30% + 45%	=	35.294118%	335,294
Dept. C	45% / 10% + 30% + 45%	=	52.941176%	502,941
			Unallocated	0

Recap:

	Dept. A	Dept. B	Dept. C	Total
Costs before allocations	$2,690,000	$3,434,000	$2,835,000	$8,959,000
Allocations:				
Advertising	441,411	543,267	465,322	1,450,000
Human resources	754,000	942,500	188,500	1,885,000
Legal	111,765	335,294	502,941	950,000
	$1,307,176	$1,821,061	$1,156,763	$4,285,000
	$3,997,176	$5,255,061	$3,991,763	$13,244,000

2. Step-Down Method

				Human Res.	
				$1,885,000	
Allocated to:					
Advertising	$\frac{16}{(16 + 12 + 140 + 175 + 35)}$	=	4.232804%	79,788	
Legal	$\frac{12}{(16 + 12 + 140 + 175 + 35)}$	=	3.174603%	59,841	
Dept. A	$\frac{140}{(16 + 12 + 140 + 175 + 35)}$	=	37.037037%	698,148	
Dept. B	$\frac{175}{(16 + 12 + 140 + 175 + 35)}$	=	46.296296%	872,685	
Dept. C	$\frac{35}{(16 + 12 + 140 + 175 + 35)}$	=	9.259259%	174,538	Rounded by $1
			Unallocated	0	

				Legal
				$950,000
			Allocation from human resources	59,841
				$1,009,841
Allocated to:				
Advertising	$\frac{5\%}{5\% + 10\% + 30\% + 45\%}$	=	5.555556%	56,102
Dept. A	$\frac{10\%}{5\% + 10\% + 30\% + 45\%}$	=	11.111111%	112,205
Dept. B	$\frac{30\%}{5\% + 10\% + 30\% + 45\%}$	=	33.333333%	336,614
Dept. C	$\frac{45\%}{5\% + 10\% + 30\% + 45\%}$	=	50.000000%	504,920
			Unallocated	0

				Advertising
				$1,450,000
			Allocation from human resources	79,788
			Allocation from legal	56,102
				$1,585,890
Allocated to:				
Dept. A	$\frac{3,766}{3766 + 4635 + 3970}$	=	30.442163%	$482,779
Dept. B	$\frac{4635}{3766 + 4635 + 3970}$	=	37.466656%	594,180
Dept. C	$\frac{3970}{3766 + 4635 + 3970}$	=	32.091181%	508,931
			Unallocated	0

Recap:

	Human Resources	Legal	Advertising	Dept. A	Dept. B	Dept. C
Costs before allocations	$1,885,000	$950,000	$1,450,000	$2,690,000	$3,434,000	$2,835,000
Allocations:						
Human resources	(1,885,000)	59,841	79,788	698,148	872,685	174,538
Legal	-	(1,009,841)	56,102	112,205	336,614	504,920
Advertising	-	-	(1,585,890)	482,779	594,180	508,931
Total	0	0	0	$3,983,132	$5,237,479	$4,023,389
					Sum of Dept. A, B and C =	$13,244,000

MA44 Solution: Cash Budget – Splash Inc.

Splash Company
Cash Budget
for the three months ended April 30, 2000

		Months		
		Feb.	March	April
	Cash balance, beginning	$39,800	$30,000	$30,000
	Add cash receipts (Schedule 1)	172,800	174,260	165,900
A	Total cash available	212,600	204,260	195,900
	Less: cash disbursements			
	Cash disbursements from operations (Schedule 2)	196,900	183,200	203,100
	Income taxes	4,000	4,000	4,000
B	Total disbursements	200,900	187,200	207,100
A - B	Excess (deficiency) of total cash available over total disbursements	11,700	17,060	(11,200)
	Financing:			
	Borrowings (at end of period) (Note 1)	18,300	12,940	41,200
	Cash balance, ending	$30,000	$30,000	$30,000

Note 1: The company requires a minimum cash balance of $30,000. Therefore, the company must borrow $18,300, $12,940 and $41,200 each month.

Schedule 1 – Cash receipts

	Feb.	March	April
Current months sales	$150,000	$193,000	$162,000
Collections from:			
Dec. sales	$43,200	--	--
Jan. sales	54,600	$32,760	--
Feb. sales	75,000	45,000	$27,000
March sales	--	96,500	57,900
April sales	--	--	81,000
	$172,800	$174,260	$165,900

Performance Management - Solutions

Schedule 2 – Cash disbursements

	Feb.	March	April
Current months purchases	$196,000	$178,000	$225,000
Payments:			
Dec. purchases	$73,500	--	--
Jan. purchases	45,000	$63,000	--
Feb. purchases	78,400	49,000	$68,600
March purchases	--	71,200	44,500
April purchases	--	--	90,000
	$196,900	$183,200	$203,100

MA45 Solution: Budgeting – City of Jimmytown

	September	October	November	Total
Cash balance begin.	$ 10,000	$ 29,000	$ 17,000	$ 10,000
Plus: cash collections:				
Month of sale (0.50)	60,000	42,500	70,000	172,500
Month follow. (0.35)	31,500	42,000	29,750	103,250
2nd month (0.15)	15,000	13,500	18,000	46,500
Total available	$ 116,500	$ 27,000	$ 134,750	$ 332,250
Less: cash disbursements:				
Water	$ 67,500	$ 90,000	$ 63,750	$ 221,250
Operating costs	20,000	20,000	20,000	60,000
Total disbursements	$ 87,500	$ 110,000	$ 83,750	$ 281,250
Cash balance ending	$ 29,000	$ 17,000	$ 51,000	$ 51,000

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MA46 Solution: Budgeting – Moore Company

1. The performance report provided for the bottling department matches an actual budget for 75,000 units to a budget based on 90,000 units. The favourable variances are misleading because a budget based on 75,000 units would be more appropriate.

2.

	Master budget	Planning variance	Flexible budget	Flexible budget variance		Actual
Volume (units)	90,000	15,000	75,000	0		75,000
Manufacturing costs:						
Direct materials	$180,000	($30,000)	$150,000	$6,000	(U)	$156,000
Direct labour	900,000	(150,000)	750,000	85,000	(U)	835,000
Variable o/h	450,000	(75,000)	375,000	(15,000)	(F)	360,000
Fixed o/h	54,000	0	54,000	6,000	(U)	60,000
Total	$1,584,000	($255,000)	$1,329,000	$82,000	(U)	$1,411,000

MA47 Solution: Budgeting - Storey Manufacturing Company

a.

		Cee	Dee
Needs:	Sales	12,000	9,000
	Ending inventory	300	200
Less beginning inventory		(400)	(150)
Production budget		11,900	9,050

b.

		DM1	DM2	DM3
Needs	Production			
	(11,900 x 10) + (9,050 x 8)	191,400		
	9,050 x 4		36,200	
	(11,900 x 2) + (9,050 x 1)			32,850
	Ending inventory	4,000	1,000	1,500
Less beginning inventory		(3,000)	(1,500)	(1,000)
Purchase budget – units		192,400	35,700	33,350
Purchase price		\$2.00	\$2.50	\$0.50
Purchase budget		\$384,800	\$89,250	\$16,675

c.

	Cee	Dee
Hours: 11,900 x 5 | 9,050 x 8	59,500	72,400
Hourly rate	\$4.00	\$4.00
Direct labour budget	\$238,000	\$289,600

d.

	Cee	Dee
Manufacturing cost per unit		
RM1: 10 x \$2 | 8 x \$2	\$20.00	\$16.00
RM2: 4 x \$2.50		10.00
RM3: 2 x \$0.50 | 1 x \$0.50	1.00	0.50
Direct labour: 5 hrs x \$4 | 8 hrs x \$4	20.00	32.00
Manufacturing overhead		
Rate: \$263,800 / (59,500 + 72,400)		
= \$263,800 / 131,900 hours		
= \$2 per DLH		
5 hrs x \$2 | 8 hrs x \$2	10.00	16.00
	\$51.00	\$74.50

Cost of goods sold	Cee	Dee
Opening inventory:		
400 x $51 | 150 x $74.50	$ 20,400	$ 11,175
Cost of goods manufactured		
11,900 x $51 | 9,050 x $74.50	606,900	674,225
Ending inventory:		
300 x $51 | 200 x $74.50	(15,300)	(14,900)
	$612,000	$670,500

e.

	Cee	Dee	Total
Sales	$1,200,000	$1,350,000	$2,550,000
Cost of goods sold	612,000	670,500	1,282,500
Gross margin	$ 588,000	$ 679,500	1,267,500
Selling and administrative expenses			605,000
Operating income			662,500
Income taxes (40%)			265,000
Net income			$397,500

MA48 Solution: Budgeting - Gowan Corporation

Cash, November 30, 2004		$12,000
Cash collections:		
Oct. Sales: 70,000 x $5 x 10%	$ 35,000	
Nov. Sales: 50,000 x $5 x 40%	100,000	
Dec. Sales: 50,000 x $5 x 50% x 0.98	122,500	257,500
Interest from investments		500
Sale of equipment		7,500
Cash disbursements:		
Direct materials	$60,000	
Direct labour		
Regular time: 75,000 bats / 7.5 x $15	150,000	
Overtime: 15,000 bats / 7.5 x $15 x 1.5	45,000	
Overhead:		
Variable: 90,000 bats x $0.30	27,000	
Fixed: ($280,000 – 40,000) / 12	20,000	
Selling:		
Variable: 50,000 x $0.20	10,000	
Fixed: $60,000 / 12	5,000	
Fixed administrative: $120,000 / 12	10,000	
Prepaid expenses: $4,200 ending balance – ($4,800 opening Balance – 3,600 expired in December)	3,000	
Income taxes	50,000	
Note payment: $144,000 / 24	6,000	
Interest on note payable: [$144,000 - (6,000 x 7)] x 1%	1,020	
Dividend payment: 7,000 shares x $0.20	1,400	(388,420)
Cash balance before financing		(110,920)
Liquidation of temporary investments		40,000
Borrowing		80,920
Cash balance, end		$10,000

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MA49 Solution: Budgeting - Martin Company

	Worst Case Scenario	Most Likely Case	Best Case Scenario
Sales (+/- 25%)	$75,000	$100,000	$125,000
Variable costs (40%-60% of cost)	45,000	45,000	50,000
Contribution margin	$30,000	$55,000	$75,000
Fixed costs	30,000	25,000	20,000
Net income	0	$30,000	$55,000

MA50 Solution: Flexible Budget Variances - Funnie Flexible Inc.

	Actual Results	Flexible Budget Variances	Flexible Budget	Sales Volume Variances	Static (Master) Budget
Units produced and sold	11000	--	11000	4000 U	15000
Revenue	$621,500	$16,500 U	$638,000	$232,000 U	$870,000
Variable costs	264,000	11,000 F	275,000	100,000 F	375,000
Contribution margin	357,500	5,500 U	363,000	132,000 U	495,000
Fixed costs	202,000	8,000 F	210,000	--	210,000
Operating income	$155,500	$2,500 F	$153,000	$132,000 U	$285,000

flexible budget variance | sales volume variance

$2,500 F | $132,000 U

static budget variance

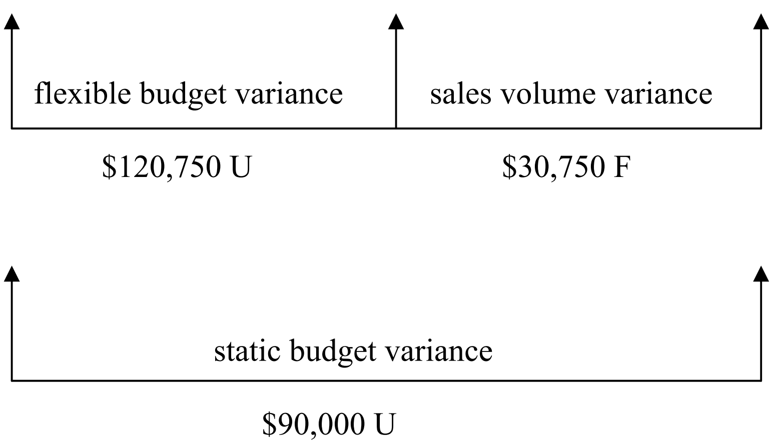
$129,500 U

MA51 Solution: Flexible Budget Variances - Appleby Inc.

Total budgeted variable costs per unit:

Direct material	$2.00
Direct labour	5.60
Variable overhead	1.25
	$8.85

	Actual Results	Flexible Budget Variances	Flexible Budget	Sales Volume Variances	Static (Master) Budget
Units produced and sold	75,000	--	75,000	--	70,000
Revenue	$1,012,500		$1,125,000	--	$1,050,000
Variable costs	660,000		663,750		619,500
Contribution margin	352,500	108,750 U	461,250	30,750 F	430,500
Fixed costs	192,000	12,000 U	180,000	--	180,000
Operating income	$160,500	$120,750 U	$281,250	$30,750 F	$250,500



MA52 Solution: Variances - Copper Bottom Pot Company Ltd.

a. i. Direct materials purchase variance:

= (AP - SP) * AQ purchased
= ([$52,000 / 4,000] - $14) * 4,000
= ($13 - $14) * 4,000
= $4,000 favourable

Direct materials usage variance:

= (AQ used - SQ) * SP
= ([4,000 - 200] - [600 * 6]) * $14
= (3,800 – 3,600) * $14
= $2,800 unfavourable

ii. No, the contract should not be signed. Although the new supplier is offering the materials at only $13 per kilogram, the materials do not seem to hold up well in production as shown by the large unfavourable direct material usage variance.

b. i. Direct labour rate variance:

= (AR - SR) * AH
= ($21 - $20) * (65 * 12)
= $1 * 780
= $780 unfavourable

Direct labour efficiency variance:

= (AH - SH) * SR
= ([65 * 12] - [1.5 * 600]) * $20
= (780 - 900) * $20
= $2,400 favourable

ii. Yes, the new labour mix should be continued. Although it increases the average hourly labour cost from $20 to $21, thereby causing a $780 unfavourable direct labour rate variance, this is more than offset by greater efficiency of labour time. Note the direct labour efficiency variance is $2,400 favourable. Thus, the new labour mix reduces overall labour costs.

MA53 Solution: Variances – Addy Company

a. DL efficiency variance = SR (AH – SHA)
4,000F = SR (29,000 – 30,000)
SR = 4,000 / 1,000 = $4

b. DL rate variance = AH (AR – SR)
$5,800F = 29,000(AR – 4)
AR = $4 – 5,800 / 29,000
AR = $4 – 0.20
= $3.80

MA54 Solution: Variances - Andres Industries

a. DM price variance = AQP (AR – SR)
= 160,000 ($1.90 – 1.80)
= $16,000 U

b. DM usage variance = SP (AQU – SQA)
= $1.80 [142,500 – (19,000 x 8 kg)]
= $1.80 (142,500 – 152,000)
= $17,100 F

c. DL rate variance = AH (AR – SR)
= 5,000 (7.56* - 8)
= $2,200 F

* $42,000 x 90% / 5,000 hours

d. DL efficiency variance = SR (AH – SHA)
= $8 [5,000 – (0.25 x 19,000)]
= $8 (5,000 – 4,750)
= $2,000 U

MA55 Solution: Variances - Brien Manufacturing Company

a.

Actual direct labour cost	
(550 x \$8.50) + (650 x \$7.50) + (375 x \$5.40)	\$11,575
Standard direct labour cost	
1,500 hours x \$6.66667	
(average direct labour standard rate)	10,000
Variance	\$1,575 U

b.

	AH (AR – SR)	
Class III	550 (8.50 – 8)	\$275 U
Class II	650 (7.50 – 7)	325 U
Class I	375 (5.40 – 5)	150 U
		\$750 U

c.

	SR (AH – SHA)	
Class III	8 (550 – 500)	\$400 U
Class II	7 (650 – 500)	1,050 U
Class I	5 (375 – 500)	625 F
		\$825 U

d.

(Total AH – total SHA) average standard rate	
(1,575 – 1,500) 6.66667	\$500 U

e.

	(A mix% - B mix %) AH (bud rate – bud average rate)	
Class III	(0.34921 – 0.33333) 1,575 (8 – 6.66667)	\$33.33 U
Class II	(0.41279 – 0.33333) 1,575 (7 – 6.66667)	41.67 U
Class I	(0.23810 – 0.33333) 1,575 (5 – 6.66667)	250.00 U
		\$325.00 U

MA56 Solution: Variances - Boutin Glass Works

a. 198,000 units x 2 hours = 396,000 hours

b. VOH efficiency variance = SR (AH – SHA)
= $0.75* (440,000 – 396,000)
= $33,000 U

* Total variable overhead = $900,000 – (200,000 x $3 fixed component)
= $900,000 – 600,000 FOH
= $300,000
Variable overhead rate at standard = $300,000 / (200,000 x 2) = $0.75

c. VOH spending variance = AH (AR – SR)
= 440,000 (0.80* - 0.75)
= $22,000 U

* $352,000 actual variable overhead / 440,000 actual direct labour hours

d. FOH budget variance = actual FOH - budgeted FOH
= $575,000 - $600,000
= $25,000 F

e. Applied FOH = 198,000 x $3 = $594,000

f. FOH volume variance = budgeted FOH - applied FOH
= $600,000 – 594,000
= $6,000 U

MA57 Solution: Variances – Ferguson Foundry Ltd.

Flexible Budget
for the year ended May 31, 2005

	Basic	Deluxe	
Units costs:			
Revenue	$300	$800	
Variable costs -			
Direct materials	70	190	
Direct labour	90	240	
Variable overhead	45	120	
Variable S&A	15	40	
	220	590	
Contribution margin	$80	$210	
Flexible budget:			Total
Sales volume	7,200	4,800	12,000
Sales revenue	$2,160,000	$3,840,000	$6,000,000
Variable costs			
Direct materials	504,000	912,000	1,416,000
Direct labour	648,000	1,152,000	1,800,000
Variable overhead	324,000	576,000	900,000
Variable S&A	108,000	192,000	300,000
	1,584,000	2,832,000	4,416,000
Contribution margin	$576,000	$1,008,000	1,584,000
Fixed costs			
Manufacturing			750,000
S&A			132,500
			882,500
Net income			$701,500

Sales volume variance
= (actual sales volume - budgeted sales volume) x budgeted CM/unit

Basic:	(7,200 - 4,500) x $80	$216,000 F
Deluxe:	(4,800 - 5,500) x $210	147,000 U
		$ 69,000 F

Budgeted average CM/unit = $1,515,000 ÷ 10,000 units = $151.50

Sales quantity variance
= (actual sales volume - budgeted sales volume) x budgeted average CM/unit
= (12,000 - 10,000) x $151.50 $303,000 F

Sales mix variance
= (actual sales-mix % - budgeted sales-mix %) x actual total units sold
x (budgeted average CM/unit - budgeted CM/unit)

Basic: (.6 - .45) x 12,000 x ($151.50 - $80)	$128,700 U
Deluxe: (.4 - .55) x 12,000 x ($151.50 - $210)	105,300 U
	$234,000 U

Market size variance
= budgeted market share %
x (actual industry sales volume - budgeted industry sales volume)
x budgeted average CM per unit
= .10 (133,333 - 100,000) x 151.50 $505,000 F

Market share variance
= (actual market share % - budgeted market share %)
x actual industry sales volume in units
x budgeted average CM per unit
= (.10 - .09) x 133,333 x $151.50 $202,000 U

Sales price variance
= actual quantity x (actual sales price - budgeted sales price)

Basic:	7,200 (325 - 300)	$180,000 F
Deluxe:	4,800 (700 - 800)	480,000 U
		$300,000 U

Direct materials price variance
= actual quantity purchased x (actual price - standard price)

Basic:	540,000 x (.90 - 1)	54,000 F
Deluxe:	912,000 x (.90 - 1)	91,200 F
		$145,200 F

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Direct materials quantity variance
= standard price (actual quantity used - standard quantity allowed)

Basic:	$1 (540,000 - 504,000*)	36,000 U
Deluxe:	$1 (912,000 - 912,000*)	-
		$36,000 U

* 7,200 x 70 = 504,000
4,800 x 190 = 912,000

Direct labour rate variance
= actual hours x (actual rate - standard rate)

Basic:	46,800 (16 - 15)	46,800 U
Deluxe:	74,400 (16 - 15)	74,400 U
		$121,200 U

Direct labour efficiency variance
= standard rate x (actual hours - standard hours allowed)

Basic:	$15 (46,800 - 43,200*)	54,000 U
Deluxe:	$15 (74,400 - 76,800*)	36,000 F
$15 (121,200 - 120,000*)		$18,000 U

* 7,200 x 6 = 43,200
4,800 x 16 = 76,800

Variable overhead spending variance
= actual hours x (actual rate - standard rate)

Basic:	46,800 (7.5 - 8*)	23,400 U
Deluxe	74,400 (7.5 - 8**)	37,200 U
		60,600 U

* $374,400 Total actual variable overhead ÷ 46,800 actual DLH
** $595,200 ÷ 74,400

Variable overhead efficiency variance
= standard rate x (actual hours - standard hours allowed)

Basic:	$7.50 (46,800 - 43,200)	27,000 U
Deluxe:	$7.50 (74,400 - 76,800)	18,000 F
		$ 9,000 U

Variance summary:

Sales volume		
Sales quantity		
Market size	505,000	
Market share	-202,000	303,000
Sales mix		-234,000
		69,000
Sales price variance		
Basic	180,000	
Deluxe	-480,000	-300,000
Direct materials		
Price variance	145,200	
Quantity variance	-36,000	109,200
Direct labour		
Rate variance	-121,200	
Efficiency variance	-18,000	-139,200
Variable overhead		
Spending variance	-60,600	
Efficiency variance	-9,000	-69,600
Variable selling and administrative		0
Fixed costs		
Manufacturing	-30,000	
Selling and administrative	-7,000	-37,000
Total variances = difference between static budget net income and actual net income		-377,600

Performance Management - Solutions

Explanation of Profit Decline

Marketing Related Factors:

1. Decreased market share in a growing total market

   The total market for woodstoves grew by 33% during the year and, had FFL maintained its market share, it should have achieved a $505,000 increase in its contribution margin over the budget. Instead, FFL's market share decreased by 1%, which reduces the previously mentioned expected increase in contribution margin by $202,000. The net result is the increase in market volume and the decreased market share should have still resulted in FFL increasing its contribution margin by $303,000 over the budget.

2. Change in mix of sales

   FFL sold more of the basic and less of the deluxe models. Since the deluxe model has a much higher contribution margin per unit ($210 vs. $80), the change in mix of sales had a negative impact on profits (i.e. decrease of $234,000). This negative impact, however, is not enough to offset the positive impact of the sales quantity increase (i.e. $234,000 decrease vs. $303,000 increase).

3. Price changes

   Even though the price of the basic model increased by 8.3%, sales volume also increased. The price increase alone would have a favourable impact of $180,000 on revenue. The problem was with the deluxe model. The price was decreased by 12.5% resulting in a revenue decrease of $480,000. Also, the volume decreased despite the drop in selling price. The net effect of selling more basic (at lower unit CM) and selling less deluxe (at a higher unit CM) was a decrease in contribution margin of $231,000.

4. Increased selling and administration costs

   Although the variable selling and administration costs were right on standard, the fixed costs increased by 5.3%.

   It appears FFL might have misjudged the market's preference for basic vs. deluxe models of woodstoves when it prepared the budget. FFL should study the market environment more carefully to ensure the marketing effort is correctly directed and to plan production better.

Production Related Factors:

1. Variable cost increases

   The variance analysis indicates FFL experienced substantial savings in direct material costs during fiscal 2004/05. This may have resulted from volume discounts that were not considered in setting the standards and arose as a result of the higher production volumes. However, this cost saving was partially offset by inefficient usage of materials. Usage of direct labour and variable overhead were also somewhat inefficient. However, these inefficiencies were not enough to offset the direct materials cost savings. The main contributors to the increase in costs were the direct labour and variable overhead rates. One might venture to guess the budget was incorrectly prepared (i.e. did not reflect expected labour rate increases) or that FFL experienced problems with the labour union during the year, resulting in a new labour contract with negotiated rates higher than anticipated.

   Overall, variable costs to produce the Deluxe Model decreased by $7 per unit, but this was not enough to offset the large decrease in selling price. On the other hand, variable production costs for the basic model increased by $18.50 per unit, indicating inefficiencies in its production process. These inefficiencies more than offset the cost savings from the deluxe model's production process.

2. Fixed cost increases

   Fixed manufacturing costs increased by 4%. This increase may have been necessary given the increased volume and change in production mix. Perhaps increased investment in machinery, supervisory staff or other fixed costs may have been required to accommodate the increased sales volume. It must be determined whether these higher costs are expected to continue in the future.

MA58 Solution: Variances, Breakeven and Pricing - PFC

a) Flexible budget report

Flexible Budget Report
for the year ended December 31, Year 7

	Master Budget	Sales Volume Variances		Flexible Budget		Flexible Budget Variances		Actual Results
Quantity	7,500			8,185				8,185
Sales revenue	$2,337,500	$76,125	F	$2,413,625	1	$37,850	F	$2,451,475
Variable costs	1,450,000	(127,150)	U	1,577,150	2	(100,160)	U	1,677,310
Contribution margin	887,500	(51,025)	U	836,475		(62,310)	U	774,165
Fixed costs	675,000	0		675,000		(45,000)	U	720,000
Net income	$212,500	$(51,025)	U	$161,475		$(107,310)	U	$54,165

total variance = $ 158,335 unfavourable

Note 1: Flexible budget sales revenue

Pine chairs: $ 225 X 5,985 =	$1,346,625
Pine tables: $ 485 X 2,200 =	1,067,000
	$2,413,625

Note 2: Variable costs is computed as follows:

Pine chairs: $190 x 5,985 =	$1,137,150
Pine tables: $200 x 2,200 =	440,000
	$1,577,150

b) Cost Variances

Direct material

Price variance = (actual quantity)(standard price – actual price)

Pine chair: (269,325)($1 - $0.91111) =		$23,940	F
Pine table: (198,000)($1 - $0.91111) =		17,600	F
Total price variance	A	$41,540	F

Usage (efficiency) variance = (standard price)(standard quantity allowed for actual output – actual quantity)

Pine chair: ($1)(239,400 – 269,325) =		$(29,925)	U
Pine table: ($1)(176,000 – 198,000) =		(22,000)	U
Total quantity variance	B	$(51,925)	U
Total direct material variance (price var. + efficiency var.)	A + B	$(10,385)	U

Note: Material quantity calculation:

	actual quantity	standard qty allowed
Pine chairs	5985 x 45 = 269,325	5985 x 40 = 239,400
Pine tables	2200 x 90 = 198,000	2200 x 80 = 176,000

Expressed pictorially:

	AQ x AP	AQ x SP	SQ allowed for actual output x SP
Pine chairs	(5985 x 45 ft/unit) x $ .91111 = 245,385	(5985 x 45 ft/unit) x $ 1.0 = 269,325	(5985 x 40 ft/unit) x $ 1.0 = 239,400

price variance = 23,940 F

usage (Efficiency) variance = 29,925 U

total DM variance = $ 5,985 U

	AQ x AP	AQ x SP	SQ allowed for actual output x SP
Pine tables	(2200 x 90 ft/unit) x $ .91111 = 180,400	(2200 x 90 ft/unit) x $ 1.0 = 198,000	(2200 x 80 ft/unit) x $ 1.0 = 176,000

price variance = 17,600 F

usage (Efficiency) variance = 22,000 U

total DM variance = $4,400 U

Total direct material variance = pine chair $5,985 U + pine tables $4,400 U = $10,385 U

Direct labour

Rate variance = (actual quantity)(standard rate – actual rate)			
Pine chair: (59,850)($10 - $11) =		$(59,850)	U
Pine table: (13,750)($10 - $12) =		(27,500)	U
Total rate variance	A	$(87,350)	U
Usage (efficiency) variance = (standard price)(standard quantity allowed for actual output – actual quantity)			
Pine chair: ($10)(59,850 – 59,850) =		$ 0	
Pine table: ($10)(17,600 – 13,750) =		38,500	F
Total usage (efficiency) variance	B	$38,500	F
Total direct labour variance (rate var. + eff. var.)	A + B	$(48,850)	U

Note: Direct labour hours calculation:

	Actual DLH	Standard DLH allowed
Pine chairs	5985 x 10 = 59,850	5985 x 10 = 59,850
Pine tables	2200 x 6.25 = 13,750	2200 x 8 = 17,600

Expressed pictorially:

	AQ x AP	AQ x SP	SQ allowed for actual output x SP
Pine chairs	(5985 x 10 hr/unit) x $ 11 = 658,350	(5985 x 10 hr/unit) x $ 10 = 598,500	(5985 x 10 hr/unit) x $ 10 = 598,500

rate variance = 59,850 U

efficiency variance = 0

total DL variance = $ 59,850 U

	AQ x AP	AQ x SP	SQ allowed for actual output x SP
Pine tables	(2200 x 6.25 hr/unit) x $ 12 = 165,000	(2200 x 6.25 hr/unit) x $ 10 = 137,500	(2200 x 8 hr/unit) x $ 10 = 176,000

rate variance = 27,500 U

efficiency var. = 38,500 F

total DL variance = $ 11,000 F

Total direct labour variance = pine chair $59,850 U + pine tables $11,000 F = $48,850 U

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Variable overhead			
Spending variance = (actual quantity)(standard rate – actual rate)			
Pine chair: (59,850)($5 - $5.50) =		$(29,925)	U
Pine table: (13,750)($5 - $7.20) =		(30,250)	U
Total spending variance	A	$(60,175)	U
Usage (efficiency) variance = (standard price)(standard quantity allowed for actual output – actual quantity)			
Pine chair: ($5)(59,850 – 59,850) =		$ 0	
Pine table: ($5)(17,600 – 13,750) =		19,250	F
Total usage (efficiency) variance	B	$19,250	F
Total variable overhead variance (spending var. + eff. var.)	A + B	$(40,925)	U

Expressed pictorially:

	AQ x AP	AQ x SP	SQ allowed for actual output x SP
Pine	(5985 x 10 hr/unit) x $ 5.50 =	(5985 x 10 hr/unit) x $ 5 =	(5985 x 10 hr/unit) x $ 5 =
chairs	329,175	299,250	299,250

spending var. = 29,925 U

efficiency variance = 0

total VOH variance = $ 29,925 U

	AQ x AP	AQ x SP	SQ allowed for actual output x SP
Pine	(2200 x 6.25 hr/unit) x $ 7.2 =	(2200 x 6.25 hr/unit) x $ 5 =	(2200 x 8 hr/unit) x $ 5 =
tables	99,000	68,750	88,000

spending var. = 30,250 U

efficiency var. = 19,250 F

total VOH variance = $ 11,000 U

Total variable overhead spending variance = pine chair $29,925 U + pine tables $11,000 U = $40,925 U.

