GLEIM

CMA Review

Part 1

Financial Reporting, Planning, Performance, and Control

by

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and

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ABOUT THE AUTHORS

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STUDY UNIT ONE
BUDGETING CONCEPTS
AND FORECASTING TECHNIQUES

Planning, Budgeting, and Forecasting

A budget is a realistic plan for the future that is expressed in quantitative terms. A budget is many tools in one; it is a planning tool, a control tool, a communication tool, and a motivational tool. As such, the area of budgeting, as tested on the CMA exam, is a composite of theory and calculations. Some of the calculations have many steps, thus making budgeting problems among the most-missed questions on the exam. Alternatively, budgeting should not be viewed as a difficult area; the concepts are easy, but you need to pay close attention to detail as you work numerical questions.

This study unit is the **first of two** on **planning, budgeting, and forecasting**. The relative weight assigned to this major topic in Part 1 of the exam is **30%**. The two study units are

Study Unit 1: Budgeting Concepts and Forecasting Techniques
Study Unit 2: Budget Methodologies and Budget Preparation

After studying the outline and answering the questions in this study unit, you will have the skills necessary to address the following topics listed in the ICMA's Learning Outcome Statements:

Part 1 – Section A.1. Budgeting concepts

The candidate should be able to:

a. describe the role that budgeting plays in the overall planning and performance evaluation process of an organization
b. explain the interrelationships between economic conditions, industry situation, and a firm's plans and budgets
c. identify the role that budgeting plays in formulating short-term objectives and planning and controlling operations to meet those objectives
d. demonstrate an understanding of the role that budgets play in measuring performance against established goals
e. identify the characteristics that define successful budgeting processes
f. explain how the budgeting process facilitates communication among organizational units and enhances coordination of organizational activities
g. describe the concept of a controllable cost as it relates to both budgeting and performance evaluation
h. explain how the efficient allocation of organizational resources is planned during the budgeting process

i. identify the appropriate time frame for various types of budgets
j. identify who should participate in the budgeting process for optimum success
k. describe the role of top management in successful budgeting
l. identify best practices guidelines for the budget process
m. demonstrate an understanding of the use of cost standards in budgeting
n. differentiate between ideal (theoretical) standards and currently attainable (practical) standards
o. differentiate between authoritative standards and participative standards
p. identify the steps to be taken in developing standards for both direct material and direct labor
q. demonstrate an understanding of the techniques that are used to develop standards such as activity analysis and the use of historical data
r. discuss the importance of a policy that allows budget revisions that accommodate the impact of significant changes in budget assumptions
s. explain the role of budgets in monitoring and controlling expenditures to meet strategic objectives
t. define budgetary slack and discuss its impact on goal congruence

Part 1 – Section A.2. Forecasting techniques

The candidate should be able to:

a. demonstrate an understanding of a simple regression equation and the measures associated with it
b. define a multiple regression equation and recognize when multiple regression is an appropriate tool to use for forecasting
c. calculate the result of a simple regression equation
d. demonstrate an understanding of learning curve analysis
e. calculate the results under a cumulative average-time learning model and under an incremental unit-time learning model
f. demonstrate an understanding of moving averages, weighted moving averages, and exponential smoothing, and calculate forecasts using these methods
g. demonstrate an understanding of time series analyses, including objectives and patterns, i.e., trend, cyclical, seasonal, and irregular
h. list the benefits and shortcomings of regression analysis, learning curve analysis, and time series analysis
i. calculate the expected value of random variables
j. identify the benefits and shortcomings of expected value techniques
k. use probability values to estimate future cash flows
l. identify the uses of sensitivity analysis
m. perform a sensitivity analysis with different values for the probabilities of the states of nature and/or the payoffs
n. identify the benefits and shortcomings of sensitivity analysis

1.1 BUDGETING CONCEPTS

1. A **budget (profit plan)** is a realistic plan for the future expressed in quantitative terms.
   a. The budget is a **planning** tool.
      1) A budget is a written plan for the future.
      2) Companies that prepare budgets anticipate problems before they occur.
         a) EXAMPLE: If a company runs out of a critical raw material, it may have to shut down. At best, it will incur extremely high freight costs to have the needed materials rushed in. The company with a budget will have anticipated the shortage and planned around it.
      3) A firm that has no goals may not always make the best decisions. A firm with a goal in the form of a budget will be able to plan.
   b. The budget is a **control** tool.
      1) A budget helps a firm control costs by setting cost guidelines.
      2) Guidelines reveal the efficient or inefficient use of company resources.
      3) A manager is less apt to spend money for things that are not needed if (s)he knows that all costs will be compared with the budget.
         a) (S)he will be accountable if controllable costs exceeding budgeted amounts.
      4) Budgets can also reveal the progress of highly effective managers. Consequently, employees should not view budgets negatively. A budget is just as likely to provide a boost to a manager's career as it is to be detrimental.
      5) Managers can also use a budget as a personal self-evaluation tool.
      6) Budgetary slack (overestimation of expenses) must be avoided, however, if a budget is to have its desired effects. The natural tendency of a manager is to negotiate for a less stringent measure of performance so as to avoid unfavorable variances from expectations.
      7) For the budgetary process to serve effectively as a control function, it must be integrated with the accounting system and the organizational structure. Such integration enhances control by transmitting data and assigning variances to the proper organizational subunits.
   c. The budget is a **motivational** tool.
      1) A budget helps to motivate employees to do a good job.
         a) Employees are particularly motivated if they help prepare the budget.
         b) A manager who is asked to prepare a budget for his/her department will work hard to stay within the budget.
      2) A budget must be seen as realistic by employees before it can become a good motivational tool.
      3) Unfortunately, the budget is not always viewed in a positive manner. Some managers view a budget as a restriction.
      4) Employees are more apt to have a positive feeling toward a budget if some degree of flexibility is allowed.

d. The budget is a means of **communication**.

1) A budget can help tell employees what goals the firm is attempting to accomplish.
2) If the firm does not have an overall budget, each department might think the firm has different goals.
3) For example, the sales department may want to keep as much inventory as possible so that no sales will be lost, but the company treasurer may want to keep the inventory as low as possible so that cash need not be spent any sooner than necessary. If the budget specifies the amount of inventory, all employees can work toward the same objectives.

2. **The Budget as a Formal Quantification of Management's Plans**

a. Corporations have goals for market share, profitability, growth, dividend payout, etc. Not-for-profit organizations also have goals, such as increased number of free meals served, lowered recidivism rate among offenders, etc.

1) These goals cannot be achieved without careful planning about the **allocation of resources** and **the expected results**.

b. A **budget** lays out in specific terms an **organization's expectations** about the consumption of resources and the resulting outcomes.

3. **Budgeting's Role in the Overall Planning and Evaluation Process**

a. **Planning** is the process by which an organization sets specific goals for itself and sets about pursuing those goals. Planning is an organization's response to the aphorism "If you don't know where you're going, any path will take you there."

1) The starting point for any organization's planning process is the formulation of its **mission statement**. The mission statement, formulated by the board and senior management, embodies the organization's reason for existing.

a) EXAMPLE: Increase shareholder value through providing global telecommunications services.

2) Next, the organization draws up its **strategic plan** containing the means by which the firm expects to fulfill its stated mission.

a) To a great extent, the strategy is made up of **long-term objectives**, a set of specific, measurable goals.
b) EXAMPLE: Hold a 35% market share of U.S. cell phone users within five years.

3) Once the long-term objectives are in place, the **priorities** of the organization will be clear.

a) Awareness of priorities is crucial for the **allocation of limited resources**.
b) EXAMPLE: How many cell towers, each of which require the outlay of construction and maintenance costs, will provide the optimum amount of coverage.

4) **Short-term objectives** flow directly from the priorities.

a) EXAMPLE: Determine the appropriate number of cell towers needed and where they can feasibly be placed in the Metro Atlanta region.

b. To **evaluate progress** toward success in each of these stages, quantification is necessary. This is the role of the various types of budgets.

1) Not all quantification is in monetary terms. To extend the previous example, although cell towers obviously have a dollar cost, they must be simply counted as well.

2) **Comparing actual results to the budget** allows the organization as a whole to evaluate its performance and managers to do the same on an individual level.

4. **Effects of External Factors on the Budgeting Process**

a. Decisions about a firm's strategy, and in turn about its budget, are dependent on **general economic conditions** and their expected trends and the availability of financial resources.

1) For instance, if the economy is entering a period of lower demand, a manufacturer will not project increased sales. If costs are not changeable, the company may budget losses for the short-term to hold on to market share.

b. **Industry situation** includes the company's current market share, governmental regulatory measures, the labor market, and the activities of competitors.

1) For instance, if input costs are rising in a firm's industry, the budget must reflect that reality; profit margins and cash flows will not be the same as in prior years. Also, a company in, or near, bankruptcy will face a different financial situation than would the market leader.

5. **Budgeting's Role in Formulating and Controlling Short-term Objectives**

a. A company's goal of increasing market share, making a steady dividend payout, etc., can only be achieved through the completion of **incremental steps**.

b. The budget lays out the **specific revenue targets and expense limitations** for each functional area and department of the organization on a month-by-month basis.

1) A budget cannot simply be a lump-sum total for a year. Incremental goals must be achieved each month or week. This is especially true in seasonal businesses, such as agricultural supply.

6. **Characteristics of a Successful Budgeting Process**

a. **Sufficient lead time.** For a budget to be useful, it must be finalized when the fiscal year begins. This often calls for months of preparation, since the overall goals and baseline assumptions must be announced before functional areas and individual departments can begin formulating their numbers.

1) The preparation of a complete organizational budget usually takes several months. A firm with a calendar year-end may start the budget process in September, anticipating its completion by the first of December.

2) The **budget planning calendar** is the schedule of activities for the development and adoption of the budget. It includes a list of dates indicating when specific information is to be provided to others by each information source.

a) Because all of the individual departmental budgets are based on forecasts prepared by others and the budgets of other departments, it is essential to have a planning calendar to integrate the entire process.

b. **Budget manual.** Everyone involved in preparing the budget at all levels must be educated on the detailed procedures for preparing and submitting their part of the overall budget.

1) Because of the number of component departments, budgets must be prepared in a standard format.

a) In addition, all concerned must be informed of the **ultimate goals** that are being pursued and the **baseline assumptions** that have been laid down. A budget may, for example, begin with a blanket mandate to raise revenues by 6.5% or to cut expenses across all departments by 2%.

2) **Distribution instructions** are vital because of the **interdependencies** of a master budget.

a) One department's budget may be dependent on another's, and functional areas must be aggregated from their constituent department budgets. The distribution instructions coordinate these interdependencies.

c. **Buy-in at all levels.** Participative budgeting has a much greater chance of acceptance by those affected and thus of achieving ultimate success than does a budget that is imposed from above.

1) See item 12. on the next page.

7. **Role of Budgets in Measuring Performance against Established Goals**

a. One of the most important reasons for adopting a budget is to provide **guideposts** for the assessment of success or failure on the part of individual managers and functional areas.

b. As the fiscal year progresses, revenues, expenses, and other metrics can be compared to the budget to determine where organizational performance is meeting, lagging, or exceeding expectations.

8. **Role of Budgeting Process in Facilitating Communication among Organizational Units and Enhancing Coordination of Organizational Activities**

a. On a detailed level, the budget informs employees at all levels what objectives the firm is attempting to accomplish.

1) If the firm does not have an overall budget, each department tends to pursue its own objectives without regard to what is good for the firm as a whole. Thus, a budget promotes **goal congruence**.

2) For example, the sales department may want to keep as much inventory as possible so that no sales will be lost, but inventory control may be judged on its turnover rate. If the budget specifies the level of inventory, the two departments have a common framework for decision making and are no longer working at cross purposes.

b. The concrete nature of a budget facilitates **coordination of the activities** of a firm. An example is the purchasing of raw materials.

1) Materials are needed prior to production, but the proper quantity to buy cannot be determined until the projected level of output is established.

a) Thus, a production budget (in units) is a prerequisite to the preparation of a materials purchases budget.

2) Similarly, a direct labor budget is based on how many units are to be produced and how fast the workers are.

a) Labor standards are also complex in that they must consider the impact of the learning curve on productivity.

9. **The Concept of Controllability**
    a. **Controllability** is a key concept in the use of budgets and other standards to evaluate performance. Controllability is the extent to which a **manager can influence** activities and related revenues and costs.
    b. **Controllable costs** are those that are under the discretion of a particular manager. Noncontrollable costs are those to which another level of the organization has committed, removing the manager's discretion.
    c. Controllability can be difficult to isolate because few costs or revenues are under the sole influence of one manager. Also, separating the effects of current management's decisions from those of former management is difficult.
        1) If responsibility exceeds the extent to which a manager can influence an activity, the result may be reduced morale, a decline in managerial effort, and poor performance.
        2) The principle of controllability must be kept in mind when the budget is used as the basis for managerial evaluation.
10. The planning process coordinates the **efficient allocation** of organizational **resources**.
11. **Time Frames for Budgets**
    a. Each phase of the organization's planning cycle has its own budget with an appropriate **time frame**.
        1) **Strategic** plans and budgets most concern senior managers and have time frames of up to 10 years or more.
        2) **Intermediate** plans and budgets most concern middle managers and have time frames of up to 2 years.
        3) **Operational** plans and budgets most concern lower-level managers and generally have time frames of 1 month to 1 year.
12. **Participation in the Budget Process**
    a. Participation in the budget preparation process is **up and down** the organization.
        1) The budget process begins with the mission statement formulated by the **board of directors**.
        2) **Senior management** translates the mission statement into a strategic plan with measurable, realizable goals.
        3) A **budget committee** composed of top management is formed to draft the budget calendar and budget manual. The budget committee also reviews and approves the departmental budgets submitted by operating managers.
        4) **Middle and lower management** receive their budget instructions, draw up their departmental budgets in conformity with the guidelines, and submit them to the budget committee.
13. **The Use of Cost Standards**
    a. Standard costs are **predetermined expectations** about how much a unit of input, a unit of output, or a given activity should cost.
        1) The use of standard costs in budgeting allows the standard-cost system to alert management when the actual costs of production differ significantly from the standard.

b. A standard cost is **not just an average** of past costs but an objectively determined estimate of what a cost should be. Standards may be based on accounting, engineering, or statistical quality control studies.

1) Because of the impact of fixed costs in most businesses, a standard costing system is usually not effective unless the company also has a flexible budgeting system (see item 6.b. in Study Unit 2, Subunit 1).

14. **Theoretical vs. Practical Standards**

a. **Ideal (theoretical) standards** are standard costs that are set for production under optimal conditions. For this reason, they are also called perfection or maximum efficiency standards.

1) They are based on the work of the most skilled workers with no allowance for waste, spoilage, machine breakdowns, or other downtime.
2) Often called "tight" standards, they can have positive behavioral implications if workers are motivated to strive for excellence. However, they are not in wide use because they can have negative behavioral effects if the standards are impossible to attain.
3) Ideal standards are ordinarily replaced by currently attainable standards for cash budgeting, product costing, and budgeting departmental performance. Otherwise, accurate financial planning will be impossible.
4) Ideal standards have been adopted by some companies that apply continuous improvement and other total quality management principles.

b. **Currently attainable (practical) standards** may be defined as the performance that is expected to be achieved by reasonably well-trained workers with an allowance for normal spoilage, waste, and downtime.

1) An alternative interpretation is that practical standards represent possible but difficult-to-attain results.

15. **Authoritative vs. Participative Standard Setting**

a. A purely **top-down (authoritative) approach** to standard setting has the advantage of ensuring total consistency across all functional areas. It is also far less complex and time-consuming than coordinating input from the middle and lower levels.

b. **Participative (grass-roots)** standard setting uses input from middle- and lower-level employees.

1) Participation encourages employees to have a sense of ownership of the output of the process. The result is an acceptance of, and commitment to, the goals expressed in the budget.
2) An imposed budget is much less likely to foster this sense of commitment.

c. Participation also enables employees to relate performance to rewards or penalties.

1) A further advantage of participation is that it provides a broader information base. Middle- and lower-level managers are often far more informed about operational realities than senior managers.

d. Disadvantages of participative standard setting include its cost in terms of time and money. In addition, the quality of participation is affected by the goals, values, beliefs, and expectations of those involved.

1) A manager who expects his/her request to be reduced may inflate the amount.
2) If a budget is to be used as a performance evaluator, a manager asked for an estimate may provide one that is easily attained.

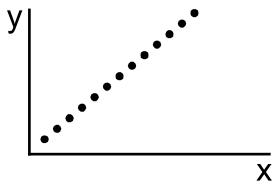
16. **Steps in Developing Standards**
    a. For **direct materials**, there is often a direct relationship between unit price and quality. In establishing its cost standards, a manufacturer must decide whether it will use an input that is
        1) Cheaper per-unit but will ultimately result in higher consumption because of low quality, or
        2) Pricier but allows more efficient usage because of lower waste and spoilage.
    b. For **direct labor**, the complexity of the production process and the restrictions on pay scales imposed by union agreements have the most impact on formulating cost standards. Human resources also must be consulted to help project the costs of benefits.
17. **Activity analysis** identifies, describes, and evaluates the activities that go into producing a particular output. Determining the resources and steps that go into the production process aids in the development of standard costs.
    a. Each operation requires its own unique set of inputs and preparations. Activity analysis describes what these inputs are and who performs these preparations.
        1) Inputs include the amounts and kinds of equipment, facilities, materials, and labor. Engineering analysis, cost accounting, time-and-motion study, and other approaches may be useful.
    b. **Historical data** may be used to set standards by firms that lack the resources to engage in the complex task of activity analysis.
18. **Revisions to the Budget**
    a. Often an organization will find that the **assumptions** under which the budget was prepared undergo **significant change** during the year. A policy must be in place to accommodate revisions to the budget resulting from these changes.
        1) Accommodation of change is a key characteristic of successful budgeting. If such a policy is not in place, managers can come to believe they are being held to a budget that is no longer possible to achieve, and morale can suffer.
    b. Information gained during the year as actual results and variances are reported can be used to help the company take corrective action. These steps make up a control loop:
        1) Establishing standards of performance (the budget)
        2) Measuring actual performance
        3) Analyzing and comparing performance with standards
        4) Devising and implementing corrective actions
        5) Reviewing and revising the standards
19. **The Role of Budgets in Monitoring and Controlling Expenditures**
    a. The initial budget is a planning tool. To monitor how actual performance compares with the budget, budget reports are produced periodically during the year.
        1) The difference between actual performance and a budgeted amount is called a **variance**. Analysis of variances reveals the efficient or inefficient use of company resources (see Study Unit 7, “Cost and Variance Measures”).

20. Participation in developing a budget may result in a **padding** of the budget, also known as budgetary slack.
    a. **Budgetary slack** is the excess of resources budgeted over the resources necessary to achieve organizational goals.
        1) The natural tendency of a manager is to negotiate for a less stringent measure of performance so as to avoid unfavorable variances from expectations.
    b. Management may create slack by overestimating costs and underestimating revenues.
        1) A firm may decrease slack by emphasizing the consideration of all variables, holding in-depth reviews during budget development, and allowing for flexibility in making additional budget changes.
    c. The existence of slack can have both positive and negative effects on the budgeting process. The existence of slack can reduce the planning benefits of a budget since the budget may not be entirely accurate.
        1) For example, a cash budget might show that $500,000 needs to be borrowed this month, whereas the money is not really needed because managers were just being cautious.
        2) Alternatively, the lack of slack may discourage managers from implementing new programs, or might cause managers to avoid routine maintenance when the budget does not show funds available in a particular period.

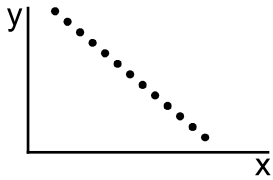
1.2 CORRELATION AND REGRESSION

1. **Forecasts** are the **basis for business plans**. Forecasts are used to project product demand, inventory levels, cash flow, etc.
    a. **Qualitative methods** of forecasting rely on the manager's experience and intuition.
    b. **Quantitative methods** use mathematical models and graphs.
        1) When some factor in the organization's environment is plotted on the X axis, the technique is **causal relationship forecasting**.
        2) When time periods are plotted on the X axis, the technique is **time-series analysis**.
2. **Correlation analysis** is the foundation of any quantitative method of forecasting.
    a. Correlation is the **strength of the linear relationship** between two variables, expressed mathematically in terms of the **coefficient of correlation (r)**. It can be graphically depicted by plotting the values for the variables on a graph in the form of a scatter diagram.
        1) The **value of r** ranges from 1 (perfect direct relationship) to –1 (perfect inverse relationship). The more the scatter pattern resembles a straight line, the greater the absolute value of r.

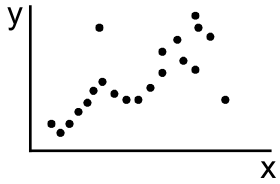
2) **Perfect direct relationship (r = 1)**



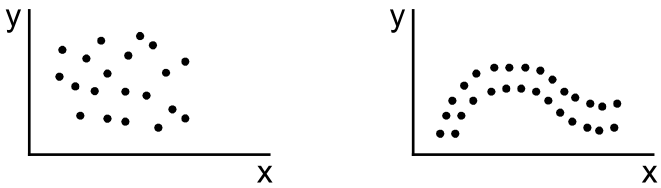
3) **Perfect inverse relationship (r = –1)**



4) **Strong direct relationship (r = 0.7)**



5) **No linear relationship (r = 0)**



a) Note from the right-hand graph of the pair above that a coefficient of correlation of zero does not mean there is no relationship at all between the two variables, only that what relationship they may have cannot be expressed as a linear equation.

b. The **coefficient of determination (r^2)**, or the coefficient of correlation squared, is a measure of how good the fit between the two variables is.

1) Mathematically, the coefficient of determination is the proportion of the total variation in the dependent variable that is accounted for by the independent variable.

2) EXAMPLE: A car dealership determines that new car sales are a function of disposable income with a coefficient of correlation of .8. This is equivalent to stating that 64% ($.8^2$) of the variation of new car sales from the average can be explained by changes in disposable income.

3. **Regression analysis**, also called least-squares analysis, is the process of **deriving the linear equation** that describes the relationship between two variables with a nonzero coefficient of correlation.

   a. **Simple regression** is used when there is one independent variable.

      1) The simple regression equation is, obviously, the algebraic formula for a straight line:

         $$y = a + bx$$

         Where: y = the dependent variable
         a = the y intercept
         b = the slope of the regression line
         x = the independent variable

      2) The best straight line that fits a set of data points is derived using calculus to **minimize the sum of the squares of the vertical distances** of each point to the line (hence the name least-squares method).

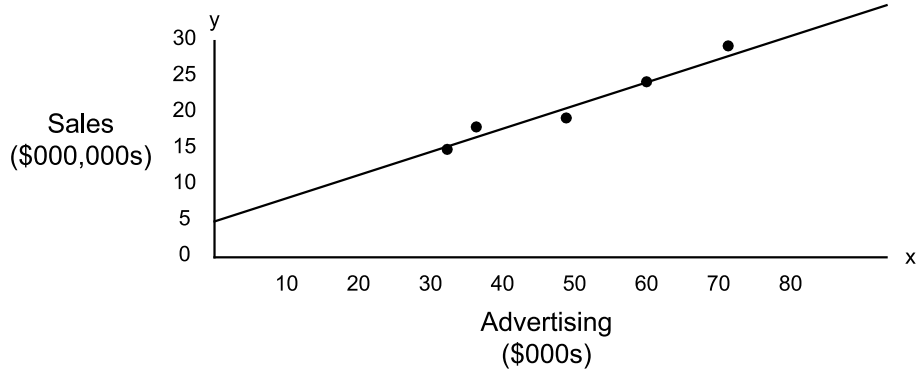
      3) EXAMPLE: A firm has collected observations on advertising expenditures and annual sales.

Advertising ($000s)	Sales ($000,000s)
71	26.3
31	13.9
50	19.8
60	22.9
35	15.1

         a) Solving with the least-squares method reveals that expected sales equal $4.2 million plus 311.741 times the advertising expenditure.

            y = $4,200,000 + 311.741x

         b) The observations are graphed as follows:



         c) The firm can now project the amount it will have to spend on advertising to generate $32,000,000 in sales.

$$\begin{aligned} y &= \$4{,}200{,}000 + 311.741x \\ \$32{,}000{,}000 &= \$4{,}200{,}000 + 311.741x \\ 311.741x &= \$27{,}800{,}000 \\ x &= \$89{,}177 \end{aligned}$$

b. Regression analysis is particularly valuable for **budgeting and cost accounting purposes**.

1) Regression analysis is almost a necessity for computing the fixed and variable portions of **mixed costs** for flexible budgeting. The y-axis intercept is the **fixed portion** and the slope of the regression line is the **variable portion**.

c. **Regression does not determine causality.**

1) Although x and y move together, the apparent relationship may be caused by some other factor. For instance, car-wash sales volume and sunny weather are strongly correlated, but car-wash sales do not cause sunny weather.

d. **Multiple regression** is used when there is more than one independent variable.

1) The example on the previous page relating advertising to sales is clearly unrealistic. Sales are dependent upon more than just advertising expenditures.

2) Multiple regression allows a firm to identify many factors (independent variables), and to weight each one according to its influence on the overall outcome.

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + etc.$$

e. **Assumptions** of the linear regression model.

1) The linear relationship established for x and y is only valid across the **relevant range**. The user must identify the relevant range and assure that (s)he does not project the relationship beyond it.

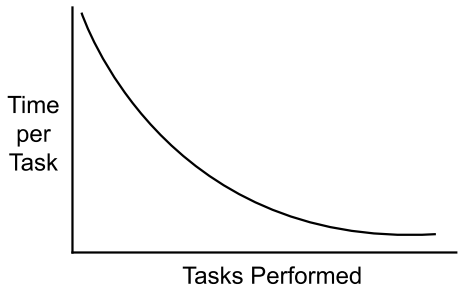
2) Regression analysis assumes that **past relationships** can be validly projected into the future.

3) The distribution of y around the regression line is constant for different values of x, referred to as **homoscedasticity** or **constant variance**. This is known as the *ceteris paribus* assumption, or that all things must remain equal. Thus, a limitation of the regression method is that it can only be used when cost patterns remain unchanged from prior periods.

1.3 LEARNING CURVE ANALYSIS

1. **Learning curve analysis** reflects the increased rate at which people perform tasks as they gain experience.

a. The time required to perform a given task becomes progressively shorter during the **early stages of production**.



b. The curve is usually expressed as a **percentage** of reduced time to complete a task for each **doubling** of cumulative production. The most common percentage used in practice is 80%.

1) The following table illustrates this phenomenon for a product whose first unit takes 100 minutes to produce:

Cumulative Units Produced	Cumulative Average Time per Unit	
1	100	
2	80	(100 × 80%)
4	64	(80 × 80%)
8	51.2	(64 × 80%)
16	40.96	(51.20 × 80%)

2) The time in the right-hand column is an average of all the units produced up to that point. However, with more sophisticated quantitative techniques, a more accurate average can be calculated of the units within each "batch."

a) With the completion of the final batch (units 9 – 16), the average had come down to 40.96%.

b) For it to reach this level from the 51.2% it had reached at the end of the fourth batch (units 5 – 8), the average of the units in the fifth batch alone must have been 30.72% [(40.96% × 2) – 51.2%].

c) CMA candidates need to be alert as to the nature of the question being asked. Sometimes the question might ask, "What is the average time per unit after two units?" From the table above, you can see that the answer is 80. Alternatively, sometimes the question asks, "What is the time to produce the second unit?" The answer would be 60. Since the first unit took 100 minutes and the average for the two units is 80 minutes (a total of 160), then the second unit must have taken only 60 minutes.

2. **Two methods** of applying learning curve analysis are in common use.

a. The **cumulative average-time learning model** projects the reduction in the cumulative average time it takes to complete a certain number of tasks.

b. The **incremental unit-time learning model** projects the reduction in the incremental time it takes to complete the last task.

c. EXAMPLE: A firm determines that 100 minutes of labor is required to complete one unit of product. Assuming an 80% learning curve, the following table illustrates the difference between the two methods.

Learning Curve 80% at Each Doubling		**Cumulative Average-Time Model**		**Incremental Unit-Time Model**	
(A)	**(B)**	**(A) × (B)**		**∑(B)**	**∑ (B) / (A)**
Unit Produced	**Cumulative Average Time per Unit**	**Cumulative Total Time**	**Time Spent on Most Recent Unit**	**Incremental Unit Total Time**	**Average Time Spent on Most Recent Unit**
1	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
2	**80.00**	**160.00**	**60.00**	**180.00**	**90.00**
3	70.21	210.63	50.63	250.21	83.40
4	**64.00**	**256.00**	**45.37**	**314.21**	**78.55**

1) Note that the 70.21 in the above table was computed using a sophisticated method that is beyond the scope of this book. For this exam, you should know how the 80 and 64 were calculated.

d. The difference between the two methods is clear in the way each calculates total time. Most CMA questions have historically used the **cumulative-average-time method**, and it is often called the "traditional" learning curve model.

3. The limitation of the learning curve in practice is the difficulty in knowing the shape of the learning curve.

   a. There is no question but that the learning curve effect exists, but companies often do not know what percentage they should use in calculations until after it is too late to use the information effectively. As a result, many companies simply assume an 80% learning curve and make decisions based on those results.

1.4 TIME SERIES ANALYSIS

1. **Time series analysis** projects future trends based on past experience (for this reason, it is also called trend analysis).

   a. Changes in business activity **over time** may have several possible components.

      1) **Secular trend** is the long-term change in spite of short-term ups and downs.
      2) **Seasonal variations** are common in many businesses, most obviously retail, which experiences a large spike in activity around the Winter holidays.
      3) **Cyclical fluctuations** are variations in the level of activity tied to the business cycle, i.e., activity in the overall economy.
      4) **Irregular or random variables** are the unexpected happenings that affect businesses (weather, strikes, fires, etc.).

   b. Time series/trend analysis encompasses three main techniques:

      1) **Simple moving average**
      2) **Weighted moving average**
      3) **Exponential smoothing**

2. **Simple moving average** is appropriate when, for instance, the demand for a product is relatively stable and not subject to seasonal variations. The data points are summed and divided by the number of time periods. This process is repeated for successive groups of time periods.

   a. EXAMPLE: A convenience store with a fairly uniform sales history wants to project future gasoline sales. The store has determined that it needs 4 months of data to make a sound projection.

Simple Moving Average

Month	Sales	4-month Cumulative Sales	Divided by: Number of Months	Equals: Next Month's Forecast	Error	Error %
September	$5,480					
October	5,550					
November	5,500					
December	5,520	$22,050	4	$5,513	$53	1.0%
January	5,460	22,030	4	5,508	58	1.1%
February	5,450	21,930	4	5,483	3	0.0%
March	5,480	21,910	4	5,478	(73)	(1.3%)
April	5,550	21,940	4	5,485	(105)	(1.9%)
May	5,590	22,070	4	5,518	(13)	(0.2%)
June	5,530	22,150	4	5,538	(33)	(0.6%)
July	5,570	22,240	4	5,560	50	0.9%
August	5,510	22,200	4	5,550	---	---

3. **Weighted moving average** allows a firm to give each data point a weight indicating its relative importance in determining the outcome.

   a. EXAMPLE: The store's owners decide that weighting the months will give them better projections. Most recent month, 60%; 2 two months ago, 20%; 3 months ago, 10%; 4 months ago, 10%. The results are calculated thusly:

Weighted Moving Average

Month	Sales	January Forecast	February Forecast	March Forecast	April Forecast	May Forecast	June Forecast
September	$5,480	10% $ 548					
October	5,550	10% 555	10% $ 555				
November	5,500	20% 1,100	10% 550	10% $ 550			
December	5,520	60% 3,312	20% 1,104	10% 552	10% $ 552		
January	5,460	*P: $5,515	60% 3,276	20% 1,092	10% 546	10% $ 546	
February	5,450	**E: $ 55	*P: $5,485	60% 3,270	20% 1,090	10% 545	10% $ 545
March	5,480	1.0%	**E: $ 35	*P: $5,464	60% 3,288	20% 1,096	10% 548
April	5,550		0.6%	**E: $ (16)	*P: $5,476	60% 3,330	20% 1,110
May	5,590			(0.3%)	**E: $ (74)	*P: $5,517	60% 3,354
June	5,530				(1.3%)	**E: $ (73)	*P: $5,557
July	5,570					(1.3%)	**E: $ 27
August	5,510						0.5%

*P = Projected
**E = Error

   b. The smaller error percentages indicate improved forecasting.

4. **Exponential smoothing** is a widespread technique for making projections because it **requires less data** be kept on hand than the moving average methods.

   a. Step 1 – **Develop some forecasts** using a more data-intensive method, such as one of the two moving average methods.

   b. Step 2 – **Set the smoothing factor** (alpha) between 0 and 1. The closer it is set to 1, the more weight is put on recent data.

      1) This feature of exponential smoothing makes it especially appropriate for **responding to trends**. For instance, if sales are steadily increasing, the smoothing factor can be set near 1 to give the more recent (i.e., higher) data more weight in the calculation.

   c. Step 3 – **Calculate the next period's forecast.** Each forecast is the sum of two components:

      1) The **current period's actual results** multiplied by the smoothing factor, and
      2) The **current period's forecast** multiplied by the smoothing factor's complement.

   d. The **general formula** for exponential smoothing is therefore

$$F_t = (\alpha)x_{t-1} + (1 - \alpha)F_{t-1}$$

Where: F = the forecast for a period
t = the time period
α = the smoothing factor ($0 < \alpha < 1$)
x = the actual result for a period

e. EXAMPLE: The convenience store is switching to exponential smoothing from weighted moving average to project its unit sales for each month. The forecast of $6,000 for September was thus derived under the old method.

Month	Smoothing Factor	Times: Actual Result	Equals: Actual Result Smoothed	Smoothing Factor Complement	Times: What Was Forecast	Equals: Forecast Smoothed	Next Month Forecast	Error	Error %
September	0.75	$5,480	$4,110	0.25	$6,000	$1,500	$5,610	$ 60	1.1%
October	0.75	5,550	4,163	0.25	5,610	1,403	5,565	65	1.2%
November	0.75	5,500	4,125	0.25	5,565	1,391	5,516	(4)	(0.1%)
December	0.75	5,520	4,140	0.25	5,516	1,379	5,519	59	1.1%
January	0.75	5,460	4,095	0.25	5,519	1,380	5,475	25	0.5%
February	0.75	5,450	4,088	0.25	5,475	1,369	5,456	(24)	(0.4%)
March	0.75	5,480	4,110	0.25	5,456	1,364	5,474	(76)	(1.4%)
April	0.75	5,550	4,163	0.25	5,474	1,369	5,531	(59)	(1.1%)
May	0.75	5,590	4,193	0.25	5,531	1,383	5,575	45	0.8%
June	0.75	5,530	4,148	0.25	5,575	1,394	5,541	(29)	(0.5%)
July	0.75	5,570	4,178	0.25	5,541	1,385	5,563	53	1.0%
August	0.75	5,510	4,133	0.25	5,563	1,391	5,523	--	--

1.5 EXPECTED VALUE

1. **Expected value** is a means of associating a **dollar amount** with each of the possible outcomes of a probability distribution.

   a. The outcome yielding the highest expected value (which may or may not be the most likely one) is the optimal alternative.

      1) The **decision** alternative is under the manager's control.
      2) The **state of nature** is the future event whose outcome the manager is attempting to predict.
      3) The **payoff** is the financial result of the combination of the manager's decision and the actual state of nature.

   b. The expected value of an event is calculated by **multiplying the probability** of each outcome **by its payoff** and summing the products.

      1) EXAMPLE: An investor is considering the purchase of two identically priced pieces of property. The value of the properties will change if a road, currently planned by the state, is built.

         a) The following are estimates that road construction will occur:

Future State of Nature (SN)	Event	Probability
SN 1	No road is ever built.	.1
SN 2	A road is built this year.	.2
SN 3	A road is built more than 1 year from now.	.7

         b) The following are estimates of the values of the properties under each of the three possible events:

Property	SN 1	SN 2	SN 3
Bivens Tract	$10,000	$40,000	$35,000
Newnan Tract	$20,000	$50,000	$30,000

c) The expected value of each property is determined by multiplying the probability of each state of nature by the value under that state of nature and adding all of the products.

		Expected Value
Bivens Tract:	.1($10,000) + .2($40,000) + .7($35,000) =	**$33,500**
Newnan Tract:	.1($20,000) + .2($50,000) + .7($30,000)	**$33,000**

Thus, the Bivens Tract is the better investment.

d) A calculation such as this is often referred to as a **payoff table**.

c. A **criticism** of expected value is that it is based on repetitive trials, whereas many business decisions involve only one trial.

1) EXAMPLE: A company wishes to launch a communications satellite.

a) The probability of launch failure is .2, and the value of the satellite if the launch fails is $0. The probability of a successful launch is .8, and the value of the satellite would then be $25,000,000. The expected value is thus

.2($0) + .8($25,000,000) = $20,000,000

b) But $20,000,000 is not a possible value for a single satellite; either it flies for $25,000,000 or it crashes for $0.

d. The difficult aspect of constructing a payoff table is of course the determination of all possible outcomes of decisions and their probabilities. Thus, a probability distribution must be established.

1) The assigned probabilities may reflect prior experience with similar decisions, the results of research, or highly subjective estimates.

e. The expected value criterion is likely to be adopted by a decision maker who is risk neutral. However, other circumstances may cause the decision maker to be risk averse or even risk seeking.

1) EXAMPLE: A dealer in luxury yachts may order 0, 1, or 2 yachts for this season's inventory.

a) The dealer projects demand for the season as follows:

Demand	Probability
0 yachts	10%
1 yacht	50%
2 yachts	40%

b) The cost of carrying each excess yacht is $50,000, and the gain for each yacht sold is $200,000. The profit or loss resulting from each combination of decision and outcome is thus as follows:

	States of Nature			Expected Value Without Perfect Info.
Decision	**Demand = 0**	**Demand = 1**	**Demand = 2**	**Totals**
Stock 0 yachts	$ 0	$ 0	$ 0	$ 0
Stock 1 yacht	(50,000)	200,000	200,000	175,000
Stock 2 yachts	(100,000)	150,000	400,000	225,000

2) In this example, a risk averse decision maker may not wish to accept the risk of losing $100,000 by ordering two yachts.

3) The benefit of expected value analysis is that it allows a manager to apply scientific management techniques to applications that would otherwise be guesswork.

a) Although exact probabilities may not be known, the use of expected value analysis forces managers to evaluate decisions in a more organized manner. At the least, managers are forced to think of all of the possibilities that could happen with each decision.

2. **Perfect information** is the certain knowledge of which state of nature will occur.

a. The **expected value of perfect information (EVPI)** is the additional expected value that could be obtained if a decision maker knew ahead of time which state of nature would occur.

1) EXAMPLE: The yacht dealer on the previous page would maximize profits if (s)he were able to determine exactly what all potential customers intended to do for the season.

a) The profit that could be obtained with this perfect knowledge of the market is calculated as follows:

States of Nature	Probability	Best Decision Alternative	Payoff	Expected Value
Demand = 0	0.1	0 Yachts	$ 0	$ 0
Demand = 1	0.5	1 Yacht	200,000	100,000
Demand = 2	0.4	2 Yachts	400,000	160,000
				$260,000

b) The difference between this amount and the best choice without perfect information is the EVPI.

Expected value with perfect information	$260,000
Expected value without perfect information	(225,000)
Expected value of perfect information (EVPI)	**$ 35,000**

c) The dealer is therefore not willing to pay more than $35,000 for perfect information about future demand.

1.6 SENSITIVITY ANALYSIS

1. Sensitivity analysis reveals how sensitive expected value calculations are to the accuracy of the initial estimates.

a. Sensitivity analysis is thus useful in determining whether expending additional resources to **obtain better forecasts** is justified.

1) If a change in the probabilities assigned to the various states of nature results in large changes in the expected values, the decision maker is justified in expending more effort to make better predictions about the outcomes.

2) The benefit of sensitivity analysis is that managers can see the effect of changed assumptions on the final objective.

a) For example, in a capital budgeting situation, a proposed investment might promise a return of $10,000 per year and a rate of return of 15%. But that $10,000 is based on an estimate. What management needs to know is how acceptable would the investment be if the return was only $6,000 per year.

b. EXAMPLE: The yacht dealer in the expected value computation illustrated on the previous page is testing different combinations of probabilities. All three of the scenarios depicted here yield the same decision (stock two yachts for the season):

Decision Alternatives	States of Nature	Payoff	Original Probability	Original Expected Value	First Alternative Probability	First Alternative Expected Value	Second Alternative Probability	Second Alternative Expected Value
Stock 0 Yachts	Demand = 0	$ 0	0.1	$ 0	0.5	$ 0	0.333	$ 0
	Demand = 1	0	0.5	0	0.1	0	0.333	0
	Demand = 2	0	0.4	0	0.4	0	0.333	0
				$ 0		**$ 0**		**$ 0**
Stock 1 Yacht	Demand = 0	(50,000)	0.1	(5,000)	0.5	(25,000)	0.333	(16,650)
	Demand = 1	200,000	0.5	100,000	0.1	20,000	0.333	66,600
	Demand = 2	200,000	0.4	80,000	0.4	80,000	0.333	66,600
				$175,000		**$ 75,000**		**$116,550**
Stock 2 Yachts	Demand = 0	(100,000)	0.1	(10,000)	0.5	(50,000)	0.333	(33,300)
	Demand = 1	150,000	0.5	75,000	0.1	15,000	0.333	49,950
	Demand = 2	400,000	0.4	160,000	0.4	160,000	0.333	133,200
				$225,000		**$125,000**		**$149,850**

1) However, the following combination indicates that only one yacht should be stocked:

Decision Alternatives	States of Nature	Payoff	Third Alternative Probability	Third Alternative Expected Value
Stock 0 Yachts	Demand = 0	$ 0	0.1	$ 0
	Demand = 1	0	0.8	0
	Demand = 2	0	0.1	0
				$ 0
Stock 1 Yacht	Demand = 0	(50,000)	0.1	(5,000)
	Demand = 1	200,000	0.8	160,000
	Demand = 2	200,000	0.1	20,000
				$175,000
Stock 2 Yachts	Demand = 0	(100,000)	0.1	(10,000)
	Demand = 1	150,000	0.8	120,000
	Demand = 2	400,000	0.1	40,000
				$150,000

2) Clearly, the more accurately the dealer is able to anticipate demand, the more profit (s)he will make. In this case, the dealer considers it worthwhile to expend further resources gathering more data about market conditions for yachts.

c. A **trial-and-error method** inherent in sensitivity analysis is obviously greatly facilitated by the use of **computer software**.

d. A major use of sensitivity analysis is in **capital budgeting**, where small changes in prevailing interest rates or payoff amounts can make a very great difference in the profitability of a project.

1.7 CORE CONCEPTS

Budgeting Concepts

- A **budget** is a planning tool, a control tool, a motivational tool, and a communication tool. A budget helps communicate to all employees what goals the firm is trying to accomplish. Without a master budget, each department might think the firm has different goals.
- **The budget is a formal quantification of management's plans.** A budget lays out in specific terms an organization's expectations about the consumption of resources and the resulting outcomes.
- The budget lays out the **specific revenue targets** and expense limitations for each functional area and department of the organization on a month-by-month basis. A budget cannot simply be a lump-sum total for a year. **Incremental goals** must be achieved each month or week. This is especially true in seasonal businesses such as agricultural supply.
- **Controllability** is the extent to which a manager can influence activities and related revenues and costs. Controllable costs are those that are under the discretion of a particular manager. Noncontrollable costs are those to which another level of the organization has committed, removing the manager's discretion. The principle of controllability must be kept in mind when the budget is used as the basis for managerial evaluation.
- The planning process **coordinates the efficient allocation** of organizational resources.
- **Participation** in the budget preparation process is up and down the organization.
- **Standard costs** are predetermined expectations about how much a unit of input, a unit of output, or a given activity should cost. The use of standard costs in budgeting allows the standard-cost system to alert management when the actual costs of production differ significantly from the standard.
  - A purely **top-down (authoritative)** approach to standard setting has the advantage of ensuring total consistency across all functional areas. It is also far less complex and time-consuming than coordinating input from the middle and lower levels.
  - **Participative (grass-roots)** standard setting uses input from middle- and lower-level employees. Participation encourages employees to have a sense of ownership of the output of the process. The result is an acceptance of, and commitment to, the goals expressed in the budget.
- Often an organization will find that the assumptions under which the budget was prepared undergo **significant change** during the year. A policy must be in place to accommodate revisions to the budget resulting from these changes.

Forecasting Analysis

- **Forecasts** are the basis for business plans. Forecasts are used to project product demand, inventory levels, cash flow, etc. **Qualitative methods** of forecasting rely on the manager's experience and intuition.
- **Correlation analysis** is the foundation of any quantitative method of forecasting. Correlation is the strength of the **linear relationship** between two variables, expressed mathematically in terms of the coefficient of correlation (r). It can be graphically depicted by plotting the values for the variables on a graph in the form of a scatter diagram. The value of r ranges from 1 (perfect direct relationship) to –1 (perfect inverse relationship).
- The **coefficient of determination** (r^2), or the coefficient of correlation squared, is a measure of how good the fit is between the two variables. Mathematically, the coefficient of determination is the proportion of the total variation in the dependent variable that is accounted for by the independent variable.

- **Regression analysis**, also called **least-squares analysis**, is the process of deriving the linear equation that describes the relationship between two variables with a nonzero coefficient of correlation. Simple regression is used when there is one independent variable. The simple regression equation is, obviously, the algebraic formula for a straight line: $y = a + bx$. Regression analysis is particularly valuable for budgeting and cost accounting purposes.

Learning Curve Analysis

- **Learning curve analysis** reflects the increased rate at which people perform tasks as they gain experience. The time required to perform a given task becomes progressively shorter during the early stages of production. The curve is usually expressed as a percentage of reduced time to complete a task for each doubling of cumulative production. The most common percentage used in practice is 80%. **Two methods** of applying learning curve analysis are in common use:
  - The **cumulative average-time learning model** projects the reduction in the cumulative average time it takes to complete a certain number of tasks. The time spent on the most recent unit is treated as if it were the average for all units so far.
  - The **incremental unit-time learning model** projects the reduction in the incremental time it takes to complete the last task. The time spent on all units so far is accumulated and the average taken.

Time Series Analysis

- **Time series analysis** projects future trends based on past experience (for this reason, it is also called trend analysis). Time series/trend analysis encompasses **three main techniques**:
  - **Simple moving average** is appropriate when, for instance, the demand for a product is relatively stable and not subject to seasonal variations. The data points are summed and divided by the number of time periods. This process is repeated for successive groups of time periods.
  - **Weighted moving average** allows a firm to give each data point a weight indicating its relative importance in determining the outcome.
  - **Exponential smoothing** is a widespread technique for making projections because it requires less data be kept on hand than the moving average methods.
    - Step 1 – Develop some forecasts using a more data-intensive method, such as one of the two moving average methods.
    - Step 2 – Set the smoothing factor (alpha) between 0 and 1. The closer it is set to 1, the more weight is put on recent data.
    - Step 3 – Calculate the next period's forecast. Each forecast is the sum of the current period's actual results multiplied by the smoothing factor, and the current period's forecast multiplied by the smoothing factor's complement.

Expected Value

- **Expected value** is a means of associating a **dollar amount** with each of the possible outcomes of a probability distribution. The outcome yielding the highest expected value (which may or may not be the most likely one) is the optimal alternative. The expected value of an event is calculated by multiplying the probability of each outcome by its payoff and summing the products. A calculation such as this is often referred to as a **payoff table**. A **criticism** of expected value is that it is based on repetitive trials, whereas many business decisions involve only one trial.

Sensitivity Analysis

- **Sensitivity analysis** reveals how sensitive expected value calculations are to the accuracy of the initial estimates. Sensitivity analysis is thus useful in determining whether expending additional resources to obtain better forecasts is justified. If a change in the probabilities assigned to the various states of nature results in large changes in the expected values, the decision maker is justified in expending more effort to make better predictions about the outcomes.

STUDY UNIT TWO
BUDGET METHODOLOGIES AND BUDGET PREPARATION

This study unit is the **second of two** on **budgeting, planning, and forecasting**. The relative weight assigned to this major topic in Part 1 of the exam is **30%**. The two study units are

Study Unit 1: Budgeting Concepts and Forecasting Techniques
Study Unit 2: Budget Methodologies and Budget Preparation

After studying the outline and answering the questions in this study unit, you will have the skills necessary to address the following topics listed in the ICMA's Learning Outcome Statements:

Part 1 – Section A.3. Budget methodologies

For each of the budget systems identified [annual/master budgets, project budgeting, activity-based budgeting, zero-based budgeting, continuous (rolling) budgets, and flexible budgeting], the candidate should be able to:

a. define its purpose, appropriate use, and time frame
b. identify the budget components and explain the interrelationships among the components
c. demonstrate an understanding of how the budget is developed
d. compare and contrast the benefits and limitations of the budget system
e. evaluate a business situation and recommend the appropriate budget solution
f. prepare budgets on the basis of information presented
g. calculate the impact of incremental changes to budgets

Part 1 – Section A.4. Annual profit plan and supporting schedules

The candidate should be able to:

a. explain the role of the sales budget in the development of an annual profit plan
b. identify the factors that should be considered when preparing a sales forecast and evaluate the feasibility of the sales forecast based on business and economic information provided
c. identify the components of a sales budget and prepare a sales budget based on relevant information provided
d. explain the relationship between the sales budget and the production budget
e. identify the role that inventory levels play in the preparation of a production budget and define other factors that should be considered when preparing a production budget
f. prepare a production budget based on relevant information provided
g. demonstrate an understanding of the relationship between the direct materials budget, the direct labor budget, and the production budget
h. explain how inventory levels and procurement policies affect the direct materials budget
i. prepare direct materials and direct labor budgets based on relevant information and evaluate the feasibility of achieving production goals on the basis of these budgets
j. identify and describe alternative ways of allocating employee benefit expense
k. demonstrate an understanding of the relationship between the overhead budget and the production budget
l. separate costs into their fixed and variable components
m. prepare an overhead budget based on relevant information provided

n. identify the components of the cost of goods sold budget and prepare a cost of goods sold budget based on relevant information provided
o. demonstrate an understanding of contribution margin per unit and total contribution margin, identify the appropriate use of these concepts, and calculate both unit and total contribution margin
p. identify the components of the selling and administrative budget
q. explain how specific components of the selling and administrative budget may affect the contribution margin
r. prepare an operational (operating) budget
s. prepare a capital expenditure budget
t. demonstrate an understanding of the relationship between the capital expenditure budget, the cash budget, and the pro forma financial statements
u. define the purposes of the cash budget and describe the relationship between the cash budget and all other budgets
v. demonstrate an understanding of the relationship between credit policies and purchasing (payables) policies and the cash budget

Part 1 – Section A.5. Top-level planning and analysis

The candidate should be able to:

a. define the purpose of a pro forma income statement, a pro forma statement of financial position, and a pro forma cash flow statement and demonstrate an understanding of the relationship among these statements and all other budgets
b. prepare pro forma income statements based on several revenue and cost assumptions
c. evaluate whether a company has achieved strategic objectives based on pro forma income statements
d. use financial projections to prepare a pro forma balance sheet and a statement of cash flows
e. identify the factors required to prepare medium- and long-term cash forecasts
f. use financial projections to determine required outside financing and dividend policy
g. determine the effect of financial forecasts on debt covenants, including debt ratio and coverage ratios
h. forecast earnings per share based on pro forma financial statements and other relevant information

2.1 BUDGET METHODOLOGIES

1. The **master budget**, also called the comprehensive budget or **annual profit plan**, encompasses the organization's **operating** and **financial plans** for a specified period (ordinarily a year or single operating cycle).

   a. The importance of carefully drafting the budget calendar is illustrated here. The information contained in the lower-numbered budgets feeds the higher-numbered budgets. For example, the production budget cannot be prepared until after the sales budget. The direct materials budget and the direct labor budget cannot be prepared until after the production budget had been completed.

   b. In the **operating budget**, the emphasis is on obtaining and using current resources.

      1) Sales budget
      2) Production budget
      3) Direct materials budget
      4) Direct labor budget
      5) Manufacturing overhead budget
      6) Ending finished goods inventory budget
      7) Cost of goods sold budget

8) Nonmanufacturing budget

a) Research and development budget
b) Design budget
c) Marketing budget
d) Distribution budget
e) Customer service budget
f) Administrative budget

9) **Pro forma income statement**

c. In the **financial budget**, the emphasis is on obtaining the funds needed to purchase operating assets. It contains the

1) Capital budget (completed before operating budget is begun)
2) Projected cash disbursement schedule
3) Projected cash collection schedule
4) Cash budget
5) **Pro forma balance sheet**
6) **Pro forma statement of cash flows**

2. A **project budget** consists of all the costs expected to attach to a particular project, such as the design of a new airliner or the building of a single ship.

a. While the project is obviously part of the company's overall line of business, the costs and profits associated with it are significant enough to be tracked separately.

b. A project will typically use resources from many parts of the organization, e.g., design, engineering, production, marketing, accounting, and human resources.

1) All of these aspects of the project budget must align with those of the firm's master budget.

c. EXAMPLE of a project budget:

Function	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Totals
Design	$ 800,000	$ 200,000	$ --	$ --	$1,000,000
Engineering	500,000	1,200,000	400,000	--	2,100,000
Production	--	2,100,000	1,500,000	1,500,000	5,100,000
Marketing	--	100,000	200,000	200,000	500,000
Accounting	100,000	100,000	100,000	100,000	400,000
Human Resources	20,000	20,000	20,000	20,000	80,000
Totals	**$1,420,000**	**$3,720,000**	**$2,220,000**	**$1,820,000**	**$9,180,000**

3. **Activity-based budgeting** applies activity-based costing principles (see Study Unit 4, Subunit 3) to budgeting. Its greatest effect is on the application of indirect costs.

a. A traditional budgeting system involves lumping all indirect costs into a single pool and allocating them to products based on a (usually arbitrary) driver such as volume.

1) EXAMPLE: A manufacturer produces two valves, a simple one and a complex one. It has budgeted production costs for the upcoming year using a volume-based budgeting system:

	Simple Valve		Complex Valve		
		50,000		10,000	
Cost Category	Total	Per Unit	Total	Per Unit	Total
Direct materials	$ 450,000	$ 9.00	$270,000	$27.00	$ 720,000
Direct labor	240,000	4.80	78,000	7.80	318,000
Total direct costs	$ 690,000	$13.80	$348,000	$34.80	$1,038,000
Allocated indirect costs	720,000	14.40	234,000	23.40	954,000
Total manufacturing costs	**$1,410,000**	**$28.20**	**$582,000**	**$58.20**	**$1,992,000**

b. Activity-based budgeting involves defining the activities that drive indirect costs.

1) A cost pool is established for each activity, and a cost driver is identified for each pool.

a) The key to successful activity-based budgeting is selecting a driver for each pool that has a direct cause-and-effect relationship with the level of activity in that pool.

2) The budgeted cost for each pool is determined by multiplying the demand for the activity by the estimated cost of a unit of the activity.

3) EXAMPLE: The manufacturer has designed an indirect-cost assignment system based on the following pools and drivers:

Indirect cost pool	Driver
Product design	Engineering hours
Production setup	Number of batches
Machining	Machine hours
Inspection & testing	Number of valves
Customer maintenance	Salesperson hours

c. Since activity-based budgeting employs multiple indirect cost pools, it provides far greater detail regarding indirect costs than traditional functional or spending-category budgeting (which only employs a single pool).

1) EXAMPLE: Note that, while the amounts of indirect costs assigned to the two products are different, indirect costs in total are (necessarily) the same as under the traditional system:

	Estimated Driver Level		Cost per Unit of Driver		Simple Valve		Complex Valve		
Cost Category					**Total**	50,000 **Per Unit**	**Total**	10,000 **Per Unit**	**Total**
Direct materials					$ 450,000	$ 9.00	$270,000	$27.00	$ 720,000
Direct labor					240,000	4.80	78,000	7.80	318,000
Total direct costs					**$ 690,000**	**$13.80**	**$348,000**	**$34.80**	**$1,038,000**
Indirect cost assignment:									
Product design:									
Simple valve	1,000	×	$23.75	=	$ 23,750	$ 0.48			$ 90,250
Complex valve	2,800	×	23.75	=			$ 66,500	$ 6.65	
Production setup:									
Simple valve	200	×	21.00	=	4,200	0.08			4,620
Complex valve	20	×	21.00	=			420	0.04	
Machining:									
Simple valve	2,000	×	3.2581	=	6,516	0.13			68,420
Complex valve	19,000	×	3.2581	=			61,904	6.19	
Inspection & testing:									
Simple valve	50,000	×	12.50	=	625,000	12.50			750,000
Complex valve	10,000	×	12.50	=			125,000	12.50	
Customer maintenance:									
Simple valve	1,500	×	17.70	=	26,550	0.53			40,710
Complex valve	800	×	17.70	=			14,160	1.42	
Total indirect costs					**$ 686,016**	**$13.72**	**$267,984**	**$26.80**	**$ 954,000**
Total manufacturing costs					**$1,376,016**	**$27.52**	**$615,984**	**$61.60**	**$1,992,000**

4. **Zero-based budgeting (ZBB)** is a budget and planning process in which each manager must justify his/her department's entire budget every budget cycle.

a. The concept originated in the U.S. Department of Agriculture in the early 1960s but was abandoned. Texas Instruments Corporation began using it in the late 1960s and early 1970s, as did the state of Georgia under Governor Jimmy Carter. Carter also tried to introduce the concept into the federal budget system when he served as president (1977–1980).

b. ZBB differs from the traditional concept of **incremental budgeting**, in which the current year's budget is simply adjusted to allow for changes planned for the coming year.

1) The managerial advantage of incremental budgeting is that the manager has to put forth less effort to justify changes in the budget.

c. Under ZBB, a manager must build the budget every year from a base of zero. All expenditures must be justified regardless of variance from previous years.

1) The objective is to encourage periodic reexamination of all costs in the hope that some can be reduced or eliminated.

d. ZBB begins with the deepest budgetary units of the entity.

1) It requires determination of objectives, operations, and costs for each activity and the alternative means of carrying out that activity.

2) Different levels of service (work effort) are evaluated for each activity, measures of work and performance are established, and activities are ranked according to their importance to the entity.

3) For each budgetary unit, a decision package is prepared that describes various levels of service that may be provided, including at least one level of service lower than the current one.

a) Accordingly, ZBB requires managers to justify each expenditure for each budget period and to review each cost component from a cost-benefit perspective.

e. The major limitation of ZBB is that it requires more time and effort to prepare than a traditional budget.