Fixed manufacturing expenses
Flexible budget variance:

Master (and flexible) budget amount (given)	$550,000	
Actual amount spent (given)	590,000	
Total fixed manufacturing budget variance	$(40,000)	U

Since fixed costs are not applied to products, there is no production volume variance.

Fixed selling and administrative expenses

Master (and flexible) budget amount (given)	$125,000	
Actual amount spent (given)	130,000	
Total fixed selling and administration budget variance	$(5,000)	U

Summary of cost variances:

Total direct material variance	$(10,385)	U
Total direct labour variance	(48,850)	U
Total variable overhead variance	(40,925)	U
Total fixed manufacturing budget variance	(40,000)	U
Total fixed selling and administrative budget variance	(5,000)	U
Total efficiency and spending variance explained	$(145,160)	U

d) Sales variances (expressed pictorially can be found below the calculations):

Note: selling price variance = actual quantity sold (AP - budgeted price) for individual products.

Sales revenue price variance

Product	Actual Price A	Budgeted Price B	Price Change C = A - B	Actual Volume D	Variance C x D	
Pine chair	$235	$225	$10	5,985	$59,850	F
Pine table	475	485	(10)	2,200	(22,000)	U
				8,185	$37,850	F

Sales volume variance

Note: SVV = (AQ sold - static budget quantity) x budgeted CM per unit

Product	Actual volume A	Budgeted volume B	C = A - B	Budgeted Individual CM	Variance D	
Pine chair	5,985	5,000	985	35	34,475	F
Pine table	2,200	2,500	(300)	285	(85,500)	U
					(51,025)	U

Supporting calculation of CM:

	Chairs	Tables	Total
Budgeted CM	175,000	712,500	887,500
Budgeted volume	÷ 5,000	÷ 2500	÷7,500
Budgeted individual CM	35.00	285.00	
Budgeted average CM			118.33

Sales mix variance

(Actual sales mix % - budgeted sales mix %) x actual total units sold x (budgeted individual contribution per unit – budgeted weighted average contribution per unit)

Chair: (73.12% - 66.66%) x 8,185 x ($35 - $118.33) =	$(44,026)	
Table: (26.88% - 33.33%) x 8,185 x ($285 - $118.33) =	(88,057)	
	$(132,083)	U

Note: Sales mix calculation (results were rounded off to last four digits):

	Actual Sales Mix	Budgeted Sales Mix
Pine Chairs	5985/8185 = 0.7312	5000/7500 = 0.6666
Pine Tables	2200/8185 = 0.2688	2500/7500 = 0.3333

Alternative method to calculate sales mix variance:

[ASM% - BSM%] x actual total quantity sold x BICM

Chair: (73.12%-66.66%) x 8185 x 35 =	$18,492	F
Table: (26.88%-33.33%) x 8185 x 285 =	(150,575)	U
	$(132,083)	U

Note that the final answer is the same regardless of the method used.

Sales quantity variance

(actual quantity – budgeted quantity) x budgeted average contribution margin

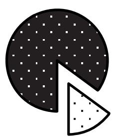
Chair: (5,985 – 5,000) x $118.33 =	$116,555	F
Table: (2,200 – 2,500) x $118.33 =	(35,499)	U
	$81,056	F

Market share and market size variance

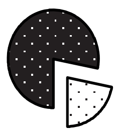
Market share variance	=	(actual market share % - budgeted market share %)(actual industry volume)(budgeted average contribution margin per unit)
	=	((8,185 ÷ 99,817) – (7,500 ÷ 93,750)) (99,817) ($118.33)
	=	(8.2% - 8%)(99,817) ($118.33)
	=	$23,623 F
Industry volume (market size) variance	=	(budgeted market share %)(actual industry volume -budgeted industry volume)(budgeted average contribution margin per unit)
	=	(7,500 ÷ 93,750) (99,817 – 93,750) ($118.33)
	=	(8%) (6,067) ($118.33)
	=	$57,434 F

Many candidates find these two variances, market share and market size, difficult to remember. The key concept to keep in mind is "what is the variance measuring", which is described below.

Market share:



Budgeted market share % ->at the beginning of the year, PFC estimated its share of the market to be 8%.



Actual market share % -> PFC's actual market share was 8.2% (8,185 ÷ 99,817).

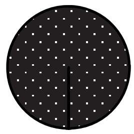
Market share variance measures the cost (or benefit) to the company of not attaining (or exceeding) its expected market share. In this case, PFC exceeded its estimate by 0.2% (8% – 8.2%).

The actual industry volume, as opposed to estimated industry volume, is used to calculate the variance since market share is concerned with the percentage held of the total market and the total market is the actual industry volume.

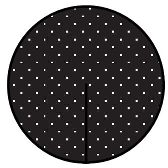
The budgeted average CM is used because the market is defined as both "tables and chairs", therefore to measure this variance, the average CM of both products must be used.

Performance Management - Solutions

Market size (industry volume):



Estimated market size (industry volume)
->at the beginning of the year, PFC estimated the market size (industry volume) to be 93,750.



Actual market size (industry volume)
-> the actual market size (industry volume) was 99,817.

Market size variance measures the cost (or benefit) to the company of the industry volume being lower (or higher) then estimated. In this case, actual industry volume exceeded estimated (99,817 actual vs. 93,750 estimated).

Since this variance is isolating the impact of the industry volume being different then estimated, the budgeted market share percentage and not the actual percentage, is used. This variance answers the question: “If we meet our estimated market share %, what is the impact of the industry volume being higher or lower than expected?”

The budgeted average CM is used because the market is defined as both “tables and chairs”, therefore, to measure this variance, the average CM of both products must be used.

Summary of sales variances, expressed pictorially:

Sales price variance			Sales volume variance		
	AQ x (AP – BP)			(AQ – BQ) x BICM	
Chairs:	5985 x (235-225) =	59,850 F	Chairs:	(5985 – 5,000) x 35 =	34,475 F
Tables:	2200 x (475-485) =	22,000 U	Tables:	(2200 –2500) x 285 =	85,500 U
		37,850 F			**51,025 U**

sales mix variance			sales quantity variance		
(ASM % - BSM %) x total sales volume x (BICM – BACM)			(AQ x- BQ) x BACM		
Chairs:	(73%-67%) x 8,185 x (35-118.33) =	44,026 U	Chairs:	(5985 – 5,000) x 118.33 =	116,555 F
Tables:	(27% - 33%) x 8,185 x (285-118.33) =	88,057 U	Tables:	(2200 –2500) x 118.33 =	35,499 U
		132,083U			**81,056 F**

market size var. =	market share var. =
57,434 F	23,623 F
calculation above	calculation above

Abbreviations:
AQ: Actual quantity
BQ: Budgeted quantity
AP: Actual price
BP: Budgeted price
BICM: Budgeted individual contribution margin
BIP: Budgeted individual price
BACM: Budgeted average contribution margin
ASM%: Actual sales mix percentage
BSM%: Budgeted sales mix percentage
AISV: Actual industry sales volume
BMS%: Budgeted market share percentage
BISV: Budgeted industry sales volume
AMS%: Actual market share percentage

d) Reconciliation of variances

Summary of variances calculated for Year 7

Sales volume variance:						
Sales quantity:						
Market size	57,434	F				
Market share	23,623	F	81,086	F		
Sales mix			(132,083)	U	(51,025)	U
Sales price variance					37,850	F
Variable cost variances:						
Direct material						
- Price	$41,540					
- Usage	(51,925)		(10,385)	U		
Direct labour						
- Rate	(87,350)					
- Efficiency	38,500		(48,850)	U		
Variable overhead						
- Spending	(60,175)					
- Efficiency	19,250		(40,925)	U	(100,160)	U
Fixed manufacturing budget variance					(40,000)	U
Fixed selling and admin. budget variance					(5,000)	U
Total variance (agrees to flexible budget report)					$(158,335)	U

e) Calculation of a price based on the "return on assets" model of pricing.

	Pine Chair	Pine Table
Current price (Year 7)	$235	$475
Variable costs (based on Year 7 actual):		
Material	41	82
Labour	110	75
Overhead	55	45
Total variable cost	206	202
Fixed manufacturing (Year 7):		
Table 370,000 ÷ 2,200		168
Chair 220,000 ÷ 5,985	37	
Full production cost	243	370
Fixed selling and administration:		
Table 20,000 ÷ 2,200		9
Chair 110,000 ÷ 5,985	18	
Full Cost	261	379
Return on net assets employed:		
Table (1,012,000 x 10%) ÷ 2,200		46
Chair (1,436,000 x 10%) ÷ 5,985	24	
Suggested price	$285	$425
Current price (Year 7)	$235	$475
Change in price	$50	$(50)

f) Determination of breakeven points using budgeted data for Year 7:

Three different methods of arriving at the correct answer to this multi-product breakeven question are: by using the weighted average contribution margin percentage (WACM%); using the weighted average contribution margin per unit (WACM/unit); or the 'product bundle' approach. All three are illustrated. It would not be necessary to do all three in an examination situation; the three approaches are illustrated to enhance the learning effectiveness of this solution.

Calculation of contribution margin:

		Pine Chair		Pine Table
Revenue per unit		$225		$485
Variable cost per unit		190		200
Contribution margin		$35		$285
Contribution margin %		15.55%		58.76%
Sales mix in units:	$\frac{5,000}{7,500}$ =	66.66%	$\frac{2,500}{7,500}$ =	33.33%
Sales mix in $	$\frac{\$1,125,000}{\$2,337,500}$ =	48.13%	$\frac{\$1,212,500}{\$2,337,500}$ =	51.87%

i) Using WACM%

WACM % = [CM% (chair) x mix% (chair)] + [CM% (table) x $ mix% (table)]
= (.1555 x .4813) + (.5876 x .5187)
= .0748 + .3048
= .3796 or 37.96%

Alternate calculation of average CM %:

$$\text{Average CM per unit} = \frac{\text{total contribution margin}}{\text{total sales in dollars}}$$

$$= \frac{\$887,500}{2,337,500}$$

$$= .3796 \text{ or } 37.96\%$$

Breakeven point in $ = fixed costs ÷ WACM %
= 675,000 ÷ .3796
= $1,777,817

which converts to

Chairs: 1,777,817 x .4813 = $855,663
855,663 ÷ 225 = 3,803 chairs

Tables: 1,777,817 x .5187 = $922,154
922,154 ÷ 485 = 1,901 tables

ii) Using WACM per unit

WACM/unit = [CM/unit (chair) x unit mix% (chair)] + [CM/unit (table) x unit mix% (table)]

= (35 x .6666) + (285 x .3333)
= 118.33

Breakeven point in units = fixed costs/WACM per unit
= 675,000 ÷ 118.33
= 5,704 units

which converts to

Chairs: 5,704 x .6666 = 3,803 chairs
3,803 x $225 = $855,600

Tables: 5,704 x .3333 = 1,901 tables
1,901 x $485 = $922,146

iii) Using product bundle approach:

	Pine Chair	Pine Table	Bundle
	Unit $	Unit $	
Selling price	$225	$485	
Variable costs	190	200	
Contribution margin	$35	$285	
Sales mix (2 chairs for every 1 table)	x 2	x 1	
(5,000 chairs for 2,500 tables converts to 2:1)	70	285	355 CM of the bundle

Number of bundles required to breakeven:

$$\text{Number of bundles required to breakeven} = \frac{\text{FC}}{\text{CM of product bundle}}$$

$$= \frac{675{,}000}{355}$$

= 1901 bundles

Performance Management - Solutions

Application of sales mix to bundles:

	Pine Chair	Pine Table
Sales mix (2 chairs for every 1 table) (number of pieces per bundle)	2	1
Number of bundles	x 1,901	x 1,901
Number of units of each product to BE	3,802	1,901

Using any of the three approaches yields the same answer (small differences are due to rounding).

MA59 Solution: Variance Analysis - F&G Inc.

a) Direct material variances:

Actual AQ x AP		Actual Quantity @ Standard Price AQ x SP		Standard Quantity @ Standard Price SQ x SP
18,000 x 2.60 = $46,800	price	18,000 x 2.90 = $52,200	usage	19,800 x 2.90 = $57,420
				(8,800 units x 2 kg / unit) x $2.90 = $51,040

DM price variance = $5,400 F

DM quantity variance = $6,380 U

b) Direct labour variances

Actual AQ x AP	Actual Quantity @ Standard Rate AQ x SP	Standard Quantity @ Standard Rate SQ x SP
$425,040 (given)	32,200 x $12.50 = $402,500	(8800 x 3.5) x 12.50 = $385,000

DL rate variance = $22,540 U

DL efficiency variance = $17,500 U

flexible budget variance = $40,040 U

c) Variable overhead variances

Actual	Actual Quantity @ Standard Rate	Standard Quantity @ Standard Rate
AQ x AP	AQ x SP	SQ x SP
$68,360 (given)	32,200 x $2.20 = $70,840	(8800 x 3.5) x 2.20 = $67,760

VOH spending variance = 2,480 F

VOH efficiency variance = 3,080 U

flexible budget variance = 600 U

d) Fixed overhead variances

Actual	Flexible Budget	Applied
AQ x AP	Lump sum amount	SQ allowed for actual prod'n x SP
	(Note 1)	(Note 2)
$112,100	8000 units x 3.5 DLH/unit x $4.10	(8800 x 3.5DLH) x $4.10
(given)	= $114,800	= $126,280

flexible budget variance = $2,700 F

production volume variance = $11,480 F

$14,180 over-applied overhead

1. Lump sum amount – this amount is the numerator when calculating the predetermined fixed overhead rate (i.e. is the estimated fixed OH). Calculation of this amount:

$$\frac{\text{estimated fixed factory overhead}}{\text{estimated activity}} = \$\,4.10/\text{DLH}$$

$$\frac{?}{\text{8,000 estimated volume x 3.5 DLH/unit}} = \$\,4.10/\text{DLH}$$

$$\text{Estimated fixed factory overhead} = \$\,114,800$$

2. Remember that fixed overhead is applied to units as they are actually produced, therefore, the amount applied is based on actual units x standard DL hours per unit or 8,800 x 3.5 DLH/unit.

MA60 Solution: Variance Analysis - Trombone Ltd.

1. a) \$5.60 per kilogram
   b) \$7,624 unfavourable
   c) 16,340 kilograms
   d) Direct labour standard

   Rate = $\dfrac{\$1{,}485{,}000}{110{,}000 \text{ hours}}$ = \$13.50 / hour

   per unit = \$13.50 / hour x 2.5 hours
   = \$33.75 / unit

   Actual direct labour rate per hour = \$13.50 + \$1.25
   = \$14.75

   Actual direct labour hours = 14,570

   e) Direct labour rate variance = \$18,212.50 U
   f) Direct labour flexible budget variance = \$23,207.50 U
   g) \$1,147 U
   h) \$43,000
   i) \$1,020 F
   j) \$2.90 per DLH
   k) \$39,820
   l) \$1,360 F

See detailed calculations on next page.

Direct material variances:

Actual AQ x AP	Actual Quantity @ Standard Price AQ x SP	Standard Quantity @ Standard Price SQ x SP
19,060 kgs x \$5.60 = \$106,736	price 19,060 kgs x 5.20 = \$99,112	usage 16,340 x 5.20 = \$84,968
		(5680 x 3 kgs) x \$5.20 = \$88,608

DM price variance = \$7,624 U

DM quantity variance = \$3,640 F

Direct labour variances

Actual AQ x AP	Actual Quantity @ Standard Rate AQ x SP	Standard Quantity @ Standard Rate SQ x SP
14,570 x \$14.75 \$214,907.50	14,570 hrs. x \$13.50 = \$196,695	(5680 x 2.5 hrs) x \$13.50 = \$191,700

DM rate variance = \$18,212.50 U

DM efficiency variance = \$4,995 U

flexible budget variance = \$23,207.50 U

Variable overhead variances:

Actual	Actual Quantity @ Standard Rate	Standard Quantity @ Standard Rate
AQ x AP	AQ x SP	SQ x SP
	14,570 x $3.10	(5680 x 2.5) x $3.10
$43,000	= $45,167	= $44,020

VOH spending variance = $2,167 F

VOH efficiency variance = $1,147 U

flexible budget variance = $1,020 F

Fixed overhead variances:

Actual	Flexible Budget	Applied
	Calculation # 1	Calculation #3 and #4
		(5680 x 2.5) x $2.90
$44,860	$39,820	= $41,180

flexible budget variance	Calculation # 2 production volume variance
= $5,040 U	= $1,360 F

$3,680 under-applied overhead

Note that to calculate the fixed overhead variances, the calculations must be done in a specific order:

Calculation #1: Actual of 44,860, which is given in the question, minus 5,040 U flexible budget variance, which is given in the question.

Calculation #2: Total under-applied overhead of 3,680 (given in question), minus unfavourable flexible budget variance of 5,040 = 1,360 F.

Calculation #3: Flexible budget amount of 39,820, determined in calculation #1, plus favourable production volume variance of 1,360 determined in calculation #2 = 41,180.

Calculation #4: 41,180 determined in calculation #3, divided by (5,680 x 2.5), which is given in the question = $2.90.

Note that the fixed overhead rate per unit is: 41,180 ÷ 5,680 = 7.25 per unit. The fixed overhead rate on a per unit basis is 7.25, while the fixed overhead rate on a per direct labour hour basis it is 2.90.

It is important to note that when using DLH's for applying fixed overhead do not use the actual direct labour hours, but use the direct labour hours that should have been used based on actual production**.**

MA61 Problem: Revenue Variances- New Look Jacket Inc.

Sales Price Variance

	Actual Sales Volume	Budgeted Sales Price/Unit	Actual Sales Price/Unit	Variance
Nylon	93,500	$35	$36	$93,500 F
Leather	16,500	150	148	33,000 U
				$60,500 F

Sales Volume Variance

	Budgeted CM/Unit	Budgeted Sales Volume	Actual Sales Volume	Variance
Nylon	$12.25	95,000	93,500	$18,375 U
Leather	46.50	5,000	16,500	534,750 F
				$516,375 F

Sales Quantity Variance

Budgeted Average CM/Unit	Budgeted Total Sales	Actual Total Sales	Variance
$13.9625	100,000	110,000	$139,625 F

Sales Mix Variance

	Actual Mix %	Bud Mix %	Actual Total Sales Volume	Bud CM/ Unit	Bud Average CM/ Unit	Variance
N	.85	.95	110,000	12.25	13.9625	18,837.50 F
L	.15	.05	110,000	46.50	13.9625	357,912.50 F
						376,750.00 F

Market Size Variance

	Budgeted Market Share %	Actual Total Industry Sales Volume	Budgeted Total Industry Sales Volume	Budgeted Average CM/Unit	Variance
N	.20	425,000	475,000	13.9625	$139,625.00 U
L	.40	125,000	12,500	13.9625	628,312.50 F
					$488,687.50 F

Market Share Variance

	Actual Total Industry Sales Volume	Budgeted Market Share %	Actual Market Share %	Budgeted Average CM/Unit	Variance
N	425,000	.20	.22	13.9625	$118,681.25 F
L	125,000	.40	.132	13.9625	467,743.75 U
					$349,062.50 U

The difference between the budgeted and actual contribution margins can be summarized by the following variances (actual variable costs behaved as budgeted):

Sales price variance	$60,500 F
Sales mix variance	376,750 F
Market size variance	488,687 F
Market share variance	349,063 U
	$576,874 F

The marketing department should be held accountable for the sales price, sales mix and market share variances. The sum of these variances add up to $78,187 F. Although the marketing department managed to increase CM by changes to the sales price and shifting the mix to leather jackets, they were unable to keep their planned market share of the leather jackets.

MA62 Problem: Revenue Variances - Sleepy Hollow Hotels, Ltd.

A. Analysis of second quarter operating results

Budgeted contribution margin:	
(45,080 standard x 80) + (22,080 deluxe x 89)	$5,571,520
Actual contribution margin:	
(41,860 standard x 79) + (26,220 deluxe x 82)	5,456,980
Variance	$114,540U

Sales price variance

	Actual volume x	Actual Daily - Room Rate	Budgeted Daily Room Rate	Variance
Std	41,860	$120	120	$0
Del	26,220	145	150	$131,100 U

=> by decreasing the daily room rate for deluxe rooms, $131,100 of revenue was lost

Sales volume variance

	Budgeted Contribution Margin / Room	Actual Rooms	Budgeted Rooms	Variance
Std	$80	41,860	45,080	$257,600 U
Del	89	26,220	22,080	368,460 F
				$110,860 F

=> the increase in sales volume resulted in an increase in total rooms occupied during the quarter, which should have generated $110,860 more contribution margin than the budget

Average budgeted contribution margin per room
= $5,571,520 ÷ (45,080 + 22,080)
= $82.9589

Sales quantity variance

Bud Average Contribution Margin / Room	Actual Rooms	Budgeted Rooms	Variance
$82.9589	68,080	67,160	$76,322 F

=> had we been able to maintain the budgeted mix, the sales volume variance would have been $76,322F rather than 110,860F

Sales mix variance

	Actual mix %	Budgeted mix %	Actual Total rooms	Budget average CM/rooms	Budget CM/room	Variance
Standard	.61486	.67123	68,080	82.9589	80	$11,354 F
Deluxe	.38514	.32877	68,080	82.9589	89	23,184 F
						$34,538 F

=> by decreasing the deluxe room rate, the mix of deluxe vs. standard room occupancy was changed. A greater proportion of deluxe rooms were occupied. Because deluxe rooms have a higher contribution margin per room per day, this change in mix should have resulted in the total contribution margin to increase by $34,538 over what would have been if the actual sales mix and contribution margin per room/day been the same as the budget

Market size variance

Bud Market Share %	Actual Market Size	Budgeted Market Size	Bud Average CM/Rooms	Variance
.05	1,237,860	1,343,200	82.9589	$436,945 U

=> as a result of the almost 8% decrease in market size, SHHL would have experienced a $436,945 decrease in CM had the market share and CM/room/day been the same as the budget. By decreasing the sales price of deluxe rooms, SHHL was able to capture a higher market share, which offset most of the negative impact of the smaller market size.

Market share variance

Bud Market Share %	Actual Market Share %	Actual Market Size	Bud Average CM/Rooms	Variance
.05	.055	1,237,860	82.9589	$513,458 F

=> SHHL's market share increased by 0.5%. Given the decreased market size, the increased market share should have resulted in increasing the total CM by $513,458 had the sales mix and CM/room/day been the same as the budget.

Variable cost variance

Standard rooms - 41,860 x (41 - 40)	$41,860 U
Deluxe rooms - 26,220 x (63 - 61)	52,440 U
	94,300 U

=> the variable costs/room/day were higher for both types of rooms. This resulted in a decrease in the total CM of $94,300. It is unknown whether this variance was caused by an increase in variable cost prices, a decrease in efficiency or an increase in service quantity or quality. The cause of this variance should be investigated to determine whether its cause was beneficial (e.g. contributed to the increased market share), unavoidable (e.g. industry price increases) or detrimental (e.g. inefficiencies that should be corrected and controlled).

Summary of Variances:

Sales price variance			$131,100U
Sales volume variance			
Sales mix variance		$34,538 F	
Sales quantity variance =			
Market size variance	$436,945 U		
Market share variance	513,267 F	76,322 F	110,860 F
Variable cost variance			94,300 U
Fixed cost variance			0
Total variance			$114,540 U

Overall, it appears SHHL's performance in the second quarter, while being worse than the budget, was not as bad as it could have been as a result of the decrease in market demand for hotel rooms.

B. Evaluation of Sales Performance

- It appears the actions of Suzie Paquin, the Vice-President of Sales, offset most of the negative effects SHHL would have experienced as a result of the decrease in market demand. By making a part of her remuneration a commission based on total revenues, she was motivated to maximize total revenues. Faced with a decrease in market demand, Suzie succeeded in increasing SHHL's market share sufficiently to generate $103,500 more in total revenue than the budget. Despite the increase in total revenues, however, SHHL experienced a decrease in total contribution margin mostly as a result of increased variable costs.

- Her focussing only on the deluxe rooms may have some negative effects. The greater demand for deluxe rooms forced SHHL to turn away some of its regular customers while standard rooms remained unoccupied. These customers may have been forced to go to one of SHHL's competitors and some may decide not to come back to SHHL. The decision to ignore standard room occupancy and push the deluxe rooms to at or near capacity may result in lost profits in both the short run and the long term. The overall contribution margin percentage of sales decreased because one dollar of revenue from a deluxe room generates $0.59 of budgeted contribution margin vs. $0.67 for a standard room. The deluxe rooms provide only $9 of additional budgeted contribution margin per room/day. The actual difference was only $3 per room/day in the second quarter. Therefore, the benefits of emphasizing deluxe rooms may not be as great as they appear at first glance.

- In the future, the focus should be placed on the market. Suzie Paquin should investigate why the market demand dropped and attempt to determine the cause of the decrease in demand for standard rooms.
  - was it mainly caused by a decrease in market demand or a shift in demand from standard to deluxe rooms?
  - did the increased demand for deluxe rooms come mostly from SHHL's repeat customers shifting from standard to deluxe rooms or did SHHL attract new customers away from its competitors?