5. A **continuous (rolling) budget** is one that is revised on a regular (continuous) basis.

a. Typically, a company continuously extends such a budget for an additional month or quarter in accordance with new data as the current month or quarter ends.

1) For example, if the budget cycle is one year, a budget for the next quarter will be available continuously as each quarter ends.

b. EXAMPLE of rolling budget:

	Fiscal Year 1				
Product Line	**1st Quarter**	**2nd Quarter**	**3rd Quarter**	**4th Quarter**	**Four Quarter Totals**
Feed	$ 12,000	$ 10,000	$ 10,000	$ 14,000	$ 46,000
Animal health	2,000	1,200	800	1,000	5,000
Fertilizer	80,000	75,000	20,000	10,000	185,000
Crop protectants	74,000	76,000	41,000	11,000	202,000
Petroleum	120,000	20,000	14,000	100,000	254,000
Farm supplies	15,000	45,000	55,000	20,000	135,000
Totals	**$303,000**	**$227,200**	**$140,800**	**$156,000**	**$827,000**

	Fiscal Year 1			Fiscal Yr 2	
Product Line	**2nd Quarter**	**3rd Quarter**	**4th Quarter**	**1st Quarter**	**Four Quarter Totals**
Feed	$ 10,000	$ 10,000	$ 14,000	$ 9,000	$ 43,000
Animal health	1,200	800	1,000	2,200	5,200
Fertilizer	75,000	20,000	10,000	90,000	195,000
Crop protectants	76,000	41,000	11,000	90,000	218,000
Petroleum	20,000	14,000	100,000	85,000	219,000
Farm supplies	45,000	55,000	20,000	10,000	130,000
Totals	**$227,200**	**$140,800**	**$156,000**	**$286,200**	**$810,200**

c. The principal advantage of a rolling budget is that it requires managers always to be thinking ahead.

1) The disadvantage is the amount of time managers must constantly spend on budget preparation.

6. A **static budget** is based on only one level of sales or production.

a. The level of production and the containment of costs are, though related, two separate managerial tasks.

1) EXAMPLE: A company has the following information for the period:

	Actual	Static Budget	Budget Variance
Production in units	1,000	1,200	200 U
Direct materials (units × $6)	$ 6,000	$ 7,200	$1,200 F
Direct labor (units × $10)	10,000	12,000	2,000 F
Variable overhead (units × $5)	5,000	6,000	1,000 F
Total variable costs	$21,000	$25,200	$4,200 F

From these results, it appears that, although the production manager failed to achieve his/her production quota, (s)he did a good job of cost control.

b. Contrast this with a **flexible budget**, which is a series of budgets prepared for many levels of activity.

1) At the end of the period, management can compare actual performance with the appropriate budgeted level in the flexible budget.

2) EXAMPLE: This is the flexible budget comparison for the company at the 1,000 unit level of production:

	Actual	Flexible Budget	Flexible Budget Variance
Production in units	1,000	1,000	--
Direct materials (units × $6)	$ 6,000	$ 6,000	$ --
Direct labor (units × $10)	10,000	10,000	--
Variable overhead (units × $5)	5,000	5,000	--
Total variable costs	$21,000	$21,000	$ --

It is clear that the production manager merely incurred the expected costs for the production level that was actually achieved.

2.2 OVERVIEW OF OPERATING BUDGET PREPARATION

1. The following is a brief introduction to the phases of drafting an operating budget. Detailed descriptions follow in Subunit 2.3.
2. The **sales budget** is usually the first budget prepared.
   a. Once a firm can estimate sales, the next step is to decide how much to produce or purchase.
   b. Sales are usually budgeted by product or department.
   c. The sales budget establishes targets for sales personnel.
   d. Sales volume affects production and purchasing levels, operating expenses, and cash flow.
3. **Production budgets** (for manufacturing firms) are based on sales in units plus or minus desired inventory buildup or reduction.
   a. They are prepared for each department.
   b. They are used to plan when items will be produced.
   c. They are usually stated in units instead of dollars.
   d. When the production budget has been completed, it is used to prepare three additional budgets:
      1) Raw materials purchases, which is similar to the purchases budget of a merchandising firm
      2) Direct labor budget, which includes hours, wage rates, and total dollars
      3) Factory overhead budget, which is similar to a department expenses budget
4. The **purchases budget** (for a retailer) can follow after projected sales have been set.
   a. It is prepared on a monthly or even a weekly basis.
   b. Purchases can be planned so that stockouts are avoided.
   c. Inventory should be at an appropriate level to avoid unnecessary carrying costs.
5. **Expense budgets** are prepared by department heads using the sales budget as a basis.
   a. Expense budgets are based on prior year's costs and adjusted for changes in prices, wages, and sales volume estimates.
6. **Equipment purchases** (or **capital expenditures**) are technically not part of the operating budget, but they must be incorporated into the preparation of the cash budget and pro forma financial statements.
   a. Capital budgets may be prepared more than a year in advance to allow sufficient time to
      1) Plan financing of major expenditures for equipment or buildings
      2) Receive custom orders of specialized equipment, buildings, etc.

7. **Cash budget** is probably the most important part of a company's budget program. An organization must have adequate cash at all times. Even with plenty of other assets, an organization with a temporary shortage of cash can be driven into bankruptcy. Proper planning can keep an entity from financial embarrassment.

   a. A cash budget details projected cash receipts and disbursements.
   b. It cannot be prepared until the other budgets have been completed.
   c. Almost all organizations, regardless of size, prepare a cash budget.
   d. It is particularly important for organizations operating in seasonal industries.
   e. Cash budgeting facilitates loans and other financing.
      1) A bank is more likely to lend money to a firm if the money will not be needed immediately.
   f. For example, assume that a company had budgeted sales of $9,000 for January, $9,700 for February, and $13,950 for March. Its cash budget might appear as follows:

Sample Company
CASH BUDGET
For Quarter Ending March 31, Year 10

	January	February	March	Total
Beginning cash balance	$ 80	$ 20	$ 1,957	$ 80
Receipts:				
Collection from sales*	6,800	9,350	11,825	27,975
TOTAL CASH AVAILABLE	$6,880	$9,370	$13,782	$28,055
Payments:				
Purchases**	$3,150	$2,760	$ 3,960	$ 9,870
Sales salaries	1,350	1,455	2,093	4,898
Supplies	360	388	588	1,306
Utilities	120	110	100	330
Administrative salaries	1,800	1,800	1,800	5,400
Advertising	80	80	80	240
Equipment purchases	0	820	3,000	3,820
TOTAL PAYMENTS	$6,860	$7,413	$11,591	$25,864
ENDING BALANCE	$ 20	$1,957	$ 2,191	$ 2,191

* Sales are 50% cash sales and 50% on credit (net 30 days). Thus, 50% of each month's sales are collected in the month of the sale and 50% are collected in the following month. For example, the February collections were calculated as follows:

50% of January sales	$4,500
50% of February sales	4,850
	$9,350

** Purchases are on terms of net 30 days. Thus, purchases are paid for in the month following the purchase. The amount paid in February ($2,760) was the total purchases for January.

2.3 THE OPERATING BUDGET

1. The **sales budget**, also called the revenue budget, is the **starting point** for the massive cycle that produces the annual profit plan (i.e., the master budget).
   a. The sales budget is an outgrowth of the **sales forecast**. The sales forecast distills recent sales trends, overall conditions in the economy and industry, market research, activities of competitors, and credit and pricing policies.
      1) For example,
         a) The company may determine that demand is highly elastic for its mature products and that growth will come only from new product introductions and from cost savings on existing products.
         b) At the same time, the company determines that a tight monetary policy on the Fed's part must cause the firm to tighten its credit standards.
         c) Simultaneously, a competitor that the firm knows is a low-cost producer is also considering moving into the markets that the budgeting company is considering.
      2) All of these factors must be taken into account when forming expectations about product sales for the coming budget cycle.
   b. The sales budget must specify both **projected unit sales and dollar revenues**.
   c. EXAMPLE of a sales budget. The demand for this firm's product is elastic, so the price cut in the third month is expected to boost sales.

	April	May	June	2nd Quarter Totals	Ref.
Projected sales in units	**1,000**	**1,200**	**1,800**	**4,000**	**SB1**
Selling price	× $400	× $400	× $380		
Projected total sales	**$400,000**	**$480,000**	**$684,000**	**$1,564,000**	**SB2**

2. The **production budget** follows directly from the sales budget.
   a. The production budget is concerned with **units only**. Product pricing is not a consideration since the goal is purely to plan output and inventory levels and the necessary manufacturing activity.
   b. To minimize finished goods carrying costs and obsolescence, the levels of production are dependent upon the projections contained in the sales budget.
   c. EXAMPLE of a production budget:

	Source	April	May	June	2nd Quarter Totals	Ref.
Projected sales in units	SB1	1,000	1,200	1,800	4,000	
Add: desired ending inventory (10% of next month's sales)		120	180	200		
Total needed		1,120	1,380	2,000	4,500	
Less: beginning inventory		(100)	(120)	(180)		
Units to be produced		**1,020**	**1,260**	**1,820**	**4,100**	**PB**

3. The **direct materials and direct labor budgets** follow directly from the production budget.
   a. The direct materials budget is concerned with both **units and input prices**.
      1) To minimize raw materials carrying costs and obsolescence, the purchasing of inputs is tied closely to the projections contained in the production budget.
      2) EXAMPLES of two direct materials budgets. Note that in the third month,
         a) The process is expected to experience improved efficiency with regard to Raw Material A.
         b) A price break on Raw Material B is expected.

Raw Material A	Source	April	May	June	2nd Quarter Totals	Ref.
Units to be produced	PB	1,020	1,260	1,820		
Raw material per finished product		× 4	× 4	× **3**		**DMB1**
Total units needed for production		4,080	5,040	5,460		
Raw material cost per unit		× $12	× $12	× **$12**		**DMB2**
Cost of units used in production		$48,960	$60,480	$65,520	**$174,960**	**DMB3**
Add: desired units in ending inventory (20% of next month's need)		1,008	1,092	1,600		
Total needs		5,088	6,132	7,060		
Less: beginning inventory		(400)	(1,008)	(1,092)		
Raw material to be purchased		4,688	5,124	5,968		
Raw material cost per unit		× $12	× $12	× $12		
Cost of raw material to be purchased		**$56,256**	**$61,488**	**$71,616**		**DMB4**

Raw Material B	Source	April	May	June	2nd Quarter Totals	Ref.
Units to be produced	PB	1,020	1,260	1,820		
Raw material per finished product		× 2	× 2	× **2**		**DMB5**
Total units needed for production		2,040	2,520	3,640		
Raw material cost per unit		× $10	× $10	× **$8**		**DMB6**
Cost of units used in production		$20,400	$25,200	$29,120	**$74,720**	**DMB7**
Add: desired units in ending inventory (20% of next month's need)		504	728	900		
Total needs		2,544	3,248	4,540		
Less: beginning inventory		(200)	(504)	(728)		
Raw material to be purchased		2,344	2,744	3,812		
Raw material cost per unit		× $10	× $10	× $8		
Cost of raw material to be purchased		**$23,440**	**$27,440**	**$30,496**		**DMB8**

   b. The **direct labor budget** depends on wage rates, amounts and types of production, numbers and skill levels of employees to be hired, etc.
      1) EXAMPLE of a direct labor budget. No new efficiencies are expected, and the wage rate is set by contract with the union.

	Source	April	May	June	2nd Quarter Totals	Ref.
Units to be produced	PB	1,020	1,260	1,820	4,100	
Direct labor hours per unit		× 2	× 2	× **2**		**DLB1**
Projected total direct labor hours		2,040	2,520	**3,640**	8,200	**DLB2**
Direct labor cost per hour		× $18.641	× $18.641	× $18.641		
Total projected direct labor cost		**$38,027**	**$46,975**	**$67,852**	**$152,854**	**DLB3**

4. The **cost of fringe benefits** must be derived once the cost of wages has been determined.
   a. EXAMPLE of an employee fringe benefit projection:

	Source	April	May	June	2nd Quarter Totals	Ref.
Projected direct labor wages	DLB3	$38,027	$46,975	$67,852	$152,854	
Employer FICA match (7.65%)		2,909	3,594	5,191	11,693	
Health insurance (12.1%)		4,601	5,684	8,210	18,495	
Life insurance (5%)		1,901	2,349	3,393	7,643	
Pension matching (4%)		1,521	1,879	2,714	6,114	
Total projected direct labor cost		**$48,960**	**$60,480**	**$87,360**	**$196,800**	**DLB4**

   b. The **full per-hour cost of labor** can now be determined. This will be used in determining the costs embedded in units remaining in ending finished goods inventory.
      1) Since a first-in, first-out (FIFO) assumption is used for all inventories and only units produced in June are expected to remain at the end of June, the calculation is only necessary for June's data.

Total projected direct labor cost	×	Total projected direct labor hours	=	Full direct labor cost per hour	Ref.
$87,360	×	3,640	=	**$24**	**DLB5**

   c. Whether employee fringes are included in direct labor costs or treated as overhead, the **effect on cost of goods sold is the same**. Both ways include the amounts in variable manufacturing costs.

5. The **manufacturing overhead budget** reflects the nature of overhead as a **mixed cost**, i.e., one that has a variable component and a fixed component (for a fuller discussion of mixed costs, see item 4.b. in Study Unit 3, Subunit 2).
   a. **Variable overhead** contains those elements that **vary** with the level of production.
      1) Indirect materials
      2) Some indirect labor
      3) Variable factory operating costs (e.g., electricity)
   b. EXAMPLE of a variable overhead budget. Note that variable overhead will be applied to finished goods on the basis of direct labor hours.

Variable overhead	Source	April	May	June	2nd Quarter Totals	Ref.
Projected total direct labor hours	DLB2	2,040	2,520	3,640	8,200	
Variable OH rate per direct labor hour		× $2	× $2	× **$2**		**MOB1**
Projected variable overhead		**$4,080**	**$5,040**	**$7,280**	**$16,400**	**MOB2**

   c. **Fixed overhead** contains those elements that **remain the same regardless** of the level of production.
      1) Real estate taxes
      2) Insurance
      3) Depreciation
   d. EXAMPLE of a fixed overhead budget. Note that fixed overhead will be applied based on the number of units produced.

Fixed overhead	Source	April	May	June	2nd Quarter Totals	Ref.
Projected fixed overhead		**$9,000**	**$9,000**	**$9,000**	**$27,000**	**MOB3**
Divided by: projected output	SB1	1,000	1,200	1,800		
Equals: Fixed OH applied per unit		$ 9.00	$ 7.50	**$ 5.00**		**MOB4**

6. The **ending finished goods inventory budget** can be prepared now that the components of finished goods cost have been projected.

   a. The end result will have a direct impact on the pro forma balance sheet. The higher the amount of costs capitalized in finished goods, the higher will be the firm's projected asset balance at year-end.

   b. EXAMPLE of a unit-cost calculation. Since a first-in, first-out (FIFO) assumption is used for all inventories and only units produced in June are expected to remain at the end of June, this calculation uses June's data.

	Source	Qty.	Source	Input cost	Cost per finished unit
Production costs in ending inventory:					
Direct materials -- raw material A	DMB1	3	DMB2	$12.00	$ 36.00
Direct materials -- raw material B	DMB5	2	DMB6	8.00	16.00
Direct labor	DLB1	2	DLB5	24.00	48.00
Variable overhead	DLB1	2	MOB1	2.00	4.00
Fixed overhead	--	1	MOB4	5.00	5.00
Finished goods cost					$109.00

   c. Now the total amount of cost embedded in ending inventory can be derived.

Total FIFO cost per finished unit		Projected units at June 30		Projected ending inventory	Ref.
$109.00	×	200	=	**$21,800**	**EFGIB**

7. The **cost of goods sold budget** combines the results of the projections for the three major inputs (materials, labor, overhead). The end result will have a direct impact on the pro forma income statement. Cost of goods sold is the single largest reduction to revenues for a manufacturer.

   a. EXAMPLE of a cost of goods sold budget for the quarter:

	Source			Ref.
Beginning finished goods inventory			$ 16,200	
Manufacturing costs:				
Direct materials used -- A	DMB3	$174,960		
Direct materials used -- B	DMB7	74,720		
Direct labor employed	DLB4	196,800		
Variable overhead	MOB2	16,400		
Fixed overhead	MOB3	27,000		
Cost of goods manufactured			489,880	
Cost of goods available for sale			$506,080	
Ending finished goods inventory	EFGIB		(21,800)	
Cost of goods sold			**$484,280**	**CGSB**

   b. Budgeted **gross margin** can now be calculated, the amount left over from sales revenue after the cost of the product:

	Source	
Sales	SB2	$1,564,000
Cost of goods sold	CGSB	(484,280)
Gross margin		**$1,079,720**

      1) The calculation of gross margin is required for GAAP-based external reporting. Cost of goods sold for this purpose must be derived using **absorption (full) costing**, i.e., by including all manufacturing costs, both variable and fixed.

      2) For internal reporting, **variable (direct) costing**, which includes only variable costs in cost of goods sold, is more useful than absorption costing.

8. **Contribution margin** is the amount left over from sales after subtracting variable-basis cost of goods sold.
   a. While impermissible for GAAP-based reporting, contribution margin is more useful to management accountants because it reveals more accurately the **change in profitability** resulting from a **given change in output**.
   b. Absorption costing (required for external reporting) includes certain amounts in cost of goods sold that do not vary directly with the level of production, such as straight-line depreciation and property taxes.
   c. Cost of goods sold calculated on a **variable-costing basis**, on the other hand, includes only those costs that vary directly with the level of production. The amount of sales left over after subtracting variable-basis cost of goods sold is contribution margin.
      1) Because costs are accumulated so differently, inventory amounts as well as cost of goods sold are different under variable costing from what they are under absorption costing.

Sales		**$ X,XXX**
Beginning inventory	$X,XXX	
Add: variable manufacturing costs	X,XXX	
Goods available for sale	$X,XXX	
Less: ending inventory	(XXX)	
Variable-basis cost of goods sold		**$(X,XXX)**
Less: variable nonmanufacturing costs		(XXX)
Contribution margin		**$ X,XXX**

      2) Contribution margin is the amount available for "contributing" to the covering of fixed costs and providing a profit (for a fuller discussion of absorption and variable costing, see Study Unit 3, Subunit 1).
   d. The **breakeven point** is the level of production at which contribution margin equals zero, i.e., the level at which all variable costs have been covered. This determination is made using **contribution margin per unit** (budgeted contribution margin ÷ budgeted units to be produced).

$$\text{Breakeven point} = \frac{\text{Total fixed costs}}{\text{Contribution margin per unit}}$$

      1) EXAMPLE: A manufacturer has budgeted total fixed costs of $1,240,000 and a budgeted contribution margin of $6.80 per unit. The breakeven point for the budget period is 182,353 units ($1,240,000 ÷ $6.80).
      2) Breakeven analysis, also called cost-volume-profit analysis, is tested in Part 2 of the CMA exam.

9. The **nonmanufacturing budget** consists of the individual budgets for **R&D, design, marketing, distribution, customer service,** and **administrative costs**.
   a. The development of separate R&D, design, marketing, distribution, customer service, and administrative budgets reflects a **value chain** approach.
      1) An alternative is to prepare a single **selling and administrative budget** for nonproduction costs.

b. The **variable and fixed portions** of selling and administrative costs must be treated **separately**.

1) Some S&A costs vary directly and proportionately with the level of sales. As more product is sold, sales representatives must travel more miles and serve more customers.

2) Other S&A expenses, such as sales support staff, are fixed; they must be paid no matter the level of sales.

3) As the variable portion of S&A costs increases, contribution margin, i.e., the amount available for covering fixed costs, is decreased.

c. EXAMPLE of a nonmanufacturing costs budget. Note the separate treatment of the variable and fixed portions.

	Source	April	May	June	2nd Quarter Totals	Ref.
Variable nonmanufacturing costs:						
Projected sales in units	SB1	1,000	1,200	1,800	4,000	
Variable S&A expenses ($3 per unit sold)		× $3	× $3	× $3		
Total variable nonmanufacturing costs		$ 3,000	$ 3,600	$ 5,400	$ 12,000	
Fixed nonmanufacturing costs:						
Research and development		$ 8,000	$ 8,000	$ 8,000	$ 24,000	
Design		4,000	4,000	4,000	12,000	
Marketing		7,000	7,000	7,000	21,000	
Distribution		10,000	10,000	10,000	30,000	
Customer service		11,000	11,000	11,000	33,000	
Administrative		50,000	50,000	50,000	150,000	
Total fixed nonmanufacturing costs		$90,000	$90,000	$90,000	$270,000	
Total nonmanufacturing costs		**$93,000**	**$93,600**	**$95,400**	**$282,000**	**NMB**

d. Note that management can make **tradeoffs** among elements of selling and administrative expenses that can **affect contribution margin**.

1) For example, use of fixed advertising expense will increase contribution margin, while the same sales level might be reached using variable sales commissions, a method that would reduce contribution margin.

10. The **operating budget** is the **culmination** of the operating budget process.

a. EXAMPLE of an operating budget:

	Source	
Sales	SB2	$1,564,000
Cost of goods sold	CGSB	(484,280)
Gross margin		$1,079,720
Nonmanufacturing costs	NMB	(282,000)
Operating income		**$ 797,720**

2.4 THE FINANCIAL BUDGET

1. Outside the operating budget cycle is the preparation of the **capital budget**, which often must be approved by the board of directors.

a. The capital budget concerns financing of **major expenditures for long-term assets** and must therefore have a **multi-year perspective**. Productive machinery must be acquired to enable the company to achieve its projected levels of output.

b. A procedure for **ranking projects** according to their risk and return characteristics is necessary because every organization has finite resources. [These procedures (net present value, internal rate of return, payback method, etc.) are tested in Part 2 of the CMA exam.]

c. The capital budget has a direct impact on the cash budget and the pro forma financial statements.

1) Principal and interest on debt acquired to finance capital purchases require **regular cash outflows**. The acquired debt also appears in the liabilities section of the pro forma balance sheet.

2) At the same time, the output produced by the new productive assets generates **regular cash inflows**. In addition, the new assets themselves appear in the assets section of the pro forma balance sheet.

2. The **cash budget** is the part of the financial budget cycle that **ties together all the schedules from the operating budget**.

a. A cash budget **projects cash receipts and disbursements** for planning and control purposes. Hence, it helps prevent not only cash emergencies but also excessive idle cash.

1) A cash budget is vital because an organization must have **adequate cash at all times**. Almost all organizations, regardless of size, prepare a cash budget.

a) Even with plenty of other assets, an organization with a temporary shortage of cash can be driven into bankruptcy.

2) Proper planning can keep an entity from financial embarrassment. Thus, cash budgets are prepared not only for annual and quarterly periods but also for monthly and weekly periods.

a) They are particularly important for organizations operating in seasonal industries.

b) The factors needed to prepare a cash forecast include all other elements of the budget preparation process, plus consideration of collection policies, bad debt estimates, and changes in the economy.

3) **Credit and purchasing policies** have a direct impact on the cash budget.

a) Loose credit policies toward customers' credit result in delayed cash receipts.

b) Taking advantage of purchase discounts results in accelerated cash outlays.

b. First, a **projected cash collection schedule** is prepared. It projects the inflows of cash from customer payments.

1) EXAMPLE of a cash collection schedule. Note the assumption that 5% of sales will prove to be uncollectible.

Projected February sales		$180,000			
Projected March sales		$220,000			
	Source	April	May	June	Ref.
Projected sales	SB2	$400,000	$480,000	$684,000	
Cash collections from sales:					
From 2nd prior month sales (30%)		54,000	66,000	120,000	
From prior month sales (50%)		110,000	200,000	240,000	
From current month sales (15%)		60,000	72,000	102,600	
Total cash collections from sales		**$224,000**	**$338,000**	**$462,600**	**PCCS**

c. Next, a **projected cash disbursements schedule** for raw materials is prepared.

1) EXAMPLE of a raw materials cash disbursements schedule:

March raw materials purchases -- A		$45,000			
March raw materials purchases -- B		$17,000			
	Source	April	May	June	Ref.
Projected raw materials cost -- A	DMB4	$56,256	$61,488	$71,616	
Cash payments for purchases of A:					
For prior month purchases (40%)		18,000	22,502	24,595	
For current month purchases (60%)		33,754	36,893	42,970	
Total cash disbursements for A		**$51,754**	**$59,395**	**$67,565**	**PCDS1**
Projected raw materials cost -- B	DMB8	$23,440	$27,440	$30,496	
Cash payments for purchases of B:					
For prior month purchases (40%)		6,800	9,376	10,976	
For current month purchases (60%)		10,200	16,464	18,298	
Total cash disbursements for B		**$17,000**	**$25,840**	**$29,274**	**PCDS2**

d. The **cash budget** is the **lynchpin** of the financial budget.

1) It combines the results of the operating budget with the cash collection and disbursement schedules to produce a comprehensive picture of where the company's cash flows are expected to come from and where they are expected to go.

2) The completed cash budget can be used to plan outside financing activities. For example, if the budget shows a cash deficit at some future date, the firm can plan ahead to borrow the necessary funds or sell stock.

3) Dividend policy can also be planned using the cash budget. For instance, dividend payment dates should correspond to a time when the firm has excess cash.

4) EXAMPLE of a cash budget. The bottom section deals with the anticipated handling of the inevitable temporary excesses and deficiencies of cash.

	Source	April	May	June
Beginning cash balance		$ 50,000	$100,206	$134,601
Cash collections from sales	PCCS	224,000	338,000	462,600
Cash available for disbursement		$274,000	$438,206	$597,201
Cash disbursements:				
For raw material A	PCDS1	$ 51,754	$ 59,395	$ 67,565
For raw material B	PCDS2	17,000	25,840	29,274
For direct labor	DLB4	48,960	60,480	87,360
For variable overhead	MOB2	4,080	5,040	7,280
For fixed overhead	MOB3	9,000	9,000	9,000
For nonmanufacturing costs	NMB	93,000	93,600	95,400
For equipment purchases	Cap. Budg.	0	0	30,000
Total disbursements		$223,794	$253,355	$325,879
Surplus of cash available over disbursements		$ 50,206	$184,851	$271,322
Desired ending cash balance		(100,000)	(100,000)	(100,000)
Surplus (deficiency) of cash		**$ (49,794)**	**$ 84,851**	**$171,322**
Financing:				
Borrowings		$ 50,000	$ 0	$ 0
Repayments:				
Principal		0	(50,000)	0
Interest		0	(250)	0
Net financing		$ 50,000	$ (50,250)	$ 0
Ending cash balance		**$100,206**	**$134,601**	**$271,322**

3. The **pro forma financial statements** can be prepared at this point.
   a. **Pro forma** is a Latin phrase meaning literally "according to form." It can be loosely translated "as if." Financial statements are referred to as pro forma when they reflect projected, rather than actual, results.
      1) The pro forma income statement is used to decide whether the budgeted activities will result in an acceptable level of income. If the initial pro forma income shows a loss or an unacceptable level of income, adjustments can be made to the component parts of the master budget.
      2) Other strategic objectives can also be observed from the pro forma income statement, such as desired rates of return, debt ratio, and the interest coverage ratio (times interest earned). The adequacy of earnings per share can also be observed from the pro forma income statement.
      3) EXAMPLE of a pro forma income statement:

Manufacturing Company
Pro Forma Statement of Income
2nd Quarter

Sales		$1,564,000
Beginning finished goods inventory	$ 16,200	
Add: cost of goods manufactured	489,880	
Goods available for sale	$506,080	
Less: ending finished goods inventory	(21,800)	
Cost of goods sold		(484,280)
Gross margin		$1,079,720
Less: selling and administrative expenses		(282,000)
Operating income		$ 797,720
Add: other revenues and gains		15,000
Less: other expenses and losses		(10,000)
Earnings before interest and taxes		$ 802,720
Less: interest expense		(250)
Earnings before income taxes		$ 802,470
Less: income taxes (40%)		(320,988)
Net income		**$ 481,482**
Basic earnings per share for 2nd quarter (5,000,000 common shares issued and outstanding)		**$0.096**

4) Revenue and cost assumptions can be changed and their effects on pro forma net income observed.

a) EXAMPLE: The company has projected gross margin to be 69% of sales ($1,079,720 ÷ $1,564,000). If gross margin is changed to 75% of sales ($1,564,000 × .75 = $1,173,000), the pro forma income statement will reflect a different bottom line.

Manufacturing Company
Pro Forma Statement of Income
2nd Quarter

Sales	$1,564,000
Cost of goods sold	(391,000)
Gross margin	$1,173,000
Less: selling and administrative expenses	(282,000)
Operating income	$ 891,000
Add: other revenues and gains	15,000
Less: other expenses and losses	(10,000)
Earnings before interest and taxes	$ 896,000
Less: interest expense	(250)
Earnings before income taxes	$ 895,750
Less: income taxes (40%)	(358,300)
Net income	**$ 537,450**
Basic earnings per share for 2nd quarter (5,000,000 common shares issued and outstanding)	**$0.107**

b. The **pro forma balance sheet** is prepared using the cash and capital budgets and the pro forma income statement.

1) The pro forma balance sheet is the beginning-of-the-period balance sheet updated for projected changes in cash, receivables, payables, inventory, etc.

2) If the balance sheet indicates that a contractual agreement may be violated, the budgeting process must be repeated.

a) For example, some loan agreements require that owners' equity be maintained at some percentage of total debt or that current assets be maintained at a given multiple of current liabilities.

c. The **pro forma statement of cash flows** classifies cash receipts and disbursements depending on whether they are from operating, investing, or financing activities.

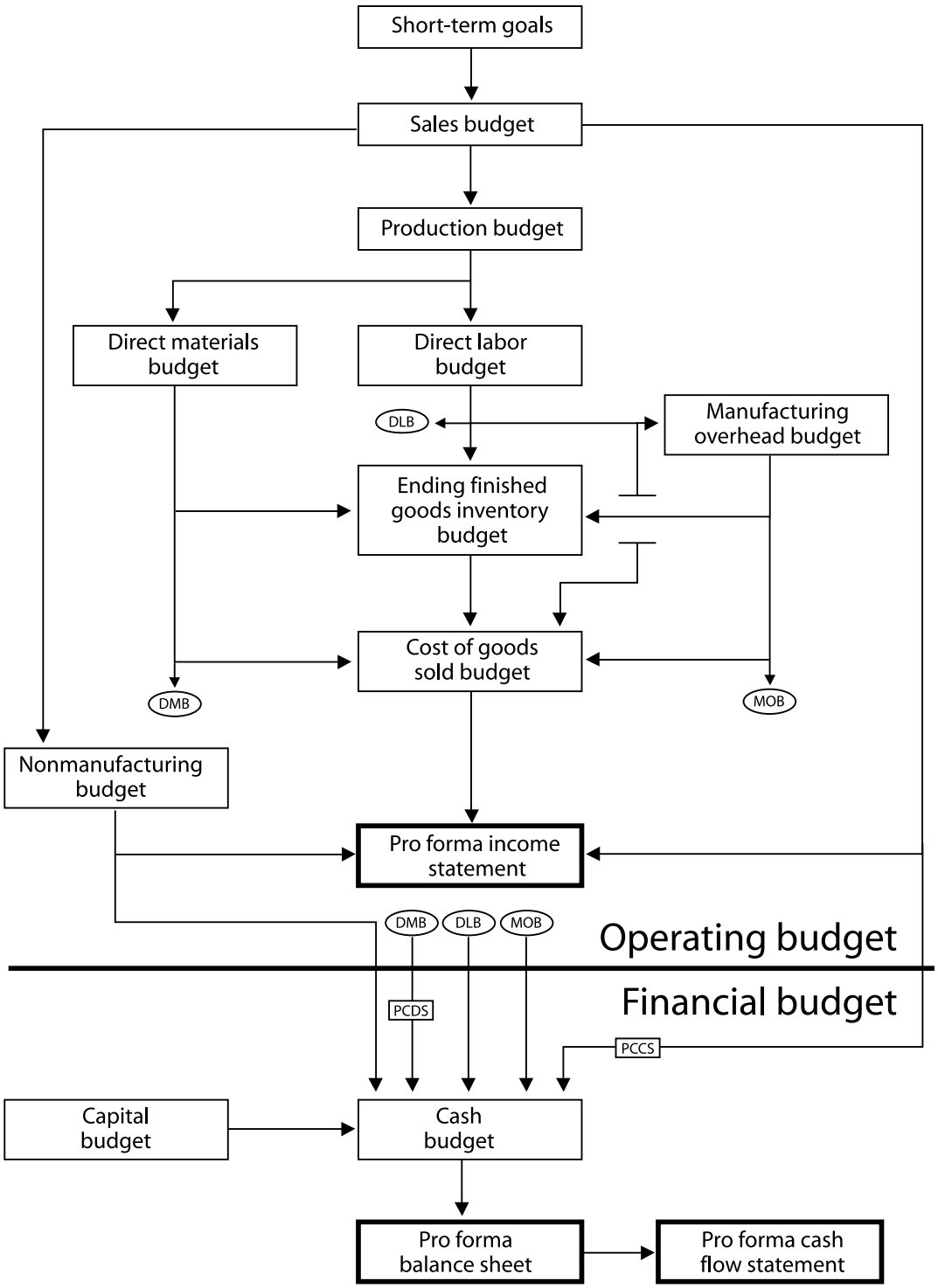
1) The direct presentation reports the major classes of gross cash operating receipts and payments and the difference between them.

2) The indirect presentation reconciles net income with net operating cash flow. Under GAAP, this reconciliation must be disclosed whichever presentation is chosen.

a) The reconciliation requires balance sheet data, such as the changes in accounts receivable, accounts payable, and inventory, as well as net income.

d. All the pro forma statements are interrelated (articulated), e.g., the pro forma cash flow statement will include anticipated borrowing. The interest on this borrowing will appear in the pro forma income statement.

4. This diagram depicts the **budget cycle** for a manufacturing firm that includes all elements of the value chain:



* PCDS = projected cash disbursements schedule
PCCS = projected cash collection schedule

2.5 CORE CONCEPTS

Budget Methodologies

- The **master budget**, also called the comprehensive budget or annual profit plan, encompasses the organization's **operating and financial** plans for a specified period (ordinarily a year or single operating cycle).
- In the **operating budget**, the emphasis is on obtaining and using current resources. It contains the
  - Sales budget
  - Production budget
  - Direct materials budget
  - Direct labor budget
  - Manufacturing overhead budget
  - Ending finished goods inventory budget
  - Cost of goods sold budget
  - Nonmanufacturing budget
  - Pro forma income statement
- In the **financial budget**, the emphasis is on obtaining the funds needed to purchase operating assets. It contains the
  - Capital budget
  - Projected cash disbursement schedule
  - Projected cash collection schedule
  - Cash budget
  - Pro forma balance sheet
  - Pro forma statement of cash flows
- A **project budget** consists of all the costs expected to attach to a particular project, such as the design of a new airliner or the building of a single ship.

Overview of Operating Budget Preparation

- The **budgetary process** begins with the sales budget, since there is no need to worry about production until you know how many units need to be produced. The sales budget sets a target for sales personnel and affects every other element of the company.
- **Production budgets** are prepared in terms of units (not dollars) and are prepared for every production department. The production budget becomes the source for the raw material purchases budget, the direct labor budget, and the factory overhead budget.

The Operating Budget

- The **sales budget**, also called the revenue budget, is the **starting point** for the massive cycle that produces the annual profit plan (i.e., the master budget).
  - The sales budget is an outgrowth of the **sales forecast**. The sales forecast distills recent sales trends; overall conditions in the economy and industry; market research; activities of competitors; and credit and pricing policies.
- The **production budget** follows directly from the sales budget.
  - The production budget is concerned with **units only**.

- The **direct materials and direct labor budgets** follow directly from the production budget.
  - The direct materials budget is concerned with **both units and input prices**.
  - The **cost of fringe benefits** must be derived once the cost of wages has been determined. Whether employee fringes are included in direct labor costs or treated as overhead, the effect on cost of goods sold is the same.
- The **manufacturing overhead budget** reflects the nature of overhead as a mixed cost, i.e., one that has a variable component and a fixed component.
  - **Variable overhead** contains those elements that vary with the level of production (indirect materials, indirect labor, variable factory operating costs).
  - **Fixed overhead** contains those elements that remain the same regardless of the level of production (real estate taxes, insurance, depreciation).
- The **ending finished goods inventory budget** can be prepared now that the components of finished goods cost have been projected.
- The **cost of goods sold budget** combines the results of the projections for the three major inputs (materials, labor, overhead).
- The **nonmanufacturing budget** consists of the individual budgets for R&D, design, marketing, distribution, customer service, and administrative costs.
  - The **variable and fixed portions** of selling and administrative costs must be treated separately.
- The **operating budget** is the culmination of the operating budget process.

The Financial Budget

- Outside the operating budget cycle is the preparation of the **capital budget**, which must be approved by the board of directors.
- The **cash budget** is the part of the financial budget cycle that **ties together** all the schedules from the operating budget. A cash budget projects cash receipts and disbursements for planning and control purposes.
  - First, a **projected cash collection schedule** is prepared. It projects the inflows of cash from customer payments.
  - Next, a **projected cash disbursements schedule** for raw materials is prepared.
  - The cash budget is not only the most important aspect of the entire budgetary process, it is also the most important from the viewpoint of CMA candidates. Candidates should be able to prepare detailed cash budgets.
- The cash budget is the **lynchpin of the financial budget**. It combines the results of the operating budget with the cash collection and disbursement schedules to produce a comprehensive picture of where the company's cash flows are expected to come from and where they are expected to go.
- The **pro forma income statement** is used to decide whether the budgeted activities will result in an acceptable level of income.
- The **pro forma balance sheet** is prepared using the cash and capital budgets and the pro forma income statement.
- The **pro forma statement of cash flows** classifies cash receipts and disbursements depending on whether they are from operating, investing, or financing activities.

STUDY UNIT THREE
COST MANAGEMENT TERMINOLOGY AND CONCEPTS

Cost Management

Cost management is at the heart of the field of management accounting. Thus, the CMA exam places great emphasis on this area of study. The candidate will face many questions involving numerical calculations and others requiring a knowledge of cost terminology and the implications of cost management decisions.

This study unit is the **first of four** on **cost management**. The relative weight assigned to this major topic in Part 1 of the exam is **25%**. The four study units are

Study Unit 3: Cost Management Terminology and Concepts
Study Unit 4: Cost Accumulation Systems
Study Unit 5: Cost Allocation Techniques
Study Unit 6: Operational Efficiency and Business Process Performance

After studying the outline and answering the questions in this study unit, you will have the skills necessary to address the following topics listed in the ICMA's Learning Outcome Statements:

Part 1 – Section C.1. Measurement concepts

The candidate should be able to:

a. demonstrate an understanding of the behavior of fixed and variable costs in the long and short terms and how a change in assumptions regarding cost type or relevant range affects these costs

Statements b. through d. are covered in Study Unit 4.
Statements e. through l. are covered in Study Unit 5.

3.1 COST MANAGEMENT TERMINOLOGY

1. **Subdisciplines of Accounting**

   a. **Financial accounting** is concerned principally with reporting to **external users**, usually through a set of financial statements produced in accordance with GAAP. Financial accounting thus has a **historical focus**.

   b. **Management accounting** is concerned principally with reporting to **internal users**. The management accountant's goal is to produce reports that improve organizational decision making. Management accounting is thus **future-oriented**.

   c. **Cost accounting** supports both financial **and** management accounting. Information about the **cost of resources** acquired and consumed by an organization underlies effective reporting for both internal and external users.

2. **Basic Definitions**
   a. A **cost** is defined by the IMA in two senses:
      1) "In **management accounting**, a measurement in monetary terms of the amount of resources used for some purpose. The term by itself is not operational. It becomes operational when modified by a term that defines the purpose, such as acquisition cost, incremental cost, or fixed cost."
      2) "In **financial accounting**, the sacrifice measured by the price paid or required to be paid to acquire goods or services. The term 'cost' is often used when referring to the valuation of a good or service acquired. When 'cost' is used in this sense, a cost is an asset. When the benefits of the acquisition (the goods or services) expire, the cost becomes an expense or loss."
   b. A **cost object** is any entity to which costs can be attached.
      1) Examples are products, processes, employees, departments, and facilities.
   c. A **cost driver** is the basis used to assign costs to a cost object.
      1) Cost driver is defined by the IMA as "a measure of activity, such as direct labor hours, machine hours, beds occupied, computer time used, flight hours, miles driven, or contracts, that is a causal factor in the incurrence of cost to an entity."
      2) The key aspect of a cost driver is the existence of a direct cause-and-effect relationship between the quantity of the driver consumed and the amount of total cost.

3. **Manufacturing vs. Nonmanufacturing**
   a. The **costs of manufacturing** a product can be classified as one of three types:
      1) **Direct materials** are those tangible inputs to the manufacturing process that can practicably be traced to the product, e.g., sheet metal welded together for a piece of heavy equipment.
         a) All costs of bringing raw materials to the production line, e.g., transportation-in, are included in the cost of direct materials.
      2) **Direct labor** is the cost of human labor that can practicably be traced to the product, e.g., the wages of the welder.
      3) **Manufacturing overhead** consists of all costs of manufacturing that are not direct materials or direct labor.
         a) **Indirect materials** are tangible inputs to the manufacturing process that cannot practicably be traced to the product, e.g., the welding compound used to put together a piece of heavy equipment.
         b) **Indirect labor** is the cost of human labor connected with the manufacturing process that cannot practicably be traced to the product, e.g., the wages of assembly line supervisors and janitorial staff.
         c) **Factory operating costs**, such as utilities, real estate taxes, insurance, depreciation on factory equipment, etc.
   b. Manufacturing costs are often grouped into the following classifications:
      1) **Prime cost** equals direct materials plus direct labor, i.e., those costs directly attributable to a product.
      2) **Conversion cost** equals direct labor plus manufacturing overhead, i.e., the costs of converting raw materials into the finished product.

c. Operating a manufacturing concern requires the incurrence of **nonmanufacturing costs**:

1) **Selling (marketing) expenses** are those costs incurred in getting the product from the factory to the consumer, e.g., sales personnel salaries and product transportation.
2) **Administrative expenses** are those costs incurred by a company not directly related to producing or marketing the product, e.g., executive salaries and depreciation on the headquarters building.

4. **Product vs. Period**

a. One of the most important classifications a management accountant can make is whether to capitalize a cost as part of finished goods inventory or to expense it as incurred.

1) **Product costs** (also called inventoriable costs) are capitalized as part of finished goods inventory. They eventually become a **component of cost of goods sold**.
2) **Period costs** are expensed as incurred, i.e., they are not capitalized in finished goods inventory and are thus **excluded from cost of goods sold**.

b. This distinction is crucial because of the required treatment of manufacturing costs for external financial reporting purposes.

1) **Under GAAP**, all manufacturing costs (direct materials, direct labor, variable overhead, and fixed overhead) must be treated as product costs, and all selling and administrative (S&A) costs must be treated as period costs.

a) This approach is called **absorption costing** (also called full costing).

2) For **internal reporting**, a more informative accounting treatment is often to capitalize only variable manufacturing costs as product costs, and treat all other costs (variable S&A and the fixed portion of both production and S&A expenses) as period costs.

a) This approach is called **variable costing** (also called direct costing).

3) The following table summarizes these two approaches:

<table>
<tr><th></th><th>Absorption Costing
(Required under GAAP)</th><th>Variable Costing
(For internal reporting only)</th></tr>
<tr><td rowspan="2">Product Costs
(Included in Cost of Goods Sold)</td><td colspan="2">Variable production costs</td></tr>
<tr><td>Fixed production costs</td><td></td></tr>
<tr><td rowspan="3">Period Costs

(Excluded from Cost of Goods Sold)</td><td></td><td>Fixed production costs</td></tr>
<tr><td colspan="2">Variable S&A expenses</td></tr>
<tr><td colspan="2">Fixed S&A expenses</td></tr>
</table>

a) These treatments are explained more fully in item 1. in Subunit 4.

5. **Direct vs. Indirect**

a. Costs can be classified by how they are assigned to cost objects.

1) **Direct costs** are ones that can be associated with a particular cost object in an economically feasible way, i.e., they can be **traced** to that object.

a) Examples are the direct materials and direct labor inputs to a manufacturing process discussed in item 3.a. on the previous page.

2) **Indirect costs** are ones that cannot be associated with a particular cost object in an economically feasible way and thus must be **allocated** to that object.

a) Examples are the indirect materials and indirect labor inputs to a manufacturing process discussed in item 3.a.3) on page 2.

b) To simplify the allocation process, indirect costs are often collected in cost pools.

i) A **cost pool** is an account into which a variety of similar cost elements with a common cause are accumulated.

ii) Manufacturing overhead is a commonly used cost pool into which various untraceable costs of the manufacturing process are accumulated prior to being allocated.

3) **Common costs** are another notable type of indirect cost. A common cost is one shared by two or more users.

a) The key to common costs is that, since they cannot be directly traced to the users that generate the costs, they must be **allocated** using some systematic and rational basis.

b) An example is depreciation on the headquarters building. This is a direct cost when treating the building as a whole, but is a common cost of the departments located in the building, and thus must be allocated when treating the individual departments.

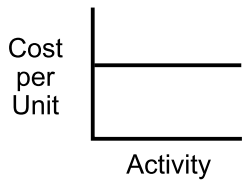
3.2 COST BEHAVIOR AND RELEVANT RANGE

1. The **relevant range** defines the limits within which per-unit variable costs remain constant and fixed costs are not changeable. It is synonymous with the **short run**.

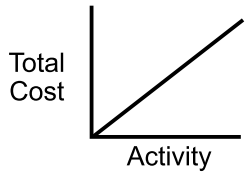
a. The relevant range is established by the efficiency of a company's current manufacturing plant, its agreements with labor unions and suppliers, etc.

2. **Variable Costs**

a. **Variable cost per unit** remains constant in the short run regardless of the level of production.



b. **Variable costs in total**, on the other hand, vary directly and proportionally with changes in volume.

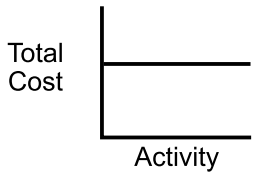


c. EXAMPLE: A company requires one unit of direct material to be used in each finished good it produces.

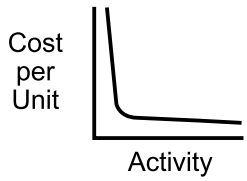
Number of outputs produced	Input cost per unit	Total cost of inputs
0	$10	$ 0
100	$10	$ 1,000
1,000	$10	$ 10,000
5,000	$10	$ 50,000
10,000	$10	$100,000

3. **Fixed Costs**

a. **Fixed costs in total** remain unchanged in the short run regardless of production level, e.g., the amount paid for an assembly line is the same even if production is halted entirely.



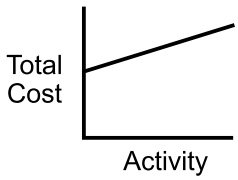
b. **Fixed cost per unit**, on the other hand, varies indirectly with the activity level.



c. EXAMPLE: The historical cost of the assembly line is settled, but its cost per unit decreases as production increases.

Number of outputs produced	Cost of assembly line	Per unit cost of assembly line
1	$1,000,000	$1,000,000
100	$1,000,000	$ 10,000
1,000	$1,000,000	$ 1,000
5,000	$1,000,000	$ 200
10,000	$1,000,000	$ 100

4. **Mixed (semivariable) costs** combine fixed and variable elements, e.g., rental expense on a car that carries a flat fee per month plus an additional fee for each mile driven.



a. EXAMPLE: The company rents a piece of machinery to make its production line more efficient. The rental is $150,000 per year plus $1 for every unit produced.

Number of outputs produced	Fixed cost of extra machine	Variable cost of extra machine	Total cost of extra machine
0	$150,000	$ 0	$150,000
100	$150,000	$ 100	$150,100
1,000	$150,000	$ 1,000	$151,000
5,000	$150,000	$ 5,000	$155,000
10,000	$150,000	$10,000	$160,000

b. Sometimes the fixed and variable portions of a mixed cost are not set by contract as in the above example and thus must be **estimated**. Two methods of estimating mixed costs are in general use:

1) The **high-low method** is the less accurate but the quicker of the two methods.

a) The difference in cost between the highest and lowest levels of activity is divided by the difference in the activity level to arrive at the variable portion of the cost.

b) EXAMPLE: A company has the following cost data:

Month	Machine Hours	Maintenance Costs
April	1,000	$2,275
May	1,600	$3,400
June	1,200	$2,650
July	800	$1,900
August	1,200	$2,650
September	1,000	$2,275

c) The numerator can be derived by subtracting the cost at the lowest level (July) from the cost at the highest level (May) [$3,400 – $1,900 = $1,500].

d) The denominator can be derived by subtracting the lowest level of activity (July) from the highest level (May) [1,600 – 800 = 800].

e) The variable portion of the cost is therefore $1.875 per machine hour ($1,500 ÷ 800).

f) The fixed portion can be calculated by inserting the appropriate values for either the high or low month in the range:

Fixed portion = Total cost – Variable portion
= $1,900 – (800 hours × $1.875)
= $1,900 – $1,500
= $400

2) The **regression (scattergraph) method** is considerably more complex and determines the average rate of variability of a mixed cost rather than the variability between the high and low points in the range.

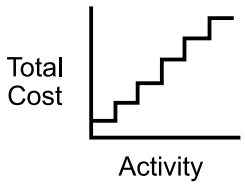
5. **Linear vs. Nonlinear Cost Functions**

a. Four of the five costs described in this subunit are **linear-cost functions**, i.e., they change at a constant rate (or remain unchanged) over the short run.

b. Fixed cost per unit, however, is an example of a **nonlinear-cost function**.

1) Note that fixed cost per unit has an asymptotic character with respect to the x axis, approaching it closely while never intersecting it (it does intersect the y axis at the zero level of activity). The function shows a high degree of variability over its range taken as a whole (see item 3.b. on the previous page).

2) Another type of nonlinear-cost function is a **step-cost function**, one that is constant over small ranges of output but increases by steps (discrete amounts) as levels of activity increase.



a) Both fixed and variable costs can display step-cost characteristics. If the steps are relatively narrow, these costs are usually treated as variable. If the steps are wide, they are more akin to fixed costs.

6. **Relevant Range and Marginal Cost**

   a. **Marginal cost** is the cost incurred by a one-unit increase in the activity level of a particular cost driver.

      1) Necessarily then, **marginal cost remains constant across the relevant range**.

   b. Management accountants capture the concept of relevant range when they say that **"All costs are variable in the long run."**

      1) Investment in new, more productive equipment results in higher total fixed costs but may result in lower total and per-unit variable costs.

3.3 COST CLASSIFICATION

1. **Cost of Goods Sold and Cost of Goods Manufactured**

   a. **Cost of goods** sold is a straightforward computation for a **retailer** because retailers have only a **single class of inventory**.

Beginning inventory	$XX,XXX
Add: purchases	X,XXX
Less: ending inventory	(X,XXX)
Cost of goods sold	**$XX,XXX**

   b. The calculation is more complex for a **manufacturer**, because manufacturers have **three distinct classes of inventory**.

      1) Cost of goods sold contains an additional component called **cost of goods manufactured**, analogous to the retailer's purchases account.

Beginning work-in-process inventory	$XX,XXX
Add: total manufacturing costs	X,XXX
Less: ending work-in-process inventory	(X,XXX)
Cost of goods manufactured	**$XX,XXX**

   c. A comparison of these computations in full is as follows:

Cost of goods sold for a retailer:

Beginning inventory		$ XXX,XXX
Add: Purchases	$X,XXX,XXX	
Less: Returns and discounts	(XX,XXX)	
Net purchases	**X,XXX,XXX**	
Add: Freight-in	XX,XXX	X,XXX,XXX
Goods available for sale		**X,XXX,XXX**
Less: Ending inventory		(XXX,XXX)
Costs of goods sold		**$X,XXX,XXX**

Cost of goods sold for a manufacturer:

Beginning raw materials inventory		$ XXX,XXX	
Add: Purchases	$X,XXX,XXX		
Less: Returns and discounts	(XX,XXX)		
Net purchases	X,XXX,XXX		
Add: Freight-in	XX,XXX	X,XXX,XXX	
Raw materials available for use		X,XXX,XXX	
Less: Ending raw materials inventory		(XXX,XXX)	
Direct materials used in production			$X,XXX,XXX
Direct labor costs			X,XXX,XXX
Manufacturing overhead costs			XXX,XXX
Total manufacturing costs for the period			**X,XXX,XXX**
Add: Beginning work-in-process inventory			XXX,XXX
Less: Ending work-in-process inventory			(XXX,XXX)
Costs of goods manufactured			**X,XXX,XXX**
Add: Beginning finished goods inventory			XXX,XXX
Goods available for sale			**X,XXX,XXX**
Less: Ending finished goods inventory			(XXX,XXX)
Costs of goods sold			**$X,XXX,XXX**

2. **Controllable vs. Noncontrollable**
   a. **Controllable costs** are those that are under the discretion of a particular manager. **Noncontrollable costs** are those to which another level of the organization has committed, removing the manager's discretion.
   b. In other words, controllability is determined at different levels of the organization; it is not inherent in the nature of a given cost.
      1) For example, an outlay for new machinery may be controllable to the division vice-president but noncontrollable to a plant manager.
3. **Avoidable vs. Committed**
   a. **Avoidable costs** are those that may be eliminated by not engaging in an activity or by performing it more efficiently. An example is direct materials cost, which can be saved by ceasing production.
   b. **Committed costs** arise from holding property, plant, and equipment. Examples are insurance, real estate taxes, lease payments, and depreciation. They are by nature long-term and cannot be reduced by lowering the short-term level of production.
4. **Incremental vs. Differential**
   a. **Incremental cost** is the additional cost inherent in a given decision. **Differential cost** is the difference in total cost between two decisions.
   b. EXAMPLE: A company must choose between introducing two new product lines.
      1) The incremental choice of the first option is the initial investment of $1.5 million; the incremental choice of the second option is the initial investment of $1.8 million.
      2) The differential cost of the two choices is $300,000.
   c. In practice, these two terms are often used interchangeably.
5. **Engineered vs. Discretionary**
   a. **Engineered costs** are those having a direct, observable, quantifiable cause-and-effect relationship between the level of output and the quantity of resources consumed.
      1) Examples are direct materials and direct labor.
   b. **Discretionary costs** are those characterized by an uncertainty in the degree of causation between the level of output and the quantity of resources consumed. They tend to be the subject of a periodic (e.g., annual) outlay decision.
      1) Examples are advertising and R&D costs.
6. **Outlay vs. Opportunity**
   a. **Outlay costs** require actual cash disbursements. Also called **explicit, accounting**, or **out-of-pocket costs**.
      1) An example is the tuition payment required to attend college.
   b. **Opportunity cost** is the maximum benefit forgone by using a scarce resource for a given purpose and not for the next-best alternative. Also called **implicit cost**.
      1) An example is the wages foregone by attending college instead of working full-time.
   c. **Economic cost** is the sum of explicit and implicit costs.
   d. **Imputed costs** are those that should be involved in decision making even though no transaction has occurred that would be routinely recognized in the accounts. They may be outlay or opportunity costs.
      1) An example is the profit lost as a result of being unable to fill orders because the inventory level is too low.

7. **Relevant vs. Sunk**
   a. **Relevant costs** are those future costs that will vary depending on the action taken. All other costs are assumed to be constant and thus have no effect on (are irrelevant to) the decision.
      1) An example is tuition that must be spent to attend a fourth year of college.
   b. **Sunk costs** are costs either already paid or irrevocably committed to incur. Because they are unavoidable and will therefore not vary with the option chosen, they are not relevant to future decisions.
      1) An example is three years of tuition already spent. The previous three years of tuition make no difference in the decision to attend a fourth year.
   c. **Historical cost** is the actual (explicit) price paid for an asset. Financial accountants rely heavily on it for balance sheet reporting.
      1) Because historical cost is a sunk cost, however, management accountants often find other (implicit) costs to be more useful in decision making.
8. **Joint vs. Separable**
   a. Often a manufacturing process involves processing a single input up to the point at which multiple end products become separately identifiable, called the **split-off point**.
      1) **Joint costs** are those costs incurred before the split-off point, i.e., since they are not traceable to the end products, they must be allocated.
      2) **Separable costs** are those incurred beyond the split-off point, i.e., once separate products become identifiable.
      3) **By-products** are products of relatively small total value that are produced simultaneously from a common manufacturing process with products of greater value and quantity (joint products).
   b. An example is petroleum refining.
      1) Costs incurred in bringing crude oil to the fractionating process are joint costs. The fractionating process is the split-off point.
      2) Once the oil has been refined into its separately identifiable end products (asphalt, diesel fuel, kerosene, etc.), all further costs are separable costs.
      3) If selling costs are lower than disposal costs, the sludge left over after the high-value products have been processed may be sold as a cheap lubricant. It is considered a by-product.
9. **Normal vs. Abnormal Spoilage**
   a. **Normal spoilage** is the spoilage that occurs under normal operating conditions. It is essentially uncontrollable in the short run.
      1) Since normal spoilage is expected under efficient operations, it is treated as a **product cost**, that is, it is absorbed into the cost of the good output.
   b. **Abnormal spoilage** is spoilage that is not expected to occur under normal, efficient operating conditions. The cost of abnormal spoilage should be separately identified and reported to management.
      1) Abnormal spoilage is typically treated as a **period cost** (a loss) because of its unusual nature.
10. **Rework, Scrap, and Waste**
    a. **Rework** consists of end products that do not meet standards of salability but can be brought to salable condition with additional effort.
       1) The decision to rework or discard is based on whether the **marginal revenue** to be gained from selling the reworked units exceeds the **marginal cost** of performing the rework.

b. **Scrap** consists of raw material left over from the production cycle but still usable for purposes other than those for which it was originally intended.

1) Scrap may be **used** for a different production process or may be **sold** to outside customers, usually for a nominal amount.

c. **Waste** consists of raw material left over from the production cycle for which there is no further use.

1) Waste is not salable at any price and must be **discarded**.

11. **Other Costs**

a. **Carrying costs** are the costs of storing or holding inventory. Examples include the cost of capital, insurance, warehousing, breakage, and obsolescence.

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

c. **Value-adding costs** are the costs of activities that cannot be eliminated without reducing the quality, responsiveness, or quantity of the output required by a customer or the organization.

12. **Manufacturing Capacity**

a. **Normal capacity** is the long-term average level of activity that will approximate demand over a period that includes seasonal, cyclical, and trend variations. Deviations in a given year will be offset in subsequent years.

b. **Practical capacity** is the maximum level at which output is produced efficiently. It allows for unavoidable delays in production for maintenance, holidays, etc. Use of practical capacity as a denominator value usually results in underapplied overhead because it always exceeds the actual level of use.

c. **Theoretical (ideal) capacity** is the maximum capacity assuming continuous operations with no holidays, downtime, etc.