Once the above questions are answered, a marketing strategy can be determined and implemented.

- SHHL should also consider basing Suzie Paquin's commission on more than total revenues. Such things as market share, customer retention and overall company profits could also be factored into the remuneration equation to ensure she makes decisions that will benefit the overall company in both the short and long term.

MA63 Solution: Cost Volume Profit Analysis - ABC Company

1. Breakeven point

	Per unit	CM ratio
Selling price	$45.00	
Variable costs:		
Direct material	$4.00	
$2 x 2 kgs		
Direct labour	1.20	
Variable overhead	0.80	
Other variable expenses per unit	0.60	
Total variable costs	$6.60	
Contribution margin	$38.40	85.33%

Breakeven in units:

$$\frac{\text{fixed Costs}}{\text{CM/unit}} = \frac{\$83{,}000}{\$38.40} = 2{,}161 \text{ units}$$

Breakeven in sales dollars:

$$\frac{\text{fixed Costs}}{\text{CM ratio}} = \frac{\$83{,}000}{85.33\%} = \$97{,}266$$

2. Breakeven in units:

Breakeven in units:

$$\frac{\text{fixed costs + target pre-tax profit}}{\text{CM/unit}}$$

$$= \frac{83{,}000 + (240{,}000 \div .6)}{38.40} = \frac{483{,}000}{38.40} = \begin{array}{c}12{,}579 \text{ units}\\ \text{(rounded)}\end{array}$$

Breakeven in sales dollars:

$$\frac{\text{fixed costs + target pre-tax profit}}{\text{CM ratio}}$$

$$= \frac{83{,}000 + (240{,}000 \div .6)}{85.33\%} = \frac{483{,}000}{85.33\%} = \begin{array}{c}\$566{,}038\\ \text{(rounded)}\end{array}$$

3.

Fixed costs:	
Fixed manufacturing costs	$60,000
Other fixed expenses	8,000
	$68,000
Contribution margin:	
As per Part 1 solution	$38.40
Less: additional variable cost for commission	(3.00)
	$35.40
CM ratio (35.40/45)	78.67%

Breakeven in units:

$$\frac{\text{fixed Costs}}{\text{CM/unit}} = \frac{\$68{,}000}{35.40} = 1{,}920 \text{ units}$$

Breakeven in sales dollars:

$$\frac{\text{fixed Costs}}{\text{CM ratio}} = \frac{\$68{,}000}{78.67\%} = \$86{,}441$$

MA64 Solution: Cost Volume Profit Analysis – Konrad Inc.

Total contribution margin:

Total contribution margin:				
X	3000 x $45/unit		$135,000	
Y	5000 x $25/unit		125,000	
Z	1000 x $28/unit		28,000	
			$288,000	A
Total sales in units:				
X		3,000		
Y		5,000		
Z		1,000	9,000	B
Average CM per unit			32	A ÷ B

Total sales in units required to breakeven:

$$\frac{\text{fixed costs}}{\text{average CM/unit}} = \frac{\$249{,}600}{32.00} = 7{,}800 \text{ units}$$

Units of X, Y and Z required to breakeven:

$$\frac{3000}{9000} \times 7800 = 2600$$

$$\frac{5000}{9000} \times 7800 = 4333$$

$$\frac{1000}{9000} \times 7800 = 867$$

$$\underline{\underline{7800}}$$

MA65 Solution: Cost Volume Profit Analysis – Excellent Textbook Company

a. Total fixed costs = (allocated fixed manufacturing costs per unit *(normal volume) + (allocated fixed marketing costs per unit) *(normal volume)
= ($6.60 x 3,000) + ($7.70 x 3,000)
= $42,900

CM/unit = (unit selling price) – (all unit variable costs)
= $43.50 – ($5.50 + $8.25 + $4.20 + $2.75)
= $43.50 - $20.70
= $22.80

Breakeven point in units = total fixed costs / CM per unit
= $42,900 / $22.80
= 1,882

CM ratio = CM/sales = $22.80 / $43.50
= 0.52414

Breakeven point in sales = total fixed costs/CM ratio
= $42,900 / 0.52414
= $81,848

OR: Breakeven units x selling price per unit
= 1,882 x $43.50
= $81,867 (difference due to rounding of the CM ratio)

b. New CM/unit = $38.50 - $20.70
= $17.80

Total contribution margin	
Before: 3,000 x $22.80	$68,400
After: 3,500 x $17.80	62,300
Decrease in TCM	$ 6,100

Do not recommend this action be taken as operating income would drop by $6,100.

MA66 Solution: Cost Volume Profit Analysis- Nixon Company

a. Variable costs per unit = ($1,400 + 1,500 + 1,000 + 1,100) / 100 units
= $5,000 / 100
= $50

CM/unit = $100 - $50 = $50

Breakeven point in units = ($500 + $2,000) / $50
= $2,500 / $50
= 50 units

b. DOL = CM / operating income = $5,000 / 2,500 = 2
Increase in operating income = 25% x 2 = 50%
New operating income = $2,500 x 1.5 = $3,750

Or: (125 units x $50) - $2,500 = $3,750

Or: Increase operating income = 25 units x $50 = $1,250
New operating income = $2,500 + 1,250 = $3,750

c. CM Ratio = $50 / $100 = 50%
Breakeven sales = ($2,500 + 1,700) / .5
= $4,200 / .5
= $8,400

MA67 Solution: Cost Volume Profit Analysis - All-Day Candy Company

a. CM/unit = $4 - $2.40 = $1.60
After-tax net income = [(390,000*1.60) - $440,000].6
= ($624,000 – $440,000).6
= $110,400

b. $440,000 / $1.60
= 275,000 boxes

c. Current CM ratio = $1.60 / $4 = 40%
New variable costs = $2*1.15 + 0.40 = $2.70

Let SP = new selling price
(SP - $2.70) / SP = 0.4
SP - $2.70 = 0.4SP
SP – 0.4SP = $2.70
0.6SP = $2.70
SP = $4.50

d. CM = $4 - $2.70 = $1.30
CM ratio = $1.30 / $4 = 32.5%
Desired operating income = $110,400 / .6 = $184,000

Desired sales volume = ($184,000 + $440,000) / 0.325
= $1,920,000

e. Let X = volume of boxes

1.30X – 440,000 = $4X(0.10) / 0.60
1.30X – 440,000 = 0.6667X
0.6333X = $440,000
X = $440,000 / 0.6333
= 694,737 boxes

MA68 Solution: Cost Volume Profit Analysis - Mistry Company

a. Weeder CM = $28 – 13 – 5 = $10
Hedge clippers CM = $36 – 12 – 4 = $20
Leaf blowers CM = $48 – 25 - 6 = $17

Budgeted net income = [(50,000*10) + (50,000*20) + (100,000*17)
– 2,600,000]*0.6
= [$500,000 + 1,000,000 + 1,700,000 – 2,600,000]*0.6
= $600,000*0.6
= $360,000

b. Let a bundle = 1 unit of weeder + 1 unit of hedge clipper + 2 units of leaf blowers (i.e. at their standard mix)

Then the bundle contribution margin = $10 + $20 + ($17 x 2) = $64
Number of bundles to breakeven = $2,600,000 / $64 = 40,625
Or: 40,625 weeders, 40,625 hedge clippers and 81,250 leaf blowers

c. Operating income desired = $450,000 / 0.60 = $750,000
Bundle selling price = $28 + $36 + ($48 x 2) = $160
Bundle CM ratio = $64 / $160 = 40%
Required sales = ($2,600,000 + $750,000) / 0.40 = $8,375,000

d. New contribution margins:
Weeder CM = $28 – 13 – 5 = $10
Hedge clippers CM = $36 – 12 – 5 = $19
Leaf blowers CM = $48 – 30 - 6 = $12

New mix: 1:1:3

Bundle contribution margin = $10 + $19 + ($12 x 3) = $65
Number of bundles to breakeven = $2,600,000 / $65 = 40,000
Or: 40,000 weeders, 40,000 hedge clippers and 120,000 leaf blowers

MA69 Solution: Relevant Costing – Special Orders - CBA Inc.

1.

Selling Price		$52.50
Variable costs:		
Direct materials		$2.10
Direct labour		1.75
Variable overhead		0.96
	Total variable costs	$4.81
CM per unit		$47.69

Since there is capacity available, this special order should be accepted as it results in additional operating income of $47,690 (1,000 units x $47.69/unit).

2. Since CBA Inc.'s annual sales equals capacity, there is no idle capacity. Therefore, the opportunity cost of foregoing normal production to manufacture this special order must be taken into consideration. The opportunity cost represents the lost contribution on normal production.

Lost contribution on normal production:

Selling price		$60.00
Variable costs:		
Direct materials		$2.10
Direct labour		1.75
Variable overhead		0.96
Variable selling and administration		10.96
	Total variable costs	$15.77
CM per unit		$44.23
Total CM lost (1,000 units x $44.23)		$44,230
CM earned on special order		$47,690
Less: CM on normal production		$44,230
Net gain by accepting the special order		$3,460

Since CBA Inc. will gain $3,460 by accepting the special order, CBA should accept it.

Performance Management - Solutions

MA70 Solution: Relevant Costing – Special Orders - Kimco Inc.

a. Change in profit = (selling price – variable costs) * no. of units
= ($12 – $7.50) * 2,000
= $9,000 increase in net income

b. The relevant minimum sales price is $1.50, (variable selling and administrative expense).

The cost of producing these products is a sunk cost and since they must be sold through regular channels, the company will incur regular selling and administrative expenses.

MA71 Solution: Relevant Costing – Special Orders - George Jackson

Revenue of special order: 5,000 x $7	$35,000
Incremental direct costs of the order:	
Material and labour: 5,000 x $5.60	(28,000)
Special device	(2,000)
Contribution margin lost on standard sales:	
Total standard sale CM:	
$25,000 ^{sales} – 8,000 ^{materials} – 9,000 ^{labour} = $8,000 x ½	(4,000)
Incremental operating income of special order	$1,000

MA72 Solution: Relevant Costing – Special Orders - Strutt Company

CM per unit for regular robes =
$\$12.50^{\text{ sales}} - 6.25^{\text{ var. manufacturing}} - 1.80^{\text{ var. marketing}} = \$4.45$

CM per unit for special order =
$\$8^{\text{ sales}} - 6.25^{\text{ var. manufacturing}} - 1.35^{\text{ var. marketing}} = \$0.40$

Total CM on special order: 10,000 x $0.40	$4,000
Total CM lost on regular sales: 2,000 x $4.45	(8,900)
Incremental operating income if special order is accepted	($4,900)

MA73 Solution: Relevant Costing – Make or Buy - Todders Ltd.

	Cost to Make		Cost to Buy	
	Per Unit	Total (30,000 units)	Per Unit	Total (30,000 units)
Direct materials	$ 5.75	$172,500		
Direct labour	10.00	300,000		
Variable overhead	1.50	45,000		
Fixed overhead increase	-	30,000		
Purchase price	-		$17.00	
Ordering, receiving and inspecting			$2.50	
		$547,500	$19.50	$585,000

By producing internally, the net benefit to Todders Ltd. is $37,500 ($585,000 - $547,500) per annum. Todders should produce internally.

Performance Management - Solutions

MA74 Problem: Relevant Costing – Make or Buy - Surtel Company

a. Cost to buy:

Purchase price: 5,000 x $8	$40,000
Freight: 5,000 x $0.50	2,500
Indirect labour	5,000
Payroll taxes and other benefits (2,800/20,000 = 14%; 5,000 x 14%)	700
	$48,200

Cost to make:

Direct materials	$17,500
Direct labour	28,000
Indirect labour	6,000
Payroll taxes and other benefits	
14% of direct and indirect labour; [(28,000 + 6000) x 14%]	4,760
Power	300
Other	500
Property taxes and insurance	1,000
	$58,060

From a purely quantitative basis, the Faktrons should be purchased from the external supplier.

Note that depreciation is not considered since it is not a relevant cost.

b. Working capital requirements may be affected – to the extent working capital increases (decreases), then the cost of carrying working capital needs to be factored in.

Impact on employee morale if we outsource, especially if the displaced labour cannot be accommodated elsewhere in the company.

Possible disruption in production scheduling if the external supplier does not supply on time.

We need to consider the technical competence and financial strength of the supplier.

MA75 Solution: Relevant Costing – Buying Decision - Tsui Company

a. 1.

2-inch: 50 tons x $210	$10,500
4-inch: 75 tons x $200	15,000
Shipping: 125 tons x $10	1,250
	$26,750

2.

Cost of steel from Jensteel:	
125 tons / 0.975 = 128.21 ton x $180	$23,078
Cost of shipping from Jensteel to pre-cut	
128.21 ton x $5	641
Cost of slitting at Pre-cut	
2-inch: 50 tons x $18	900
4-inch: 75 tons x $15	1,125
Cost of shipping to Tsui:	
125 tons x $7.50	938
	$26,682

3.

Cost of steel from Jensteel:	
200 tons / 0.975 = 205.13 ton x $180	$36,923
Cost of shipping from Jensteel to Pre-cut	
205.13 ton x $5	1,026
Cost of slitting at Pre-cut	
2-inch: 100 tons x $18 x 0.88	1,584
4-inch: 100 tons x $15 x 0.88	1,320
Cost of shipping to Tsui:	
200 tons x $7.50	1,500
Cost of storage: 75 tons x 1.50 x 2 months	225
	$42,578

For comparison purposes, the cost for immediate needs is:

Cost of steel: $36,923 x 125/200	$23,077
Cost of shipping from Jensteel to Pre-cut	
$1,026 x 125/200	641
Cost of slitting:	
2-inch: $1,584 x 50/100	792
4-inch: $1,320 x 75/100	990
Cost of shipping to Tsui: $1,500 x 125/200	938
Cost of storage: $225 x 125/200	141
	$26,579

b. The steel has to be shipped and handled twice – there could be slack time and shipping problems.

If quality problems occur, we would be dealing with one supplier as opposed to two. Also, as there are costs with dealing with vendors, it would be cheaper dealing with only one.

MA76 Solution: Relevant Costing – Drop a Product Line - Licnep Ltd.

To decide whether to continue making ice cream, Licnep Ltd. must determine whether or not ice cream is profitable by removing allocated common fixed costs (i.e. considering only those costs directly attributable to each product line).

	Soda (000s)	Juice (000s)	Ice Cream (000s)
Sales	$48,330	$44,980	$26,230
Variable costs	16,500	19,600	12,700
Contribution margin	$31,830	$25,380	$13,530
Less:			
Direct fixed costs (Note 1)	8,720	18,300	10,065
	$23,110	$7,080	$3,465

Note 1: Calculation of direct fixed costs:

Soda	$21,800 x 40%	=	$8,720
Juice	$24,400 x 75%	=	$18,300
Ice cream	$18,300 x 55%	=	$10,065

Conclusion:

By considering only direct costs, ice cream is earning a profit and, therefore, should not be discontinued.

MA77 Solution: Relevant Costing – Drop a Product Line - Andres Company

Alternative A:

Reduction in variable costs		
Current variable costs: ($285,000 + 270,000)	$555,000	
New variable costs: $925,000 x 52%	481,000	$74,000
Incremental fixed costs: $480,000 – 430,000		(50,000)
Incremental income		$24,000

Alternative B:

CM lost on Product Ex ($925,000 – 555,000)	($370,000)
CM increase on Product Zee:	
($575,000 – 150,000 – 80,000) x 50%	172,500
Fixed costs avoided	30,000
Rent	157,500
Incremental income	($10,000)

Note that the reallocation of rent is not relevant since total rent will remain the same.

Given that the company would lose $10,000 per year if they discontinued the Ex product line, recommend Alternative A be adopted.

Performance Management - Solutions

MA78 Solution: CM Analysis and Scarce Resources - John's Company

	X	Y
Selling price	$128.00	$98.00
Variable costs:		
Direct materials	$6.00	$3.50
Direct labour		
X: $15/hr x 2.5 hrs	37.50	
Y: $15/hr x 1.5 hrs		22.50
Variable overhead		
X: $5.50/hr x 2.5 hrs	13.75	
Y: $6.60/hr x 1.5 hrs		9.90
Variable selling and administration	25.00	20.00
Variable costs per unit	$82.25	$55.90
Contribution margin per unit	$45.75	$42.10
Machine hours required per unit	÷ 3	÷ 5
CM per machine hour	$15.25	$8.42

Optimum production quantities:

Since Product X has a higher CM per constraining factor (machine hours), John's Company should maximize production of X.

Available machine hours	5500	hours
Machine hours required for Product X	÷ 3	
Maximum production capacity of X	1833	units
Total demand of X	600	units

Total machine hours available	5500
Less: machine hours required to meet demand for X (600 units x three machine hours/unit)	(1800)

Machine hours available for Y	3700	
Machine hours required for Product Y	÷ 5	
Total units of Y to produce	740	units

Since the demand for Product X is 600 units, John's Company should produce 600 units of Product X. The remaining capacity can be used to produce 740 units of Product Y.

MA79 Solution: CM Analysis and Scarce Resources - Paulie Limited

	A	B
Selling price	$11.30	$19.25
Variable costs:		
Direct materials		
A: 2 kgs x $1/kg	$2.00	
B: 3 kgs x $0.80/kg		$2.40
Direct labour		
A: .25 x $12/hr	$3.00	
B: .75 x $12/hr		$9.00
Variable overhead	$1.50	$1.75
Variable expenses	$6.50	$13.15
Contribution margin per unit	$4.80	$6.10
Machine hours required per unit	÷ 4.0	÷ 6.0
CM per machine hour	$1.20	$1.02

Since Product A has a higher contribution margin per constraining factor, production of Product A should be maximized. Using the available capacity to produce only Product A results in production of Product A of 12,400 units (49,600 machine hours ÷ four machine hours per unit). However, since annual demand of Product A is 4,000 units, only 4,000 units of Product A should be produced. This leaves 33,600 machine hours [49,600 – (4,000 annual demand for Product A x four machine hours)] available for Product B. This translates into 5,600 units (33,600 machine hours ÷ six machines per unit) of Product B. Since demand for Product B is 5,000 units, the company should restrict production of Product B to 5,000 units. This means there is idle capacity of 3,600 machine hours [49,600 – (4,000 x 4) – (5,000 x 6)].

MA80 Solution: CM Analysis and Scarce Resources - Ronson Electric

	Product X	Product Y	Product Z
Contribution margin per unit	$18	$12	$9
Raw material required per unit of product (kgs)	6	2	4
Contribution margin per kilogram	$3	$6	$2.25
Order filling sequence	2	1	3

As a resource constraint problem, the correct approach is to determine the contribution margin per unit of input. This allows Ronson to identify the most effective use of raw material.

MA81 Solution: CM Analysis and Scarce Resources- Lam Company

Amount of presumed scarce resources required to meet maximum demand:	
Heavy duty fibre: (250 x 80) + (500 x 40)	40,000
Regular fibre: (250 x 20) + (500 x 40)	25,000
Direct labour hours: (250 x 5) + (500 x 5)	3,750

The only binding constraint is regular fibre.

	Commercial	Residential
Selling price	$1,000	$800
Variable costs per roll*		
Direct labour	150	150
Variable overhead	90	90
Contribution margin	$760	$560
Kg of regular fibre	20	40
CM per kg of regular fibre	$38	$14

Production plan:	Regular fibre
Commercial rolls: 250 rolls x 20 kg	5,000
Residential rolls: 375 rolls x 40 kg	15,000
	20,000

- Note that the cost of fibre was not considered. This fibre is in stock and will not, once depleted, be replaced. The cost of fibre is, therefore, sunk and not relevant for purposes of calculating contribution margins.

MA82 Solution: Linear Programming - Tranta Company

Objective function:

Maximize contribution margin:

450A + 375B

Constraints:

Assembly:	$10A + 6B \leq 144$
Finishing:	$4A + 3B \leq 100$
Direct material:	$10A + 10B \leq 16{,}000$
Non-negativity constraint:	$A, B \geq 0$

MA83 Solution: Linear Programming – XYZ Inc.

Objective function to maximize contribution:

Total CM = 8X + 5Y

Constraints:

Material:	$3.5X + 2Y \leq 2400$
Labour:	$.75X + .25Y \leq 800$
Machine 1:	$1.50X + .50Y \leq 220$
Machine 2:	$.50X + .50Y \leq 244$
Non-negativity constraint:	$X, Y \geq 0$

MA84 Solution: Linear Programming - The Fluffy Toy Company

a. Bob the Rat: CM/machine hour = (\$2.50 - \$1.50)/1 = \$1
Bob the Cat: CM/machine hour = (\$3 - \$2.25)/.5 = \$1.50

Since Bob the Cat provides the greatest contribution per machine hour, the company should produce 4,000 Bob the Cat stuffed animals (2,000 total machine hours x 2 Bob the Cat stuffed animals per hour) and zero Bob the Rat stuffed animals.

b. Let X = number of Bob the Rats and Y = the number of Bob the Cats.

$Z = X + .75Y$	(objective function)
$X + .5Y \leq 2{,}000$	(machine constraint)
$X \leq 1{,}500$	(demand constraint)
$Y \leq 3{,}000$	(demand constraint)
$X \geq 0$	(non-negativity)
$Y \geq 0$	(non-negativity)

MA85 Solution: Linear Programming - Harrington Corporation

a. CM for Product A = \$4 – 1 = \$3
CM for Product B = \$3.50 – 0.50 = \$3
CM for Product C = \$6 – 2 = \$4

Objective function: maximize TCM = \$3A + \$3B + \$4C

b. $2A + 2B + 3C \leq 150$

c. $A + 2B + 2.5C \leq 100$

MA86 Solution: Linear Programming - Pools and Things Ltd.

a. Time required to produce maximum demand:

	Machine Hours	Labour Hours
Department 1		
Regular chairs	16,000	16,000
Lounge chairs	20,700	10,350
	36,700	26,350
Available hours	40,000	25,000
Excess capacity	3,300	(1,350)
Department 2		
Regular chairs	16,000	8,000
Lounge Chairs	20,700	10,350
	36,700	18,350
Available hours	35,000	20,000
Excess capacity	(1,700)	1,650

Thus, we are dealing with two constraints: direct labour hours in Department 1 and machine hours in Department 2.

CM/Unit:

	Regular Chairs	Lounge Chairs
Selling price	$42	$79
Direct materials	(5)	(8)
Other variable production	(20)	(41)
Variable selling	(2)	(3)
CM/unit	$15	$27

Let R = regular chairs and L = lounge chairs

Objective function   Maximize $15R + $27L

Subject to: Dept 1 DLH: $.5R + .5L \leq 25{,}000$
Dept 2 MH: $.5R + L \leq 35{,}000$
Demand: $R \leq 32{,}000$
$L \leq 20{,}700$
Non-negative: $R \geq 0, L \geq 0$

Performance Management - Solutions

b.

	Q1	Q2	Q3	Q4
Cash – beginning	$100,000	$32,800	$34,875	$28,925
Collections (1)	492,267	695,800	695,800	695,800
	592,267	728,600	730,675	724,725
Cash disbursements				
Variable production and sel.	385,000	385,000	385,000	385,000
Direct materials (2)	51,667	77,500	77,500	77,500
Fixed production costs	35,000	35,000	35,000	35,000
Fixed administration	65,000	65,000	65,000	65,000
Term loan repayment	90,000	90,000	90,000	90,000
Term loan interest	21,000	19,425	17,850	16,275
	647,667	671,925	670,350	668,775
Minimum cash balance	25,000	25,000	25,000	25,000
Cash excess (deficiency)	-80,400	31,675	35,325	30,950
Borrowing	90,000			
Repayment		20,000	30,000	30,000
Interest	1,800	1,800	1,400	800
Cash balance – end of year	$32,800	$34,875	$28,925	$25,150

(1) Collections

	Q1	Q2	Q3	Q4
Sales	710,000	$710,000	$710,000	$710,000
Collections	492,267	695,800	695,800	695,800
A/R balance – end	217,733	231,933	246,133	260,333

Cash collected – 1st quarter	
1st month sales: $236,667 x 98%	$231,934
2nd month sales: $236,667 x 90%	213,000
3rd month sales: $236,667 x 20%	47,333
	$492,267
Cash collected – other quarters	
$710,000 x 98%	$695,800

(2) Direct materials

1st quarter: $25,833 x two months	$51,667
Other quarters: $25,833 x three months	77,500

c. Outdoor Furniture Ltd.
Budgeted Income Statement
for the first year of operations

Sales	$2,840,000
Cost of goods sold	
Direct materials	310,000
Other variable production	1,420,000
Fixed production costs	140,000
Depreciation	240,000
	2,110,000
Gross margin	730,000
Selling and administrative	
Administration	260,000
Variable selling	120,000
Interest	80,350
Bad debt expense	56,800
	517,150
Net income before taxes	212,850
Provision for income taxes	
Current	61,140
Future*	24,000
	85,140
Net income	$127,710

*	Net income before taxes	$212,850
	Add back depreciation	240,000
	Less: CCA	(300,000)
	Taxable income	152,850
		x 40%
	Current portion	$61,140
	Future portion = ($300,000 – 240,000) x 40%	$24,000

Performance Management - Solutions

Outdoor Furniture Ltd.
Budgeted Balance Sheet
as at the end of the first year of operation

Assets	
Current assets	
Cash	$ 25,150
Accounts receivable	203,533
	228,683
Fixed assets	
Equipment	1,500,000
Less: accumulated depreciation	240,000
	1,260,000
	$1,488,683
Liabilities and shareholders’ equity	
Current liabilities	
Accounts payable	$ 25,833
Bank loan	10,000
Income taxes payable	61,140
Current portion of long-term debt	360,000
	456,973
Long-term debt	480,000
Future income taxes	24,000
	504,000
Shareholders' equity	
Common stock	400,000
Retained earnings	127,710
	527,710
	$1,488,683

MA87 Solution: Decision Analysis under Uncertainty – Slick Ltd.

Two decisions have to be made: the quantity of material that should be ordered and the price that should be charged. The quantity of materials to order depends on the state of the economy and the price. The price to set depends on the state of economy and the quantity of material ordered. Four approaches to analyzing the situation are presented. Each approach results in the same answer. It is not necessary to calculate each approach in an examination situation, all four are presented to enhance the learning potential of this question.

<u>Approach 1</u>

Prepare two decision tables, one for each possible unit price. For each price, choose the material quantity order level that maximizes the expected contribution and then find the best unit price/order quantity combination.

Price = $5.25 per unit

Order Quantity	State of Economy	
	Weak (.6)	Strong (.4)
200,000 units	($5.25 × 180,000) – ($3 × 200,000) = $945,000 – $600,000 = $345,000	($5.25 – $3) × 200,000 = $450,000
240,000 units	($5.25 × 180,000) – ($2.90 × 240,000) = $945,000 – $696,000 = $249,000	($5.25 × 200,000) – ($2.90 × 240,000) = $1,050,000 – $696,000 = $354,000

Expected CM if order 200,000 units = ($345,000 × .6) + ($450,000 × .4)
= $207,000 + 180,000
= $387,000

Expected CM if order 240,000 units = ($249,000 × .6) + ($354,000 × .4)
= $149,400 + $141,600
= $291,000

Therefore, if the price is set at $5.25 per unit, the best quantity to order is 200,000 units for an expected contribution margin of $387,000.

Performance Management - Solutions

Price = $5 per unit

Order Quantity	State of Economy	
	Weak (.6)	Strong (.4)
200,000 units	($5 – $3) × 200,000 = $400,000	$400,000 ($5-$3) x 200000
240,000 units	($5 × 200,000) – ($2.90 × 240,000) = $1,000,000 – $696,000 = $304,000	($5 – $2.90) × 240,000 = $504,000

Expected CM if order 200,000 units =($400000 x 0.6) + ($400000 x 0.4)
= $400,000

Expected CM if order 240,000 units = ($304,000 × .6) + ($504,000 × .4)
= $182,400 + $201,600
= $384,000

Therefore, if the price is set at $5 per unit, the best quantity to order is 200,000 units for an expected contribution margin of $400,000.