3.4 COSTING TECHNIQUES

1. **Absorption vs. Variable Costing**

a. **Absorption costing** (sometimes called full or full absorption costing) treats all manufacturing costs as product costs.

1) The inventoried cost of the product thus includes all production costs, whether variable or fixed. This technique is **required for reporting under GAAP**.

2) **Gross margin** is the net of sales revenue and absorption cost of goods sold. It represents the amount **available to cover selling and administrative expenses**.

b. **Variable costing** (also called direct costing) considers only variable manufacturing costs to be product costs, i.e., inventoriable (the phrase “direct costing” is considered misleading because it implies traceability).

1) Fixed manufacturing costs are considered period costs and are thus expensed as incurred. This technique is **not allowed under GAAP** but is very useful for internal decision making.

2) **Contribution margin** is the net of sales revenue minus all variable costs (both manufacturing and S&A). It represents the amount **available to cover fixed costs**.

c. The illustration below highlights the differing treatment of the four main categories of cost.

1) The accounting for variable production costs and fixed selling and administrative expenses is identical under the two methods.

2) The **difference** lies in the varying treatment of **fixed production costs** and **variable selling and administrative expenses**.

Legend	Cost component
(a)	Variable production costs
(b)	Fixed production costs
(c)	Variable selling and administrative expenses
(d)	Fixed selling and administrative expenses

		Absorption Costing (Required under GAAP)		Variable Costing (For internal reporting only)	
	Sales		**$X,XXX**		**$X,XXX**
	Beg. finished goods inventory	$X,XXX		$X,XXX	
Product Costs	Add: variable production costs	X,XXX (a)		X,XXX (a)	
	Add: fixed production costs	X,XXX (b)		-	
	Goods available for sale	$X,XXX		$X,XXX	
	Less: end. finished goods inventory	(X,XXX)		(XXX)	
	Cost of goods sold		**$(X,XXX)**		**$(X,XXX)**
	Less: variable S&A expenses		-		(XXX) (c)
	Gross margin (abs.) / Contribution margin (var.)		**$X,XXX**		**$X,XXX**
Period Costs	Less: fixed production costs		-		(X,XXX) (b)
	Less: variable S&A expenses		(XXX) (c)		-
	Less: fixed S&A expenses		(XXX) (d)		(XXX) (d)
	Operating income		**$X,XXX**		**$X,XXX**

2. **Actual vs. Normal Costing**

a. **Actual costing** is the most accurate method of accumulating costs. However, it is also the least timely and most volatile method.

1) After the end of the production period, all actual costs incurred for a cost object are totaled; indirect costs are allocated.

2) Because per-unit costs depend on the level of production in a period, large fluctuations arise from period to period. This volatility can lead to the reporting of misleading financial information.

b. **Normal costing** charges actual direct materials and direct labor to a cost object, but applies overhead on the basis of budgeted (normalized) rates. This compensates for the fluctuations in unit cost inherent in actual costing.

c. **Extended normal costing** extends the use of normalized rates to direct material and direct labor, so that all three major input categories use normalized rates.

3. **Accumulating Manufacturing Costs**

a. **Job-order costing** is appropriate when producing products with individual characteristics or when identifiable groupings are possible.

1) Costs are attached to specific "jobs." Each job will result in a single, identifiable end product.

2) Examples are any industry that generates custom-built products, such as shipbuilding.

b. **Process costing** is used when similar products are mass produced on a continuous basis.

1) Costs are attached to specific departments or phases of production. Examples are automobile and candy manufacturing.

2) Since costs are attached to streams of products rather than individuals, process costing involves calculating an average cost for all units. The two widely used methods are weighted-average and first-in, first-out (FIFO).

3) Some units remain unfinished at the end of the period. For each department to adequately account for the costs attached to its unfinished units, the units must be restated in terms of equivalent units of production (EUP).

c. **Activity-based costing (ABC)** attaches costs to activities rather than to physical goods.

1) ABC is a response to the distortions of product cost information brought about by peanut-butter costing, which is the inaccurate averaging or spreading of costs like peanut butter over products or service units that use different amounts of resources.

a) A major cause of peanut-butter costing is the significant increase in indirect costs brought about by the increasing use of technology.

2) The difference between traditional (that is, volume-based) costing systems and ABC can be summarized as follows:

a) Under volume-based systems, a single pool collects all indirect costs and the total cost in the pool is then allocated to production.

b) Under ABC, by contrast, every activity that bears on the production process has its own cost pool. The costs in each pool are assigned based on a cost driver specific to the activity.

d. **Life-cycle costing** emphasizes the need to price products to cover all the costs incurred over the lifespan of a product, not just the costs of production.

1) Costs incurred before production, such as R&D and product design, are referred to as upstream costs.

2) Costs incurred after production, such as marketing and customer service, are called downstream costs.

4. **Standard Costing, Flexible Budgeting, and Variance Analysis**

a. **Standard costing** is a system designed to alert management when the actual costs of production differ significantly from target (“standard”) costs.

1) Standard costs are predetermined, attainable unit costs. A standard cost is not just an average of past costs, but an objectively determined estimate of what a cost should be.

2) Standard costs can be used with both job-order and process-costing systems.

b. **Flexible budgeting** is the calculation of the quantity and cost of inputs that should have been consumed given the achieved level of production.

1) Flexible budgeting supplements the **static budget**, which is the company’s best projection of the resource consumption and levels of output that will be achieved for an upcoming period.

c. The static and flexible budgets are compared to the **actual results** and the differences are calculated. These differences are referred to as **variances**.

1) Variance analysis enables **management by exception**, the practice of giving attention primarily to significant deviations from expectations (whether favorable or unfavorable).

5. **Allocating Joint Costs**

a. The **physical unit method** is the simplest. The total joint cost is allocated to the separable products in proportion to some physical measure, such as volume or weight. Total joint costs are multiplied by:

(Units of each product ÷ Total units)

b. The **sales-value at split-off method** is based upon each of the separable products' relative proportion of total sales value ultimately attributable to the period's production. Total joint costs are multiplied by:

(Estimated selling price at split-off ÷ Total selling price at split-off)

c. The **estimated net realizable value method** is a variation of the relative sales value method. The significant difference is that, under the estimated NRV method, all separable costs necessary to make the product salable are subtracted before the allocation is made. Total joint costs are multiplied by:

[(Estimated final price – Separable costs) ÷ Total estimated final price]

d. The **constant gross-margin percentage NRV method** is based on using the same gross margin percentage for all of the products. There are three steps under this method:

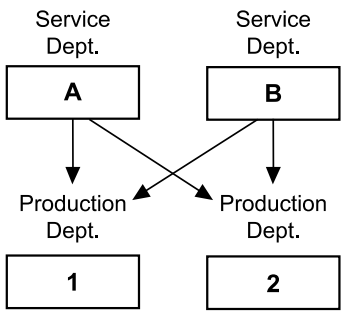
1) Determine the overall gross-margin percentage.
2) Subtract the appropriate gross margin from the final sales value of each product to calculate total costs for that product.
3) Subtract the separable costs to arrive at the joint cost amount.

6. **Allocating Service Department Costs**

a. The **direct method** is the simplest but least accurate of the methods.

1) All service department costs are allocated directly to production departments. No allocation is made of the cost of services rendered to other service departments.

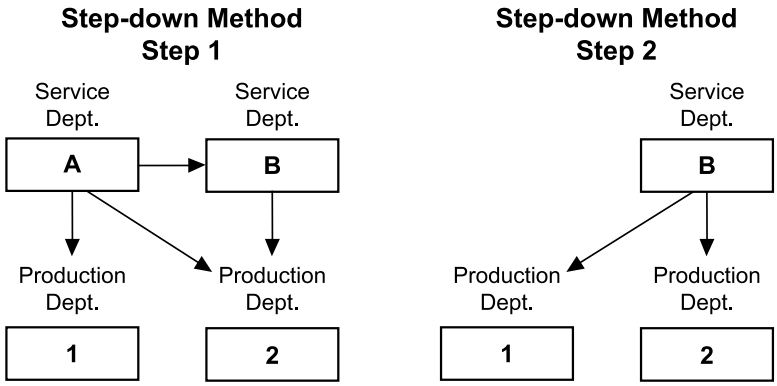
Direct Method



b. The **step-down method** is a sequential process. It is slightly more involved than the direct method but is more accurate.

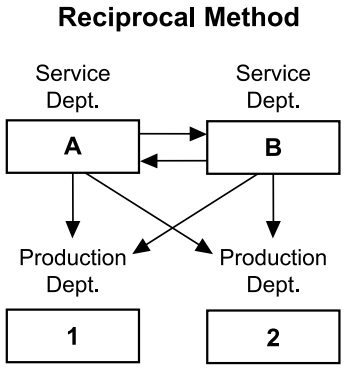
1) The service departments are allocated in order, from the one that provides the most service to other service departments down to the one that provides the least.

2) As each allocation is performed, the costs of the services departments are allocated to both the remaining service departments and the production departments.



c. The **reciprocal method** is by far the most complex and most accurate of the three methods.

1) Simultaneous equations are used to allocate each service department's costs among all other service departments and production departments.



7. **Miscellaneous**

a. **Target costing** is the practice of calculating the price for a product by adding the desired unit profit margin to the total unit cost. It is an adjunct concept of target pricing.

3.5 CORE CONCEPTS

Cost Management Terminology

- A **cost object** is any entity to which costs can be attached. A **cost driver** is the basis used to assign costs to a cost object. The cost driver is the cause of the cost.
- The **costs of manufacturing** a product can be classified as one of **three types**: direct materials, direct labor, and manufacturing overhead. Overhead typically consists of indirect materials, indirect labor, and factory operating costs.
- Manufacturing costs are often grouped as either **prime costs** (direct materials plus direct labor) or **conversion costs** (direct labor plus manufacturing overhead).
- Operating a manufacturing concern also requires the incurrence of **nonmanufacturing costs**, consisting of selling (marketing) costs and administrative expenses.
- **Product costs** (also called inventoriable costs) are capitalized as part of finished goods inventory. They eventually become a component of cost of goods sold. **Period costs** are expensed as incurred, i.e., they are not capitalized in finished goods inventory and are thus excluded from cost of goods sold.
- For **external reporting, all manufacturing costs** (direct materials, direct labor, variable overhead, and fixed overhead) must be treated as product costs, and all selling and administrative (S&A) costs must be treated as period costs. This approach is called absorption costing (also called full costing).
- For **internal reporting, only variable manufacturing costs** are capitalized as product costs. All other costs (variable S&A and the fixed portion of both production and S&A expenses) are treated as period costs. This approach is called variable costing (also called direct costing).
- **Direct costs** are ones that can be associated with a particular cost object in an economically feasible way, i.e., they can be **traced** to that object. **Indirect costs** are ones that cannot be associated with a particular cost object in an economically feasible way and thus must be **allocated** to that object.
- To simplify the allocation process, **indirect costs** are often collected in **cost pools**. A cost pool is an account into which a variety of similar cost elements with a common cause are accumulated. Manufacturing overhead is a commonly used example.

Cost Behavior and Relevant Range

- The **relevant range** defines the limits within which per-unit variable costs remain constant and fixed costs are not changeable. It is synonymous with the **short run**.
  - **Variable cost per unit** remains constant in the short run regardless of the level of production. **Variable costs in total**, on the other hand, vary directly and proportionally with changes in volume.
  - **Fixed costs in total** remain unchanged in the short run regardless of production level. **Fixed cost per unit**, on the other hand, varies indirectly with the activity level.
  - **Mixed (semivariable) costs** combine fixed and variable elements.
- **Marginal cost** is the cost incurred by a one-unit increase in the activity level of a particular cost driver. Necessarily then, marginal cost remains **constant across the relevant range**.

Cost Classification

- Cost of goods sold is a straightforward computation for a **retailer** because retailers have only a **single class of inventory**. The calculation is more complex for a **manufacturer** because manufacturers have **three distinct classes of inventory**. The manufacturer's cost of goods manufactured is analogous to the retailer's purchases account.
- Costs can be defined in **conceptual groupings**.
  - Controllable vs. noncontrollable costs
  - Avoidable vs. committed costs
  - Incremental vs. differential cost
  - Engineered vs. discretionary costs
  - Outlay vs. opportunity cost (explicit vs. implicit)
  - Economic vs. imputed cost
  - Relevant vs. sunk costs (historical cost is a sunk cost)
- **Manufacturing processes** their own particular cost groups.
  - Joint costs, separable costs, and by-products
  - Normal vs. abnormal spoilage
  - Rework, scrap, and waste

Costing Techniques

- Absorption vs. Variable Costing
  - **Absorption costing** treats all manufacturing costs as product costs. The inventoried cost of the product thus includes all production costs, whether variable or fixed. This technique is required under GAAP.
  - **Variable costing** considers only variable manufacturing costs to be product costs, i.e., inventoriable. Fixed manufacturing costs are considered period costs and are thus expensed as incurred. This technique is permitted for internal reporting only.
- Normalized Costing
  - **Actual costing** is the most accurate, but also the least timely and most volatile, method of accumulating costs.
  - **Normal costing** charges actual direct materials and direct labor to a cost object, but applies overhead on the basis of budgeted (normalized) rates.
  - **Extended normal costing** extends the use of normalized rates to manufacturing overhead so that all three major input categories use normalized rates.
- Cost Accumulation Systems
  - **Job-order costing** for manufacturing customized products
  - **Process costing** for mass production
  - **Activity-based costing (ABC)** when overhead is a high proportion of the total cost
  - **Life-cycle costing** to track a product's lifetime costs
- **Standard costing** is a system designed to alert management when the actual costs of production differ significantly from target ("standard") costs. Standard costs are predetermined, attainable unit costs.
- Four methods for **allocating joint costs** are
  - Physical unit method
  - Sales-value at split-off method
  - Estimated net realizable value (NRV) method
  - Constant gross-margin percentage NRV method
- Three methods for **allocating service department costs** are in common use:
  - Direct method
  - Step-down method
  - Reciprocal method

STUDY UNIT FOUR
COST ACCUMULATION SYSTEMS

This study unit is the **second of four** on **cost management**. The relative weight assigned to this major topic in Part 1 of the exam is **25%**. The four study units are

Study Unit 3: Cost Management Terminology and Concepts
Study Unit 4: Cost Accumulation Systems
Study Unit 5: Cost Allocation Techniques
Study Unit 6: Operational Efficiency and Business Process Performance

After studying the outline and answering the questions in this study unit, you will have the skills necessary to address the following topics listed in the ICMA's Learning Outcome Statements:

Part 1 – Section C.1. Measurement concepts

The candidate should be able to:

Statement a. is covered in Study Unit 3.

b. identify cost objects and cost pools and assign costs to appropriate activities
c. demonstrate an understanding of the nature and types of cost drivers and the causal relationship that exists between cost drivers and costs incurred
d. demonstrate an understanding of the various methods for measuring costs and accumulating work-in-process and finished goods inventories

Statements e. through l. are covered in Study Unit 5.

Part 1 – Section C.2. Costing systems

For each cost accumulation system identified (job-order costing, process costing, activity-based costing, life-cycle costing), the candidate should be able to:

a. define the nature of the system, understand the cost flows of the system, and identify its appropriate use
b. calculate inventory values and cost of goods sold
c. demonstrate an understanding of the proper accounting for normal and abnormal spoilage
d. discuss the strategic value of cost information regarding products and services, pricing, overhead allocations, and other issues
e. identify and describe the benefits and limitations of each cost accumulation system

For the following specific cost accumulation systems, the candidate should be able to:

f. demonstrate an understanding of the concept of equivalent units in process costing and calculate the value of equivalent units
g. define the elements of activity-based costing such as cost pool, cost driver, resource driver, activity driver, and value-added activity
h. calculate product cost using an activity-based system and compare and analyze the results with costs calculated using a traditional system

i. explain how activity based costing can be utilized in service firms
j. demonstrate an understanding of the concept of the life-cycle costing and the strategic value of including upstream costs, manufacturing costs, and downstream costs

4.1 JOB-ORDER COSTING

1. Job-order costing is concerned with **accumulating costs by specific job**.
   a. This method is appropriate when producing products with individual characteristics (e.g., yachts), or when identifiable groupings are possible (e.g., jewelry). Units (jobs) should be dissimilar enough to warrant the special record keeping required by job-order costing.
2. The first step in the process is the receipt of a **sales order** from a customer requesting a product or special group of products.
   a. The sales order is approved and a **production order** is issued.
3. Costs are recorded by classification, such as direct materials, direct labor, and manufacturing overhead, on a **job cost sheet** (may be manual or automated), which is specifically prepared for each job.
   a. The physical inputs required for the production process are obtained from suppliers.

Raw materials	$XXX	
Accounts payable		$XXX

   b. Production commences and three "documents" feed cost amounts into the costing system:
      1) **Materials requisition forms** request **direct materials** to be pulled from the warehouse and sent to the production line.

Work-in-process -- Job 1015	$XXX	
Raw materials		$XXX

      2) **Time tickets** track the **direct labor** that workers expend on various jobs.

Work-in-process -- Job 1015	$XXX	
Wages payable		$XXX

      3) These two major components of product cost are charged to work-in-process using the **actual amounts** incurred.
   c. Under job-order costing, the third component, **manufacturing overhead**, is charged using an **estimated rate**.
      1) The application of an estimated overhead rate is necessary under job-order costing because the outputs are customized and the processes vary from period to period.
         a) Contrast this with the treatment of overhead under process costing (item 2.f. in Subunit 4.2) in which actual overhead costs incurred are charged to work-in-process at the end of the period.

2) As indirect costs are paid throughout the year, they are collected in the **manufacturing overhead control account**.

a) Note that work-in-process is not affected when actual overhead costs are incurred.

Manufacturing overhead control	$XXX	
Property taxes payable		$XXX
Manufacturing overhead control	$XXX	
Prepaid insurance		$XXX
Manufacturing overhead control	$XXX	
Accumulated depreciation -- factory equipment		$XXX

3) Overhead costs are applied to ("absorbed" by) each job based on a **predetermined overhead application rate** for the year (such as $5 per direct labor hour, or machine hour, etc., or based on an activity-based costing system).

a) At the beginning of the year, an estimate is made of the total amount that will be spent for manufacturing overhead during that year.

b) This total is divided by the allocation base, such as direct labor hours or machine hours, to arrive at the application rate.

c) The amount applied equals the number of units of the allocation base used during the period times the application rate.

i) The credit is to manufacturing overhead applied, a contra-account for manufacturing overhead control.

Work-in-process -- Job 1015	$XXX	
Manufacturing overhead applied		$XXX

d) By tracking the amounts applied to the various jobs in a separate account, the actual amounts spent on overhead are preserved in the balance of the overhead control account.

i) In addition, the firm can determine at any time how precise its estimate of overhead costs for the period was by comparing the balances in the two accounts. The closer they are (in absolute value terms), the better the estimate was.

4) At the **end of the period**, the overhead control and applied accounts are **netted**.

a) If the result is a **credit**, overhead was **overapplied** for the period. If the result is a **debit**, overhead was **underapplied**.

i) If the variance is **immaterial**, it can be closed directly to cost of goods sold.

ii) If the variance is **material**, it should be allocated based on the relative values of work-in-process, finished goods, and cost of goods sold.

d. The amounts from the input documents are accumulated on **job-cost sheets**. These serve as a subsidiary ledger page for each job.

1) The total of all job-cost sheets will equal the balance in the general ledger work-in-process account.

2) Once the job is completed, but before it is delivered to the customer, the job cost sheet serves as the subsidiary ledger for the finished goods inventory account.

4. Output that does not meet the quality standards for salability is considered spoilage.
   a. If the spoilage is the amount expected in the ordinary course of production, it is considered **normal spoilage**.
      1) The accounting treatment is to include normal spoilage as a product cost.
      2) This is accomplished by allowing the net cost of the spoilage to remain in the work-in-process account of the job that generated it.
         a) If the normal spoilage is worthless and must be discarded, no entry is made.
         b) If the normal spoilage can be sold, the entry is:

Spoiled inventory (at fair market value)	$XX	
Work-in-process -- Job 1015		$XX

   b. If the spoilage is over and above the amount expected in the ordinary course of production, it is considered **abnormal spoilage**.
      1) The accounting treatment is to highlight abnormal spoilage as a period cost so that management can address the deficiency that caused it.
      2) This is accomplished by charging a loss account for the net cost of the spoilage.
         a) If the abnormal spoilage is worthless and must be discarded, the entry is:

Loss from abnormal spoilage (costs up to point of inspection)	$XX	
Work-in-process -- Job 1015		$XX

         b) If the abnormal spoilage can be sold, the entry is:

Spoiled inventory	$XX	
Loss from abnormal spoilage (difference)	XX	
Work-in-process -- Job 1015 (costs up to point of inspection)		$XX

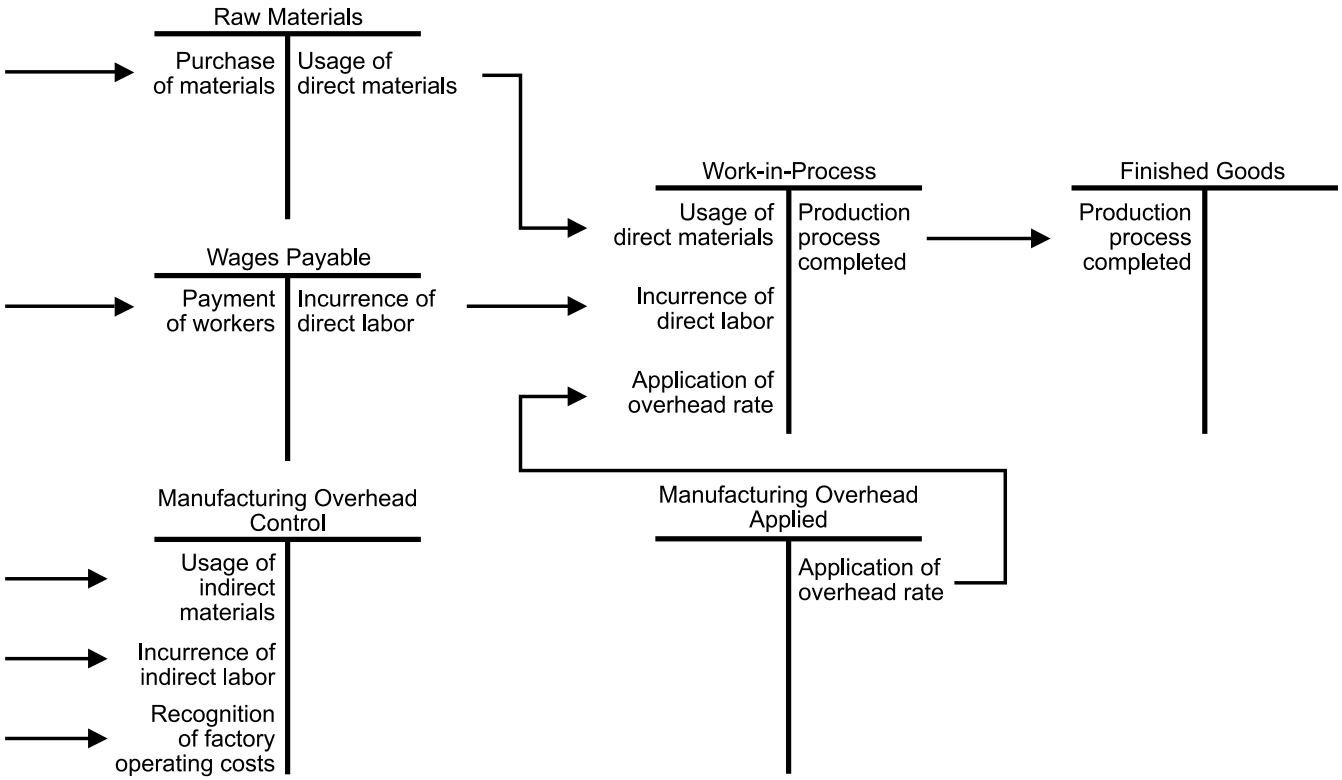
5. When a **job order is completed**, all the costs are transferred to finished goods.

Finished goods	$X,XXX	
Work-in-process -- Job 1015		$X,XXX

6. When the **output is sold**, the appropriate portion of the cost is transferred to cost of goods sold.

Cost of goods sold	$X,XXX	
Finished goods		$X,XXX

7. The following diagram depicts the **flow of cost accumulation** in a job-order costing system:



4.2 PROCESS COSTING

1. Process cost accounting is used to assign costs to inventoriable goods or services. It is applicable to **relatively homogeneous products** that are mass produced on a continuous basis (e.g., petroleum products, thread, computer monitors).
   a. Where job-order costing uses subsidiary ledgers to keep track of specific jobs, process costing typically has a **work-in-process account for each department** through which the production of output passes.
   b. Process costing is an averaging process that calculates the average cost of all units:
      1) Costs are accumulated for a cost object that consists of a large number of similar units of goods or services;
      2) Work-in-process is stated in terms of equivalent units;
      3) Unit costs are established.
2. The accumulation of costs under a process costing system is **by department rather than by project**. This reflects the continuous, homogeneous nature of the manufacturing process.
   a. As in job-order costing, the physical inputs required for the production process are obtained from suppliers.

Raw materials	$XXX	
Accounts payable		$XXX

   b. **Direct materials** are used by the first department in the process.

Work-in-process -- Department A	$XXX	
Raw materials		$XXX

c. **Conversion costs** are the sum of direct labor and manufacturing overhead. The nature of process costing makes this accounting treatment more efficient (the implications of this for the calculation of unit quantities are covered in item 4. on the next page).

Work-in-process -- Department A	$XXX	
Wages payable (direct and indirect labor)		$XXX
Manufacturing supplies (indirect materials)		XXX
Property taxes payable		XXX
Prepaid insurance		XXX
Accumulated depreciation -- factory equipment		XXX

d. The products **move from one department** to the next.

Work-in-process -- Department B	$XXX	
Work-in-process -- Department A		$XXX

e. The **second department adds** more direct materials and more conversion costs.

Work-in-process -- Department B	$XXX	
Raw materials		$XXX

Work-in-process -- Department B	$XXX	
Wages payable (direct and indirect labor)		$XXX
Manufacturing supplies (indirect materials)		XXX
Property taxes payable		XXX
Prepaid insurance		XXX
Accumulated depreciation -- factory equipment		XXX

f. Because manufacturing overhead is assigned to work-in-process as part of conversion costs, there is **rarely an overhead control or overhead applied account** under process costing, and the issue of over- or underapplied overhead does not arise.

1) The exception is when a standard costing system is used. Under standard costing, a predetermined overhead rate (as in job-order costing) is used to assign overhead costs.

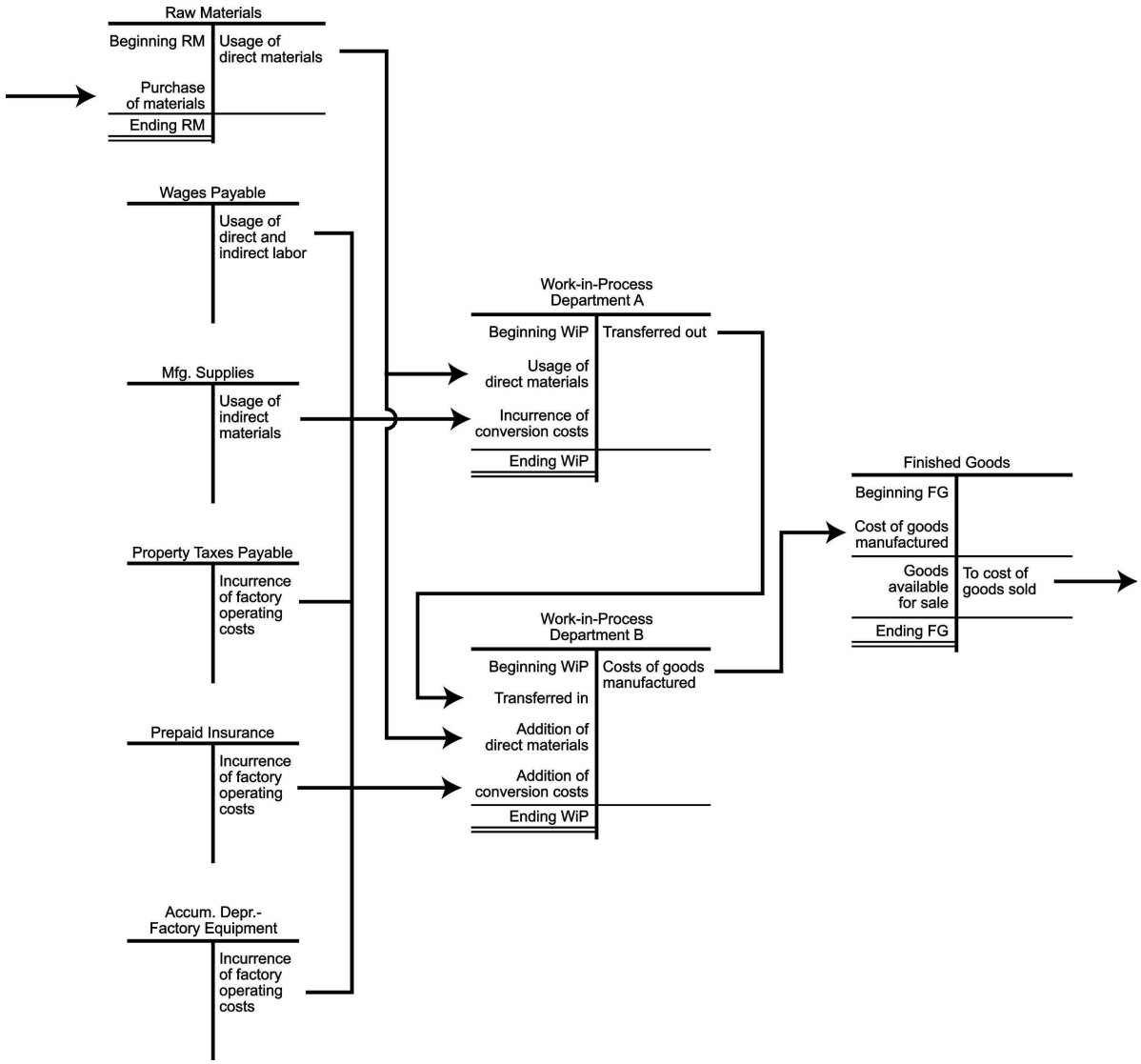
g. When processing is finished in the last department, all the costs are transferred to **finished goods**.