Recommendation:

Slick Ltd. should order 200,000 units of material and set the price at $5 per unit of Zap to gain a contribution next year of $400,000.

Approach 2

Prepare two decision tables, one for each possible quantity ordered. For each quantity, choose the price that maximizes expected contribution and then find the best order quantity/unit price combination.

Order 200,000

Unit Price	State of Economy	
	Weak (.6)	Strong (.4)
$5.25	($5.25 × 180,000) – ($3 × 200,000) = $945,000 – $600,000 = $345,000	($5.25 – $3) × 200,000 = $450,000
$5	($5 – $3) × 200,000 = $400,000	$400,000 ($5-$3) x 200,000

Expected CM if price is $5.25 = ($345,000 × .6) + ($450,000 × .4)
= $207,000 + 180,000
= $387,000

Expected CM if price is $5 = $ 400000 x (0.6+0.4)
= $400,000

Therefore, if 200,000 units are ordered, the price should be set at $5 for an expected contribution margin of $400,000.

Order 240,000 units

Unit Price	State of Economy	
	Weak (.6)	Strong (.4)
$5.25	($5.25 × 180,000) – ($2.90 × 240,000) = $945,000 – $696,000 = $249,000	($5.25 × 200,000) – ($2.90 × 240,000) = $1,050,000 – $696,000 = $354,000
$5	($5 × 200,000) – ($2.90 × 240,000) = $1,000,000 – $696,000 = $304,000	($5 – $2.90) × 240,000 = $504,000

Expected CM if price is $5.25 = ($249,000 × .6) + ($354,000 × .4)
= $149,400 + $141,600
= $291,000

Expected CM if price is $5 = ($304,000 × .6) + ($504,000 × .4)
= $182,400 + $201,600
= $384,000

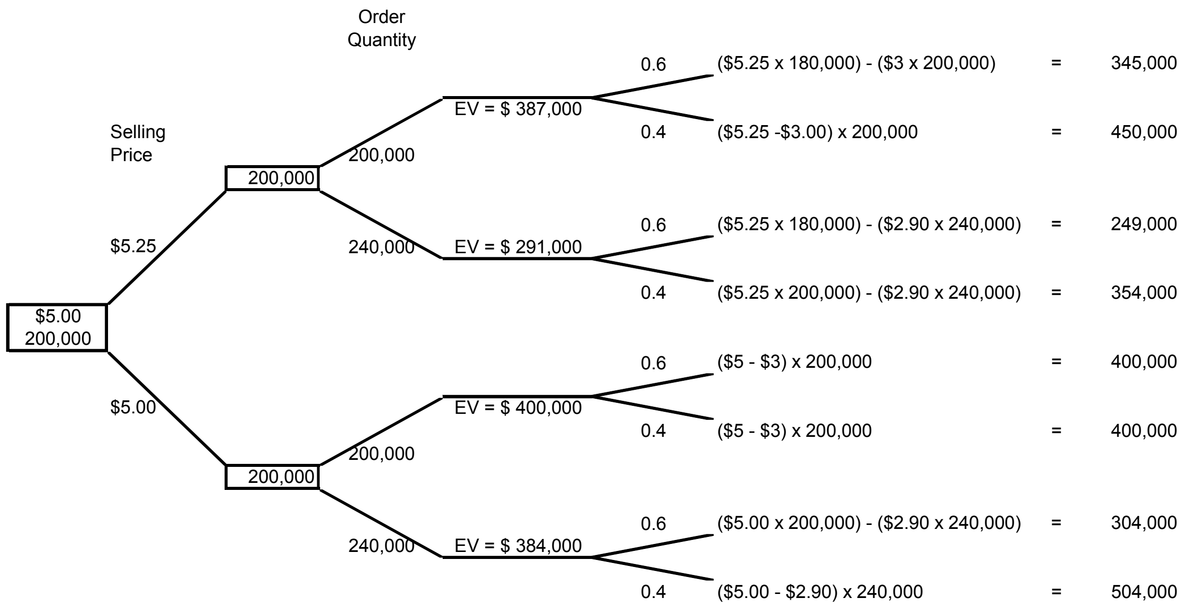
Performance Management - Solutions

Therefore, if 240,000 units of material are ordered, the best selling price is $5 for an expected contribution margin of $384,000.

Recommendation:

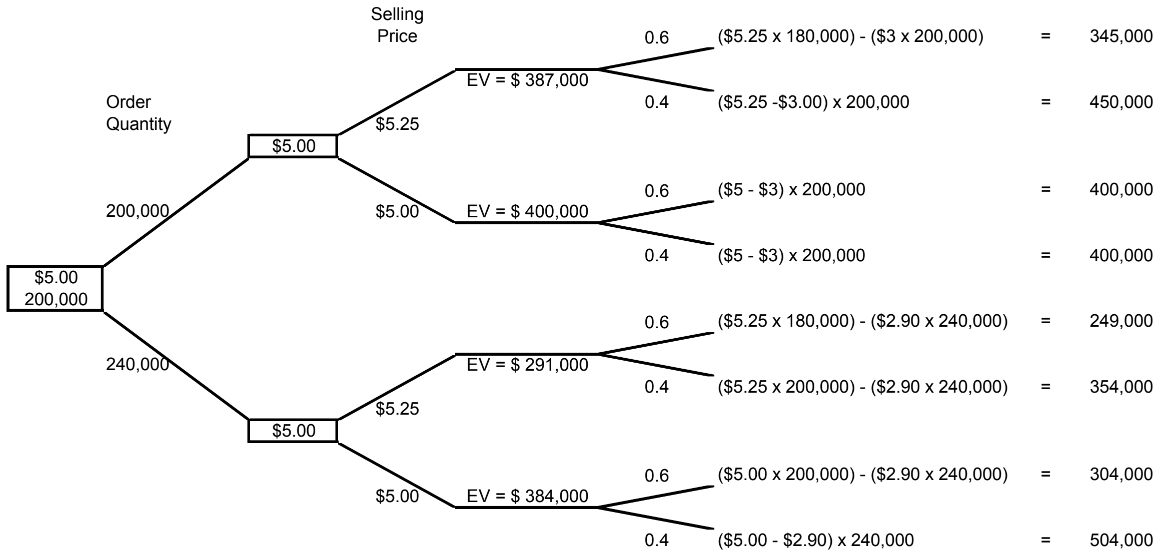
Slick Ltd. should order 200,000 units of material and set the price at $5 per unit of Zap to gain a contribution next year of $400,000.

<u>Approach 3</u>



From the above tree, the highest expected CM is $400,000; therefore, Slick Ltd should set the price at $5 per Zap and order 200,000 units of material to maximize the expected contribution.

Approach 4



From the above tree, the highest expected CM is $400,000; therefore, Slick Ltd should set the price at $5 per Zap and order 200,000 units of material to maximize the expected contribution.

MA88 Solution: Decision Analysis under Uncertainty - Dynaco Company

		Machine Breakdowns Per Week						
		0	1	2	3	4	5	
Repair Time (minutes)	Probability	10%	10%	20%	25%	30%	5%	Weekly cost
60	30%	0	**2.16**	**8.64**	**16.20**	**25.92**	**5.40**	**58.32**
120	50%	0	**7.20**	**28.80**	**54.00**	**86.40**	**18.00**	**194.40**
180	20%	0	**4.32**	**17.28**	**32.40**	**51.84**	**10.80**	**116.64**
		0	**13.68**	**54.72**	**102.60**	**164.16**	**32.40**	**369.36**

Cost per hour of machine repair is $72 and cost per minute of machine repair is $1.20, calculated as $72/60 = $1.20.

Example of calculation of one of the cells (second column). Once you have mastered the calculation of one of the cells, follow the same process for the remaining cells.

Step 1
Under probability 0.1 with one breakdown, this means there is a 10% (1 X 0.1) chance with one machine breakdown per week. With that in mind the required minutes to fix one machine is either 18, 60 or 36 minutes. To calculate the probable minutes, you multiply the minutes with the probability (e.g. 60 minutes x 0.3 = 18 minutes).

Step 2
Combine all calculated data.

Estimated number of machine breakdowns = 0.1 x 1 = 0.1
Estimated minutes required to fix machine = 60 x 0.3 = 18 minutes
Estimated cost to repair machine = 0.1 x 18 minutes x $1.20 = $2.16

Use this methodology to work your way down each column.

An alternate method to calculate the cost is on the next page.

Alternate method to calculate:

A Machine breakdowns per week	B Probability	A x B	
0	.10	0	
1	.10	.10	
2	.20	.40	
3	.25	.75	
4	.30	1.20	
5	.05	.25	
		2.7	Estimated machine breakdowns

A Repair time (minutes)	B Probability	A x B	
60	.3	18	
120	.5	60	
180	.2	36	
		114	Minutes or 1 hour 54 minutes

Cost per minute:
$72 / 60 minutes = $1.20 Per minute

Calculation of repair cost:
2.7 x 114 x $1.20 = $369.36

Performance Management - Solutions

MA89 Solution: Payoff tables (Expected Values) and EVPI - Germain Ltd.

a) To determine the maximum amount Germain would be willing to pay for the perfect information, first calculate the expected value of the alternatives without the information.

Maximum amount willing to pay = {expected value of the benefit under perfect information – expected value of the benefit without perfect information)

One way of approaching this is to set up a payoff table:

Alternatives	200,000 Orders P = .7	300,000 Orders P = .3	Expected Value
Status quo	$2,000,000[1]	$16,000,000[3]	$6,200,000
New service	$1,900,000[2]	$16,600,000[4]	$6,310,000

[1](140 x 200,000) – 26,000,000 = $2,000,000

26,000,000 + 1,500,000

[2][((140 + 10)– 3) x 200,000] – 27,500,000 = $1,900,000
[3](140 x 300,000) – 26,000,000 = $16,000,000
[4](147 x 300,000) – 27,500,000 = $16,600,000

Even without additional information, Germain should invest in the new technology with an expected value of $6,310,000. Incremental expected value is $110,000.

With perfect information, the expected value is
($2,000,000 x .7) + ($16,600,000 x .3) = $6,380,000

Thus, Germain should be willing to pay $6,380,000 - $6,310,000 = $70,000 for the information.

Another approach is an incremental analysis as follows:

Expected orders = (0.7 x 200,000) + (.3 x 300,000) = 230,000

The incremental benefit of the new service is [230,000 x ($10 - $3)] - $1,500,000 = $110,000; hence, without additional information, Germain should invest in the new technology and earn an incremental income of $110,000.

With perfect information, the incremental value of the new service is
0 x .7 + [(300,000 x $7) - $1,500,000] x .3 = $180,000

Therefore, Germain should be willing to pay up to $180,000 - $1 10,000 = $70,000 for the information.

b) The limitations of the analysis are:

- it assumes stable prices and costs within each of the alternatives and states;
- it assumes perfect foresight about the outcomes;
- it assumes the marketing research firm can, in fact, obtain perfect information;
- it makes use of quantitative information only and disregards qualitative issues, such as employee reaction and customer reaction to the new service and awareness of what competitors are/will be doing;
- in this instance, there are only two point estimates of demand instead of a distribution of demand at various prices; and
- it assumes the decision makers have confidence in the probability and sales estimates.

MA90 Solution: Expected Values (Payoff Tables) - AMC Corporation

1. Pay table

First, the profit on each alternative should be computed.

Low selling price ($8.20)

Selling price	$8.20
Variable costs	5.60
Contribution margin	$2.60

Units		CM / unit		Total CM	Probability
15,000	x	$2.60	=	$39,000	.05
10,000	x	$2.60	=	$26,000	.85
8,000	x	$2.60	=	$20,800	.10

High selling price ($14.50)

Selling price	$14.50
Variable costs	5.60
Contribution margin	$8.90

Units		CM / unit		Total CM	Probability
4,700	x	$8.90	=	$41,830	.05
3,800	x	$8.90	=	$33,820	.65
2,600	x	$8.90	=	$23,140	.30

Alternatives	Demand		
	Low	Medium	High
Low selling price (S_1)	$20,800	$26,000	$39,000
High selling prices (S_2)	$23,140	$33,820	$41,830

Expected value of low selling price ($8.20):
= .10 ($20,800) + .85 ($26,000) + .05 ($39,000)
= $2,080 + $22,100 + $1,950
= $26,130

Expected value of high selling price ($14.50):
= .05 ($41,830) + .65 ($33,820) + .30 ($23,140)
= $2,091.50 + $21,983 + $6,942
= $31,016.50

Conclusion:

Since the expected value of the higher price ($14.50/unit) has a higher expected value, AMC Corporation should set the price of the new product at $14.50 per unit.

2. Decision tree approach

Payoff table in decision tree format:

low price (S_1)	low demand P(low) = .10	\$20,800 x .10	=	2,080
				+
	medium demand P(medium) = .85	\$26,000 x .85	=	22,100
				+
	high demand P(high) = .05	\$39,000 x .05	=	1,950
		EV	=	\$26,130
high price (S_2)	low demand P(low) = .30	\$23,140 x .30	=	6,942
				+
	medium demand P(medium) = .65	\$33,820 x .65	=	21,983
				+
	high demand P(high) = .05	\$41,830 x .05	=	2,091.50
		EV	=	\$31,016.50

Conclusion:

The selling price should be set at the higher price of $14.50, as this alternative provides the highest expected value.

MA91 Solution: Payoff Tables (Expected Values) and EVPI - Etam Repap Inc.

1. Payoff table solution

Payoff table:

	Event		
Alternatives	Completely Successful	Partially Successful	Failure
Rearrange a_1	\$200,000	\$310,000	\$510,000
Do not rearrange a_2	\$400,000	\$400,000	\$400,000

EV of alternatives:

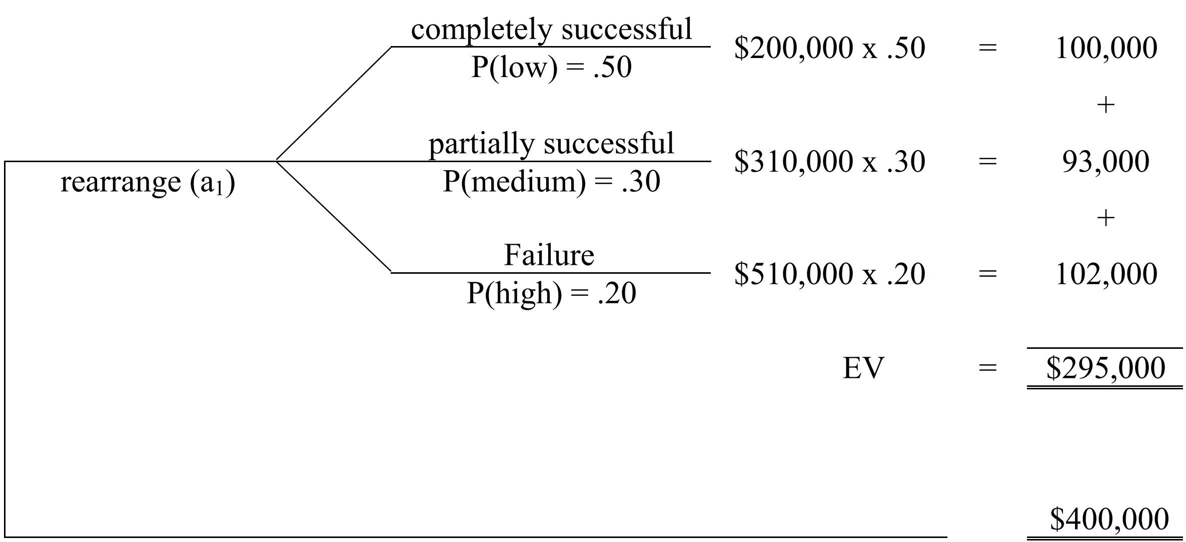
a_1: Rearrange: = \$200,000 (.5) + \$310,000 (.3) + \$510,000 (.20)
= \$100,000 + \$93,000 + \$102,000
= \$295,000

a_2: Do not rearrange: = \$400,000

Conclusion:

It is in Etam's best interest to rearrange as the expected value is lower under this alternative.

2. Payoff tree solution:



Conclusion:

Rearrange, as the EV of operating costs are lower than not rearranging.

<u>3. EVPI</u>

If perfect information was available (i.e. the probabilities were known with certainty), the optimal decision strategy is:

If completely successful, rearrange
If partially successful, rearrange
If a failure, do not rearrange

The expected value of this decision strategy is:

.5 x $200,000	=	$100,000
.3 x $310,000	=	93,000
.2 x $400,000	=	80,000
		$273,000

The maximum amount Etam Repap Inc. should be willing to pay to obtain perfect information is:

EV without perfect information	=	$295,000
EV with perfect information	=	273,000
		$22,000

Performance Management - Solutions

MA92 Solution: Expected Values (Payoff Tables) – HotDogs

a.

	States		Expected
	No Rain	Rain	Payoff
Actions:	p = .40	p = .60	
Outside	$1,600	$400	$880
Inside	600	1,400	1,080

You should set up inside as the expected payoff is higher.

b. The expected value with perfect information is: $1,600(.4) + 1,400(.6) = $1,480
The expected value of perfect information is $1,480 – 1,080 = $400

c. $1,600p + 400(1-p) = 600p + 1,400(1-p)$
$1,600p + 400 -400p = 600p + 1,400 – 1,400p$
$2,000p = 1,000$
$p = .5$

MA93 Solution: Expected Values (Payoff Tables) - Propeller Inc.

Expected demand = (200,000 x 0.4) + (300,000 x 0.3) + (400,000 x 0.2) + (500,000 x 0.1)
= 80,000 + 90,000 + 80,000 + 50,000
= 300,000

Single purpose machine: $0.60(300,000) + 20,000 = $200,000
Semi-automatic machine: $0.40(300,000) + 50,000 = $170,000
Automatic machine: $0.20(300,000) + 120,000 = $180,000

Select semi-automatic machine.

MA94 Solution: Expected Values (Payoff Tables) - QTI Ltd.

Expected value after three days = (5,000 x 0.4) + (8,000 x 0.2) + (12,000 x 0.3) + (30,000 x 0.1)
= $2,000 + 1,600 + 3,600 + 3,000
= $10,200

Recommend you hold onto the investment as the expected payoff is $200 more than what could be received now. However, consider there is a 60% chance you will receive less than $10,000. Any risk adverse investor will sell the investment now.

MA95 Solution: Expected Values (Payoff Tables) - The Elwood Company

($75,000 x 0.75) + ($50,000 x 0.25) = $68,750

MA96 Solution: Expected Values (Payoff Tables) - The Gallant Company

Expected variable cost to make
= ($10 x 0.10) + (12 x 0.30) + (14 x 0.40) + (16 x 0.20)
= $13.40

Cost to buy: 18,000 / 0.90 x $15		$300,000
Cost to make:		
Variable costs: 18,000 / 0.96 x $13.40	$251,250	
Avoidable fixed costs	32,500	283,750
Annual savings if thermocouplers are made		$16,250

Performance Management - Solutions

MA97 Solution: Expected Values (Payoff Tables) - The Finch Company

a. Payoff Table:

	States		
	Running properly p = 0.90	Not running properly p = 0.10	Expected payoff
Investigate	$4,000	$4,000 + 8,000 = $12,000	$4,800
Do not investigate	$0	$40,000	$4,000

The variance should not be investigated.

b. Let x = the probability the assembly department is running properly

Then: $4,000x + 12,000(1-x) = 40,000(1-x)
$4,000x + 12,000 – 12,000x = 40,000 – 40,000x
32,000x = 28,000
x = 87.5%

MA98 Solution: Pricing- Katz Inc.

1. Cost of goods sold as a % of sales = $55,000/$100,000 = 55%
Mark-up as a % of cost = 55,000 / 45,000 = 122%

2. Initial bid:

Direct materials	$1,200
Direct labour	600
Overhead	250
Total cost	$2,050
Add: mark-up @ 122%	2,501
Initial bid	$4,552

MA99 Solution: Pricing - Classic Corporation

Variable manufacturing costs: $1 x 10,000	$10,000
Variable marketing costs*: $2 x 10,000	20,000
Desired profit margin	15,000
	$45,000
	/ 10,000 units
Desired selling price	$4.50

* It could be assumed the company would not incur variable marketing costs on a special order. However, because the question is silent on the issue, it was assumed these costs were relevant.

Note on fixed costs:
Total fixed manufacturing costs = 100,000 x .25 = 25,000
Total fixed marketing costs = 100,000 x .65 =65,000

The relevant range, as per the information provided in the question, is 25,000 units to 160,000 units. This means, the fixed costs will not change if production volume is within the relevant range of 25,000 to 160,000 units.

An order is received for 10,000 units. The total production still falls within the relevant range [100,000 budgeted production + 10,000 special order = 110,000 units]. Since fixed costs will not change with this special order, they are irrelevant.

Entrance Examination Study Manual

Performance Measurement

CMA Ontario
2011

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Responsibility Accounting

Skill Level:	R/U	A/A
4.1.1.1 Defines the various responsibility centres (cost, revenue, profit, investment) and describes the appropriateness of allocating performance responsibility to each centre		
a) Understands the primary responsibilities of the various types of responsibility centres in terms of activities, inputs and outputs	✓	
b) Explains how responsibility centres improve employee accountability	✓	
c) Evaluates and recommends which type of responsibility centre to assign to different business units	✓	✓
d) Uses financial and non-financial measures (e.g. ROI, RI, quality indicators, employee and customer satisfaction surveys, etc.) to evaluate performance of responsibility centres	✓	✓
4.1.1.4 Describes applicable methods of measuring organizational performance in relation to internal operational goals set by the planning and budgeting function		
b) Determines appropriate performance measures and related performance targets for various operational units (e.g. cost, revenue, profit and investment centres, production, support, etc.) of a given organization	✓	✓
c) Calculates various performance measures (e.g. return on investment, residual income, variances, market share, profit margin and quality control statistics) and identifies the merits and limitations of each in evaluating the performance of operational units and managers	✓	✓
d) Prepares and analyzes performance reports for various operational units of a given organization and recommends remedial actions when actual performance varies significantly from expected performance	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Note that each of the CMA Competency Map requirements listed above have been extracted from different subtopics in the performance measurement section of the CMA Competency Map to facilitate efficient studying. These topics are similar in nature.

Types of Responsibility Centres

Responsibility centre – any unit where there is control over costs revenues or investments.

Type of Centre	Area of Control
Cost	Costs
Revenue	Revenues
Profit	Both revenues and costs
Investment	Revenues, costs and use of investment funds

Controllability and Responsibility Accounting

Responsibility accounting is an approach to organization control that holds managers or units responsible for items such as revenues or costs they have control over. One author has described responsibility accounting as follows:

> "By definition it [responsibility accounting] is a system of accounting, which is tailored to an organization so that costs are accumulated and reported by levels of responsibility within the organization. Each supervisory area in the organization is charged only with the cost for which it is responsible and over which it has control."
>
> Source: *John A. Higgins, "Responsibility Accounting" Arthur Anderson Chronicle, April 1952, p. 94*

A major component of responsibility accounting is the controllability principle, which states managers should be accountable only for what they can control. If a manager is responsible for uncontrollable factors, the manager is being evaluated unfairly. This leads to frustration and, ultimately, higher employee turnover.

Performance Reports

Performance reporting must synchronize with the unit's type of centre. Common performance reports:

Type of Centre	*Type of Report*
Cost	Cost report comparing actual to budget for major cost categories, supplemented with detailed variance calculations and explanations.
Revenue	Revenue report detailing actual revenues compared to budget, supplemented with sales variance calculations and explanations.
Profit	Income statement, with detailed variances calculations and explanations
Investment	Income statement, including calculation of ROI or residual income.

Behavioural Implications of Responsibility Accounting

As stated earlier, the main concept of responsibility accounting is responsibility over items under a manager's/unit's control. The performance evaluation method used must align with the type of responsibility centre; otherwise, managers will make inappropriate decisions. For example, a cost centre manager evaluated only on cost containment is motivated to reduce costs but perhaps sacrifice quality. A revenue centre manager evaluated only on sales may focus attention on high revenue but low margin products.

Performance Evaluation of Responsibility Centres

The responsibility centre's performance evaluation system must reflect its type. On the one hand, it is important to evaluate managers and units on what they have control over; otherwise, the performance evaluation system will be ineffective and desired behaviours will not occur. On the other hand, it is important the performance evaluation system not exclude important performance elements from performance measurement.

Type of Centre and Reward System

Centre Type	Controllable Factors	Common Performance Evaluation Methods
Cost	Variable costs Some fixed costs	Ability to meet budgets, as measured by variances. This method evaluates based on cost containment.
Revenue	Revenues	Ability to meet predetermined revenue targets, market share percentage targets and any other applicable sales targets. This method evaluates based on sales levels.
Profit	Costs and revenues	Ability to meet profit targets; performance evaluation system could incorporate methods used for cost and revenue centres.
Investment	Costs Revenues Investments	ROI Residual income EPS

ROI and Residual Income

Return on Investment (ROI)

ROI combines the investment turnover ratio and the earnings ratio.

$$\text{Investment turnover} = \frac{\text{sales}}{\text{assets employed}}$$

The investment turnover ratio measures asset productivity.

$$\text{Earnings ratio} = \frac{\text{income}}{\text{sales}}$$

The earnings ratio is the percentage of profit for each dollar sold – in effect, a measure of operating efficiency.

ROI combines two ratios, productivity and efficiency:

$$\text{ROI} = \frac{\text{sales}}{\text{assets employed}} \times \frac{\text{income}}{\text{sales}}$$

$$= \frac{\text{income}}{\text{assets employed}}$$

Generally, if ROI is used as a performance measurement to compare divisions in the same company, using operating income to calculate ROI is preferred. This is because taxes are out of divisional managers' control. If ROI is used to compare one company to another company, net income is commonly used to calculate ROI. This is because shareholders are concerned with the net income of a company, not operating income. The increase in the value of a company, vis-à-vis the increase in the total equity of a company, is due to increases in net income, not operating income.

Residual Income (RI)

Residual income is the operating income above a required rate of return on assets employed. The idea is to identify whether accounting income is sufficient to compensate the providers of the organization's capital.

Formula:

$$RI = \text{operating income} - \left(\text{required rate of return} \times \text{assets employed} \right)$$

Example:

Basic data:

Assets employed	$200,000
Operating income	$36,000
Required rate of return	13%

$$ROI = \frac{\$36{,}000}{\$200{,}000} = 18\%$$

$$RI = \$36{,}000 - (\$200{,}000 \times .13) = \$10{,}000$$

New project opportunity:

Investment required	$20,000
Estimated increase in operating income	$3,000
Required rate of return	13%

$$\text{ROI on new project} = \frac{\$3{,}000}{\$20{,}000} = 15\%$$

$$\text{RI on new project} = \$3{,}000 - (\$20{,}000 \times .13) = \$400$$

A manager evaluated on ROI would not accept the project because it decreases his overall ROI, while a manager evaluated on RI would accept the project as it increases the total return on invested capital.

ROI: Advantages and Disadvantages

Advantages:

- is a comprehensive measure, as it measures asset use and profit
- focuses managements' attention on maximizing profit on total assets employed
- useful for comparing various divisions' performance
- provides incentive to use existing assets to their full extent
- provides incentive to limit acquisition of additional resources to those which will increase ROI

Disadvantages:

- managers will forego investments that provide an adequate return on capital but lower ROI
- ROI may not be completely controllable by a manager. To counter this, include only profit components and assets controllable by a manager

RI: Advantages and Disadvantages

Advantages:

- new investments, which meet the target are continually made
- is a comprehensive measure that considers both profit and investment
- focuses management on maximizing profit

Disadvantages:

- difficulty in measuring profit and investment in investment centres
- a short run measure of performance that ignores trends and the effects of current activities on future performance

Comprehensive example – ROI vs. RI

	ROI Div. A		RI Div. B
Average operating assets	$100,000	a	$100,000
Net operating income	$ 20,000	b	$ 20,000
ROI	20%	b/a	
Required rate of return 15% (15% x 100,000)			$ 15,000
Residual income			$ 5,000

Required:
The managers in Divisions A and B are evaluated respectively based on ROI and RI. Will a new project with a required investment of $25,000 and return of 18% on invested assets be accepted by Division A and Division B?

		Division A		
		New Project	Present	Overall
Average operating assets	A	$25,000	$100,000	$125,000
Net operating income	B	4,500*	20,000	24,500
ROI	B/A			
*25,000 x 18% = $4,500		18%	20%	19.6%

	Division B		
	New Project	Present	Overall
Average operating assets	$25,000	$100,000	$125,000
Net operating income	4,500	20,000	24,500
Minimum required rate of return 15% (5% x 25,000)	3,750	15,000	18,750
	750	5,000	5,750

Conclusion:
Division A will refuse new project as overall rate of return is only 19.6%, a decrease from 20%
Division B will accept project as overall residual income increases

Multiple Performance Measures

Using only ROI or RI to measure a manager's performance only considers the financial impact of performance and is limited to the variables included in the formulas. Other measures, both financial and non-financial, can be used to measure performance. Examples of other measures:

- increased market share
- improved efficiency
- liquidity ratios, such as inventory or receivables turnover
- defect rates
- customer satisfaction surveys
- employee surveys
- employee turnover
- product development
- safety record

A combination of measures specific to a company's industry and competitive position are often used to evaluate managers or divisions.

Performance Measures: Short-Term vs. Long-Term

ROI and RI focus on short-term measures of performance when they are used to evaluate the ongoing performance of an organization unit. Therefore, managers are disinclined to undertake expenditures that, in the long-term, increase organization profitability, but, in the short-term, reduce profitability. To avoid focusing on the short-term, long-term performance compensation plans can be put in place, along with the short-term plan, particularly for upper level executives. By including both long-term and short-term performance measures in a performance plan, companies are more assured of long-term success.

Evaluating Managers vs. Organizational Unit

Managers must be evaluated separately from their responsibility centres unit. A manager may be performing poorly due to a downturn in the economy or other uncontrollable factors, which does not reflect a manager's ability. In these instances, it is important not to evaluate based strictly on financial results, but on the manager's performance relative to the circumstances the manager faces.

Use of Variance Results: Feedback vs. Blame

Variance results should be used in a positive reinforcing manner. Reports delivered to management that show the comparison of actual results to budget are called feedback. These results will highlight problem areas where corrective action is needed. For this feedback to be used effectively, it is important the managers in an area with problems are presented the information in a non-threatening way. Placing blame results in frustrated managers and employees and can cause higher turnover and absenteeism.

Transfer Pricing

Skill Level:	R/U	A/A
4.1.1.2 Explains the objectives and applies the methods of transfer pricing in domestic and international settings		
a) Explains why it is necessary to set transfer prices for transactions between responsibility centres and understands the objectives of a transfer price system	✓	
b) Defines and applies different transfer pricing systems (e.g. based on market price, variable cost, full cost, negotiation) and calculates the appropriate transfer price under each system	✓	✓
c) Recommends a transfer pricing system for a given situation in an organization, taking into account taxation and behavioural implications	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Transfer pricing is concerned with the price one profit centre charges another profit centre within the company for products or services provided. Since the supplying profit centre's revenue becomes the receiving profit centre's cost, the transfer price chosen can have a significant impact on the evaluation of a profit centre's performance.

As the transfer price chosen can impact performance evaluation, it is important the transfer price is perceived as equitable to all parties involved. When there is a market price for the transferred good or service, market price is the appropriate transfer price. However, transfer pricing is often an issue for intermediate products that have no market value.

Methods of Transfer Pricing

Four categories of transfer pricing methods:

1. Cost based
2. Market based
3. Negotiated
4. Imposed

Cost Based

This method transfers goods at cost or cost plus a mark-up. Cost may be variable, absorption, full (i.e. absorption cost plus an allocation of selling and administration costs) or any other reasonable estimate of cost. The costs used in each of these approaches may be actual or standard.

Transferring at actual cost does not motivate the production manager of the transferring unit to control costs – inefficiencies are passed on through higher transfer prices. Using standard costs eliminates this problem; however, the standards must be reasonable. Variable cost transfer prices cover short-term costs, but long-term costs, typically fixed costs, are not covered using this approach. Absorption costing covers all (variable and fixed) costs in the long-term.

Example of cost based transfer prices:

Basic data:

	Costs			
	Standard (Budget)		Actual	
Beginning finished goods inventory	0		0	
Ending finished goods inventory	0		0	
Direct materials	\$2.00	per unit	\$1.80	per unit
Direct labour	\$3.50	per unit	\$3.75	per unit
Variable overhead	\$3.00	per unit	\$3.15	per unit
Fixed production overhead	\$120,000		\$143,000	
Production volume	20,000		22,000	
Fixed production overhead rate:				
\$120,000 ÷ 20,000	\$6.00	per unit	---	
\$143,000 ÷ 22,000	---		\$6.50	per unit
Variable selling and administration	\$2.20	per unit	\$2.25	per unit
Fixed selling and administration	\$40,000		\$46,200	
Fixed selling and administration per unit				
\$40,000 ÷ 20,000	\$2.00	per unit	---	
\$46,200 ÷ 22,000	---		\$2.10	per unit

The mark-up is 15%

Transfer prices using various costing approaches, at standard:

	Variable Production Cost	Total Variable Cost	Absorption Production Cost	Absorption Production cost plus variable selling and admin.	Full Cost
Cost					
Direct material	$2.00	$2.00	$2.00	$2.00	$2.00
Direct labour	3.50	3.50	3.50	3.50	3.50
Variable overhead	3.00	3.00	3.00	3.00	3.00
Variable selling and administration	---	2.20	---	2.20	2.20
Fixed production overhead	---	---	6.00	6.00	6.00
Fixed selling and administration	---	---	---	---	2.00
Total costs	$8.50	$10.70	$14.50	$16.70	$18.70
Mark-up (15%)	1.28	1.61	2.18	2.51	2.81
Transfer price	$9.78	$12.31	$16.68	$19.21	$21.51

If basing transfer prices on standard costs without a mark-up, the transfer price ranges from $8.50 to $18.70, depending on the costs included. Including mark-up results in transfer prices from $9.78 to $21.51.

Transfer prices using various costing approaches, at actual:

	Variable Production Cost	Total Variable Cost	Absorption Production Cost	Absorption Production cost plus variable selling and admin.	Full Cost
Cost					
Direct material	$1.80	$1.80	$1.80	$1.80	$1.80
Direct labour	3.75	3.75	3.75	3.75	3.75
Variable overhead	3.15	3.15	3.15	3.15	3.15
Variable selling and administration	---	2.25	---	2.25	2.25
Fixed production overhead	---	---	6.50	6.50	6.50
Fixed selling and administration	---	---	---	---	2.10
Total costs	$8.70	$10.95	$15.20	$17.45	$19.55
Mark-up (15%)	1.31	1.64	2.28	2.62	2.93
Transfer price	$10.01	$12.59	$17.48	$20.07	$22.48

If basing transfer prices on actual costs without a mark-up, the transfer price ranges from $8.70 to $19.55, depending on the costs included. Including mark-up results in transfer prices from $10.01 to $22.48. Note that these prices are higher than the transfer prices based on standard costs – inefficiencies are passed on to the receiving division.

When to use Cost Based Transfer Prices:

- when market prices are unavailable, which is common for intermediate products
- when the transferring division is treated as a cost centre. In this case, a profit is not necessary, as performance evaluation is based on cost control.

Short -Term vs. Long -Term

In the short-term, variable cost transfer pricing policy results in decisions that best use available resources (e.g. idle capacity), which benefits the company as a whole because fixed costs do not change.

Disadvantages and Advantages of Cost Based Transfer Pricing:

Disadvantages:

- using actual costs transfers inefficiencies
- can lead to sub-optimal decisions as divisional managers make decisions that are beneficial for their unit, but detrimental to the company as a whole. This is particularly the case in absorption or full cost based transfer prices. Even if there is idle capacity, a manager may refuse a special order if it does not meet the absorption or full cost transfer price. This can result in the buying manager purchasing externally, resulting in lower overall company profit.

Advantages:

- costs are likely available since they will be computed for other purposes
- for organization units that do not control investment or revenues, cost based transfer prices are consistent with the appropriate performance measure for those units

Market Based

This method transfers prices based on current market prices. When there is a readily available market price, the transfer price is set equal to the market price less any costs avoided by buying inside instead of outside.

When to use Market Based Transfer Prices:

- when a competitive external market for the product exists
- when managers have the autonomy to purchase externally or internally
- when transferring and receiving divisions are treated as a profit or investment centre and, therefore, are evaluated on profit based measures, such as ROI or residual income.

Disadvantages and Advantages of Market Based Transfer Pricing:

Advantages:

- as the transfer price is based on competitive market conditions, managers are motivated to become more efficient – the market sets the price; therefore, to increase profit, costs must be reduced.
- easy to use when market prices are readily available

Disadvantages:

- a market price may not exist for the exact product
- in some industries, market prices can fluctuate widely creating uncertainties in planning for both the supplying and receiving profit centre managers

Negotiated Transfer Pricing

Under this method, the transfer price is determined through negotiation between the buying and selling division.

When to use Negotiated Transfer Pricing:

- when an external market does not exist and market prices are not available
- when divisions are forced to purchase internally
- where there is not an excessive number of transfers subject to negotiation

Advantages and Disadvantages of Negotiated Transfer Pricing:

Advantages:

- of all transfer pricing methods, negotiated transfer pricing provides managers with the greatest control over divisional profits

Disadvantages:

- negotiations may be time consuming and require a great deal of data, which can be costly to accumulate
- the bargaining parties may not be able to resolve disputes; to counter this an organization needs a mediation or arbitration mechanism
- disputes can result in conflict and hostility between divisions
- focus is on divisional results, not the company as a whole

Imposed Transfer Pricing

This occurs when upper management mandates a transfer price. The units subject to the transfer price cannot negotiate and, therefore, this method removes a level of autonomy from these managers. This can have a negative effect on performance:

- loss of autonomy can result in hostility towards upper management or the company as a whole
- managers can only influence costs, unforeseen circumstances, which increase costs, such as rapidly rising raw material prices, cannot be passed on to the buying division, resulting in lower profit for the selling division
- since divisions cannot influence revenue, sub-optimal decisions, such as selling externally, may be made. This is detrimental to the company as a whole.
- profit based performance evaluation criteria will be seen as unfair because the selling and buying divisions do not have control over revenues or costs. This demotivates managers.

Minimum and Maximum Transfer Price

There is a general rule of thumb for setting minimum and maximum transfer prices:

minimum	=	variable costs (incremental outlay costs)	+	opportunity cost to the overall company (i.e. lost CM on outside sales)

If there is idle capacity, opportunity costs are zero. If there is no idle capacity, the opportunity cost is the foregone contribution on the products that were not produced in order to make capacity available.

maximum	=	market price

A transfer price higher than market price would be seen as unfair by the buying division.

Note that on the Entrance Examination, the transfer pricing question is typically asked from the perspective of one of the divisions or the whole company. For example, candidates could be asked:
"What is the minimum transfer price the selling division would be willing to accept?"
"What is the minimum transfer price the buying division would be willing to accept?"
"What is the best transfer price from the whole company's perspective?"

The answer also depends on whether a division is a cost centre or profit centre.

General Criteria for Selecting a Transfer Price

The selection criteria outlined previously can be generalized into the following three criteria:

1. Goal congruence – a transfer pricing system should result in decisions made at the divisional level that are congruent with overall company goals.
2. Goal attainment – a transfer pricing system should result in managerial effort towards a stated goal.
3. Divisional autonomy – in a decentralized organization, managers must be free to make decisions. A transfer pricing scheme in this circumstance must ensure divisional autonomy is maintained.

Domestic vs. International Transfer Pricing

While domestic transfer pricing is concerned with fairly compensating an internal division for products it has produced and supplied to another division, international transfer pricing is usually set according to another purpose, such as lowering a company's worldwide taxes. For example, a company can choose a transfer price to locate profit in a division in a country with a low corporate tax rate. Transfer pricing guidelines set down by international bodies, such as the OECD, are intended to result in transfer prices that reflect the underlying economic characteristics of the good or product being transferred. In these settings, the international transfer price is consistent with the objectives of internal transfer pricing. However, if the international transfer price reflects other considerations, such as negotiations between tax authorities about sharing tax revenues, international transfer prices will no longer be consistent with the objectives of internal transfer prices and the resulting profits reported by the profit centres will no longer reflect the principle of controllability.

Factors influencing international transfer pricing decisions:

- tax rates
- income repatriation restriction
- dividend repatriation restrictions
- duties and tariffs
- exposure to foreign exchange rate fluctuations
- political climate
- the need to maintain cash flows in the foreign division
- competitive position of the foreign division
- trade treaties that restrict transfer pricing

Behavioural Implications of Transfer Pricing in Multi-National Organizations

Since transfer prices are set according to motives other than performance evaluation of divisional managers, the transfer price could result in hostility, a lack of managerial effort towards goals such as profit maximization or goal incongruent decisions. The potential negative consequences are particularly strong if divisional managers are evaluated based on profit performance evaluation measures. To resolve this situation an organization could use dual transfer prices, one for performance evaluation purposes and one for financial reporting purposes. The result is divisional managers are not penalized for transfer pricing decisions that are beyond their control. The disadvantage is two sets of records must be kept, which can be time consuming and costly.

Measuring Organizational Performance

Skill Level:	R/U	A/A
4.1.1.3 Describes applicable methods of measuring organizational performance in relation to strategic goals, target markets and customers, competitive business strategies, growth strategies and corporate and social responsibility		
a) Explains how the performance measurement system affects the success of strategy implementation	✓	
b) Understands that effective performance measures are aligned with strategic goals, key success factors and the needs of stakeholders	✓	
c) Identifies and understands the effects of various factors that require consideration in designing a performance measurement system for a given organization (e.g. short- and long-term objectives, internal and external forces, cause-and-effect relationships among performance measures, financial and non-financial factors, periodic comparisons and benchmarking, social capital, linking budgets to strategy, quality vs. cost, manufacturing vs. service operations, etc.)	✓	✓
e) Determines appropriate performance measures and related performance targets for activities of a given organization (e.g. return on marketing activities, etc.)	✓	✓
f) Recognizes factors that improve the effectiveness of an organization's performance measurement system, such as setting SMART goals (i.e. specific, measurable, attainable, realistic and tangible goals) and measures that are timely, precise and objective	✓	✓
g) Describes potential problems with a given organization's performance measurement system (e.g. too many measures, wrong or out-of-date measures, employees build slack into the targets, measures are not balanced) and proposes corrective action	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

After an organization has gone through an effective strategic planning process, it understands its current position, including strengths and weaknesses, current resources and needs, and it knows where it wants to be in the future. However, strategic planning itself gives an organization no means to determine whether it is actually accomplishing its vision and goals. Performance measurement is the process of taking an organization's strategic plans and determining how success will be determined and measured. The actual data used to measure the success of an organization at meeting its goals are called "performance measures". Performance measurement describes the process involved in identifying and measuring these data.

It is important that performance measures are aligned with strategic goals, key success factors (KSF) and the needs of stakeholders. By measuring whether progress towards reaching strategic goals is being achieved, an organization is in a position to take corrective action where necessary. Measuring the utilization of internal key success factors is important to ensure these

KSF's are utilized to their fullest potential. It is also important to measure external KSF's and whether these external KSF's are being met. For example, if an industry KSF is speed of service, an organization should measure whether their services are meeting this industry KSF. It is also important to measure whether the needs of key stakeholders are being met because, if their needs are not being met, support from these stakeholders will be lost.

Factors to Consider in Designing a Performance Measurement System

When designing performance measurements, it is necessary to consider the following factors:

- Short- and long-term objectives:
  Short-term objectives are targets that are to be achieved soon or, alternatively, are milestones related to a long-term target that is to be achieved in the short-term.

  Long-term objectives are targets that are to be achieved in three to five years. Measurements for the long-term targets are geared toward prompting actions now that will permit reaching targeted long-range performance later.

- Internal and external forces:
  External measures are those that relate to customers and shareholders (e.g. customer satisfaction and return on investment). Internal measures relate to the processes and capabilities that create value for customers and shareholders (e.g. process efficiency and employee satisfaction).

- Cause and effect relationships among performance measures:
  One performance measure can cause changes in another performance measure. For example, a performance measure related to delivering a quality product is to reduce the number of customer returns and, therefore, the number of returns is tracked and quality control initiatives are undertaken to reduce the number of product returns. At the same time, there may be another measure related to cost, which measures a reduction in cost of production. The need for greater quality control increases production cost and, therefore, this measure will suffer as a result of the quality control initiatives. For this reason, it is necessary to consider performance measures in their entirety and not in isolation.

- Financial and non-financial measures:
  Financial measures are those expressed in monetary terms (e.g. cost per unit). Non-financial measures are measured in non-monetary units (e.g. number of unsatisfied customers). It is important to note that not everything can be measured directly in monetary terms, which is why it is necessary to include non-financial performance measures. Areas such as customer service, goal attainment, innovation and employee involvement cannot be directly measured in monetary terms, but can be important to an organization, especially in the long-term, since they are likely to drive long-term financial performance.

- Periodic comparisons and benchmarking:
  Periodic comparison refers to comparing the results of current measures to previous years. The trend in these measures indicates if the company is improving over time. Benchmarking refers to comparing performance against industry leaders. Sources of information for benchmarking include industry consultants, trade journals and business literature, professional networks developed at external conferences, attendance at "Best Practices" seminars and suppliers.

- Linking budgets to strategy:
  It is necessary to allocate resources in ways that support effective execution of strategies. Therefore, it is necessary to budget so that projects contributing to strategy implementation are funded, efforts to strengthen or create new competencies and capabilities are funded, and the use of resources are shifted as necessary (e.g. downsizing in one area and upsizing in another or eliminating activities that are no longer necessary) to achieve the chosen strategies.

Factors in Setting Effective Performance Measures

Effective performance measures will have the characteristics of "SMART" goals. "SMART" is an acronym as follows:

- **S**pecific – measures need to be clear and specific to the objective being measured
- **M**easurable – it is necessary to create a measure that can actually be measured
- **A**ttainable – if a measure is impossible to attain, employees will be unmotivated and will not attempt to achieve the objective the measure is designed to address.
- **R**ealistic – the goal must be realistic with respect to the resources available, knowledge and time.
- **T**angible – for measures to be motivating for employees, they must ultimately be a tangible measure. (Note: Some sources use "T" for Time based, which refers to ensuring there is enough time to achieve the goal, while at the same time, not allowing too much time such that focus on the goal is distracted.)

Other factors that impact the effectiveness of performance measures include indicators that are:

- Meaningful:
  The measures are directly related to the goals and objectives of the company or department.

- Comprehensive:
  The measures must consider all the important features of the product, company or department.

- Valid and reliable:
  The indicators show what they are supposed to do and will continue to do over time.

- Understandable:
  The measures can be easily understood.

- Timely:
  The data can be gathered, compiled and reported in a time frame where the information will still be useful.
- Resistant to undesired behaviour:
  Measuring performance can bring unintended behaviour that causes the performance measure to improve, but damages the organization because there are unmeasured consequences of the behaviour. A performance measure may motivate the person being measured to manipulate the measure itself .For example, a salesperson could book sales in the next period if the quota had been achieved for this period.
- Non-redundant:
  The measures limit "information overload" by assuring that each measure examines a distinctive area of the product, project, department or company.
- Sensitive to data collection costs:
  It should not cost more time and/or money to collect and process data than the information is worth. For example, if it takes a financial analyst two weeks to gather and process data for one measure, the cost of compiling that measure may not provide enough benefit to warrant the cost.
- Focused on sphere of influence:
  Good sets of measures emphasize "success" where management action can create change. However, few measures can be completely controlled by the organization. This needs to be considered when creating measures.

Problems in Setting Performance Measures

Common problems with performance measurement systems are:

1. Too many measures – these result in "information overload", which often results in managers and employees ignoring data or using it ineffectively.

2. Focusing on the short-term – many companies only collect financial and operational data, ignoring measures of current performance that can improve future financial performance

3. Failing to base business decisions on the measures – if they believe performance measures assess the wrong or uncontrollable performance, managers may make decisions based on intuition and past experience rather than the measures being reported to them. If data is valid, it will likely be used appropriately.

4. "Dumbing down" the measurement data – sometimes data can be summarized so much it becomes meaningless. If business decisions are based on measurement data, then the data needs to be reported clearly and understandably.

5. Too few measures – making business decisions with too few measures is just as problematic as basing them on too many measures. Some companies tend to measure too

few key variables and, therefore, do not understand the "whole picture" of the health of the company.

6. Inconsistent, conflicting and unnecessary measures – all data should lead to an ultimate measure of success for the company. An example of conflicting measures would be measuring reduction of office space per staff while, at the same time, measuring staff satisfaction with facilities.

7. Driving the wrong performance – exceptional performance in one area could be disastrous in another. An example is a situation in which the manager of a fast food chicken restaurant scores 100% on his efficiency measure (the ratio of how many pieces of chicken sold to the amount thrown away) by waiting until the customer orders the chicken before cooking it. However, the end result was dissatisfied customers (from waiting too long) and lack of repeat business. Thus, the "efficiency ratio" drove the wrong performance and drove customers away.

8. Encouraging competition and discouraging teamwork – comparing performance results of organizational unit to organizational unit or one employee to another can create fierce competition to be "Number 1" at the expense of destroying a sense of teamwork.

9. Establishing unrealistic and/or unreasonable measures (similar to SMART goals discussed previously) – measures must fit into the organization's budgetary and personnel limits and must be cost effective. They also must be achievable. Nothing can demoralize an employee quicker than a goal that can never be reached.

10. Failing to link measures – measures should be linked to the company's strategic plan and should cascade down into the organization (horizontal and vertical linkage). Measures without linkage are like a boat without water – useless and going nowhere.

11. Measuring progress too often or not often enough – there needs to be a balance. Measuring progress too often could result in unnecessary effort and excessive costs, which means the measure is not cost beneficial. On the other hand, not measuring progress often enough may result in learning about potential problems after it's too late to take remedial action.

12. Ignoring the customer – often, a company's measures are only related to an organization's internal components and processes and ignore the customer. However, ultimately, it is the customer who drives a company's performance. If customers are not satisfied, the company is doomed to fail.

13. Playing the "blame game" – managers may ask "who's to blame" instead of asking "what went wrong". They look for the answers in the people instead of the process. A faulty process makes employees look faulty. Often the process needs correcting, not the people.

14. Not understanding the purpose of the performance measurement system – the purpose of a performance measurement system is not to collect data, but rather to collect data upon which to make critical business decisions that will ultimately drive business improvement. Collecting data for data's sake results in redundancy and non-value-added cost.

Strategy Mapping and the Balanced Scorecard

Skill Level:	R/U	A/A
4.1.1.3 Describes applicable methods of measuring organizational performance in relation to strategic goals, target markets and customers, competitive business strategies, growth strategies and corporate and social responsibility		
d) Describes various organizational performance measurement systems, such as the balanced scorecard, the pillars of the Baldridge Award and Six-Sigma	✓	✓
4.1.1.4 Describes applicable methods of measuring organizational performance in relation to internal operational goals set by the planning and budgeting function		
a) Understands how performance measurement systems cascade down from the corporate strategy level to the operational level	✓	
4.1.1.5 Describes best practices and emerging issues in performance measurement in a given industry (e.g. strategy mapping, target setting, performance based budgeting)	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Strategy Mapping

Strategy mapping is a tool that provides focus for the balanced scorecard. The strategy map identifies the measurement implications for each of the balanced scorecard perspectives for the organization or for a particular organization initiative. For example, suppose the organization is undertaking an initiative to improve profitability by reducing the costs of poor quality. From the financial perspective, the target might be to reduce the cost of poor quality by $1,000,000. From the customer perspective, the target might be to reduce the number of warranty claims with the target being to reduce the number of claims by 20%. From the process perspective, the target might be to improve the process that creates the defects that cause the majority of the warranty claims. From the learning perspective, the target might be to conduct a training program designed to help employees identify and reduce process errors. The target might be to have 75% of production employees pass through this training program.

The material that follows has been extracted from the CMA Canada Management Accounting Guideline 'Applying the Balanced Scorecard". It has been reprinted with permission.

The Balanced Scorecard

The balanced scorecard is a focused set of vital financial and non-financial measures of performance. The balanced scorecard was first put forth by Robert Kaplan and David Norton in the 1990s.

The balanced scorecard serves three important roles in organizations:

1. It provides a means for organizations to state and test the cause and effect relationships between the activities organizations undertake and the financial results the activities generate.
2. It provides a means of aligning organization behaviour with organization goals.
3. It focuses the organization's performance measurement system on performance planners believe create organization success.

The four categories (financial, customer, internal business processes, learning and growth) in Kaplan and Norton's Balanced Scorecard can be described as follows:

i) Financial. The first category on the Kaplan and Norton balanced scorecard is financial. Managers devising financial measures should ask themselves, "How can we show our strategy is succeeding financially?" At the highest level, long-term profitability and stock price growth demonstrate financial success of the strategy. But managers should also consider financial measures particular to their strategy. If the company is young, on a high growth trajectory, sales growth by sales channel may be a critical financial measure. If the company operates in a mature business, cash flow may be the right measure. If it falls in between, economic profit, a measure that charges the company for the cost of equity capital, may be the right measure.

ii) Customer. The second category in the Kaplan and Norton model is the customer perspective. Managers devising customer measures should ask themselves, "How can we show we're delivering to customers the value they expect?" At the highest level, many companies track customer satisfaction, but other measures are also necessary, such as customer retention, market share and share of wallet (i.e. share of a customer's business in a particular product or service line).

iii) Internal business process. The third category in the Kaplan and Norton model is internal business. Managers developing measures for this perspective should ask, "What processes must we excel at to deliver value to our customers?" For example, Analog Devices measures chip yield, cycle time, on-time delivery and parts per million defects to gauge the performance of manufacturing processes.

iv) Learning and growth. The fourth category in the Kaplan and Norton model is learning and growth. From this perspective, managers should ask, "What action must the company take to prepare the people and organization for the future?"

Incentive Structures

Skill Level:	R/U	A/A
4.2.1.1 Describes the incentive structures and related human resources issues, including behavioural implications		
a) Explains how a given organization's incentive plan impacts employee motivation and goal congruence	✓	
b) Understands the characteristics of effective reward and incentive systems (e.g. clear, measurable and accepted objectives, rewards linked to desired behaviour and outcomes, measures clear and visible, prompt feedback, perceived to be fair and equitable, flexible, adapts to changing circumstances, targets are specific, achievable and challenging, etc.)	✓	
d) Identifies the benefits of various non-financial incentives and rewards (e.g. praise, recognition, peer feedback, promotion, increased autonomy, increased responsibilities, etc.)	✓	✓
e) Understands the benefits and shortcomings of basing compensation and rewards on individual, work team, business unit or company performance	✓	✓
4.2.1.4 Identifies ethical issues related to incentive and compensation systems		
c) Explains potential drawbacks of team based incentive systems (e.g. free-riding) and how they can be mitigated	✓	✓
4.2.1.1 Describes the incentive structures and related human resources issues, including behavioural implications		
f) Assesses the effectiveness of a given organization's incentive plan in achieving its goals, recognizes potential problems (e.g. agency problems, measures and targets not congruent with strategy, short-terms measures vs. long-term goals, basing incentives on performing assigned functions instead of on achieving results, incentives not valued by employees, incentives based on outcomes the employee does not control or influence, etc.) and proposes corrective actions	✓	✓
g) Outlines the role of the Board of Directors in determining the compensation of a given organization's CEO	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Note to candidates: Knowledge requirements from different areas of the CMA Competency Map which are similar in nature have been amalgamated into one section to facilitate efficient studying.