Finished goods	$X,XXX	
Work-in-process -- Department B		$X,XXX

h. As **products are sold**, the costs are transferred to cost of goods sold.

Cost of goods sold	$X,XXX	
Finished goods		$X,XXX

3. The following diagram depicts the **flow of cost accumulation** in a process costing system:



4. Some units remain unfinished at the end of the period. For each department to account adequately for the costs attached to its unfinished units, the units must be restated in terms of equivalent units of production.

   a. **Equivalent units of production (EUP)** is the number of complete goods that could have been produced using the inputs consumed during the period.

      1) The EUP conversion is a two-phase process: First, the **equivalent units** are determined, then the **per-unit cost** is calculated.

      2) The two calculations are made separately for direct materials and conversion costs (transferred-in costs are by definition 100% complete). Conversion costs are assumed to be uniformly incurred.

b. Two methods of calculating EUP are in common use: weighted-average and FIFO.

1) Under the **weighted-average method**, units in beginning work-in-process inventory are treated as if they were started and completed during the current period.

2) Under the **first-in, first-out (FIFO) method**, units in beginning work-in-process inventory are part of the EUP calculation. The calculation is thus more complex than weighted-average but tends to be more accurate.

5. EXTENDED EXAMPLE: A department of a manufacturing concern is preparing its cost reports for the month.

a. The first step is to prepare a quantity schedule. The quantity schedule reconciles the number of units that were worked on during the period with the status of those units at the end of the period.

	Units	Completed for Direct Materials	Completed for Conversion Costs
Beginning work-in-process	2,000	80%	40%
Units started during period	8,000		
Units to account for	10,000		
Units transferred to next department	9,000		
Ending work-in-process	1,000	90%	70%
Units accounted for	10,000		

b. Using the information in the quantity schedule, the equivalent units of production can be calculated.

1) In all EUP calculations, **three "populations" of units must be accounted for**:

a) Those in beginning work-in-process inventory
b) Those started and completed during the current period
c) Those remaining uncompleted in ending work-in-process inventory

2) Moreover, there are **two possible treatments of direct materials**. In some processes, all direct materials are added at the beginning of production. In other processes, materials are added evenly throughout the process.

c. When **direct materials are added at the beginning of the process**

1) Under weighted-average, prior period and current period costs are both considered. Thus, direct materials costs embedded in beginning WIP, as well as those added during the period, are used in the calculation.

2) Under FIFO, only current period activity is considered. Since all DM were added in the previous period, no DM costs are added in the current period.

3) Under both methods, ending WIP is by definition 100% complete.

EUP for direct materials -- added at beginning of process:

	Weighted Average		FIFO	
Beginning WIP	2,000 units × 100% (a)	= 2,000	2,000 units × 0% (c)	= 0
Started and completed	7,000 units × 100%	= 7,000	7,000 units × 100%	= 7,000
Ending WIP	1,000 units × 100% (b)	= 1,000	1,000 units × 100% (d)	= 1,000
Totals	10,000	**10,000**	10,000	**8,000**

(a) Always 100%
(b) Degree of completeness
(c) Needed to complete
(d) Degree of completeness

d. When **direct materials are added evenly throughout the process**

1) Under weighted-average, the treatment of beginning WIP is the same as that when materials are added at the beginning (i.e., all units treated as started and completed in the current period).

2) Under FIFO, the costs incurred in the current period for beginning WIP are only those needed to complete them.

3) Under both methods, ending WIP uses the percentage of completion.

EUP for direct materials -- added throughout process:

	Weighted Average					FIFO				
Beginning WIP	2,000 units	×	100% (a)	=	2,000	2,000 units	×	20% (c)	=	400
Started and completed	7,000 units	×	100%	=	7,000	7,000 units	×	100%	=	7,000
Ending WIP	1,000 units	×	90% (b)	=	900	1,000 units	×	90% (d)	=	900
Totals	10,000				**9,900**	10,000				**8,300**

(a) Always 100%
(b) Degree of completeness
(c) Needed to complete
(d) Degree of completeness

e. **Conversion costs** by their nature are added evenly throughout the process. The treatment of all three populations is thus the same as that for materials added throughout.

EUP for conversion costs:

	Weighted Average					FIFO				
Beginning WIP	2,000 units	×	100% (a)	=	2,000	2,000 units	×	60% (c)	=	1,200
Started and completed	7,000 units	×	100%	=	7,000	7,000 units	×	100%	=	7,000
Ending WIP	1,000 units	×	70% (b)	=	700	1,000 units	×	70% (d)	=	700
Totals	10,000				**9,700**	10,000				**8,900**

(a) Always 100%
(b) Degree of completeness
(c) Needed to complete
(d) Degree of completeness

f. The costs to be allocated are presented in this table:

	Direct Materials	Conversion Costs
Beginning work-in-process	$25,000	$10,000
Added during the month	55,000	50,000

g. The per-unit costs under each of the two methods can now be derived.

1) Under the **weighted-average** method, **all direct materials and conversion costs** are averaged in, both those incurred in the current period and those in beginning work-in-process.

2) Under the **FIFO** method, **only the costs incurred in the current period** are included in the calculation, because only the work performed in the current period is included in EUP.

Per-unit costs -- direct materials added at beginning of process:

	Weighted-average		FIFO	
Direct materials:	$25,000 + $55,000 / 10,000 EUP	= $8.000	$55,000 / 8,000 EUP	= $6.875
Conversion costs:	$10,000 + $50,000 / 9,700 EUP	= $6.186	$50,000 / 8,900 EUP	= $5.618
Total per-unit cost		**$14.186**		**$12.493**

Per-unit costs -- direct materials added throughout process:

	Weighted-average		FIFO	
Direct materials:	$25,000 + $55,000 / 9,900 EUP	= $8.081	$55,000 / 8,300 EUP	= $6.627
Conversion costs:	$10,000 + $50,000 / 9,700 EUP	= $6.186	$50,000 / 8,900 EUP	= $5.618
Total per-unit cost		**$14.267**		**$12.245**

h. The final step is the valuation of ending inventory. Physical, not equivalent, units are used:

Ending inventory valuation -- direct materials added at beginning:

Weighted-average	$14.186	× 1,000 units	= $14,186
FIFO	$12.493	× 1,000 units	= $12,493

Ending inventory valuation -- direct materials added throughout:

Weighted-average	$14.267	× 1,000 units	= $14,267
FIFO	$12.245	× 1,000 units	= $12,245

6. **Spoilage** in Process Costing

a. As with job-order costing, the cost of a **normal** level of spoilage is left in cost of goods sold; **abnormal** spoilage is recognized separately as a loss.

b. Recognizing the loss resulting from abnormal spoilage under process costing is a multi-step process.

1) The manufacturer establishes **inspection points**, that is, the places in the production process where those goods not meeting specifications are pulled from the process. This is in contrast to job-order costing, in which a unit can be judged to be spoiled at any time.

a) The typical arrangement is to inspect units as they are being transferred from one department to the next. This way, **each department** has its own amount of spoilage, calculated using its own equivalent-unit costs.

2) The loss is equal to the number of units of abnormal spoilage multiplied by the department's equivalent-units costs, whether weighted-average or FIFO.

Loss on abnormal spoilage	$XXX	
Work-in-process -- Department A		$XXX

3) The following calculations serve as a check that all costs have been accounted for.

Weighted-Average

Costs in beginning WiP:				
Direct materials	$XX,XXX			
Conversion costs	XX,XXX			
Total costs in beginning WiP		$ XX,XXX		
Costs added in current period:			Cost of good units transferred out	$XXX,XXX
Direct materials	XX,XXX		Normal spoilage	XX,XXX
Conversion costs	XX,XXX		Abnormal spoilage	XX,XXX
Total costs added in current period		XX,XXX	Ending WiP	XX,XXX
Total costs to account for		$XXX,XXX	Total costs accounted for	$XXX,XXX

FIFO

Costs in beginning WiP		$ XX,XXX	Total from beginning WiP	$ XX,XXX
Costs added in current period:			Started and completed	XX,XXX
Direct materials	$XX,XXX		Normal spoilage	XX,XXX
Conversion costs	XX,XXX		Abnormal spoilage	XX,XXX
Total costs added in current period		XX,XXX	Ending WiP	XX,XXX
Total costs to account for		$XXX,XXX	Total costs accounted for	$XXX,XXX

4.3 ACTIVITY-BASED COSTING

1. **Activity-based costing (ABC)** is a response to the significant increase in the incurrence of indirect costs resulting from the rapid advance of technology.
   a. ABC is a **refinement of an existing costing system** (job-order or process).
      1) Under a traditional (volume-based) costing system, overhead is simply dumped into a single cost pool and spread evenly across all end products.
      2) Under ABC, indirect costs are attached to activities that are then rationally allocated to end products.
   b. ABC may be used by manufacturing, service, or retailing entities.
2. The inaccurate averaging or spreading of indirect costs over products or service units that use different amounts of resources is called **peanut-butter costing**.
   a. Peanut-butter costing results in **product-cost cross-subsidization**, the condition in which the miscosting of one product causes the miscosting of other products.
   b. The peanut-butter effect of using a **traditional (i.e., volume-based) costing system** can be summarized as follows:
      1) Direct labor and direct materials are traced to products or service units.
      2) A single pool of indirect costs (overhead) is accumulated for a given organizational unit.
      3) Indirect costs from the pool are assigned using an allocative (rather than a tracing) procedure, such as using a single overhead rate for an entire department, e.g., $3 of overhead for every direct labor hour.
         a) The effect is an averaging of costs that may result in significant inaccuracy when products or service units do not use similar amounts of resources.

3. EXAMPLE: The effect of product-cost cross-subsidization can be illustrated as follows:
   a. A company produces two similar products.
      1) Both products require one unit of raw material and one hour of direct labor. Raw materials costs are $14 per unit, and direct labor is $70 per hour.
   b. During the month just ended, the company produced 1,000 units of Product A and 100 units of Product B. Manufacturing overhead for the month totaled $20,000.
   c. Using direct labor hours as the overhead allocation base, per-unit costs and profits are calculated as follows:

	Product A	Product B	Total
Raw materials	$ 14,000	$ 1,400	
Direct labor	70,000	7,000	
Overhead {$20,000 × [$70,000 ÷ ($70,000 + $7,000)]}	18,182		
Overhead {$20,000 × [$7,000 ÷ ($70,000 + $7,000)]}		1,818	
Total costs	**$102,182**	**$ 10,218**	**$112,400**
Selling price	$ 119.99	$ 119.99	
Cost per unit	(102.18)	(102.18)	
Profit per unit	**$ 17.81**	**$ 17.81**	

   d. The company's management accountants have determined that overhead consists almost entirely of production line setup costs, and that the two products require equal setup times. Allocating overhead on this basis yields vastly different results.

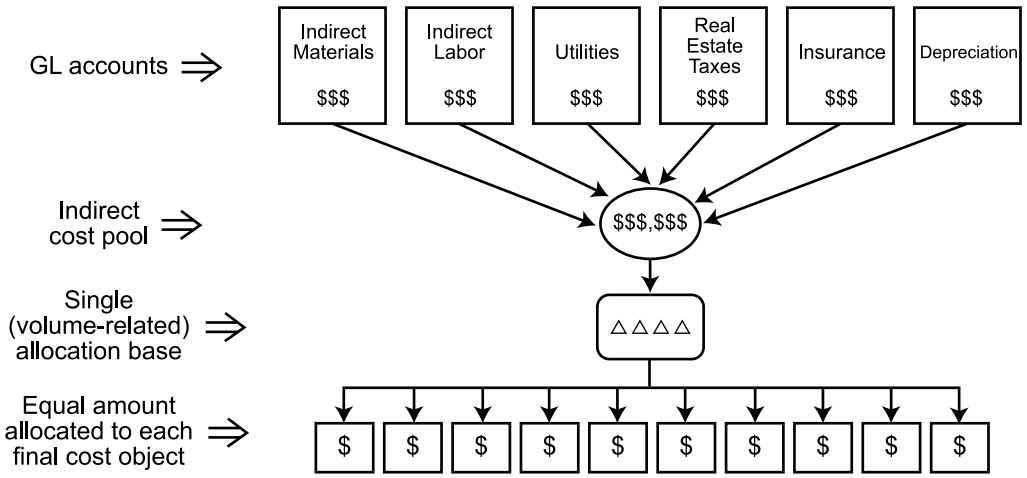
	Product A	Product B	Total
Raw materials	$14,000	$ 1,400	
Direct labor	70,000	7,000	
Overhead ($20,000 × 50%)	10,000		
Overhead ($20,000 × 50%)		10,000	
Total costs	**$94,000**	**$18,400**	**$112,400**
Selling price	$119.99	$119.99	
Cost per unit	(94.00)	(184.00)	
Profit per unit	**$ 25.99**	**$ (64.01)**	

   e. Rather than the comfortable profit the company believed it was making on both products using peanut-butter costing, it becomes clear that the company is losing money on every unit of Product B that it sells. The high-volume Product A has been heavily subsidizing the setup costs for the low-volume Product B.

4. The previous example assumed a single component of overhead for clarity. In reality, overhead is made up of many components.

   a. The **peanut-butter effect** of traditional overhead allocation is illustrated in the following diagram:

Overhead Allocation in a Traditional (Volume-Based) Cost Accumulation System



5. Volume-based systems were appropriate throughout the decades when direct costs were the bulk of manufacturing costs. With **increasing automation**, however, overhead became an ever greater percentage of the total. ABC was developed to deal with this increasing complexity of overhead costs.

   a. **Volume-based systems**, as illustrated above, involve

      1) Accumulating costs in **general ledger accounts** (utilities, taxes, etc.),
      2) Using a **single cost pool** to combine the costs in all the related accounts,
      3) Selecting a **single driver** to use for the entire indirect cost pool, and
      4) Allocating the indirect cost pool to **final cost objects**.

   b. **Activity-based systems**, by contrast, involve

      1) Identifying organization **activities** that constitute overhead,
      2) Assigning the costs of **resources** consumed by the activities, and
      3) Assigning the costs of the activities to **final cost objects**.

6. **Step 1 – Activity Analysis**

   a. An **activity** is a set of work actions undertaken within the entity, and a **cost pool** is established for each activity.

   b. Activities are classified in a **hierarchy** according to the level of the production process at which they take place.

      1) **Unit-level activities** are performed for each unit of output produced. Examples are using direct materials and using direct labor.
      2) **Batch-level activities** occur for each group of outputs produced. Examples are materials ordering, materials handling, and production line setup.
      3) **Product-sustaining** (or service-sustaining) **activities** support the production of a particular product (or service), irrespective of the level of production. Examples are product design, engineering changes, and testing.
      4) **Facility-sustaining activities** concern overall operations and therefore cannot be traced to products at any point in the production process. Examples are accounting, human resources, maintenance of physical plant, and safety/ security arrangements.

c. EXAMPLE: Fabulous Foundry uses a job-order system to accumulate costs for the custom pipe fittings of all sizes that it produces.

1) Since the 1950s, Fabulous has accumulated overhead costs in six general ledger accounts (indirect materials, indirect labor, utilities, real estate taxes, insurance, and depreciation), combined them into a single indirect cost pool, and allocated the total to its products based on machine hours.

a) At the time this system was established, overhead was a relatively small percentage of the foundry's total manufacturing costs.

b) With increasing reliance on robots in the production process and computers for monitoring and control, overhead is now a greater percentage of the total while direct labor costs have shrunk.

2) To obtain better data about product costs, Fabulous has decided to refine its job-order costing system by switching to activity-based costing for the allocation of overhead.

a) The foundry's management accountants conducted extensive interviews with production and sales personnel to determine how the incurrence of indirect costs can be viewed as activities that consume resources.

b) The accountants identified five activities and created a cost pool for each to capture the incurrence of indirect costs:

Activity	**Hierarchy**
Product design	Product-sustaining
Production setup	Batch-level
Machining	Unit-level
Inspection & testing	Unit-level
Customer maintenance	Facility-sustaining

7. **Step 2 – Assign Resource Costs to Activities**

a. Once the activities are designated, the next step in enacting an ABC system is to **assign the costs of resources** to the activities. This is termed **first-stage allocation**.

b. **Identifying resource costs** is not the simple matter it is in volume-based overhead allocation (where certain GL accounts are designated for combination into a single cost pool).

1) A **separate accounting system** may be necessary to track resource costs separately from the general ledger.

c. Once the resources have been identified, resource drivers are designated to allocate resource costs to the activity cost pools.

1) **Resource drivers** are measures of the resources consumed by an activity.

d. EXAMPLE: Fabulous Foundry's management accountants identified the following resources used by its indirect cost processes:

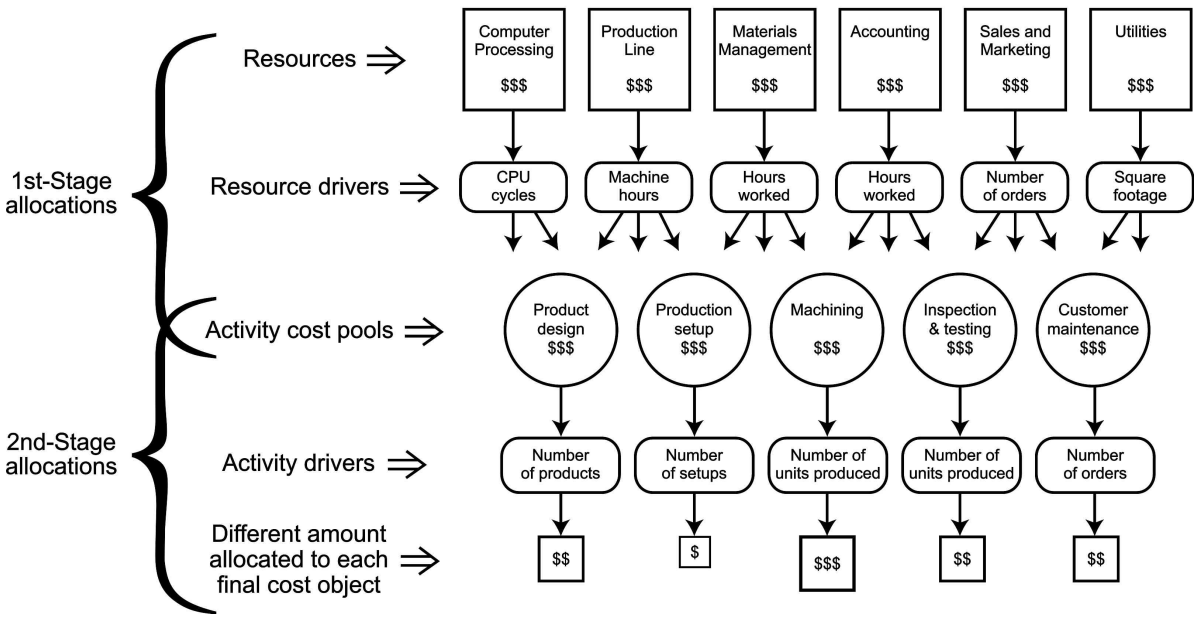
Resource	**Driver**
Computer processing	CPU cycles
Production line	Machine hours
Materials management	Hours worked
Accounting	Hours worked
Sales & marketing	Number of orders

8. **Step 3 – Allocate Activity Cost Pools to Final Cost Objects**
   a. The final step in enacting an ABC system is **allocating the activity cost pools** to final cost objects. This is termed **second-stage allocation**.
   b. Costs are reassigned to final-stage (or, if intermediate cost objects are used, next-stage) cost objects on the basis of activity drivers.
      1) **Activity drivers** are measures of the demands made on an activity by next-stage cost objects, such as the number of parts in a product used to measure an assembly activity.
      2) EXAMPLE: Fabulous Foundry's management accountants have designated these drivers to associate with their corresponding activities:

Activity	**Driver**
Product design	Number of products
Production setup	Number of setups
Machining	Number of units produced
Inspection & testing	Number of units produced
Customer maintenance	Number of orders

9. The differences between traditional overhead allocation and activity-based costing are illustrated in the following diagram:

Indirect Cost Assignment in an Activity-Based Costing System



10. **Drivers** (both resource and activity) must be chosen on the basis of a **cause-and-effect relationship** with the resource or activity cost being allocated, not simply a high positive correlation.
    a. A **cost object** may be a job, product, process, activity, service, or anything else for which a cost measure is desired.
    b. **Intermediate cost objects** receive temporary accumulations of costs as the cost pools move from their originating points to the final cost objects.
       1) For example, work-in-process is an intermediate cost object, and finished salable goods are final cost objects.

11. Design of an ABC system starts with process value analysis, a comprehensive understanding of how an organization generates its output.
    a. A **process value analysis** involves a determination of which activities that use resources are value-adding or nonvalue-adding and how the latter may be reduced or eliminated.
        1) A **value-adding activity** contributes to customer satisfaction or meets a need of the entity. The perception is that it cannot be omitted without a loss of the quantity, quality, or responsiveness of output demanded by the entity or its customers.
        2) A **nonvalue-adding activity** does not make such a contribution. It can be eliminated, reduced, or redesigned without impairing the quantity, quality, or responsiveness of the product or service desired by customers or the entity.
    b. The linkage of product costing and continuous improvement of processes is **activity-based management (ABM)**. It encompasses driver analysis, activity analysis, and performance measurement.
12. Using the four-level driver-analysis model, activities are grouped, and drivers are determined for the activities.
    a. Within each grouping of activities, the cost pools for activities that can use the same driver are combined into **homogeneous cost pools**.
        1) In contrast, traditional systems assign costs largely on the basis of unit-level drivers.
    b. A difficulty in applying ABC is that, although the first three levels of activities (unit-, batch-, and product-level) pertain to specific products or services, facility-level activities do not.
        1) Thus, **facility-level costs** are not accurately assignable to products or services. The theoretically sound solution may be to treat these costs as **period costs**.
        2) Nevertheless, organizations that apply ABC ordinarily assign them to products or services to obtain a full-absorption cost suitable for external financial reporting in accordance with GAAP.
13. An **advantage** of ABC is that product costing is improved, making for better decision making.
    a. The process value analysis performed as part of ABC provides information for eliminating or reducing nonvalue-adding activities (e.g., scheduling production, moving components, waiting for the next operating step, inspecting output, or storing inventories).
        1) The result is therefore not only more accurate cost assignments, especially of overhead, but also better cost control and more efficient operations.
    b. A **disadvantage** of ABC is the increased time and effort needed to:
        1) Maintain a separate accounting system to capture resource costs.
        2) Design and implement drivers and cost pools.
        3) ABC-derived costs of products or services **may not conform with GAAP**; for example, ABC may assign research costs to products but not such traditional product costs as plant depreciation, insurance, or taxes.
14. **Organizations most likely to benefit** from using ABC are those with products or services that vary significantly in volume, diversity of activities, and complexity of operations; relatively high overhead costs; or operations that have undergone major technological or design changes.

a. Although the previous illustrations have assumed a manufacturing operation, **service organizations** can also use ABC and most of the advantages will be similar. However, service organizations may have some difficulty in implementing ABC because they tend to have relatively high facility-level costs that are difficult to assign to specific service units.

1) Service organizations also engage in many nonuniform human activities for which information is not readily accumulated.
2) Moreover, output measurement is more problematic in service than in manufacturing entities.
3) Nevertheless, ABC has been adopted by various insurers, banks, railroads, and healthcare providers.

15. Direct labor (hours or dollars) has long been the most common base for allocating overhead because of the simplicity of the calculation, but it is not always relevant.

a. Companies now use dozens of different allocation bases depending upon how activity affects overhead costs. One company reported that it used 37 different bases to allocate overhead, some of which were averages of several activities.
b. In principle, a separate overhead account or subsidiary ledger account should be used for each type of overhead.
c. In the past, "people were cheap and machines were expensive." This meant that direct labor was ordinarily a larger component of total production cost than overhead and was the activity that drove (caused) overhead costs.

1) Due to the lowered cost of computers and robotics and the expansion of employee benefits ("machines are cheap and people are expensive"), overhead is more likely to be a large component of total production cost, with direct labor often a small percentage.
2) Most overhead costs vary in proportion to product diversity and the complexity of an operation.

a) Direct labor is not a cost driver for most overhead costs.

3) Allocating a very large cost (overhead) using a very small cost (direct labor) as a base is irrational.

a) A small change in direct labor on a product can make a significant difference in total production cost, an effect that may rest on an invalid assumption about the relationship of the cost and the allocation base.

d. As previously noted, ABC is more useful when overhead costs are relatively high.

1) Also, the more diverse a company's line of products or services or the more significant the volume differences among its products or services, the more beneficial ABC will be.
2) Simple averaging procedures such as direct-labor-based costing are valid only when products or services are absolutely uniform. For example, a simple allocation basis in a factory with large and small machines and high-priced and low-cost labor that work together would not be very exact.

16. Companies use ABC because of its ability to solve costing problems that conventional cost accounting either creates or fails to address.

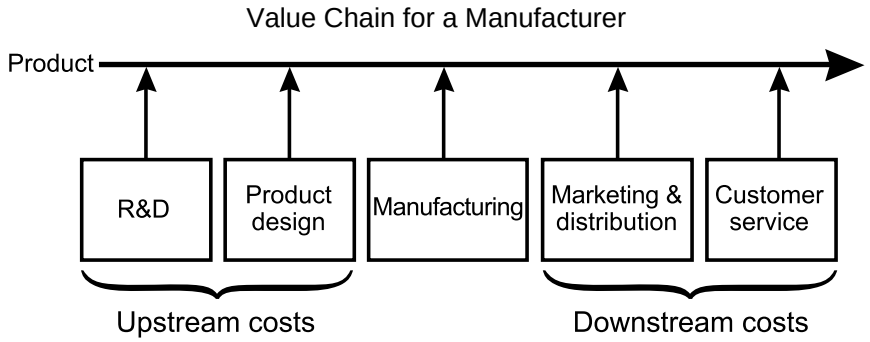
a. These problems include suboptimal pricing, poor allocation of costs, and incorrect direction by management.
b. For example, if overhead is allocated at 700% of direct labor, managers may try to reduce direct labor costs by $1 to reduce the amount of overhead allocated by $7.

1) But the better decision may be to ignore direct labor and concentrate on such cost-cutting efforts as eliminating setups, engineering changes, and movement of materials.

17. ABC is the theoretically preferred method of overhead allocation, but its disadvantage is its cost of implementation.
    a. Initial costs are quite high, and continuing costs of application can also be significant. Thus, if a company has a low level of fixed costs, there is little or no advantage to using ABC as compared to a simple overhead application method, such as a fixed amount per direct labor hour.
    b. Similarly, if a company produces a single product, there is no advantage. Also, if volume levels among various products do not vary too much, there is little advantage.
    c. The real benefits of ABC occur when a company has a high level of fixed costs and produces a wide variety of products with widely varying levels of production.

4.4 LIFE-CYCLE COSTING

1. A life-cycle approach to budgeting estimates a product's revenues and expenses over its entire sales life cycle beginning with research and development, proceeding through the introduction and growth stages into the maturity stage, and finally into the harvest or decline stage.
    a. Accordingly, **life-cycle costing** takes a long-term view of the entire cost life cycle, also known as the **value chain**.



    b. This information is important for pricing decisions because revenues must cover costs incurred in each stage of the value chain, not just production.
2. Life-cycle costing emphasizes the relationships among costs incurred at different value-chain stages, for example, the effect of reduced design costs on future customer-service costs.
    a. Because it makes a distinction between **incurring costs** (actually using resources) and **locking in (designing in) costs**, life-cycle costing highlights the potential for cost reduction activities during the upstream phase of the value chain.
    b. It is in this phase that the greatest opportunity exists to minimize downstream costs. Indeed, it has been **estimated that 90% or more of costs are committed** (not incurred) before production begins.
3. In contrast, traditional approaches focus on cost control (as opposed to cost reduction) during production and treat pre- and postproduction (upstream and downstream) costs as period costs that are largely ignored in determining the profitability of specific products.
    a. Other costs that traditional methods ignore are the **after-purchase costs** (operating, support, repair, and disposal) incurred by customers.

b. Accordingly, **whole-life cost** is a concept closely associated with life-cycle cost.

1) Whole-life cost equals the life-cycle cost plus after-purchase costs.
2) Attention to the reduction of all whole-life costs through analysis and management of all value-chain activities is a powerful competitive tool because of the potential for increasing customer satisfaction.

c. Life-cycle and whole-life cost concepts are associated with target costing and target pricing.