Incentives and Motivation and Goal Congruence

Incentive systems can provide employees with rewards such as prizes, cash and recognition. These rewards are called extrinsic rewards because they come from outside the individual to the individual. Appropriate job design can also provide employees with the opportunity to experience satisfaction with their work. These rewards are called intrinsic rewards because they come from inside the individual. Most of the discussion below focuses on extrinsic rewards.

A company's incentive plan should motivate employees to perform to the best of their abilities and in the company's best interests. Incentive plans typically include both monetary rewards and non-financial rewards.

Goal congruence exits when individuals/groups working toward their individual goals simultaneously work toward achieving the organization's goals. In other words, employees working in their own best interest take actions that aligned with the overall goals of top management. Employees should be motivated to apply effort. Effort is defined as exertion towards reaching a goal, including both physical and mental actions.

A well structured incentive pay plan can help encourage goal congruence between the two parties.

Characteristics of Effective Reward and Incentive Systems

For a reward and incentive program to be effective, it should include the following elements:

- Objectives are clear, well understood and broadly accepted
    - link incentives to achieving only the performance targets in the strategic plan
    - ensure that the targets to be attained are clear and understood
- Rewards are clearly linked to performance and desired behaviours
- Performance measures are clear and highly visible
- Feedback is prompt, clear and unambiguous
- Compensation "system" is perceived as fair and equitable (perceived unfairness will demotivate employees – avoid rewarding non-performers)
- Structure is flexible; it can adapt to changing circumstances (i.e. if circumstances change, such as the economy entering a severe recession, the plan must be flexible and change to accommodate the circumstances)

Non-Financial Incentives

Compensation includes both financial and non-financial incentives. Non-financial incentives include:

- provide attractive perks and fringe benefits
- rely on promotion from within when possible
- make sure ideas and suggestions of employees are valued and respected
- create a work environment where there is genuine sincerity, caring and mutual respect among all employees
- share financial and strategic information with employees
- have attractive office space and facilities
- praise employees when they do a job well
- recognize employees with gifts or other tokens of appreciation
- provide additional time off
- state strategic vision in inspirational terms to make employees feel they are part of something worthwhile
- be flexible in how company approaches people management in multicultural environments
- provide stimulating assignments or additional responsibilities
- provide autonomy
- provide opportunities for promotion

Basing Compensation on Individuals vs. Teams vs. the Organization

First, it is necessary to categorize the different types of variable pay plans under each category: individual, team or organizational.

Types of Variable Pay Plans		
Individual	Group/Team	Organizational
Piece rate systems Bonuses Special incentives (trips, rewards, merchandise) Merit pay	Gain sharing Bonuses Awards	Profit sharing Employee stock plans Executive stock options Deferred compensation

Advantages and disadvantages of basing performance pay on individual effort, group/team effort or organizational effort is summarized as follows:

	Pay is based on Individual Effort	Pay is based on Group/Team Effort	Pay is based on Plant-Wide Effort (gain sharing)	Pay is based on Corporate Wide Effort
Conditions under which the pay structure is likely to be successful or favourable	• When the contributions of individual employees can be accurately isolated. • When the job demands autonomy. • When cooperation is less critical to successful performance or when competition is to be encouraged.	• When work tasks are so intertwined, it is difficult to single out who did what. • When the company's organization facilitates the implementation of team based incentives. • When the objective is to foster entrepreneurship in self-managed work groups.	• Gain sharing is more likely to work well in small to mid-size plants. • When technology limits improvements in efficiency, gain sharing is less likely to be successful. • If a company has multiple plants with varying levels of efficiency, the plan must take this variance into account so efficient plants are not penalized and inefficient plants rewarded. • Gain sharing is less likely to be successful in companies with a traditional hierarchy of authority. • Gain sharing is most appropriate in situations where demand for the organization's product or service is relatively stable.	• Profit sharing and ESOPs are the plans of choice for larger organizations. • Corporations with multiple interdependent plants or business units often find corporate wide plans most suitable because it difficult to isolate the financial performance of any given segment of the corporation. • Unlike gain sharing, profit sharing and ESOP programs are attractive to organizations facing highly cyclical ups and downs in the demand for their product. • When used in conjunction with other incentives, corporate wide programs can promote greater commitment to the organization by creating common goals and a sense of partnership among managers and workers.
Advantages:	• Performance that is rewarded is likely to be repeated. • Individuals are goal oriented and financial incentives can shape an individual's goals over time. • Assessing the performance of each employee individually helps the organization achieve individual equity. • Individual based plans fit in with an individualistic culture	• They foster group cohesiveness. • They aid performance measurement.	• Gain sharing plans can provide a vehicle to elicit active employee input and improve the production process. • Gain sharing plans can increase the level of cooperation across workers and teams by giving everyone a common goal. Gain sharing plans are subject to fewer measurement difficulties than individual or team based incentives. • Because gain sharing plans do not require managers to sort out the specific contributions of individuals or interdependent teams, it is easier to formulate bonus calculations and to achieve acceptance of these plans. Moreover the workers, who have the best idea of who is contributing, can impose group sanctions on non-performers.	• Financial flexibility for the organization. • Increased employee commitment. • Tax advantages.

	Pay is based on_Individual Effort	Pay is based on Group/Team Effort	Pay is based on Plant-Wide_Effort (gain sharing)	Pay is based on Corporate Wide Effort
Disadvantages	• Tying pay to goals may promote single mindedness. • Many employees do not believe pay and performance are linked. • Individual pay plans may work against achieving quality goals. • Individual based programs promote inflexibility in some organizations.	• Possible lack of fit with individualistic cultural values. • The free riding effect. • Social pressures to limit performance. • Difficulties in identifying meaningful groups. • Intergroup competition leading to a decline in overall performance.	• Protection of low performers if this is the group norm. • Problems with the criteria used to trigger rewards. • Management-labour conflict. • Individuals may not feel they can have an impact	• Employees may be at considerable risk. • Limited effect on productivity • Long-term financial difficulties.

Challenges of Incentive Plans

Challenges of incentive plans include:

- Agency theory:

Agency theory examines the issues when a principal (owner or superior) hires an agent (manager or subordinate) to undertake decisions on the principal's behalf. Agency theory focuses on situations where there is a built in conflict so the agent is not intrinsically motivated to act in the principal's best interests.

- Goals of principals and agents may conflict:
  - It is difficult or expensive for the principal to verify what the agent is actually doing
    - hard for Board of Directors to confirm managers are actually acting in shareholders' interests
    - managers may opportunistically pursue their own interests; a bonus may be structured such that the manager acts in a manner to enhance his/her bonus, while undertaking action that is not in the best interest if the shareholders
    - managers may reward themselves with excessive salaries or perquisites
  - Principal and agent may have different attitudes and preferences toward risk, which means, the manager may either take on to much risk to earn a bonus or, alternatively, not accept enough risk to enhance profit.

The term 'moral hazard' is used to describe situations where agents are motivated to take advantage of information available only to them and act in ways that benefit them at the expense of the principal. For example, an agent might take credit and receive rewards for a job well done because the principal is unaware that, given the circumstances the agent faced, a much better performance level could have been achieved.

The Role of the Board of Directors in Determining CEO Compensation

The general roles of the Board of Directors are to review and approve senior management's major strategic decisions, to ensure management has developed and monitors key risk management systems, to provide for proper succession in senior management positions and, in general, to protect the rights of shareholders. In determining executive pay, including the CEO is an important task of the Board of Directors.

Incentive Plans and Legal and Regulatory Requirements

It is necessary for companies to comply with various legal and regulatory agencies, such as:

- Employment Standards Act
- Human Rights legislation
- Trade Union legislation
- Tax laws
- Pension laws
- Disclosure requirements

The requirements of the above noted legislation is detailed and specific and is beyond the scope of the Entrance Examination.

Note to candidates: For the purpose of the Entrance Examination, it is sufficient to be aware of the different legislation that applies to HR policies.

Theories of Work Motivation

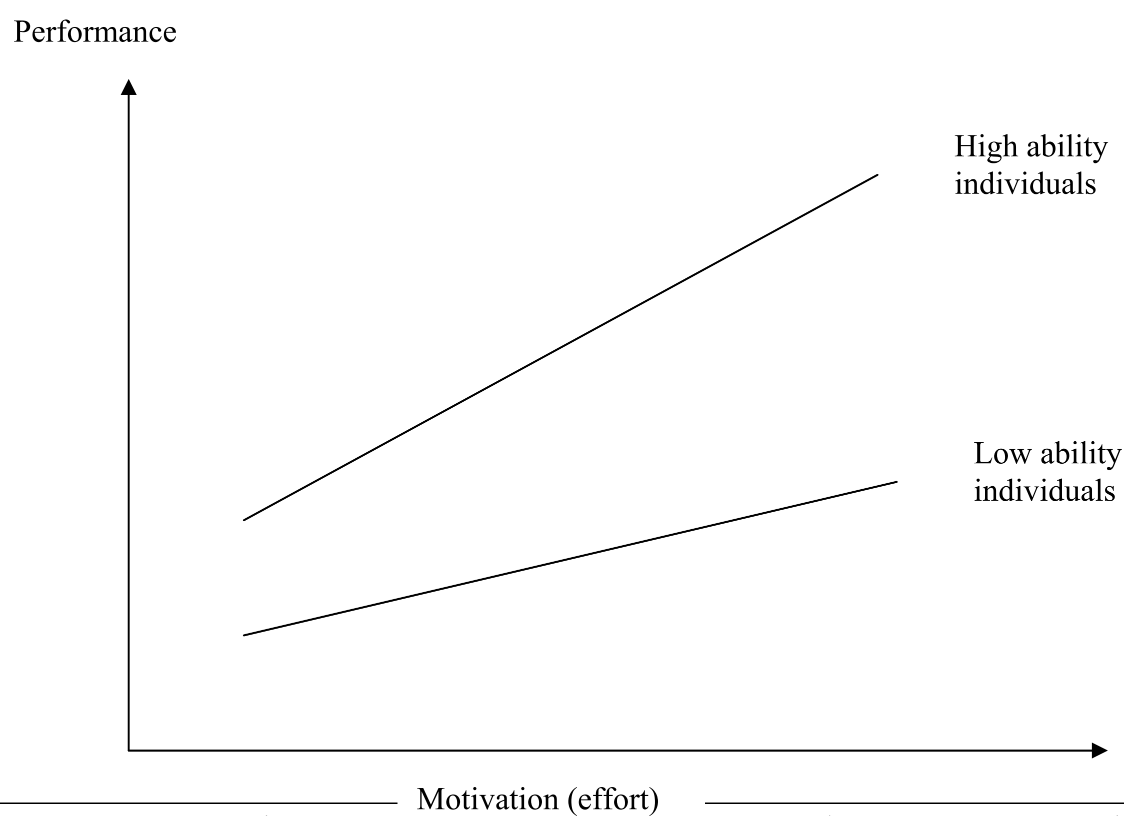
Skill Level:	R/U	A/A
4.2.1.1 c) Understands various theories and practices pertaining to work motivation (e.g. intrinsic/extrinsic, equity theory, needs theory, expectancy theory, transformational change, attribution theory, personality types, job design, positive and negative reinforcement, feedback, culture, etc.) and how they are used in designing individual performance measurement systems	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Properties of Motivation

There are two major factors an individual contributes to performing a task:
- ability
- motivation

Ability is an individual's physical skills, mental skills, knowledge and experience. Motivation is the effort the individual applies to the task. Performance is a function of ability and motivation. The relationship between ability, motivation and performance can be depicted as:

How Ability Moderates the Effects of Motivation on Performance:



Motivation is a complex area and, because people's motives differ widely, it is difficult to motivate employees. Other factors contributing to the complexity of motivation are:

- one or many motives may cause an individual to behave in a certain manner
- people who have the same motives may engage in different behaviour
- people who have different motives may engage in the same behaviour
- motives cannot be observed, but are inferred from behaviour (this inference can be fraught with errors)
- motives constantly change
- motives may not decrease in importance when the desired goal is attained

Intrinsic vs. Extrinsic Motivation

Intrinsic rewards are rewards that come from within the individual and extrinsic rewards come from external sources. Intrinsic rewards are closely related to personality traits. Examples of intrinsic and extrinsic rewards include:

Extrinsic

- pay
- fringe benefits
- promotions
- perks (e.g. large office, office with window)
- bonuses

Intrinsic

- feelings of:
  - competence
  - accomplishment
  - responsibility
  - personal growth

Motivation Theories

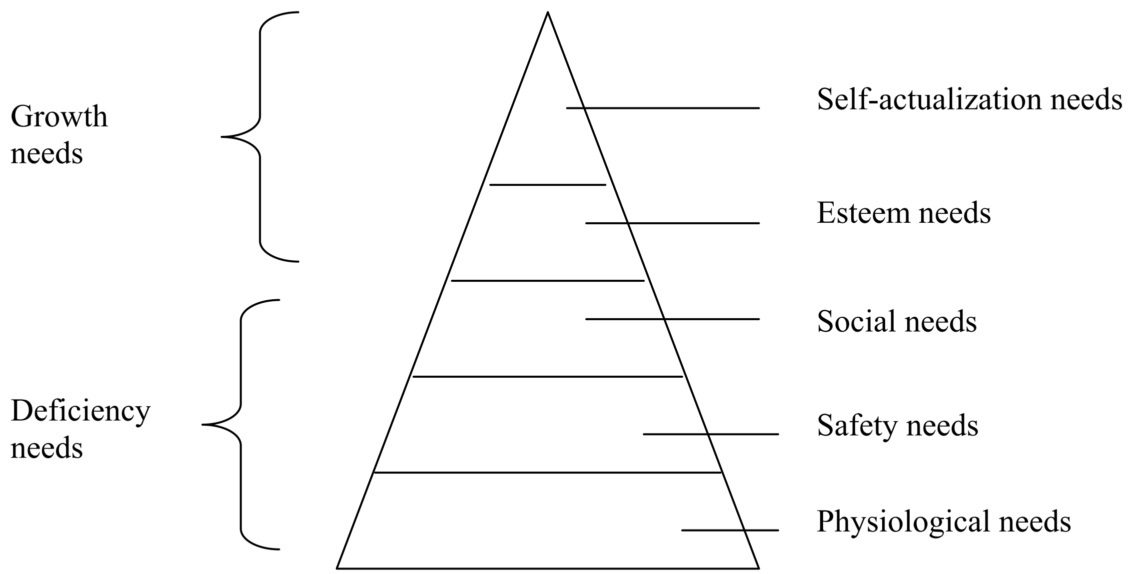
Need Theory

The two major contributors to the need theory are David McClelland, who focused on three sets of needs (the need for achievement, affiliation and power) and Abraham Maslow, who focused on a five layer hierarchy of needs.

McClelland Studies

The three needs, achievement, affiliation and power, determine how an employee will behave in job assignments. High achievers are driven by performance based satisfaction rather than monetary gain. For these individuals, intrinsic rewards are important, however, extrinsic rewards are also important as they are seen as feedback on performance. High achievers do well with challenging job assignments because they are motivated by challenge. The need for power is a prerequisite of leadership. To function effectively as leaders, managers should have a reasonably high need for power. However, this does not mean domineering. Individuals with a high need for affiliation tend to be warm and friendly. However, an overemphasis on the need for affiliation can result in ineffectiveness, as these individuals may avoid being direct and confrontational, even though it may be appropriate in a given situation. Different jobs require different personalities. When assigning roles or job assignments to individuals, it is important to consider their need levels in each of the three categories.

Maslow's Hierarchy of Needs



Deficiency Needs

These are lower order needs that must be satisfied to ensure existence and security.

Physiological needs – need for food, water, sleep, oxygen, warmth and freedom from pain. If these needs are not met, an individual's actions will be geared to meeting them.

Safety needs – need to feel free from threats and secure. Employers help meet these needs by providing benefits, such as life or disability insurance.

Social needs – need for affection and love. Employers cannot directly fulfill these needs, but can encourage employees to fulfill them by encouraging a balanced lifestyle (balance between work and home).

Growth Needs

Esteem needs – this is the desire for achievement, prestige, recognition, appreciation and attention. Employers fulfill these needs through extrinsic and intrinsic rewards.

Self Actualization Needs – this is the desire for self-fulfillment and may find expression in many ways (e.g. maternally, athletically or artistically). Not all individuals have the desire to develop their own potential.

Maslow's hierarchy of needs travels from bottom to top – as the lower need is met, the next need on the hierarchy emerges. However, if a deficiency need arises, a lower order need can supersede a higher order need. This will last until the lower order need is met.

Companies satisfy lower order needs through pay and other benefits and by providing a good work atmosphere. However, to fulfill esteem needs, a company would have to ensure positions and responsibilities meet these needs. The ideal organization provides opportunities for independence, recognition and responsibilities. A poor work environment results in low satisfaction and motivation, which leads to higher turnover.

Equity Theory

Equity theory relates to feelings of fairness. The Equity Theory postulates that people will strive to restore equity (usually defined as the ratio of an individual's outcomes (rewards) to the individual's input (effort and personal characteristics) if they feel an imbalance exists. To measure whether inequity exists, an employee compares his or her own inputs and the consequent outcomes with a similar person (called the comparison other). Outcomes are defined as anything an employee views as being provided by their job or organization. An input is anything a person believes he or she should be compensated for. Typical inputs and outputs include:

Input	Outcomes
Effort	Salary
Education	Fringe benefits
Training	Travel allowance
Experience	Number of subordinates
Loyalty	Autonomy
Age	Titles
	Status symbols
	Job assignments
	Time off
	Opportunities for overtime

If an employee feels he or she is not being treated fairly, the employee may attempt to restore equity be reducing inputs or increasing outcomes. Example of activities for each includes:

Inputs	Outcomes
• become less productive	• ask for a raise
• become less loyal	• ask for increased responsibility
	• change titles
	• arrange for additional time off

An employee may also attempt to influence the comparison other by undertaking such activities as pressuring the individual to work harder or persuading the manager to alter the comparison other's pay. If the employee feels he or she is not able to correct the imbalance, the employee has several options:

- resign from the job
- choose a different comparison other
- alter his or her perception of the situation so the inequity no longer seems unjustified

Organizations must take into consideration the implications of the equity theory. The perception of fairness is important in determining any reward system. If employees perceive the reward to be inequitable, they will not be motivated, which leads to high employee turnover.

Expectancy Theory

This theory represents an attempt to explain motivation in terms of anticipated rewards. The most common expectancy model is Vroom's Model. This model argues that the psychological force on an employee to exert effort is a function of his or her expectancies about the future and the attractiveness (called valence in this model) of specific future outcomes. Two types of expectations are important:

- expectation that effort will lead to performance
- expectation that performance will lead to rewards

Effort → Performance Expectancy

When determining whether or not to carry out a course of action, an employee considers whether or not their effort will translate into a desired accomplishment. If not, the motivation to perform dissipates.

Performance → Outcome Expectancy

This means whether or not a given level of performance results in a particular outcome. If an employee believes performance will lead to a desired outcome, the employee will be motivated to perform.

Valence

This is the value an employee places on the rewards he or she expects to receive. Valence, the value an employee attributes to a reward, is a personal decision, varies from individual to individual and cannot be accurately predicted. Therefore, it is important to ask an individual the value he or she attaches to anticipated outcomes.

There are three main implications regarding motivation arising from expectancy theory. First, employees must believe that effort and measured performance are closely related. A job should be designed so that efforts translate into performance. This means, obstacles to performance must be removed and employees must see the results of their efforts. Second, managers must ensure there is a clear link between rewards (i.e. outcomes) and measured performance. Finally, rewards must be valued.

Transformational vs. Transactional Leadership

Source: Ethics, Character and Authentic Transformational Leadership (1998). Bernard M. Bass and Paul Steidlmeier. Center for Leadership Studies. School of Management, Binghamton University, Binghamton, NY. http://cls.binghamton.edu/BassSteid.html

Transformational leadership contains four components: charisma or idealized influence (attributed or behavioural), inspirational motivation, intellectual stimulation and individualized consideration (Bass, 1985, 1998, Bass & Avolio, 1993). Shamir, House and Arthur (1993) and Conger and Kanungo (1988) conceive of the same components as all falling under the category of charismatic leadership.

Followers identify with the charismatic leaders' aspirations and want to emulate the leaders. If the leadership is transformational, its charisma or idealized influence is envisioning, confident and sets high standards for emulation. Its inspirational motivation provides followers with challenges and meaning for engaging in shared goals and undertaking. Its intellectual stimulation helps followers to question assumptions and to generate more creative solutions to problems. Its individualized consideration treats each follower as an individual and provides coaching, mentoring and growth opportunities (Bass, 1985). If such transformational leadership is authentic, it is characterized by high moral and ethical standards in each of the above dimensions.

Transactional leadership involves contingent reinforcement. Followers are motivated by the leaders' promises, praise and reward. Or, they are corrected by negative feedback, reproof, threats or disciplinary actions. The leaders react to whether the followers carry out what the leaders and followers have 'transacted' to do. In contingent rewarding behaviour, leaders either make assignments or they may consult with followers about what is to be done in exchange for implicit or explicit rewards and the desired allocation of resources. When leaders engage in active management-by-exception, they monitor follower performance and correct followers' mistakes. When leaders engage in passive management-by-exception, they wait passively for followers' mistakes to be called to their attention before taking corrective action with negative feedback or reprimands. Laissez-faire leaders avoid leading.

Attribution Theory

Attribution theory (proposed by Fritz Heider): the inference process that is used to deduce another's dispositions or traits from observations of their behaviour.

People perceive behaviour as being caused by either internal factors (the individual) or external factors (the environment). In other words, whether people initiate actions or merely react to their environment. In addition, the outcome of a particular action is perceived to be the result of the environment, personal traits, influences or personal power (ability) and effort (trying). To make an accurate attribution of a person, a manager must be able to take these various factors into account.

Expectations refer to performance expectations. Expectations are communicated both verbally and non-verbally and, therefore, are a more subtle approach to influencing employee performance. This approach to influencing employee behaviour is usually not deliberate. Many studies have shown people will live up to what is expected of them. For example, if a student is labelled a star pupil, the student will live up to those expectations. Studies involving people of all ages have shown that this phenomenon will occur, regardless of whether the expectations are positive or negative.

Positive and Negative Reinforcement Theory

Reinforcement theory states that responses that are followed by a desirable experience will be more likely to occur in the future, while responses that are followed by undesirable experiences will be less likely to occur. In other words, behaviour that results in pleasant outcomes is more likely to recur, while behaviour that results in unpleasant outcomes is less likely to recur. This is known as the Law of Effect (originally proposed by Thorndike).

Positive and negative reinforcement are used in what is known as operant conditioning. Positive reinforcement is any positive event used to increase the frequency of response. Negative reinforcement is accomplished by withholding or removing an adverse consequence when the desired behaviour occurs (e.g. a loud buzzer sounds when a worker fails to monitor a machine's operation and turns off when the worker responds appropriately).

Another way of viewing negative reinforcement is if negative consequences are contingent upon (follow) a behaviour, the probability of the behaviour occurring again is weakened.

Reinforcement theories can be used to influence behaviour – appropriate or desirable work behaviour should be reinforced, while inappropriate work behaviours should not be reinforced or should be negatively reinforced.

Human Resource Policies

Skill Level:	R/U	A/A
4.2.1.3 Describes the role of human resource policies in the design of incentive systems a) Understands how human resource policies (e.g. training and development, promotion, employment equity, prevention of discrimination and harassment, health, safety and environment, benefits and pensions, etc.) complement a given organization's incentive system	✓	
4.2.1.5 Describes the role of the competitive environment in employee recruitment and retention b) Understands the various monetary and non-monetary incentives and compensation that attract and retain employees (e.g. competitive pay, profit sharing, flexibility, training, promotion, child care facilities, job sharing, status symbols, permission to work from home, vacation time, travel opportunities, perks, etc.) and proposes a total compensation package for given competitive market conditions	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Note to candidates: Knowledge requirements from different areas of the CMA Competency Map, which are similar in nature, have been amalgamated into one section to promote efficient studying.

Human Resource Policies

A number of human resource policies complement the incentive program. These policies include:

- Training and development:
  - help employees maximize their potential
  - serve as internal change agents to the organization
  - provide counselling and career development
- Promotion:
  - engaging in policies such as promoting from within the organization, which keeps employees motivated
- Employment equity:
  - ensuring employment equity, which keeps employees motivated and reduces employee turnover

- Prevention of discrimination and harassment:
  - an organization in which employees feel discriminated against or harassed has a high turnover and low morale; by encouraging a culture of acceptance, morale will be higher, which, in turn, tends to increase motivation
- Health, safety and environment:
  - a safe workplace makes employees feel more secure
- Benefits and pensions:
  - a high quality benefit or pension plan can significantly increase an employee's satisfaction.

Monetary and Non-Monetary Compensation Policies in Recruitment and Retention

It is necessary to have sufficient monetary and non-monetary policies in order that high quality employees can be recruited and retained.

Monetary Compensation Policies

This topic has been addressed previously in this manual (under 'Incentive Structures').

Non-Monetary Compensation Policies

In addition to the policies mentioned above, companies can introduce other elements to recruit and retain employees, which include:

- Flexible hours:
  Provide employees with the ability to set their own hours, within reason, allowing them to deal with other commitments, such as family. Flexible hours are a benefit that may entice employees to accept a job offer.
- Training:
  A company with a strong training program tends to attract high quality candidates.
- Child care facilities:
  Many large companies provide on-site child care facilities, which is particularly attractive to parents of young children. This encourages potential employees to consider job offers.

- Job sharing:
  A potential employee may seek part-time employment; however, part-time opportunities may not be available. An ingenious solution is job sharing, whereby, a job is performed by two people, with each employee working sufficient part-time hours, as if a full time employee were working.

- Status symbols:
  Some employees or potential recruits are motivated by status symbols, such as a corner office or a prime parking spot.

- Opportunity to work from home:
  Allowing employees to work from home provides flexibility, which encourages new recruits to accept employment. It also motivates current employees, which aids in retaining them.

- Vacation or additional unpaid time off:
  Providing extra vacation or allowing employees to take additional unpaid time off is a perk many employees covet. This policy will encourage higher quality employees to apply for positions and encourage current employees to stay with the company.

- Travel opportunities:
  If an employee has an opportunity to travel with their employer, the employee will be more likely to stay with the employer (assuming the employee desires to travel).

Ethics and Incentive Plans

Skill Level:	R/U	A/A
4.2.1.4 Identifies ethical issues related to incentive and compensation systems		
a) Explains how incentive systems can encourage employees to behave ethically or to violate a given organization's code of business conduct and ethics	✓	✓
b) Understands how ethical values are affected by cultural differences	✓	
d) Understands the ethics of fair pay (relation between corporate executive and shop floor worker) and explains the importance of pay equity between similar job positions and within industries	✓	✓
R/U = Remembering and Understanding A/A = Application and Analysis		

Ethics and Incentive Plans

Ethics and Employee Behaviour

A set of ethical principles is at the centre of many boundary systems (e.g. codes of conduct). Ethical principals represent a set of standards relating to acceptable behaviour. Thus, a well designed incentive system should take ethics into consideration. Managers whose compensation has a significant portion based on performance, such as bonuses, may feel pressured to engage in unethical behaviour to earn the bonus, which could include:

- requests to tailor information to favour particular individuals or groups
- pleas to falsify reports or test results
- solicitations for confidential information
- pressures to ignore questionable or unethical practices

When designing an incentive plan, it is important to take these factors into consideration so employees are not tempted to engage in unethical behaviour.

Organizational Culture and Ethics

The organization's culture also impacts ethical behaviour. Organizational culture refers to the overall environment of the company and the attitude towards ethical behaviour. If unethical behaviour is seen to be tolerated, employees are apt to be tempted to engage in unethical behaviour.

Pay Fairness and Fair Equity

- Pay fairness:
  This refers to what people believe they deserve to be paid in relation to what others deserve to be paid.

- Pay equity:
  This refers to perceptions based on comparisons between an individual's ratio of inputs and outcomes and the ratios of others doing similar work. Inputs are what an employee gives to his/her job and outcomes are what he/she gets out of doing the job.

  Example 1: Equity is perceived to exist

  The compensation an employee receives is perceived to be fair by that employee and, therefore, the employee's motivation is sustained.

  Example 2: Inequity in the form of underpayment is perceived to exist.

  The compensation received by an employee is perceived to be too little. The employees' motivation is undermined and the employee may engage in activities to seek redress. To reduce inequity, the employee may:
    - reduce effort
    - try to influence manager to increase outcomes (complain, file grievance, etc.)
    - try to influence co-workers' inputs (criticize others outcomes or inputs)
    - withdraw emotionally or physically (engage in absenteeism, tardiness or quit)

Methods of Compensation

Skill Level:	R/U	A/A
4.2.2 Describes the methods of compensation (e.g. cash, stock and options), corresponding tax implications and related factors for a given organization		
a) Describes various methods of compensation (e.g. bonus pool, gain sharing, stock options, profit sharing, employee stock ownership, performance shares, etc.)	✓	✓
b) Understands and evaluates the benefits and shortcomings of various methods of compensation, including those related to tax implications for the organization and its employees (e.g. dividend vs. salary for owner-managers)	✓	✓
c) Discusses the benefits of deferring a portion of the incentive payout into the future	✓	
R/U = Remembering and Understanding A/A = Application and Analysis		

Methods of Compensation

Piece rate wages: Employees are paid a fixed amount for each unit of production. A pure piece-rate plan only pays a person for what they do. A modified piece rate plan will provide a modest base salary and then apply a piece rate differential on top of it. Incentive pay linked to individual performance can have a disastrous impact on team building.

Bonuses: Bonuses, usually in the form of cash, are rewards given to individuals who achieve performance targets. Bonuses are intended to give employees an incentive to pursue their assigned tasks. Since bonuses target and reward specific behaviour, it is important the bonus motivate behaviour that is in the organization's best interests.

Group based incentives: Gain sharing is a formula based group incentive focused on productivity gains rather than profits. For example, workers may share in efficiency gains measured as favourable labour hour efficiency (use) variances.

Organizational based incentives: Programs that distribute compensation based on established formulas tied to company profitability. These organization wide plans usually focus on current financial results and tend to ignore longer-term or non-financial measures of performance.

Employee stock options (ESOP): The primary reason organizations grant stock options is to encourage employees to adopt the values of upper management. Research indicates these plans increase job satisfaction. Despite their positive effect on employee satisfaction, their effect on performance is unclear. To ensure work motivation also increases, employees must have an opportunity to have some influence over the business.

Pay schemes must also be adjusted based on who they are designated for. For example, it is difficult to motivate a professional with money and promotions, since they tend to already be well paid and are enjoying what they do. This group cares about interesting work and support. On the other hand, a contingent worker (one relying on temporary jobs), part-timers and independent contractors, don't always identify with the organization employing them or display the same level of commitment. Their priority may instead be security and stability since their current position may not provide this.

Another challenge is trying to motivate low skilled service workers. There are no easy answers to this dilemma. Unless wages and benefits levels increase significantly, people in these positions may continue to feel dissatisfied.

Executive compensation: Boards determine the type and amount of compensation offered to the most senior executives in organizations. Most often, the compensation is either in the form of a cash bonus or stock options – the latter being the right to purchase company stock at a specified price. The cash bonus focuses on rewarding past performance, while stock options focus on motivating senior executives to undertake courses of action that increase the value of the organization; thereby, increasing the value of their stock options. Stock options are usually only granted to the most senior executives, while cash bonuses may be offered to executives at all levels.

Performance Measurement Problems

ME1 Problem: Transfer Pricing – The Whole Company

The Whole Company is an integrated multi-divisional manufacturing company. Two of its divisions, Rod and Champ, are profit centres and their division managers have full responsibility for production and sales (both internal and external). Both the Rod and Champ division managers are evaluated by top management on the basis of total profit.

Rod Division is the exclusive producer of a special equipment component called Q-32. Since there is no outside competition for Q-32, the Rod division manager used the results of a market study together with statistical probability analysis, to set the price at $450 per unit of Q- 32. At this price, the normal sales and production volume is 21,000 units per year; however, production capacity is 26,000 units per year. Standard production costs for one unit of Q- 32 based on normal production volume are:

Direct materials	$175
Direct labour	75
Variable overhead	50
Fixed overhead	90
Total unit production costs	$390

Champ Division produces machinery for several large customers on a contractual basis. It has recently been approached by a potential customer to produce a specially designed machine, which would require one unit of Q-32 as its main component. The potential customer has indicated it would be willing to sign a long-term contract for 10,400 units of the machine per year at a maximum price of $650 per unit. Although Champ Division has sufficient idle capacity to accommodate the production of this special machine, the division manager is not willing to accept the contract unless he can negotiate a reasonable transfer price with the Rod division manager for Q- 32. He has calculated the unit costs to produce the special machine are:

Direct material other than Q 32	$100
Direct labour	50
Variable overhead	35
Fixed overhead	50
Total unit production costs before transfer of Q 32	$235

Required:

(a) What is the maximum unit transfer price the Champ division manager should be willing to accept for Q-32 if he wishes to accept the contract for the special machine? Support your answer.

(b) What is the minimum unit transfer price the Rod division manager should be willing to accept for Q-32? Support your answer.

(c) Assume Rod Division would be able to sell its capacity of 26,000 units of Q-32 per year in the outside market if the selling price was reduced by 5%. From top management's point of view, evaluate, considering both quantitative and qualitative factors, whether Rod Division should lower its market price or transfer the required units of Q-32 to Champ Division.

(d) Assume top management has decided to impose a dual transfer pricing system for Q-32, which would satisfy the Rod division manager and encourage the Champ division manager to accept the contract for the special machine. Discuss the implications of this decision.

ME2 Problem: Transfer Pricing – Diversified Liquid Products

Diversified Liquid Products (DLP) is a multi-divisional manufacturer of various liquid products. The divisions are autonomous segments with each division responsible for its own sales, cost of operations and equipment acquisition. Divisional performance is evaluated annually based on ROI. Each division serves a different market. Because the markets and products of the divisions are so different, there have never been any transfers between divisions.

The Consumer Division manufactures products purchased by individuals for household use. The division plans to introduce a new household cleaning product called Sludge. Roberta Katz, the Consumer Division manager, has discussed the supply of the glass container for Sludge with Nathan Danielson of the Industrial Division. They both believe a glass container currently made by the Industrial Division for packaging its product Lubri-Solve could be modified for use with Sludge. Consequently, Katz asked Danielson for a price for the glass containers. The following conversation took place about the price to be charged for the glass containers.

Danielson: "Roberta, we can make the necessary modifications to the glass container easily. The specifications used in packaging Sludge are slightly different so the raw materials should cost about 10% more than those used for the glass container for Lubri-Solve. However, the labour time should be the same because the glass container fabrication process is the same. I would price the glass container at our regular rate: full cost plus a 30% mark-up. According to my calculations, that would be $20.53 per glass container."

Katz: "That's higher than I expected, Nathan. I was thinking a good price would be your variable manufacturing cost. After all, your fixed costs will be incurred regardless of this job. In addition, I have received a quotation from one of the Consumer Division's regular suppliers to provide us with the glass container at $19 each."

Danielson: "Roberta, I am at capacity. By making the glass container for you, I have to cut my production of Lubri-Solve. The labour time freed by not having to mix chemicals and package Lubri-Solve can be shifted to the production of Scrubo, our other product. I'd like to sell the glass containers to you at variable cost, but I have excess demand for both products. I don't mind changing my product mix to Scrubo as long as I can continue to make the same ROI for my division. Here are my standard costs for the two products and a schedule of my manufacturing overhead." (See Exhibits 1 and 2.)

Exhibit 1 – Industrial Division Standard Costs and Prices

	Lubri-Solve	Scrubo
Direct materials:		
Chemicals	$7.35	$6.50
Glass container	6.40	—
Paper box (purchased)	—	6.00
Direct labour:		
Chemical mixing (0.5 hrs. @ $7.50/hr.)	3.75	3.75
Glass container (0.5 hrs. @ $7.50/hr.)	3.75	—
Packaging (0.5 hrs. @ $7.50/hr.)	3.75	3.75
Manufacturing overhead ($10/DLH)	15.00	10.00
Total standard cost	$40.00	$30.00
Selling price (including 30% mark-up)	$52.00	$39.00

Exhibit 2 – Industrial Division Manufacturing Overhead Budget

Overhead Item	Description	Amount
Supplies	Variable	$370,000
Indirect labour	Variable	375,000
Supervision	Fixed	150,000
Power	Variable	180,000
Heat and light	Fixed	120,000
Property tax and insurance	Fixed	130,000
Depreciation	Fixed	1,100,000
Employee benefits	Variable	575,000
	Total overhead	$3,000,000
	Capacity in direct labour hours (DLH)	300,000
	Overhead rate per direct labour hour	$10

Katz:	"I guess I see your point, Nathan, but I don't want to price myself out of the market. In addition to pricing, I am also concerned about delivery. We'll need the glass containers within two weeks of placing our order or we risk losing some important potential customers. Our outside supplier claims they can meet our timing needs."
Danielson:	"Oh-oh. That lead time is a bit short considering the production rescheduling we need to do. I can't promise you a lead time shorter than four weeks at the moment."
Katz:	"There's quite a few issues that need to be addressed here, Nathan. As we have no previous experience in transferring goods between our divisions, I think we should speak with the controller at corporate headquarters before we can agree on a transfer price."

<u>Required:</u>

Calculate the transfer price that satisfies Danielson's ROI requirements.

ME3 Problem: Transfer Pricing – West Industries

West Industries is a highly decentralized corporation with independent operating divisions. Each division is evaluated and rewarded based on its total net income. One division, Visic, manufactures and sells air conditioners. It is projecting a sales forecast of 17,400 for next year.

Another division, Weber, makes and sells compressors. Its projected income statement for next year follows:

Weber Division
Pro Forma Income Statement
for next year

	Per Unit	Totals
Sales revenues	$100	$6,400,000
Less cost of goods sold:		
Direct materials	12	768,000
Direct labour	8	512,000
Variable overhead	10	640,000
Fixed overhead	11	704,000
	41	2624000
Gross profit	59	3,776,000
Operating expenses:		
Variable selling expenses	6	384,000
Fixed selling expenses	4	256,000
Fixed administrative expenses	7	448,000
Total operating expenses	17	1,088,000
Pre-tax net income	$42	$2,688,000

Weber has the capacity to produce 75,000 compressors annually. Visic, currently purchasing from an outside source at $70, proposes that Weber transfer compressors to them at a transfer price of $50. The Visic manager justified the low bid based on cost savings that should be realized if compressors are transferred. Because specifications for this compressor are slightly different from Weber's standard model, $1.50 per compressor of direct materials cost can be saved and no variable selling expenses will be incurred on compressors transferred.

Required:

a. Compute the estimated effect on Weber's net income if the 17,400 compressors are transferred at $50 each.

b. Determine whether it would be in West Industries' best interests for Weber to transfer compressors at $50 each.

c. What is the minimum transfer price you would accept as the Weber manager?

ME4 Problem: Transfer Pricing – Parker Corporation

Parker Corporation has two divisions, Ajax and Defco. Both are profit centers. One of the products Ajax manufactures is electrical fitting 1726, which is protected under patent and, thus, is not available from any other source. Its variable costs are $4.25 per unit and its normal sales price is $7.50.

Defco has just been awarded an Air Force contract for the manufacture of a special brake unit. Because Defco was only operating at 50% capacity, it purposefully bid low to increase its chances of winning the contract in what, the manager believed, would be a competitive process, due to the sagging state of the defence contracting and airline manufacturing industries. The brake's bid sheet shows:

Purchased parts from outside vendors	$22.50
Ajax electrical fitting 1726	5.00
Other variable costs	14.00
Standard variable manufacturing and delivery costs	41.50
Indirect cost mark-up for fixed factory overhead, administration costs and profit	8.00
Brake bid price	$49.50

Required:

a. Recommend whether or not Ajax should supply fitting 1726 to Defco.

b. Discuss whether a transfer is in Parker's long-term economic interest.

ME5 Problem: Transfer Pricing – Canadian Motors International

Canadian Motors International (CMI) is an international company organized into three divisions, each of which is treated as an investment centre. Divisional performance evaluation and managerial bonuses are based on achieving a 12% divisional return on investment (ROI). Divisional ROI is calculated as pre-tax divisional income divided by divisional investment. See Exhibit 1 for a diagram showing the structure of CMI.

Paul Sing, President of CMI, is concerned about both divisional and overall corporate performance. The following discussion took place recently between Paul Sing and Erin Hunter, the new controller.

Paul Sing, President: "I wonder if the growth we enjoyed in the early eighties was really worth it. Now that we're an international organization, I'm not sure what's going on in each of the divisions."

Erin Hunter, Controller: "But you've laid out some ground rules for the divisional managers to work within. I heard you say this morning they are supposed to act as independent business units and maximize divisional return on investments."

Paul Sing, President: "I've also instructed the divisional managers to buy from and sell to each other, whenever possible, and the price for these internal transactions has to be set at 1.25 times full production cost. Every time I turn around, one of them is complaining about what the other divisions are doing."

The Engine Division (ED) manufactures standard carburetor engines and fuel-injected engines. The manufacturing process involves product design, machining of parts, assembly and quality assurance. ED has developed a strong reputation based on product quality and the guarantee of complete customer satisfaction. Lately, CMI management has expressed some concerns regarding the overall profitability of ED given CMI's overall desired rate of return of 12% before taxes (the corporate tax rate in Canada is 40%). All carburetor engines produced by ED are sold to the Snowmobile Division (SD) of CMI.

Information concerning the manufacture of the engines is provided in Exhibit 2. The manager of ED has been complaining that his division's ROI is decreasing as carburetor engine sales to SD increase. He has argued with Paul Sing that he should be allowed to increase the price of carburetor engines to $500 which is the market price for a similar engine. Alternatively, the ED manager has threatened to stop producing carburetor engines. Sales prospects for the fuel-injected engine are virtually limitless at the current price of $600 per engine. The only restriction facing ED is an upper limit of 200,000 machine hours per year.

The Snowmobile Division (SD) manufactures snowmobiles valued for their durability and performance. Information on the profitability of SD is shown in Exhibit 3. SD buys all its carburetor engines from ED.

Paul Sing has been pleased with the past performance of SD as sales and profits have continued to increase. He decided to ask the SD manager how a price increase in carburetor engines would affect sales. The reply was that snowmobile sales are price sensitive and the proposed increase in the price of engines from ED would require SD to increase the domestic price of the snowmobile to $3,400. This would cause the domestic sales volume to fall to 3,500 units per year. The SD manager also complained that ED's service has steadily decreased over the past year, causing delays in the production of snowmobiles and, if delivery times do not improve, sales could be lost.

The International Division (ID) of CMI is located in Sweden where the corporate tax rate is 30%. ID's only business activity is to sell snowmobiles imported from SD. ID pays a 20% import duty based on the transfer price. Customs officials in Sweden carefully monitor the invoices of imported manufactured goods to ensure the goods are priced at "fair values". The government of Sweden considers any price between full production cost and 150% of full production cost to be within its definition of fair value. Information on ID is provided in Exhibit 4.

While ID is only two years old, it has gained a significant market share in Sweden by following a penetration pricing strategy. All indications are sales will continue to grow. In response to a recent inquiry by Paul Sing, ID's manager indicated the proposed increase in the cost of a snowmobile from SD would lead him to increase the ID sales price by $300 per unit, causing volumes to decline to 1,700 per year.

At the end of their meeting, Paul Sing requested Erin Hunter to analyze the company's current situation, including the ED manager's two proposals and recommend improvements. Specifically, he would like her to determine the impact of each proposal on the pre-tax income and return on investment for each division and the company as a whole, along with the behavioural implications of these proposals. Paul Sing would also like a discussion of the relevant considerations in setting CMI's domestic and international transfer pricing policies. Other issues, such as organization structure, performance evaluation, the bonus system and improvement of the company's future profitability are other concerns Paul Sing would like her to address.

Required:

As Erin Hunter, the new controller, prepare a report to Paul Sing, President of Canadian Motors International.

Exhibit 1
Canadian Motors International

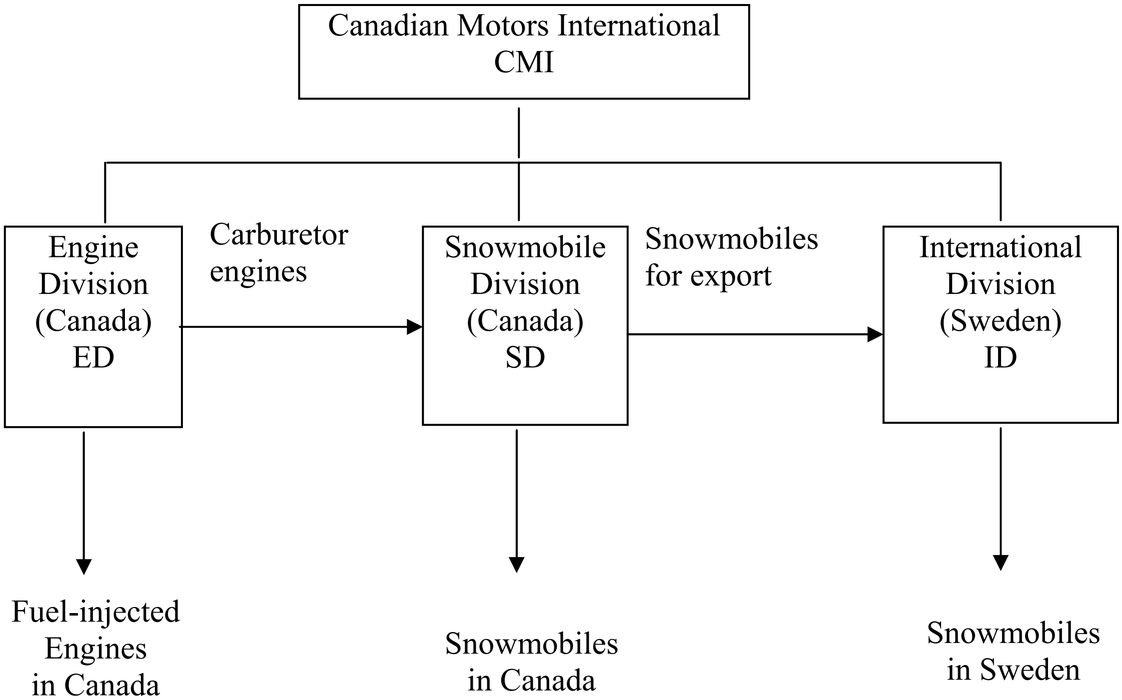


Exhibit 2
Engine Division

	Carburetor		Fuel Injected		Total
	Per Unit	Total	Per Unit	Total	Engine Division
Volume (units)		6,000		22,000	28,000
Revenue	$400	$2,400,000	$600	$13,200,000	$15,600,000
Direct costs:					
Materials	$150	$900,000	$135	$2,970,000	3870,000
Labour	70	420,000	90	1,980,000	2,400,000
Production overhead					
- variable	45	270,000	25	550,000	820,000
- fixed	55	330,000	72	1,584,000	1,914,000
Variable selling & admin.	10	60,000	37	814,000	874,000
Total direct costs	$330	$1,980,000	$359	$7,898,000	9,878,000
Fixed selling and admin.					4,733,000
Total costs					1,4611,000
Pre-tax divisional income					$989,000
Machine hours	4	24,000	8	176,000	200,000
Divisional investment					$11,697,000
Divisional ROI					8.5%

Exhibit 3
Snowmobile Division

	Per Unit	Volume	Total
Sales: domestic	$3300	4000	$13200000
Sales: transfers to ID	$3610	2000	7220000
Total sales		6000	20420000
Direct materials (Note)	$1300	6000	7800000
Direct labour	1200	6000	7200000
Variable production overhead	100	6000	600000
Fixed production overhead	288	5000	1728000
Selling and administration:			
Variable	52	6000	312000
Fixed	361	6000	2166000
Total costs	$3301		19806000
Pre-tax divisional income			$614000
Divisional investment			$4083000
Divisional ROI			15.0%

Note: Includes engines at $400 per engine.

Performance Measurement - Problems

Exhibit 4
International Division
(in C$)

	Per Unit	Total
Volume		2000
Revenue	$4700	$9400000
Cost of snowmobiles (Note)	4332	8664000
Gross margin	368	736000
Selling and administration:		
Variable	47	94000
Fixed	86	172000
	133	266000
Pre-tax divisional income	$235	$470000
Divisional investment		$2379000
Divisional ROI		19.8%

Note: As acquired from the Snowmobile Division at 125% of full production cost (rounded to the nearest dollar) plus 20% import duty on goods imported into Sweden.

ME6 Problem: Transfer Pricing – Seagull Controls Limited

Seagull Controls Limited manufactures small control units used in process control equipment. It has two operating divisions: the Component Division and the Device Division. The Component Division was set up originally as an autonomous cost centre with the mission of supplying a high quality control component, CTR1, to the Device Division, where it is made part of a Precision Control Unit (PCU). The CTR1 component is designed specifically for the PCU and there is no immediate external market for the component.

In 2002, Seagull expanded and automated its manufacturing facilities. With the expansion, the Component Division had enough capacity to not only to satisfy the internal requirements of the Device Division, but also to accept a contract to produce a new control component, CTR2. The contract was for 25,000 units per year for five years.

The Component Division has been treated as a profit centre since the commencement of production and sales of CTR2. Its performance evaluation is based on divisional net income before taxes, just like the Device Division. Since the CTR2 contract provided a net margin of 20%, the Component Division also demanded a transfer price for the CTR1, which would generate a 20% net margin. The Device Division had no choice but to accept this transfer price as it could not locate another supplier providing the same quality of the CTR1 as the Component Division.

Exhibits 1 and 2 provide budgeted net margin data for the two divisions for 2004.

Dave Demski, manager of the Device Division, was concerned about the high transfer price of the CTR1 component as it was negatively affecting the division's net income before taxes. In late 2003, Dave began investigating possible external sources of the CTR1 component at more reasonable prices. In January 2004, Dave signed a contract with an external supplier for delivery of 10,000 units of the CTR1 component throughout the year at a price of $210 per unit, starting in February 2004. This would result in a savings of $900,000 for the Device Division when compared with the internal transfer price.

Dave believed the Component Division would not object as it could pursue an opportunity to supply another new component, JAFAR, to Apex Automotive. However, the contract Dave signed for CTR1 contained the following two options for Dave to make changes if necessary:

1) The contract could be cancelled within 10 days of signing at a penalty of 12% of the full contract price.

2) The order quantity could be decreased, within 30 days of signing the contract, to 2,000 units but at a lump sum cost of $100,000 to cover tooling costs in addition to the $210 per unit price.

When Carl Chevis, manager of the Component Division, heard of the contract, he was upset. Carl, who has been with the company for a number of years, believed the mission of the Component Division is to supply the high quality CTR1 component internally. Any other business, such as the sale of the new CTR2 component, is supplementary. He felt Dave's actions would hurt the Component Division's net income before taxes for 2004. Carl requested a meeting with Lucie Lambert, President of Seagull Controls Limited, to discuss the matter.

During the meeting, both Dave and Carl presented their cases to Lucie Lambert. Carl indicated that if the Device Division were to purchase the CTR1 components externally, it would cause considerable financial difficulties for the Component Division. Carl admitted he was considering pursuing a potential contract with Apex Automotive to supply the JAFAR component. Apex is ordering several samples of 500 units of JAFAR from various potential suppliers in 2004 for $700 per unit. If Apex prefers the quality of the Component Division's sample, Apex will order 8,000 units of JAFAR per year for 2005 and 2006 at $700 per unit.

If Apex places this two year order, the efficiency of the Component Division's plant must be improved. Currently, a large portion of each shift is spent on complex process warm-up and shutdown procedures. Increased efficiency can be achieved with continuous manufacturing.

The plant can be converted to continuous operation by expanding plant operations from two eight hour shifts to three eight hour shifts and a capital investment of $2,000,000. This investment would be placed in the Class 8 pool of assets with a 20% CCA rate for tax purposes, but would be depreciated on a straight-line basis over two years. The investment would have no salvage value any time after completing the expansion. The conversion to continuous operation requires complex adjustments and would take a year to implement. After implementation is complete, the plant's capacity will have doubled.

Net margin information for the JAFAR order, assuming plant expansion, is provided in Exhibit 3. Carl indicated to Lucie that, with his high tech equipment, he will be able to produce a high quality JAFAR component and he feels there is a 75% chance of receiving the two year contract with Apex Automotive beginning in 2005.

Back in her office, Lucie felt confused about the conflict between Dave and Carl and wondered how things went wrong so fast. At the last retreat with the Board of Directors, the Board clarified Seagull's mission statement: the company is committed to growing as quickly as possible into Canada's leading integrated manufacturer of small process control devices. It will do this by ensuring it has the most innovative technology and the most flexible responses to customer delivery needs. Both managers expressed positively to the Board that the performance evaluation system and the divisional programs provide them the tools and motivation they need to increase sales of the PCU by 10% per year.

Lucie asked Mario Mancini, the company controller, to analyze the situation and recommend the company's best course of action to resolve the conflict between Dave and Carl and to enhance corporate growth.

In his preliminary analysis, Mario decided to include the following in his report:

1. An analysis of the various sourcing options for the CTR1 component in 2004.
2. A net present value analysis of the opportunity to produce JAFAR for Apex Automotive.
3. A review of Seagull Controls Limited's management control system, including sourcing, performance evaluation and transfer pricing policies.
4. Recommendations to promote corporate growth.

Required:

As Mario Mancini, the company controller, prepare a report to Lucie Lambert, President of Seagull Controls Limited. Assume the company's tax rate is 45% and its after-tax cost of capital is 12%.

Exhibit 1

Seagull Controls Limited
Component Division
Budgeted Production and Sales Data for CTR1 and CTR2 Components
for the year ending December 31, 2004

	CTR1 Component	CTR2 Component
Production and sales (units)	14,000	25,000
Internal transfer price	$300	
External selling price		$175
Cost per unit:		
Direct materials	54	22
Direct labour[1]	40	20
Factory overhead[2]	116	58
Selling[3]	-	10
General and administrative[4]	30	30
	240	140
Net income before tax	$ 60	$ 35
Net margin	20%	20%

Notes:

1 The rate is $25 per direct labour hour for both types of components.

2 Factory overhead is applied on an actual machine hour basis. The variable overhead rate is $28 per machine hour and the fixed overhead rate is $30 per machine hour, based on the practical capacity of 60,000 machine hours.

3 There are no selling expenses for internal transfers of the CTR1 component and selling expenses for the CTR2 component are 40% variable and 60% fixed.

4 The general and administrative expenses are fixed and are allocated to the two types of components on the basis of units transferred and sold.

Exhibit 2

Seagull Controls Limited
Device Division
Budgeted Production and Sales Data for Precision Control Unit (PCU)
for the year ending December 31, 2004

	Precision Control Unit
Production and sales (units)[1]	14,000
Selling price	$820
Cost per unit:	
CTR1 component	300
Other direct materials	84
Direct labour[2]	72
Factory overhead[3]	140
Selling[4]	20
General and administrative[5]	122
	738
Net income before tax	$ 82
Net margin	10%

Notes:

1 Budgeted sales volume for 2004 reflects a 10% increase over the 2003 sales volumes.

2 The rate is $24 per direct labour hour.

3 Factory overhead is applied on an actual machine hour basis. The variable overhead rate is $16 per machine hour and the fixed overhead rate is $12 per machine hour, based on the expected activity. Practical capacity of the plant is 100,000 machine hours.