1) A firm may determine that market conditions require that a product sell at a given **target price**.
2) Hence, a **target cost** can be determined by subtracting the desired unit profit margin from the target price.
3) The cost reduction objectives of life-cycle and whole-life cost management can therefore be determined using target costing.

d. **Value engineering** is a means of reaching targeted cost levels.

1) Value engineering is a systematic approach to assessing all aspects of the value chain cost buildup for a product.

a) The purpose is to minimize costs without reducing customer satisfaction.

2) For this purpose, distinguishing between value-adding and nonvalue-adding activities is useful.

a) A value-adding activity contributes to customer value or satisfies a need of the entity. A nonvalue-adding activity does not make such a contribution.
b) Accordingly, value engineering seeks to minimize nonvalue-adding activities and their costs by reducing the cost drivers of those activities.
c) Value-engineering also attempts to minimize the costs of value-adding activities by improving their efficiency.

4. For **financial statement purposes**, costs during the **upstream phase must be expensed in the period incurred**.

a. For management accounting purposes, the costs (such as R&D) that result in marketable products represent a life-cycle investment and must therefore be capitalized.

1) The result is that organizations that focus on a product's life cycle must develop an accounting system consistent with GAAP for financial reporting purposes.
2) However, it should allow for capitalization and subsequent allocation of upstream costs for management accounting purposes.

b. Essentially, life-cycle costing requires the accumulation of all costs over a product's lifetime, from inception of the idea to the abandonment of the product.

1) These costs are then allocated to production on an expected unit-of-output basis.

c. The **internal income statement** for a product will report total sales for all periods, minus all expenses to date.

1) A risk reserve may be established as an account contra to the capitalized costs.
2) The reserve consists of any deferred product costs that might not be recovered if sales are less than planned.

d. The overall **advantage** of life-cycle costing is that it provides a better measure for evaluating the performance of product managers.

1) Traditional financial statements, however, might report that certain products were extremely profitable because upstream costs were expensed in previous periods.

2) For example, if a substantial investment is made in the development of a new product, but that product quickly becomes obsolete due to new technology, how worthwhile was the investment?
3) Life-cycle costing combines all costs and revenues for all periods to provide a better view of a product's overall performance.

4.5 CORE CONCEPTS

Job-Order Costing

- **Job-order costing** is concerned with accumulating costs by specific job. This method is appropriate when producing **products with individual characteristics** or when identifiable groupings are possible, e.g., yachts, jewelry.
  - **Direct costs** (direct materials and direct labor) are charged at the actual amounts incurred.
  - **Manufacturing overhead** is charged using an estimated rate. Overhead costs are applied to ("absorbed" by) each job based on a predetermined overhead application rate for the year. At the end of the period, overhead may have been overapplied or underapplied.
- Output that does not meet the quality standards for salability is considered spoilage.
  - If the spoilage is the amount expected in the ordinary course of production, it is considered **normal spoilage** and treated as a **product cost**.
  - If the spoilage is over and above the amount expected in the ordinary course of production, it is considered **abnormal spoilage** and is treated as a period cost.

Process Costing

- Process cost accounting is used to assign costs to relatively **homogeneous products** that are **mass produced** on a continuous basis (e.g., petroleum products, thread, computer monitors).
- **Direct materials** are used by the first department in the process. **Conversion costs** are the sum of direct labor and manufacturing overhead. The products move from one department to the next. Each department adds more direct materials and more conversion costs.
- **Equivalent units of production (EUP)** is the number of complete goods that could have been produced using the inputs consumed during the period.
  - The EUP conversion is a two-phase process: First, the equivalent units are determined, then the per-unit cost is calculated.
  - The two calculations are made separately for direct materials and conversion costs (transferred-in costs are by definition 100% complete). Conversion costs are assumed to be uniformly incurred.
- **Two methods** of calculating EUP are in common use:
  - Under the **weighted-average** method, units in beginning work-in-process inventory are treated as if they were started and completed during the current period.
  - Under the **first-in, first-out (FIFO)** method, units in beginning work-in-process inventory are part of the EUP calculation. The calculation is thus more complex than weighted-average but tends to be more accurate.

Activity-Based Costing

- **Activity-based costing (ABC)** is a response to the significant increase in the incurrence of **indirect costs** resulting from the rapid advance of technology. ABC is a refinement of an existing costing system (job-order or process).
- **Volume-based systems** involve accumulating costs in general ledger accounts (utilities, taxes, etc.), using a single cost pool to combine the costs in all the related accounts, selecting a single driver to use for the entire indirect cost pool, and allocating the indirect cost pool to final cost objects.
- **Activity-based systems**, by contrast, involve identifying organization activities that constitute overhead, assigning the costs of resources consumed by the activities, and assigning the costs of the activities to final cost objects.
- **Activities** are classified in a hierarchy according to the level of the production process at which they take place: unit-level activities, batch-level activities, product-sustaining (or service-sustaining) activities, and facility-sustaining activities.
- Once the activities are designated, the next step in enacting an ABC system is to **assign the costs of resources to the activities**. This is termed first-stage allocation. A separate accounting system may be necessary to track resource costs separately from the general ledger.
- Once the resources have been identified, resource drivers are designated to allocate resource costs to the activity cost pools. Resource drivers are measures of the resources consumed by an activity.
- The final step in enacting an ABC system is **allocating the activity cost pools to final cost objects**. This is termed second-stage allocation. Costs are reassigned to final-stage (or, if intermediate cost objects are used, next-stage) cost objects on the basis of activity drivers. Activity drivers are measures of the demands made on an activity by next-stage cost objects, such as the number of parts in a product used to measure an assembly activity.
- A **cost object** may be a job, product, process, activity, service, or anything else for which a cost measure is desired. **Intermediate cost objects** receive temporary accumulations of costs as the cost pools move from their originating points to the final cost objects. For example, work-in-process is an intermediate cost object, and finished salable goods are final cost objects.

Life-Cycle Costing

- A **life-cycle approach** to budgeting estimates a product's revenues and expenses over its **entire sales life cycle** beginning with research and development, proceeding through the introduction and growth stages into the maturity stage, and finally into the harvest or decline stage. Accordingly, life-cycle costing takes a **long-term view** of the entire cost life cycle, also known as the value chain.
- Life-cycle costing emphasizes the relationships among costs incurred at **different value-chain stages**, for example, the effect of reduced design costs on future customer-service costs. Because it makes a distinction between **incurring costs** (actually using resources) and **locking in (designing in) costs**, life-cycle costing highlights the potential for cost reduction activities during the upstream phase of the value chain.
- Essentially, life-cycle costing requires the **accumulation of all costs over a product's lifetime**, from inception of the idea to the abandonment of the product. These costs are then allocated to production on an expected unit-of-output basis.

STUDY UNIT FIVE
COST ALLOCATION TECHNIQUES

This study unit is the **third of four** on **cost management**. The relative weight assigned to this major topic in Part 1 of the exam is **25%**. The four study units are:

Study Unit 3: Cost Management Terminology and Concepts
Study Unit 4: Cost Accumulation Systems
Study Unit 5: Cost Allocation Techniques
Study Unit 6: Operational Efficiency and Business Process Performance

After studying the outline and answering the questions in this study unit, you will have the skills necessary to address the following topics listed in the ICMA's Learning Outcome Statements:

Part 1 – Section C.1. Measurement concepts

The candidate should be able to:

Statement a. is covered in Study Unit 3.
Statements b. through d. are covered in Study Unit 4.

e. identify and calculate the components of cost measurement techniques such as actual costing, normal costing, and standard costing; identify the appropriate use of each technique; and describe the benefits and limitations of each technique
f. demonstrate an understanding of the characteristics of variable (direct) costing and absorption (full) costing and the benefits and limitations of these measurement concepts
g. calculate inventory costs, cost of goods sold, and operating profit using both variable costing and absorption costing
h. demonstrate an understanding of how the use of variable costing or absorption costing affects the value of inventory, cost of goods sold, and operating income
i. prepare summary income statements using variable costing and absorption costing
j. determine the appropriate use of joint product and by-product costing
k. demonstrate an understanding of concepts such as split-off point and separable costs
l. determine the allocation of joint product and by-product costs using the physical measure method, the sales value at split-off method, constant gross profit (gross margin) method, and the net realizable value method; and describe the benefits and limitations of each method

Part 1 – Section C.3. Overhead costs

The candidate should be able to:

a. distinguish between fixed and variable overhead expenses
b. determine the appropriate time frame for classifying both variable and fixed overhead expenses
c. demonstrate an understanding of the different methods of determining overhead rates, e.g., plant-wide rates, departmental rates, and individual cost driver rates
d. describe the benefits and limitations of each of the methods used to determine overhead rates

e. identify the components of variable overhead expense
f. determine the appropriate allocation base for variable overhead expenses
g. calculate the per-unit variable overhead expense
h. identify the components of fixed overhead expense
i. identify the appropriate allocation base for fixed overhead expense
j. calculate the fixed overhead application rate
k. describe how fixed overhead can be over- or underapplied and how this difference should be accounted for in the cost of goods sold, work-in-process, and finished goods accounts
l. compare and contrast traditional overhead allocation with activity-based overhead allocation
m. calculate overhead expense in an activity-based costing setting
n. identify and describe the benefits derived from activity-based overhead allocation
o. explain why companies allocate the cost of service departments, such as human resources or information technology, to divisions, departments, or activities
p. calculate service or support department cost allocations using the direct method, the reciprocal method, the step-down method, and the dual allocation method
q. estimate fixed costs using the high-low method and demonstrate an understanding of how regression can be used to estimate fixed costs

5.1 ABSORPTION (FULL) VS. VARIABLE (DIRECT) COSTING

1. Accountants have two different views about whether fixed factory overhead (manufacturing overhead) costs should be assigned to products.
    a. The prevailing view for external reporting purposes is that product cost should include all manufacturing costs: direct labor, direct materials, and all factory overhead--both fixed and variable. This method is commonly known as full costing or absorption costing.
    b. The alternative method is known as variable or direct costing. This method assigns only variable manufacturing costs to products. Fixed overhead costs are considered as period costs and are deducted in the period in which they are incurred.
2. Under **absorption costing** (sometimes called full or full absorption costing), the fixed portion of manufacturing overhead is “absorbed” into the cost of each product.
    a. **Product cost** thus includes **all manufacturing costs, both fixed and variable**.
    b. Absorption-basis cost of goods sold is subtracted from sales to arrive at gross margin.
    c. Total selling and administrative (S&A) expenses (i.e., both fixed and variable) are then subtracted from gross margin to arrive at operating income.
    d. This method is **required under GAAP** for external reporting purposes **and under the Internal Revenue Code** for tax purposes. The justification is that, for external reporting, product cost should include all manufacturing costs.
3. **Variable costing** (sometimes called direct costing) is more appropriate for internal reporting.
    a. The term “direct costing” is somewhat misleading because it suggests traceability, which is not what is meant in this context. “Variable costing” is more suitable.
    b. **Product cost** includes **only variable manufacturing costs**.

c. Variable-basis cost of goods sold and the variable portion of S&A expenses are subtracted from sales to arrive at **contribution margin**.

1) This figure (sales – total variable costs) is an important element of the variable costing income statement because it is the amount available for **covering fixed costs** (both manufacturing and S&A).
2) For this reason, some accountants call the method **contribution margin reporting**.
3) This is an important metric internally but is generally irrelevant to outside financial statement users.

4. The **theory** behind the variable costing method is that fixed overhead costs are the costs of maintaining capacity, not the cost of producing a product.

a. If a company has a fixed rental expense of $10,000 per month on its factory building, that cost will be $10,000 regardless of whether there is any production. If the company produces zero units, the cost will be $10,000; if the company produces 10,000 units, the cost will be $10,000. Therefore, the $10,000 is not viewed as a cost of production; therefore, it is not added to the cost of the inventories produced. That $10,000 was a cost of maintaining a certain level of production capacity.

b. To emphasize, variable costing is used only for internal decision making purposes; it is not permitted under GAAP or the tax provisions of the Internal Revenue Service.

c. The main advantage of the variable costing method is that income cannot be manipulated by management action, whereas management can manipulate income when using the absorption method.

5. EXAMPLE: A firm, during its first month in business, produced 100 units and sold 80 while incurring the following costs:

Direct materials	$1,000
Direct labor	2,000
Variable overhead	1,500
Manufacturing costs used in variable costing	**$4,500**
Fixed overhead	3,000
Manufacturing costs used in absorption costing	**$7,500**

a. The impact on the financial statements from using one method over the other can be seen in these calculations:

	Absorption Basis	**Variable Basis**
Manufacturing costs	$7,500	$4,500
Divided by: units produced	÷ 100	÷ 100
Per-unit cost	$ 75	$ 45
Times: ending inventory	× 20	× 20
Value of ending inventory	**$1,500**	**$ 900**

b. The per-unit selling price of the finished goods was $100, and the company incurred $200 of variable selling and administrative expenses and $600 of fixed selling and administrative expenses.

c. The following are partial income statements prepared using the two methods:

		Absorption Costing (Required under GAAP)		Variable Costing (For internal reporting only)	
	Sales		**$ 8,000**		**$ 8,000**
	Beginning finished goods inventory	$ 0		$ 0	
Product Costs	Plus: variable production costs	4,500 (a)		4,500 (a)	
	Plus: fixed production costs	3,000 (b)			
	Goods available for sale	$7,500		$4,500	
	Less: ending finished goods inventory	(1,500)		(900)	
	Cost of goods sold		**$(6,000)**		**$(3,600)**
	Less: variable S&A expenses				(200) (c)
	Gross margin (abs.) / Contribution margin (var.)		**$ 2,000**		**$ 4,200**
Period Costs	Less: fixed production costs				(3,000) (b)
	Less: variable S&A expenses		(200) (c)		
	Less: fixed S&A expenses		(600) (d)		(600) (d)
	Operating income		**$ 1,200**		**$ 600**

d. The $600 difference in operating income ($1,200 – $600) is the **difference between the two ending inventory values** ($1,500 – $900).

1) In essence, the absorption method carries 20% of the fixed overhead costs ($3,000 × 20% = $600) on the balance sheet as an asset because 20% of the month's production (100 available – 80 sold = 20 on hand) is still in inventory.

6. As production and sales levels change, the two methods have varying impacts on **operating income**.

a. When **everything produced** during a period **is sold** that period, the two methods report the **same operating income**.

1) Total fixed costs budgeted for the period are charged to sales revenue in the period under both methods.

b. When **production and sales are not equal** for a period, the two methods report **different** operating income.

1) ILLUSTRATION:

When production
⌂ ⌂ ⌂ ⌂ ⌂ ⌂ ⌂ ⌂
exceeds sales,
⌂ ⌂ ⌂
ending inventory expands.
↑↑↑↑↑↑↑↑↑↑↑↑↑↑
Under absorption costing,
some fixed costs are still embedded in ending inventory.
Under variable costing,
all fixed costs have been expensed.
Therefore,
operating income is higher under absorption costing.

When production
⌂ ⌂ ⌂
is less than sales,
⌂ ⌂ ⌂ ⌂ ⌂ ⌂ ⌂ ⌂
ending inventory contracts.
↓↓↓↓↓↓
Under absorption costing,
fixed costs embedded in beginning inventory get expensed.
Under variable costing,
only the current period's fixed costs are expensed.
Therefore,
operating income is higher under variable costing.

c. The diagram on the previous page illustrates the **perverse incentive inherent to absorption costing** and reveals why many companies prefer variable costing for internal reporting.

1) Operating income increases whenever production exceeds sales.

2) A production manager can thus increase absorption-basis operating income merely by increasing production, whether there is any customer demand for the additional product or not.

a) The company must also deal with the increased carrying costs resulting from swelling inventory levels.

3) This practice, called **producing for inventory**, can be effectively discouraged by using variable costing for performance reporting and consequent bonus calculation.

d. EXTENDED EXAMPLE: A company has the following sales and cost data:

	Year 1		Year 2	Year 3
Production in units	40,000		50,000	0
Sales in units	30,000		30,000	30,000
Ending inventory in units (FIFO)	10,000		30,000	0
Unit sales price	$1.00			
Unit variable cost	$0.50			
Fixed manufacturing costs	$4,000	per year		
Variable S&A expenses	$0.03333	per unit		
Fixed S&A expenses	$1,000	per year		

1) Compare the 3-year income statements prepared under the two methods:

Absorption Costing (Required under GAAP)				**Variable Costing (For internal reporting only)**			
	Year 1	Year 2	Year 3		Year 1	Year 2	Year 3
Sales	**$30,000**	**$30,000**	**$30,000**	**Sales**	**$30,000**	**$30,000**	**$30,000**
Beginning inventory	$ 0	$ 6,000	$17,400	Beginning inventory	$ 0	$ 5,000	$15,000
Variable mfg. costs	20,000	25,000	0	Variable mfg. costs	20,000	25,000	0
Fixed mfg. costs	4,000	4,000	4,000				
Goods available for sale	$24,000	$35,000	$21,400	Goods avail. for sale	$20,000	$30,000	$15,000
Less: ending inventory	(6,000)	(17,400)	0	Less: ending inventory	(5,000)	(15,000)	0
Absorption CGS	**$18,000**	**$17,600**	**$21,400**	**Variable CGS**	**$15,000**	**$15,000**	**$15,000**
				Variable S&A exps.	(1,000)	(1,000)	(1,000)
Gross margin	**$12,000**	**$12,400**	**$ 8,600**	**Contribution margin**	**$14,000**	**$14,000**	**$14,000**
				Fixed mfg. costs	(4,000)	(4,000)	(4,000)
Variable S&A expenses	(1,000)	(1,000)	(1,000)				
Fixed S&A expenses	(1,000)	(1,000)	(1,000)	Fixed S&A expenses	(1,000)	(1,000)	(1,000)
Operating income	**$10,000**	**$10,400**	**$ 6,600**	**Operating income**	**$ 9,000**	**$ 9,000**	**$ 9,000**

2) Note that, assuming zero inventory at the beginning of Year 1 and at the end of Year 3, the **total operating income for the 3-year period is the same** under either costing method.

	Absorption Costing	**Variable Costing**
Year 1	$10,000	$ 9,000
Year 2	10,400	9,000
Year 3	6,600	9,000
3-Year Total	**$27,000**	**$27,000**

3) Absorption costing shows a higher operating income than variable costing in Years 1 and 2 because fixed overhead has been capitalized and does not get expensed until Year 3.

a) Variable costing, on the other hand, treats fixed overhead as an expense of the period in which the cost is incurred.

b) In Year 2, despite the same cash flow, there is a $1,400 difference between the final operating income figures. There is an even greater difference in Year 3.

4) If fixed costs increase relative to variable costs, the differences become more dramatic (here, 50% of the selling price is variable manufacturing cost, and fixed overhead is no more than 20% of the variable manufacturing cost).

5) From an internal point of view, a manager can manipulate absorption income by changing production levels. But, with variable costing, a manager cannot manipulate simply by changing production levels.

6) Note that, under the absorption method, management was able to show higher incomes in Years 1 and 2 by overproducing. If the manager was being given a bonus for a higher level of income, (s)he could obtain the bonus by producing more units than could be sold. As a result, some fixed costs would be added to the balance sheet as inventories. Thus, the income statement and balance sheet both look good, despite the fact that the production manager has done a bad thing: (S)he has produced excessive inventories, which require the company to incur storage and financing costs. Spoilage may also be a result.

e. Under the variable costing method, a production manager cannot manipulate income levels by overproducing. Given the same cost structure every year, the income levels will be based on sales, not the level of production.

1) Both methods treat selling and administrative expenses, whether fixed or variable, as period costs. Also, both methods treat variable factory overhead as product costs. They differ only in the classification of fixed factory overhead.

2) Because of the difference in treatment of fixed factory overhead, income and inventory levels will differ between the two methods. Since fixed manufacturing costs are excluded from inventories, the amount shown on the balance sheet for inventories will be lower under the variable costing method.

3) Income levels will differ whenever sales are at a different level than production. Income will be higher or lower under variable costing depending upon whether inventories are increased during the period or liquidated. If inventories increase during a period, the variable costing method will show a lower income because all fixed costs are being subtracted on the income statement, while under the absorption method, some fixed costs are being capitalized as inventories. Variable costing will show a higher income in periods when inventories decline because the absorption method forces the subtraction of all of the current period fixed costs, plus some fixed costs incurred (and capitalized) in prior periods.

4) When production and sales are equal during a period, both methods will show the same income.

5) Under variable costing, profits always move in the same direction as sales volume. Profits reported under absorption costing behave erratically and sometimes move in the opposite direction from sales trends.

6) In the long run, the two methods will report the same total profits if sales equal production. The inequalities between production and sales are usually minor over an extended period.

7. Benefits of Variable Costing for Internal Purposes

a. Although the use of variable costing for financial statements is prohibited, most agree about its superiority for internal reporting. It is far better suited than absorption costing to the needs of management. Management requires a knowledge of cost behavior under various operating conditions. For planning and control, management is more concerned with treating fixed and variable costs separately than with calculating full costs. Full costs are usually of dubious value because they contain arbitrary allocations of fixed cost.

1) Under variable costing, the cost data for profit planning and decision making are readily available from accounting records and statements. Reference to auxiliary records and supplementary analyses is not necessary.
2) For example, cost-volume-profit relationships and the effects of changes in sales volume on net income can easily be computed from the income statement prepared under the variable costing concept, but not from the conventional absorption cost income statement based on the same data.
3) Profits and losses reported under variable costing have a relationship to sales revenue and are not affected by inventory or production variations.
4) Absorption cost income statements may show decreases in profits when sales are rising and increases in profits when sales are decreasing, which may be confusing to management. Attempts at explanation by means of volume variances often compound rather than clarify the confusion. (Production volume variances not only are unnecessary but also are frustrating and confusing to management.)
5) If variable costing is used, the favorable margin between selling prices and variable cost should provide a constant reminder of profits forgone because of lack of sales volume. A favorable margin justifies a higher production level.
6) The full impact of fixed costs on net income, partially hidden in inventory values under absorption costing, is emphasized by the presentation of costs on an income statement prepared under variable costing.
7) Proponents of variable costing maintain that fixed factory overhead is more closely correlated to capacity to produce than to the production of individual units.
8) Production managers cannot manipulate income by producing more or fewer products than needed during a period. Under absorption costing, a production manager could increase income simply by producing more units than are currently needed for sales.

b. Variable costing is also preferred over absorption costing for studies of relative profitability of products, territories, and other segments of a business. It concentrates on the contribution that each segment makes to the recovery of fixed costs that will not be altered by decisions to make and sell. Under variable costing procedures,

1) The marginal income concept leads to better pricing decisions, which are the principal advantage of variable costing.
2) The impact of fixed costs on net income is emphasized by showing the total amount of such costs separately in financial reports.
3) Out-of-pocket expenditures required to manufacture products conform closely with the valuation of inventory.
4) The relationship between profit and the major factors of selling price, sales mix, sales volume, and variable manufacturing and nonmanufacturing costs is measured in terms of a single index of profitability.

a) This profitability index, expressed as a positive amount or as a ratio, facilitates the analysis of cost-volume-profit relationships, compares the effects of two or more contemplated courses of action, and aids in answering many questions that arise in profit planning.

5) Inventory changes have no effect on the breakeven computations.
6) Marginal income figures facilitate appraisal of products, territories, and other business segments without having the results hidden or obscured by allocated joint fixed costs.
7) Questions regarding whether a particular part should be made or bought can be more effectively answered if only variable costs are used.
   a) Management must consider whether to charge the product being made with variable costs only or to charge a percentage of fixed costs as well.
   b) Management must also consider whether the making of the part will require additional fixed costs and a decrease in normal production.
8) Disinvestment decisions are facilitated because whether a product or department is recouping its variable costs can be determined.
   a) If the variable costs are being covered, operating a department at an apparent loss may be profitable.
9) Management is better able to judge the differences between departments if certain fixed costs are omitted from the statements instead of being allocated arbitrarily.
10) Cost figures are guided by the sales figures.
   a) Under variable costing, cost of goods sold will vary directly with sales volume, and the influence of production on gross profit is avoided.
   b) Variable costing also eliminates the possible difficulties of having to explain over- or underapplied factory overhead to higher management.

5.2 JOINT PRODUCT AND BY-PRODUCT COSTING

1. When two or more separate products are produced by a common manufacturing process from a common input, the outputs from the process are **joint products**.
   a. **Joint (common) costs** are those costs incurred up to the point where the products become separately identifiable, called the split-off point.
      1) Joint costs include direct materials, direct labor, and manufacturing overhead. Because they are not separately identifiable, they must be allocated to the individual joint products.
      2) EXAMPLE: Crude oil can be refined into multiple salable products. All costs incurred in getting the crude oil to the distilling tower are joint costs.
   b. At the **split-off point**, the joint products acquire separate identities. Costs incurred after split-off are separable costs.
      1) **Separable costs** can be identified with a particular joint product and allocated to a specific unit of output.
      2) EXAMPLE: Once crude oil has been distilled into asphalt, fuel oil, diesel fuel, kerosene, and gasoline, costs incurred in further refining and distributing these individual products are separable costs.

2. Several methods are available to **allocate joint costs**. These can be grouped into two approaches.

   a. A **physical measure-based approach** employs a physical measure such as volume, weight, or a linear measure.

      1) The **physical-unit method** allocates joint production costs to each product based on their relative proportions of the measure selected.

      2) EXAMPLE: A refinery processes 1,000 barrels of crude oil and incurs $100,000 of processing costs. The process results in the following outputs. Under the physical unit method, the joint costs up to split-off are allocated as follows:

Asphalt	$100,000 × (300 barrels ÷ 1,000 barrels)	=	$ 30,000
Fuel oil	$100,000 × (300 barrels ÷ 1,000 barrels)	=	30,000
Diesel fuel	$100,000 × (200 barrels ÷ 1,000 barrels)	=	20,000
Kerosene	$100,000 × (100 barrels ÷ 1,000 barrels)	=	10,000
Gasoline	$100,000 × (100 barrels ÷ 1,000 barrels)	=	10,000
Joint costs allocated			$100,000

      3) The physical-unit method's simplicity makes it appealing, but it does not match costs with the individual products' revenue-generating potential. Basically, there is almost no situation where the physical-unit method is beneficial. Its advantage is that it is easy to use. However, its limitations are that it treats low-value products that are large in size as if they were valuable. As a result, a large, low-value product might always show a loss, whereas small, high-value products will always show a profit.

   b. A **market-based approach** assigns a proportionate amount of the total cost to each product on a quantitative basis.

      1) These allocations are performed using the entire production run for an accounting period, not units sold. This is because the joint costs were incurred on all the units produced, not just those sold.

      2) Three major methods of allocation are available under this approach.

         a) The **sales-value at split-off method** is based on the relative sales values of the separate products at split-off.

            i) EXAMPLE: The refinery estimates that the five outputs can sell for the following prices at split-off:

Asphalt	300 barrels @ $ 60/barrel	= $	18,000
Fuel oil	300 barrels @ $180/barrel	=	54,000
Diesel fuel	200 barrels @ $160/barrel	=	32,000
Kerosene	100 barrels @ $ 80/barrel	=	8,000
Gasoline	100 barrels @ $180/barrel	=	18,000
Total sales value at split-off			$130,000

            The total expected sales value for the entire production run at split-off is thus $130,000. Multiply the total joint costs to be allocated by the proportion of the total expected sales of each product:

Asphalt	$100,000 × ($18,000 ÷ $130,000)	= $	13,846
Fuel oil	$100,000 × ($54,000 ÷ $130,000)	=	41,538
Diesel fuel	$100,000 × ($32,000 ÷ $130,000)	=	24,616
Kerosene	$100,000 × ($ 8,000 ÷ $130,000)	=	6,154
Gasoline	$100,000 × ($18,000 ÷ $130,000)	=	13,846
Joint costs allocated			$100,000

b) The **estimated net realizable value (NRV)** method also allocates joint costs based on the relative market values of the products.

i) The significant difference is that, under the estimated NRV method, all separable costs necessary to make the product salable are subtracted before the allocation is made.

ii) EXAMPLE: The refinery estimates final sales prices as follows:

Asphalt	300 barrels @ $ 70/barrel =	$ 21,000
Fuel oil	300 barrels @ $200/barrel =	60,000
Diesel fuel	200 barrels @ $180/barrel =	36,000
Kerosene	100 barrels @ $ 90/barrel =	9,000
Gasoline	100 barrels @ $190/barrel =	19,000

From these amounts, separable costs are subtracted (these costs are given):

Asphalt	$21,000 – $1,000 =	$ 20,000
Fuel oil	$60,000 – $1,000 =	59,000
Diesel fuel	$36,000 – $1,000 =	35,000
Kerosene	$ 9,000 – $2,000 =	7,000
Gasoline	$19,000 – $2,000 =	17,000
Total net realizable value		$138,000

Multiply the total joint costs to be allocated by the proportion of the final expected sales of each product:

Asphalt	$100,000 × ($20,000 ÷ $138,000) =	$ 14,493
Fuel oil	$100,000 × ($59,000 ÷ $138,000) =	42,754
Diesel fuel	$100,000 × ($35,000 ÷ $138,000) =	25,362
Kerosene	$100,000 × ($ 7,000 ÷ $138,000) =	5,072
Gasoline	$100,000 × ($17,000 ÷ $138,000) =	12,319
Joint costs allocated		$100,000

c) The **constant gross-margin percentage NRV** method is based on allocating joint costs so that the gross-margin percentage is the same for every product.

i) There are three steps under this method:

- Determine the overall gross-margin percentage.
- Subtract the appropriate gross margin from the final sales value of each product to calculate total costs for that product.
- Subtract the separable costs to arrive at the joint cost amount.

ii) EXAMPLE: The refinery uses the same calculation of expected final sales price as under the estimated NRV method:

Asphalt	300 barrels @ $ 70/barrel =	$ 21,000
Fuel oil	300 barrels @ $200/barrel =	60,000
Diesel fuel	200 barrels @ $180/barrel =	36,000
Kerosene	100 barrels @ $ 90/barrel =	9,000
Gasoline	100 barrels @ $190/barrel =	19,000
Total of final sales prices		$145,000

The final sales value for the entire production run is thus $145,000. From this total, the joint costs and total separable costs are deducted to arrive at a total gross margin for all products:

$145,000 – $100,000 – $7,000 = $38,000

The gross margin percentage can then be derived:

$38,000 ÷ $145,000 = 26.21%

Deduct gross margin from each product to arrive at a cost of goods sold:

Asphalt	$21,000 – ($21,000 × 26.21%) =	$15,497
Fuel oil	$60,000 – ($60,000 × 26.21%) =	44,276
Diesel fuel	$36,000 – ($36,000 × 26.21%) =	26,565
Kerosene	$ 9,000 – ($ 9,000 × 26.21%) =	6,641
Gasoline	$19,000 – ($19,000 × 26.21%) =	14,021

Deduct the separable costs from each product to arrive at the allocated joint costs:

Asphalt	$15,497 – $1,000 =	$ 14,497
Fuel oil	$44,276 – $1,000 =	43,276
Diesel fuel	$26,566 – $1,000 =	25,565
Kerosene	$ 6,641 – $2,000 =	4,641
Gasoline	$14,021 – $2,000 =	12,021
Joint costs allocated		$100,000

d) The three market-based methods are far superior to the physical-quantity method, although they do require more work and more record keeping. However, they produce more usable results.