4 The selling expenses for the Precision Control Unit (PCU) are 30% variable and 70% fixed.

5 The general and administrative expenses for the PCU are fixed.

Exhibit 3

Seagull Controls Limited
Component Division
Cost and Sales Data for 2005 and 2006 JAFAR Component

Selling price	$700
Cost per unit:[1]	
Direct materials	200
Direct labour	100
Factory overhead	265
Selling (variable)	10
General and administrative	30
	605
Net income before tax	$ 95
Net margin	13.6%

Note:

1 The direct labour and variable overhead rates are the same as those of the CTR1 and CTR2 components. The fixed factory overhead rate, including depreciation, for the Component Division would be reduced to $25 per machine hour based on the expanded practical capacity of 120,000 machine hours. Total fixed general and administrative expenses would be unaffected by the plant expansion, but would continue to be allocated to the components at $30 per unit transferred or sold.

ME7 Problem: ROI and RI - General

Show how both return on investment (ROI) and residual income (RI) are computed and explain how each works. Discuss and compare the strengths and weaknesses of the measures for performance evaluation.

ME8 Problem: ROI and RI – Osti Industries

Osti Industries produces tool and die machinery for manufacturers. The company expanded vertically in 2004 by acquiring one of its suppliers of alloy steel plates, Robertson Steel Company. In order to manage the two separate businesses, the operations of Robertson are reported separately as an investment center.

Osti monitors its divisions on the basis of both unit contribution and return on average investment (ROl), with investment defined as average operating assets employed. Management bonuses are determined on ROl. All investments in operating assets are expected to earn a minimum return of 11% before income taxes.

Robertson's cost of goods sold is considered to be entirely variable, while the division's administrative expenses are not dependent on volume. Selling expenses are a mixed cost with 40% attributed to sales volume. Robertson's ROl has ranged from 11.8% to 14.7% since 2004. During the fiscal year ended November 30, 2009, Robertson contemplated a capital acquisition with an estimated ROI of 11.5%; however, division management decided against the investment because it believed the investment would decrease Robertson's overall ROI.

The 2009 operating statement for Robertson follows. The division's operating assets employed were $15,750,000 at November 30, 2009, a 5% increase over the 2008 year-end balance.

Robertson Steel Division
Operating Statement
for the year ended November 30, 2009
($000 Omitted)

Sales revenue		$25,000
Less expenses:		
Cost of goods sold	$16,500	
Administrative expenses	3,955	
Selling expenses	2,700	23,155
Income from operations before income taxes		$ 1,845

Performance Measurement - Problems

Required:

a. Calculate the unit contribution for Robertson Steel Division if 1,484,000 units were produced and sold during the year ended November 30, 2009.

b. Calculate the following performance measures for 2009 for the Robertson Steel Division:

   1. Pre-tax return on average investment in operating assets employed (ROI).

   2. Residual income (RI) calculated on the basis of average operating assets employed.

c. Explain why Robertson management would have been more likely to accept the contemplated capital acquisition if RI rather than ROl had been used as a performance measurement.

ME9 Problem: ROI and RI – Three Companies

The following partial information is available for three companies:

	Company I	Company II	Company III
Sales	$1,185,000		$3,690,000
Net income	$159,975		$571,950
Average assets employed		$4,500,000	
Net income % (% of sales)		6.8%	
Investment turnover		1.5	
Return on investment	4.0%		8.0%

Required:

Fill in the empty boxes.

Performance Measurement - Problems

ME10 Problem: ROI and Residual Income- Bate Inc.

A division of Bate Inc. sells widgets. This division has experienced the following average annual results based on the past three years:

Total fixed costs	$680,000
Variable costs	$16.50 / unit
Average sales per year	50,000 units
Average assets employed	$1,565,000
Average ROI	15%

Required:

1. What selling price must be charged to ensure the division maintains its average ROI of 15%?

2. Assume residual income is used to measure performance and the minimum rate of return required is 20%. What is the minimum selling price required to meet the minimum rate of return using residual income?

ME11 Problem: ROI and Residual Income – Divisional Income

The following two divisions, Division I and II, annual results are:

	Division I	Division II
Assets employed	$1,000,000	$3,000,000
Net income	$180,000	$420,000

Required:

1. Calculate ROI for each division.

2. Calculate residual income assuming the minimum required rate of return is:
   a) 12%
   b) 15%
   c) 17%

Performance Measurement - Problems

Performance Measurement Solutions

ME1 Solution: Transfer Pricing – The Whole Company

(a)

Maximum price per machine		$650
Variable costs other than Q-32:		
Direct materials	100	
Direct labour	50	
Variable overhead	35	185
Contribution available for purchase of Q-32		465

The Champ Division manager should, therefore, be willing to accept a maximum transfer price of $465 per unit of Q- 32. Note, however, that no profit would be earned by the Champ Division if the transfer price was set at $465 per unit.

(b)

Rod Division has enough excess capacity to produce 5,000 units of Q-32; therefore, the Rod Division manager should be willing to accept the variable cost of $300 per unit of Q-32 for up to 5,000 units transferred. Once maximum capacity is reached, any additional units transferred would have an additional opportunity cost. These units could be sold in the outside market for $450 per unit; therefore, the Rod Division manager would be willing to accept a minimum transfer price of $450 per unit for units transferred in excess of 5,000 units.

For the situation currently facing the company, a minimum average transfer price per unit of Q-32 can be calculated as follows:

Variable costs of Q-32:	
Direct materials	$ 175.00
Direct labour	75.00
Variable overhead	50.00
Total variable costs per unit	$300.00
x 10,400 units	x 10,400
	$3,120,000
Plus opportunity cost of lost sales of 5,400 units to outside customers (450-300) x 5,400	810,000
Total incremental costs	$3,930,000
Divided by 10,400 units	÷ 10,400
Incremental cost per unit	$ 377.88

Therefore, the Rod Division manager should be willing to accept any transfer price, which is equal to or greater than $377.88 per unit for 10,400 units of Q-32.

(c)
Lower price:

Sales revenue [($450 x .95) x 26,000 units)		$11,115,000
Variable manufacturing costs ($300 x 26,000 units)		7,800,000
Contribution margin for the company		$ 3,315,000

Transfer to Champ:

Sales revenue ($450 x 15,600 units) + ($650 x 10,400 units)		$13,780,000
Variable manufacturing costs of Rod ($300 x 26,000 units)	7,800,000	
Variable manufacturing costs of Champ ($185 x 10,400 units)	1,924,000	9,724,000
Contribution margin for the company		4,056,000

Based on the above quantitative analysis, Rod Division should transfer the required Q-32 to Champ Division because it would provide the Whole Company with a $741,000 ($4,056,000 - $3.315,000) increase in annual profits. Some qualitative factors, which should be considered, however, are:

1. The reaction of other Q-32 customers due to the decreased availability of Q-32 on the market. These customers may seek a substitute for their requirements of Q-32. If a reasonable substitute is found, overall demand for Q-32 may fall.

2. There may be a possibility of expanding the capacity for production of Q-32 at a reasonable cost.

3. Champ Division may have other ways to use up its idle capacity, which would produce an even greater increase in profits.

(d)
Although divisional autonomy would be violated, the imposed transfer prices would encourage the divisions to make the best decision for the company overall: accept the contract for the special machine and transfer the required units of Q-32 from Rod to Champ. Initially, therefore, goal congruence would be achieved.

A dual transfer pricing system may, at first glance, seem like the perfect solution since the division managers each gets what he/she wants. But it may lead to reduced managerial effort , which would cause problems in the long-term. The division managers would have reduced incentive to operate efficiently (any ‘problems’ are taken care of by the internal accounting system), which may ultimately result in reduced profits and customer dissatisfaction.

ME2 Solution: Transfer Pricing – Diversified Liquid Products

Transfer price analysis:

Variable costs	$13.29
Opportunity costs	5.50
Transfer price	$18.79

Variable costs:

Direct material ($6.40 x 110%)	$7.04
Direct labour (0.5 hrs @ $7.50 / hr.)	3.75
Variable overhead (0.5 hrs @ $5 / hr.)	2.50
Total variable cost per unit	$13.29

Overhead analysis:

	Variable Amount		Fixed Amount	
	Total	Per DLH	Total	Per DLH
Supplies	$370,000	$1.23		
Indirect labour	375,000	1.25		
Supervision			$150,000	$0.50
Power	180,000	0.60		
Heat and light			120,000	0.40
Property tax and insurance			130,000	0.43
Depreciation			1,100,000	3.67
Employee benefits	575,000	1.92		
Totals	$1,500,000	$5.00	$1,500,000	$5.00

Opportunity cost analysis:

	Lubri-Solve	Scubo
Selling price	$52.00	$39.00
Variable cost:		
Material	$13.75	$12.50
Labour:		
1.5 DLH x $7.50 / DLH	11.25	
1.0 DLH x $7.50 / DLH		7.50
Variable overhead:		
1.5 DLH x $5 / DLH	7.50	
1.0 DLH x $5 / DLH		5.00
Total variable costs	$32.50	$25.00
Contribution margin per unit	$19.50	$14.00
Opportunity cost of shifting production = $5.50		

ME3 Solution: Transfer Pricing – West Industries

a.	Contribution margin on compressors transferred out:	
	17,400 x ($50 – 10.50 ^{DM} – 8 ^{DL} – 10 ^{VOH})	
	= 17,400 x $21.50	$374,100
	Contribution margin lost on external sales:	
	6,400* x ($100 – 12 ^{DM} – 8 ^{DL} – 10 ^{VOH} – 6 Var Sel)	
	6,400 x $64	(409,600)
	Incremental income	($35,500)
	* Weber's capacity	75,000
	Less: expected sales ($6,400,000 / 100)	64,000
	Excess capacity	11,000
	Units required by Visic	17,400
	External sales lost	6,400
b.	From the company's perspective:	
	Savings by not purchasing externally	
	17,400 x $70	$1,218,000
	Cost of making compressors	
	17,400 x (10.50 ^{DM} + 8 ^{DL} + 10 ^{VOH})	
	= 17,400 x $28.50	(495,900)
	Contribution margin lost on external sales	(409,600)
	Incremental income	$312,500
c.	Variable cost	$28.50
	Opportunity cost of lost sales:	
	$409,600 / 17,400	23.54
	Minimum transfer price	$52.04

ME4 Solution: Transfer Pricing – Parker Corporation

a. If Ajax is operating at capacity, then the minimum transfer price will be equal to the normal sales price of $7.50. If the Ajax Division has enough capacity to supply the Defco Division, then the minimum transfer price will be equal to the variable cost of $4.25.

On the other hand, the Defco Division's maximum transfer price is $5 + the $8 cost mark-up = $13.

b. If the Defco contract is a one-time contract and does not result in Ajax having to turn away regular customers, then the transfer is in Parker's long-term economic interest.

If the Defco contract is a recurring contract, then the transfer is in Parker's long-term economic interest since the lost CM on Ajax customers will be offset on a recurring basis by Defco's contract.

However, if we are dealing with a one-time contract and Ajax has to turn away regular customers, then the transfer is in the long-term economic interests of Parker only if it is reasonably assured Ajax will continue operating at capacity after the contract.

ME5 Solution: Transfer Pricing – Canadian Motors International

1. Analysis of the proposal to increase the transfer price of carburetors to $500

Impact on sales and production volumes:

ID sales drop from	2,000 units to	1,700 units
SD domestic sales from	4,000 units to	3,500 units
Total sales drop from	6,000 units to	5,200 units

ED capacity	200,000 MH
Requirement for 5,200 carburetor engines: 5,200 x 4	20,800
Available for fuel-injected engines	179,200

Number of fuel-injected engines produced - 179,200÷ 8 22,400

Engine Division:

Contribution margin:	
Carburetors [5,200 x ($500 - 275)]	$1,170,000
Fuel-injection [22,400 x ($600 - 287)]	7,011,200
	8,181,200
Fixed costs:	
Production	(1,914,000)
Selling and administration	(4,733,000)
Pre-tax divisional income	$1,534,200
Divisional ROI ($1,534,200 ÷ $11,697,000)	13.1%

Snowmobile Division:

Transfer price to International Division -	
SD variable production costs – per Exhibit 3	$2,600
Increase in cost of motors	100
Fixed production costs per unit – $1,728,000 ÷ 5,200 units	332
Fully absorbed cost	3,032
	x 1.25
Transfer price to ID	$3,790

Total revenues:	
Domestic - 3,500 units @ $3,400	$11,900,000
International - 1,700 @ $3,790	6,443,000
	18,343,000
Variable costs - ($2,700 + 52 variable selling) x 5,200 units	(14,310,400)
Total contribution margin	4,032,600
Less fixed costs:	
Production	(1,728,000)
Selling and administration	(2,166,000)
Pre-tax divisional income	$ 138,600
Divisional ROI ($138,600 ÷ 4,083,000)	3.4%

International Division:

Revenues - 1,700 @ $5,000	$8,500,000
Variable costs [($3,790 x 1.2) + 47] x 1,700	7,811,500
Contribution margin	688,500
Fixed costs	(172,000)
Pre-tax divisional income	$ 516,500
Divisional ROI ($516,500 ÷ 2,379,000)	21.7%

Summary:

	Engine Division	Snowmobile Division	International Division	Total
Pre-tax Income:				
Proposed	$1,534,200	$ 138,600	$516,500	$2,189,300
Current	989,000	614,000	470,000	2,073,000
Change	$ 545,200	$(475,400)	$ 46,500	$ 116,300
ROI:				
Proposed	13.1%	3.4%	21.7%	12.1%
Current	8.5%	15.0%	19.8%	11.4%
Change	4.6%	(11.6%)	1.9%	0.7%

The only manager that will be unhappy with the new transfer price is the Snowmobile Division manager. However, the overall company's results are better, therefore, the change should be made.

Performance Measurement - Solutions

2. Analysis of the proposal to stop production of carburetor engines

Maximum transfer price (from SD Division's point of view) =		$500.00
Minimum transfer price (from ED Division's point of view) -		
Variable cost of producing a carburetor engine		$275.00
Fixed costs (assumed avoidable) of carburetor engine production -		
$330,000 ÷ 5,200 engines		63.46
Fuel-injected engine CM lost when one carburetor engine is transferred:		
CM on fuel-injected engine =		
$600 - 287 = 313 ÷ 2 (two carburetor engines are manufactured in lieu of one fuel-injected engine)		156.50
		$494.96

Therefore, it is profitable for the company as a whole to transfer carburetor engines. If the transfer price is $494.96, the engine division is as well off as it would be if it were to sell only fuel-injected engines.

Impact on company net income if carburetor engines are purchased externally:

Increased CM on sale of fuel-injected engines:	
5,200 x 4 MH ÷ 8 MH = 2,600 x $313	$ 813,800
VC savings of not manufacturing carburetor engines:	
5,200 x $275	1,430,000
Cost of purchasing carburetor engines externally:	
5,200 x $500	(2,600,000)
Fixed cost savings	330,000
Incremental company income	$ (26,200)

(This incremental income can also be calculated as the profit differential times the number of units transferred: [$500 - 494.96] x 5,200 units = $26,208)

Note that this incremental company income is also the incremental Engine Division income since transfers are assumed to be at $500; thereby, having no impact on the Snowmobile and International Divisions.

Note that if the demand for engines from the Snowmobile Division drops below 4,817*, the company and the Engine Division would be better off purchasing carburetor engines externally.

* $500 - 275 - 156.5 = $68.50 = maximum per unit fixed costs of carburetor production
$330,000 / $68.50 = 4,817 engines

3. Transfer Pricing Policies

The following should be considered when considering transfers between ED and SD:

- promotion of goal congruence: the transfer pricing policy should aim to achieve top management's goals (i.e. achieving the 12% ROI)

- promotion of a sustained high level of managerial effort

- promotion of a high level of sub-unit autonomy – divisional managers should be given freedom to set transfer prices and to buy/sell engines/snowmobiles internally or externally. If the SD manager is given this autonomy and is faced with the decision to purchase internally a poor quality carburetor engine for $500 or an external high quality engine at the same price, he will do so. This will provide an incentive for the ED manager to provide a better quality product.

International transfer pricing – for external reporting purposes, the transfer prices to be considered are (1) full cost and (2) 150% of full cost:

	Full Cost	150% of full Cost
Cost	$3,032.00	$4,548.00
Tax cost in Canada (40%)	$0.00	$(606.40)
Custom duties in Sweden (20%)	(606.40)	(909.60)
Tax savings in Sweden (30%)	1,091.52	1,637.28
	$485.12	$121.28

Therefore, transfers should be made at full cost. This does not, however, preclude the use of a different transfer price for purposes of performance evaluation. This should be at the market price of $3,400. This will reduce the SD Division net income to ($524,400), a reduction of $663,000 [1,700 units x ($3,790 - 3,400)].

Performance Measurement - Solutions

4. Organizational Structure

The key to making an organization structure work is to match performance evaluation to factors controllable by the division and to ensure the transfer pricing and performance evaluation systems motivate the divisions to act in a manner that strives to achieve company goals.

Clearly, the ED and SD Divisions are true investment centres.

The ID Division, however, is nothing more than a sales outlet for SD products in another country. On the assumption the ID does not sell our competition's products, the ID should be treated as a revenue centre or as part of the SD Division.

5. Other issues

- performance evaluation and bonuses are based on a single measure. This motivates divisional managers to focus on improving divisional ROI, but not necessarily the company's ROI. Other factors such as service to customers, market share improvement and product quality, should also be considered.

- using the same target ROI for all divisions may not be appropriate. Business risks involved in the different industries could be quite different, resulting in some divisions having an advantage over other divisions.

- the use of ROI may be inducing the managers of highly profitable divisions to reject projects that have projected ROI's in excess of 12%, but less that the division's ROI.
  - projects that have long-term benefits may be rejected because of short-term negative effects on divisional ROI
  - the ROI target could also lead managers to take actions that cause short-term increases in divisional ROI, but are in conflict with the long-term interests of the company (i.e. reducing discretionary expenses such as R&M)
  - other ROI related problems: inflation, depreciation method

- it appears the performance evaluation of divisional managers is not distinguished from performance evaluation of divisions. Often, the most talented manager is put in charge of the weakest division in an attempt to improve the weak division's operations.

ME6 Solution: Transfer Pricing – Seagull Controls Limited

A. Sourcing of CTR1 Components in 2004

Capacity calculations:

Practical capacity (machine hours)	60,000
Required for CTR2 (maximum) - 25,000 x 1 hour	-25,000
Required for CTR1: 14,000 x 2 hours	-28,000
Required for JAFAR: 500 x 5 hours	-2,500
Excess capacity	4,500

Option 1:
Purchase 10,000 units from external suppliers: 10,000 x $210 = $2,100,000

Option 2:
Cancel Contract and pay penalty (calculated from the company's point of view):

Variable production costs:	
Direct materials	$54
Direct labour	40
Variable overhead: 2 hours x $28	56
	$150
	x 10,000
	$1,500,000
Penalty: $2,100,000 x 12%	252,000
	$1,752,000

Option 3:
Buy 2,000 units of CTR1 externally

Internal production costs: 8,000 x $150	$1,200,000
External purchase costs: 2,000 x $210	420,000
Tooling cost to external supplier	100,000
	$1,720,000

Discussion:

- Option 3 is the least costly

- Need to consider the quality and reliability of delivery of external components – considering the difference between Options 2 and 3 is only $32,000, Option 3 may not be worthwhile

- Recommend they choose Option 2

B. Apex Automotive Opportunity

NPV analysis:

Capital cost			($2,000,000)
Tax shield: [(2,000,000)(.2)(.45) ÷ (.12 + .2)] x (1.06 ÷ 1.12)			532,366
Increased fixed overhead:			
New FOH: 120,000 x $25		$3,000,000	
Old FOH: 60,000 x $30		1,800,000	
Increase		1,200,000	
Less: increase in depreciation ($2,000,000 ÷ 2)		-1,000,000	
		200,000	
	x (1-t)	0.55	
	N = 2, I = 12, PMT = 110,000, PV =		(185,906)
Annual cash inflows:			
Selling price		$700	
Direct materials		-200	
Direct labour		-100	
Variable overhead: 5 hours* x $28		-140	
Variable selling		-10	
		250	
	x Units	8000	
	x (1-t)	0.55	
	N = 2, I = 12, PMT = 1,100,000		1,859,056
Net present value if we get APEX order			$205,516

* combined OH rate = $28 + 25 = $53
Hours = $265 ÷ 53 = 5

NPV if we do NOT receive APEX order:	
Capital cost	-2,000,000
Tax shield	532,366
Increase in fixed overhead	-185,906
	-1,653,540
Expected NPV: (205,516 x 75%) + (-1,653,540 x 25%)	-2,562,488

Performance Measurement - Solutions

Note: The 500 unit order is not included, since it has no bearing on the decision

Discussion:

- order is not guaranteed

- not clear if we should proceed with expansion before order is received (i.e. what is the lead time for expansion)

- with a 10% annual increase if PCU's, we have enough capacity as is:

CTR2: 25,000 x 1MH	25,000
CTR1: 14,000 x 1.1 x 1.1 x 2MH	33,880
	58,880

- not advisable to pursue APEX order unless uncertainty is dealt with

C. Review of Management Control System

- Component Division (CD) was set up to supply the CTR1 component to the Device Division (DD)
  - this was reinforced at the recent Board of Directors retreat
  - mission statement would support treating CD as a cost centre and basing its performance on controlling costs, while maintaining high quality

- Conflict began when CD began producing the CTR2 and began being evaluated on the basis of divisional NIBT (i.e. as a profit centre)
  - this caused both managers to make sub-optimal decisions…
  - CD manager was motivated to set a transfer price that provided a reasonable gross margin
  - the high TP led the DD manager to sign a contract with an external supplier which was not in the best interests of the company overall (goal incongruence)

- Minimum transfer price = variable production costs = $150

  Maximum transfer price = outside supplier price = $210

  Net loss to the company: 10,000 x (210 - 150) = $600,000

- Options to solve conflict:

    1 Treat CD as a cost centre:
    - responsible for controlling costs and quality
    - division managers' performance should be at least partially based on overall company profits and achieving company goals; this will give the manager an incentive to consider opportunities for using idle capacities

    2 Continue to treat CD as a profit centre, but impose a sourcing policy:
    - sourcing policy would require both divisions to supply/source the CTR1 component internally
    - need a transfer pricing policy:

        variable cost – will maximize DD income and minimize CD income, but would ensure the CD's income is unaffected by internal transfers

        full cost – charge an appropriate amount of FOH

        Negotiated – somewhere between minimum and maximum

        Market – usually the best (must have a stable market price)

    3 Centralize the organization's structure:
    - either by top management or combine both divisions

Recommend # 2 with market price as a transfer price.

ME7 Solution: ROI and RI - General

Return on investment = (operating income) / (average operating assets)

Residual income = (operating income) – (average operating assets)(required rate of return)

	Advantage	Disadvantage
ROI	· It encourages managers to pay careful attention to the relationship among sales, expenses and investments, as should be the case in an investment centre. · It encourages cost efficiency. · It discourages excessive investment in operating assets.	· It discourages managers from investing in projects that would decrease the divisional ROI, but increase the profits of the company as a whole (generally projects with an ROI less than a division's current ROI would be rejected). · It encourages managers to focus on the short-term at the expense of the long-term (myopic behaviour).
RI	· Managers are encouraged to accept any project that earns above the minimum rate. · Managers' interests are aligned with the company's as a whole (goal congruence).	· It encourages managers to focus on the short-term at the expense of the long-term (myopic behaviour). · As an absolute measure (i.e. dollars), it is difficult to make direct comparisons across divisions as the level of investment may differ across divisions.

ME8 Solution: ROI and RI – Osti Industries

a.

Sales revenue per unit: $25,000 / 1,484	$16.85
Cost of goods sold: $16,500 / 1,484	(11.12)
Variable selling: $2,700 x 40% / 1,484	(0.73)
Contribution margin per unit	$5.00

b. 1 Average assets = [(15,750,000 / 1.05) + 15,750,000] / 2
= (15,000,000 + 15,750,000) / 2
= $15,375,000

ROI = $1,845 / 15,375 = 12%

2 RI = $1,845,000 – (15,375,000 x 11%)
= $1,845,000 – 1,691,250
= $153,750

c. Accepting the new investment would have increased RI.

ME9 Solution: ROI and RI – Three Companies

	Company I	Company II	Company III
Sales	$1,185,000	$6,750,000	$3,690,000
Net income	$159,975	$459,000	$571,950
Average assets employed	$3,999,375	$4,500,000	$7,149,375
Net income % (% of sales)	13.50%	6.8%	15.5%
Investment turnover	.296	1.5	.516
Return on investment	4.0%	10.2%	8.0%

Supporting calculations:

Company I:

$$\text{Net income as a \% of sales} = \frac{\$159{,}975}{\$1{,}185{,}000} = 13.50\%$$

$$\text{Average assets employed} = \frac{\text{net income}}{\text{ROI}} = \frac{\$159{,}975}{.04} = \$3{,}999{,}375$$

$$\text{Investment turnover} = \frac{\text{sales}}{\text{assets employed}} = \frac{\$1{,}185{,}000}{\$3{,}999{,}375} = .296$$

Company II:

$$\text{Investment turnover} = \frac{\text{sales}}{\text{assets employed}}$$

$$1.5 = \frac{\text{sales}}{\$4{,}500{,}000}$$

$$\text{Sales} = \$6{,}750{,}000$$

$$\text{Net income} = \$6{,}750{,}000 \text{ x } 6.8\%$$
$$= \$459{,}000$$

$$\text{ROI} = \frac{\text{net income}}{\text{assets employed}} = \frac{\$459{,}000}{\$4{,}500{,}000}$$

$$= 10.2\%$$

Company III:

$$\text{Net income \%} = \frac{\text{net income}}{\text{sales}} = \frac{\$571{,}950}{\$3{,}690{,}000} = 15.5\%$$

$$\text{Average assets employed} = \frac{\text{net income}}{\text{ROI}} = \frac{\$571{,}950}{.08} = \$7{,}149{,}375$$

$$\text{Investment turnover} = \frac{\text{sales}}{\text{assets employed}} = \frac{3{,}690{,}000}{7{,}149{,}375} = .516$$

Company III

$$\text{Net income \%} = \frac{\text{net income}}{\text{sales}} = \frac{\$571{,}950}{3{,}690{,}000} = 15.5\%$$

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$$\text{Investment turnover} = \frac{\text{sales}}{\text{assets employed}} = \frac{3{,}690{,}000}{7{,}149{,}375} = .516$$

ME10 Solution: ROI and Residual Income- Bate Inc.

$$\text{ROI} = \frac{\text{net income}}{\text{average assets employed}}$$

$$.15 = \frac{\text{net income}}{\$1{,}565{,}000}$$

Net income = $234,7
50

Sales:

Sales	$1,739,750
Variable costs (50,000 x $16.50)	825,000
Contribution margin	$914,750
Fixed costs	680,000
Income	$234,750

Selling price:

$1,739,750 ÷ 50,000 units = $34.80 (rounded)

2.

RI = operating income – (minimum rate of return x assets employed)

RI = operating income – (20% x $1,565,000)

RI = operating income – 313,000

Operating income must be $313,000 to meet the desired rate of return. Therefore, sales required can be calculated as follows:

Sales	$1,818,000
Variable costs (50,000 x $16.50)	825,000
Contribution margin	$993,000
Fixed costs	680,000
Income	$313,000

Selling price:
$1,818,000 ÷ 50,000 units = $36.36

ME11 Solution: ROI and Residual Income – Divisional Income

1. $$\text{ROI} = \frac{\text{net income}}{\text{assets employed}}$$

	Division I	Division II
net income / assets employed	180,000 / 1,000,000	420,000 / 3,000,000
ROI	18%	14%

2. RI = operating Income – (minimum rate of return x assets employed)

Division I:

12%	RI = 180,000 – (.12 x 1,000,000) = 60,000
15%	RI = 180,000 - (.15 x 1,000,000) = 30,000
17%	RI = 180,000 – (.17 x 1,000,000) = 10,000

Division II:

12%	RI = 420,000 – (.12 x 3,000,000) = 60,000
15%	RI = 420,000 - (.15 x 3,000,000) = (30,000)
17%	RI = 420,000 – (.17 x 3,000,000) = (90,000)

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