3. **By-products** are one or more products of relatively small total value that are produced simultaneously from a common manufacturing process with products of greater value and quantity.

   a. The first question that must be answered in regard to by-products is: Do the **benefits** of further processing and bringing them to market **exceed the costs**?

Selling price	$X,XXX
Less: additional processing costs	(XXX)
Less: selling costs	(XXX)
Net realizable value	**$X,XXX**

      1) If the **net realizable value** is zero or negative, the by-products should be discarded as scrap.

   b. Once the decision is made to proceed with further processing, two more questions must be answered to determine the **proper accounting treatment** for by-products:

      1) Will the net realizable value of the by-products be **material** enough to warrant recognizing them as inventory on the **balance sheet**?

      2) Will the expected proceeds from the sale of the by-products be reported as **revenue** or as a reduction to **cost of goods**?

c. If the by-products are **material**, they are recognized at the **time of production** and recorded in a separate inventory account, as in this example:

Finished goods inventory – Asphalt (net manufacturing costs)	$XX,XXX	
Finished goods inventory – Fuel oil (net manufacturing costs)	XX,XXX	
Finished goods inventory – Diesel fuel (net manufacturing costs)	XX,XXX	
Finished goods inventory – Kerosene (net manufacturing costs)	XX,XXX	
Finished goods inventory – Gasoline (net manufacturing costs)	XX,XXX	
By-product inventory – Sludge (estimated net realizable value)	X,XXX	
Work-in-process (total manufacturing costs for period)		$XXX,XXX

1) The amount of miscellaneous revenue (or reduction to cost of goods sold) reported is the **entire estimated net realizable value** of the by-products generated during the period.

a) This treatment is justifiable when a ready market for the by-products is available.

2) Because revenue (or cost of goods sold) was affected at the time of production, these accounts are unaffected when the by-products are sold.

Cash	$X,XXX	
By-product inventory – Sludge		$X,XXX

d. If the by-products are **immaterial**, they are not recognized until the **time of sale** and are thus not recorded on the balance sheet.

1) The amount of miscellaneous revenue or reduction to cost of goods sold reported is the **actual proceeds** from the sale of the by-products.

e. Regardless of the timing of their recognition in the accounts, by-products usually do not receive an allocation of joint costs because the cost of this accounting treatment ordinarily exceeds the benefit.

4. The decision to **sell or process further** is made based on whether the incremental revenue to be gained by further processing exceeds the incremental cost thereof.

a. The joint cost of the product is irrelevant because it is a sunk cost.

5.3 OVERHEAD COSTS AND NORMAL COSTING

1. **Manufacturing overhead** consists of all costs of manufacturing that are not direct materials or direct labor.

a. **Indirect materials** are tangible inputs to the manufacturing process that cannot practicably be traced to the product, e.g., the welding compound used to put together a piece of heavy equipment.

b. **Indirect labor** is the cost of human labor connected with the manufacturing process that cannot practicably be traced to the product, e.g., the wages of assembly line supervisors and janitorial staff.

c. **Factory operating costs**, such as utilities, real estate taxes, insurance, depreciation on factory equipment, etc.

2. Unlike direct materials and direct labor, which are purely variable costs, overhead contains both variable and fixed components.

a. **Variable overhead costs** include indirect materials, indirect labor, utilities, and depreciation expense under any method that ties depreciation to the level of output.

1) The **time frame** for planning variable overhead is the **short run**, i.e., the period within which per-unit variable costs remain constant and therefore predictable.

b. **Fixed overhead costs** include real estate taxes, insurance, and depreciation expense under any method that is not tied to the level of output.

1) The **time frame** for planning fixed overhead is the **long run**. Such cost elements as real estate taxes and depreciation are determined by capital expenditures, i.e., those that by their nature span multiple years.

3. In traditional cost accounting, overhead is accumulated in **two indirect cost pools** (one for variable overhead and one for fixed), then allocated to production using an **appropriate allocation base** for each.

a. The crucial quality of an allocation base is that it be a **cost driver** of the costs in the pool to be allocated.

1) Recall that a cost driver must capture a **cause-and-effect relationship** between the level of the driver and the level of the cost being allocated.

b. In **labor-intensive** industries, direct labor hours or cost is an appropriate driver. In **capital-intensive** industries, machine hours is more appropriate.

1) It is therefore possible that variable and fixed overhead will employ the same allocation base.

2) Overhead is usually not allocated on the basis of units produced because of the lack of a cause-and-effect relationship.

4. Once appropriate allocation bases have been selected, the **predetermined overhead application rates** are calculated.

a. An estimate is made of the total amount of variable or fixed overhead that will be incurred during the period **(numerator)**. An estimate is then made of the total quantity of each allocation base that will be expended **(denominator)**. The quotient is the application rate for that budget period.

b. EXAMPLE: A manufacturer is preparing its budget for the upcoming year and has compiled the following estimates of total costs:

Cost Element	Variable Overhead	Fixed Overhead
Indirect materials	$ 80,000	
Indirect labor	46,000	
Utilities	155,000	
Real estate taxes		$ 81,000
Insurance		54,000
Straight-line depreciation		240,000
Totals	$281,000	$375,000

The variable elements of overhead vary directly with the level of production, so the company has chosen to use units of output as the allocation base for variable overhead. The fixed elements of overhead are related directly to the level of productive capacity, such as factory space and amount of machinery, so the company has decided that it will use machine hours as the allocation base for fixed overhead.

The company's best projection is that 1,110,000 units will be produced and 57,000 machine hours will be expended during the upcoming year. The overhead allocation rates can thus be calculated as follows:

Variable overhead application rate: $281,000 ÷ 1,110,000 units of output = $0.253 per unit
Fixed overhead application rate: $375,000 ÷ 57,000 machine hours = $6.579 per unit

c. A significant conceptual challenge is understanding **the need to apply fixed overhead** using an allocation base rather than simply to recognize one-twelfth of the estimated total every month.

1) Since fixed costs are by their nature unchanging within the relevant range, using an allocation base at first appears to unnecessarily complicate the bookkeeping process. But, one way or another, **fixed costs must be covered** by selling products to customers.

2) The **advantage** of applying fixed overhead at a predetermined rate is that an allocation base, even if only indirectly, reflects the level of productive activity.

a) If production is way down or way up in a particular month, using an allocation base will result in a fixed overhead **production-volume variance**, also called the **denominator-level variance**.

b) The existence of a production-volume/denominator-level variance alerts management to the fact that fixed costs are being spread among fewer or more units, respectively, than anticipated.

5. During the budget period, **actual overhead costs** are accumulated in the **control accounts** as they are **incurred**.

a. EXAMPLE: At the end of October, the company entered the following journal entries to recognize actual overhead costs incurred during the month:

Variable overhead control	$22,050	
Raw materials (withdrawals for indirect materials)		$ 6,059
Wages payable (indirect labor)		4,120
Utilities (bill from utility provider)		11,871
Fixed overhead control	$31,250	
Real estate taxes ($81,000 ÷ 12 months)		$ 6,750
Insurance expense ($54,000 ÷ 12 months)		4,500
Depreciation expense ($240,000 ÷ 12 months)		20,000

6. At the end of the period, **overhead is applied to work-in-process** based on the actual level of the driver.

a. EXAMPLE: During October, the company produced 91,000 units and expended 4,000 machine hours. The journal entry to apply overhead for October is as follows:

Work-in-process	$49,339	
Variable overhead applied (91,000 units × $0.253)		$23,023
Fixed overhead applied (4,000 hours × $6.579)		26,316

7. Inevitably, the overhead amounts applied throughout the year will vary from the amount actually incurred, which is only determinable once the job is complete.

a. This variance is called over- or underapplied overhead.

1) **Overapplied overhead** (a credit balance in overhead applied) results when product costs are overstated because the

a) Activity level was higher than expected, or
b) Actual overhead costs were lower than expected.

2) **Underapplied overhead** (a debit balance in overhead applied) results when product costs are understated because the

a) Activity level was lower than expected, or
b) Actual overhead costs were higher than expected.

b. Over- and underapplied overhead is subject to one of two treatments:

1) If the variance is considered **immaterial**, it can be closed directly to cost of goods sold.

a) EXAMPLE:

If overapplied:		
Variable overhead applied (balance)	$23,023	
Cost of goods sold (difference)		$ 973
Variable overhead control (balance)		22,050
If underapplied:		
Fixed overhead applied (balance)	$26,316	
Cost of goods sold (difference)	4,934	
Fixed overhead control (balance)		$31,250

2) If the variance is considered **material**, it should be allocated based on the relative values of work-in-process, finished goods, and cost of goods sold.

a) EXAMPLE: Work-in-process, finished goods, and cost of goods sold bear a 20:20:60 cost relationship.

If overapplied:		
Variable overhead applied (balance)	$23,023	
Work-in-process (overapplied amount × allocation %)		$ 195
Finished goods (overapplied amount × allocation %)		195
Cost of goods sold (overapplied amount × allocation %)		583
Variable overhead control (balance)		22,050
If underapplied:		
Fixed overhead applied (balance)	$26,316	
Work-in-process (underapplied amount × allocation %)	987	
Finished goods (underapplied amount × allocation %)	987	
Cost of goods sold (underapplied amount × allocation %)	2,960	
Fixed overhead control (balance)		$31,250

8. The above example was prepared using a **traditional (volume-based) overhead allocation** system, i.e., one where only two indirect cost pools were used, one for variable overhead and one for fixed overhead.

a. **Activity-based costing (ABC)** arose in response to the significant increase in the incurrence of indirect costs resulting from the rapid advance of technology. ABC is a refinement of an existing costing system, such as job-order or process.

1) Under ABC, indirect costs are attached to activities rather than simply dumped in one or two indirect cost pools (see Subunit 3 in Study Unit 4 for a fuller discussion).

2) EXAMPLE: A foundry has reengineered its indirect cost assignment system using activity-based costing principles. It now uses five pools for overhead instead of two:

Indirect cost pool	Driver
Product design	Engineering hours
Production setup	Number of batches
Machining	Machine hours
Inspection & testing	Number of valves
Customer maintenance	Salesperson hours

b. Since ABC employs multiple indirect cost pools, it provides far greater detail regarding overhead than does traditional functional or spending-category budgeting.

1) EXAMPLE: Activity-based costing allows the foundry to calculate much more accurate cost data about its two products:

Cost Category	Actual Driver Level		Cost per Unit of Driver		Simple Valve	Complex Valve	Total
Direct materials					$ 438,716	$288,017	$ 726,733
Direct labor					241,505	78,885	320,390
Total direct costs					**$ 680,221**	**$366,902**	**$1,047,123**
Indirect cost assignment:							
Product design:							
Simple valve	1,101	×	$23.75	=	$26,149		$89,941
Complex valve	2,686	×	23.75	=		$63,793	
Production setup:							
Simple valve	200	×	21.00	=	4,200		4,620
Complex valve	20	×	21.00	=		420	
Machining:							
Simple valve	2,155	×	3.2581	=	7,021		68,612
Complex valve	18,904	×	3.2581	=		61,591	
Inspection & testing:							
Simple valve	50,000	×	12.50	=	625,000		750,000
Complex valve	10,000	×	12.50	=		125,000	
Customer maintenance:							
Simple valve	1,600	×	17.70	=	28,320		40,834
Complex valve	707	×	17.70	=		12,514	
Total indirect costs					**$ 690,690**	**$263,318**	**$ 954,007**
Total manufacturing costs					**$1,370,911**	**$630,220**	**$2,001,130**

9. During times of low production, per-unit overhead charges will skyrocket. This leads to higher product costs during years of lower production and to **distortions in the financial statements**.

a. EXAMPLE: A manufacturing firm is expecting the following units of production and sales over a three-year period. Note that production is expected to fluctuate but sales are expected to be even:

	Year 1	Year 2	Year 3	Totals
Production	10,000	6,000	8,000	24,000
Sales	7,000	7,000	7,000	21,000

Variable overhead costs are calculated at $1 per unit, and fixed overhead is projected to remain constant over the period:

	Year 1	Year 2	Year 3	Totals
Variable overhead cost	$10,000	$ 6,000	$ 8,000	$24,000
Fixed overhead cost	20,000	20,000	20,000	60,000
Total overhead cost	**$30,000**	**$26,000**	**$28,000**	**$84,000**

For simplicity, a single overhead application rate is used in this example:

	Year 1	Year 2	Year 3
Estimated total overhead / Estimated production	$30,000 / 10,000 = $3.00	$26,000 / 6,000 = $4.33	$28,000 / 8,000 = $3.50

These fluctuations in the applied overhead rate will lead to fluctuations in unit cost:

	Year 1	Year 2	Year 3
Direct materials	$ 3.00	$ 3.00	$ 3.00
Direct labor	4.00	4.00	4.00
Manufacturing overhead	3.00	4.33	3.50
Total unit cost	**$10.00**	**$11.33**	**$10.50**

The comparative income statements make clear the distorting effect:

	Year 1	Year 2	Year 3	Totals
Production:				
From Year 1	7,000	3,000		
From Year 2		4,000	2,000	
From Year 3			5,000	
Expected unit sales	7,000	7,000	7,000	
Expected selling price	× $12	× $12	× $12	
Total expected sales	$84,000	$84,000	$84,000	$252,000
Cost of goods sold:				
From Year 1	$70,000	$30,000		
From Year 2		45,333	$22,667	
From Year 3			52,500	
Total expected CGS	$70,000	$75,333	$75,167	$220,500
Gross margin	**$14,000**	**$ 8,667**	**$ 8,833**	**$ 31,500**

Large fluctuations in gross margin are reported during a period when there was no fluctuation at all in the company's underlying cost structure, and sales were the same every year.

b. To prevent these distortions in the financial statements, **normal costing** derives the overhead application rate by looking at several years at a time, not just one.

1) EXAMPLE: Instead of using a different overhead application rate for each year, the company uses a single average figure for the period.

a) The company expects to produce 24,000 units over 3 years.

b) Dividing the fixed overhead for each year of $20,000 by an average of 8,000 units per year yields a fixed overhead application rate of $2.50.

c) The new total overhead application rate per unit is $3.50 ($1.00 variable cost + $2.50 fixed cost).

d) The new per-unit cost for all three years is thus $10.50 ($3.00 direct materials + $4.00 direct labor + $3.50 overhead application rate).

e) The revised income statements prepared using a normalized overhead rate reveal the smoothing effect on gross margin:

	Year 1	Year 2	Year 3	Totals
Production:				
From Year 1	7,000	3,000		
From Year 2		4,000	2,000	
From Year 3			5,000	
Expected unit sales	7,000	7,000	7,000	
Expected selling price	× $12	× $12	× $12	
Total expected sales	$84,000	$84,000	$84,000	$252,000
Cost of goods sold:				
From Year 1	$73,500	$31,500		
From Year 2		42,000	$21,000	
From Year 3			52,500	
Total expected CGS	$73,500	$73,500	$73,500	$220,500
Gross margin	**$10,500**	**$10,500**	**$10,500**	**$ 31,500**

c. **Extended normal costing** applies the use of a normalized rate to direct costs as well as to manufacturing overhead.

1) Also called standard costing, this technique is discussed in detail in Study Unit 7.

d. The following table summarizes the use of rates in the three costing methods described:

	Actual Costing	Normal Costing	Extended Normal Costing
Direct Materials	Actual	Actual	Budgeted
Direct Labor	Actual	Actual	Budgeted
Manufacturing Overhead	Actual	Budgeted	Budgeted

10. All the examples of overhead application so far have employed a **single plantwide rate**. This method has the benefit of simplicity.

a. However, some production departments may be labor-intensive while others are machine-intensive. In these cases, the use of a single driver for applying overhead to every phase of the production results in the miscosting of products.

b. A more accurate method is the use of **departmental rates**.

1) EXAMPLE: A company is preparing its overhead budget for the coming year and has selected direct labor hours as the allocation base.

	Budgeted Overhead	Allocation Base	Overhead Application Rate
Department A	$ 60,000		
Department B	40,000		
Total process	$100,000	20,000	$5.00 per direct labor hour

2) A study by the company's management accountants reveals that Department A heavily employs direct labor while Department B is far more automated.

a) Of the total direct labor hours budgeted for the year, 15,000 are projected for Department A and only 5,000 for Department B.

b) At the same time, Department A is projected to consume 8,000 machine hours while Department B is projected to use 16,000.

3) Instead of applying a single plantwide application rate, then, a more accurate allocation can be obtained by using a different allocation base for each production department.

	Budgeted Overhead	Allocation Base	Overhead Application Rate
Department A	$ 60,000	15,000	$4.00 per direct labor hour
Department B	$ 40,000	16,000	$2.50 per machine hour

c. When indirect costs represent a large proportion of total production costs, activity-based costing, which uses cost pools for all costs (not just overhead), may be the most appropriate cost accumulation system.

5.4 ALLOCATION OF SERVICE DEPARTMENT COSTS

1. **Service (support) department costs** are considered part of overhead (indirect costs). Thus, they cannot feasibly be traced to cost objects and therefore must be allocated to the operating departments that use the services.
   a. When service departments also render services to each other, their costs may be allocated to each other before allocation to operating departments.
   b. Four criteria are used to allocate costs:
      1) **Cause and effect** should be used if possible because of its objectivity and acceptance by operating management.
      2) **Benefits received** is the most frequently used alternative when a cause-and-effect relationship cannot be determined.
         a) However, it requires an assumption about the benefits of costs, for example, that advertising which promotes the company but not specific products was responsible for increased sales by the various divisions.
      3) **Fairness** is sometimes mentioned in government contracts but appears to be more of a goal than an objective allocation base.
      4) **Ability to bear** (based on profits) is usually unacceptable because of its dysfunctional effect on managerial motivation.
2. **Three methods** of service department allocation are in general use:
   a. The **direct method** is the simplest.
      1) The direct method allocates service department costs directly to the producing departments without regard for services rendered by service departments to each other.
      2) Service department costs are allocated to production departments based on an allocation base appropriate to each service department's function.
      3) EXAMPLE:
         a) A company has the following service department costs and allocation bases:

Service Department	Costs to Be Allocated	Allocation Base
Information Technology	$120,000	CPU cycles
Custodial Services	40,000	Floor space
Total	**$160,000**	

         b) The production departments have the following preallocation costs and allocation base amounts:

Production Department	Preallocation Costs	CPU Cycles Used	%	Floor Space in Sq. Ft.	%
Milling	$300,000	60,000,000	62.5%	56,000	70.0%
Finishing	200,000	36,000,000	37.5%	24,000	30.0%
Totals	**$500,000**	**96,000,000**	**100.0%**	**80,000**	**100.0%**

c) The direct method allocates the service department costs to the production departments as follows:

	Service Departments		Production Departments		
	Information Technology	Custodial Services	Milling	Finishing	Total
Totals before allocation	$120,000	$40,000	$300,000	$200,000	$660,000
Allocate IT (62.5%, 37.5%)	(120,000)	--	75,000	45,000	0
Allocate Custodial (70.0%, 30.0%)	--	(40,000)	28,000	12,000	0
Totals after allocation	**$ 0**	**$ 0**	**$403,000**	**$257,000**	**$660,000**

b. The **step** or **step-down method** allocates some of the costs of services rendered by service departments to each other.

1) The step method derives its name from the procedure involved: The service departments are allocated in order, from the one that provides the most service to other service departments down to the one that provides the least.

2) EXAMPLE:

a) The services that each service department provides the other must be ascertained:

	Provided by IT		Provided by CS	
Service Department	CPU Cycles Used	%	Floor Space in Sq. Ft.	%
Information Technology	196,000,000	98.0%	20,000	80.0%
Custodial Services	4,000,000	2.0%	5,000	20.0%
Totals	**200,000,000**	**100.0%**	**25,000**	**100.0%**

b) Looking just at reciprocal service department activity, custodial services provides 80% of its services to information technology, but IT only provides 2% of its services to custodial. Thus, custodial will be allocated first.

c) The next step is to determine the relative proportions of the three departments that will receive the first allocation (the second allocation will only be distributed to the two production departments, whose allocation bases were determined under the direct method on the preceding page).

Allocate Custodial Services:	Floor Space in Sq. Ft.	%	Amount to Be Allocated	Departmental Allocations
To Milling	56,000	56.0%	$40,000	$22,400
To Finishing	24,000	24.0%	40,000	9,600
To Information Technology	20,000	20.0%	40,000	8,000
Totals	**100,000**	**100.0%**		**$40,000**

d) The step-down allocation is performed as follows:

	Service Departments		Production Departments		
	Custodial Services	Information Technology	Milling	Finishing	Total
Totals before allocation	$ 40,000	$120,000	$300,000	$200,000	$660,000
Allocate Custodial	(40,000)	8,000	22,400	9,600	0
Totals after first allocation	**$ 0**	**$128,000**	**$322,400**	**$209,600**	**$660,000**

Allocate IT:	CPU Cycles Used	%	Amount to Be Allocated	Departmental Allocations
To Milling	60,000,000	62.5%	$128,000	$ 80,000
To Finishing	36,000,000	37.5%	128,000	48,000
Totals	**96,000,000**	**100.0%**		**$128,000**

		Production Departments		
	Information Technology	Milling	Finishing	Total
Totals after first allocation	$128,000	$322,400	$209,600	$660,000
Allocate IT	(128,000)	80,000	48,000	0
Totals after second allocation	**$ 0**	**$402,400**	**$257,600**	**$660,000**

c. The **reciprocal method** is the most complex and the most theoretically sound of the three methods. It is also known as the simultaneous solution method, cross allocation method, matrix allocation method, or double distribution method.

1) The reciprocal method recognizes services rendered by all service departments to each other.

2) EXAMPLE:

a) The reciprocal method requires calculating the allocation base amounts for information technology, i.e., the service department that was not allocated to the other service department under the step method.

Allocate Information Technology:	CPU Cycles Used	%
To Milling	60,000,000	60.0%
To Finishing	36,000,000	36.0%
To Custodial Services	4,000,000	4.0%
Totals	**100,000,000**	**100.0%**

b) Use linear algebra to calculate fully reciprocated information technology costs (FRITC) and fully reciprocated custodial services costs (FRCSC):

FRITC = Preallocation IT costs + (FRCSC × Portion of custodial effort used by IT)
= $120,000 + (FRCSC × 20%)

FRCSC = Preallocation custodial costs + (FRITC × Portion of IT effort used by custodial)
= $40,000 + (FRITC × 4%)

c) These algebraic equations can be solved simultaneously.

FRITC = $120,000 + (FRCSC × 20%)
= $120,000 + {[$40,000 + (FRITC × 4%)] × 20%}
= $120,000 + [($40,000 + .04FRITC) × .2]
= $120,000 + $8,000 + .008FRITC
.992FRITC = $128,000
FRITC = $129,032

FRCSC = $40,000 + (FRITC × 4%)
= $40,000 + ($129,032 × .04)
= $40,000 + $5,161
= $45,161

d) The reciprocal allocation is performed as follows:

	Service Departments		Production Departments		
	Custodial Services	**Information Technology**	**Milling**	**Finishing**	**Total**
Totals before allocation	$40,000	$120,000	$300,000	$200,000	$ 660,000
Allocate Custodial Services (20.0%, 56.0%, 24.0%)	(45,161)	9,032	25,290	10,839	0
Allocate Information Technology (4.0%, 60.0%, 36.0%)	5,161	(129,032)	77,419	46,452	0
Totals after allocation	**$ 0**	**$ 0**	**$402,710**	**$257,290**	**$ 660,000**

3. The examples presented employed a **single rate** to allocate the costs of each support department. Some firms find that employing **dual-rate** allocation provides more useful information.

   a. EXAMPLE: The company has decided to allocate the IT department's costs using a dual-rate method, one rate for the costs of IT's investment in hardware and software (fixed), and another rate for the costs of services provided (variable).

      1) The IT department has determined that $40,000 of its total allocable costs are associated with variable costs. These will henceforth be allocated using technician and programmer hours.

         a) The company's technicians and programmers worked a total of 1,600 hours on projects for the Milling and Finishing Departments during the period. Variable IT costs will thus be applied at the rate of $25 per hour ($40,000 ÷ 1,600).

      2) The remaining $80,000 of allocable IT costs are associated with the department's investment in fixed plant. These costs will continue to be allocated using CPU cycles.

         a) Since the company's central computers consumed a total of 96 million CPU cycles doing processing for the Milling and Finishing Departments during the period, fixed IT costs will be applied at the rate of $0.00083 per cycle ($80,000 ÷ 96,000,000).

      3) The dual-rate allocations will be made as follows:

Allocate to Milling:	**Driver Units Consumed**			**Application Rate**		**Totals**
Variable IT costs	60,000,000	cycles	×	$0.00083	=	$50,000
Fixed IT costs	640	hours	×	$25.00	=	$16,000
Total						**$66,000**

Allocate to Finishing:	**Driver Units Consumed**			**Application Rate**		**Totals**
Variable IT costs	36,000,000	cycles	×	$0.00083	=	$30,000
Fixed IT costs	960	hours	×	$25.00	=	$24,000
Total						**$54,000**

         a) The total amount of IT department costs has been allocated ($66,000 + $54,000 = $120,000).

   b. The dual-rate method can be used to refine a system currently using a single rate under any of the other methods (direct, step-down, reciprocal).

5.5 CORE CONCEPTS

Absorption (Full) vs. Variable (Direct) Costing

- Under **absorption costing** (sometimes called full or full absorption costing), the **fixed portion of manufacturing overhead** is "absorbed" into the cost of each product.
  - Product cost thus includes all manufacturing costs, both fixed and variable. Absorption-basis cost of goods sold is subtracted from sales to arrive at **gross margin**.
  - This method is **required under GAAP** for external reporting purposes and under the Internal Revenue Code for tax purposes.
- **Variable costing** (sometimes called direct costing) is more appropriate for **internal reporting**.
  - Product cost includes **only variable manufacturing costs**. Variable-basis cost of goods sold and the variable portion of S&A expenses are subtracted from gross margin to arrive at **contribution margin**.
- When production exceeds sales, operating income is higher under absorption costing. This is the **perverse incentive** inherent to absorption costing and reveals why many companies prefer variable costing for internal reporting. A production manager can increase absorption-basis operating income merely by increasing production, whether there is any customer demand for the additional product or not.

Joint Product and By-Product Costing

- When two or more separate products are produced by a **common manufacturing process** from a common input, the outputs from the process are joint products. Joint (common) costs are those costs incurred up to the point where the products become separately identifiable, called the **split-off point**.
  - At the split-off point, the joint products acquire separate identities. Costs incurred after split-off are **separable costs**.
- **Several methods** are available to **allocate joint costs**.
  - A physical measure-based approach employs a physical measure such as volume, weight, or a linear measure. The **physical-unit method** allocates joint production costs to each product based on their relative proportions of the measure selected.
  - The **sales-value at split-off method** is based on the relative sales values of the separate products at split-off.
  - The **estimated net realizable value (NRV) method** also allocates joint costs based on the relative market values of the products.
  - The **constant gross-margin percentage NRV method** is based on allocating joint costs so that the gross-margin percentage is the same for every product.
- **By-products** are one or more products of relatively small total value that are produced simultaneously from a common manufacturing process with products of greater value and quantity. They can be sold or discarded.

Overhead Costs and Normal Costing

- Whenever **overhead** is to be allocated, as in job-order costing and activity-based costing, an **appropriate allocation base** must be chosen. In traditional cost accounting, allocation bases include direct labor hours, direct labor cost, machine hours, materials cost, and units of production. The crucial quality of an allocation base is that it be a **cost driver** of the costs in the pool to be allocated.
- Overhead is usually allocated to products based upon the **level of activity**. For example, if overhead is largely made up of machine maintenance, the activity base may be machine hours. The predetermined overhead application rate equals budgeted overhead divided by the budgeted activity level (measure of capacity).

- Inevitably, the overhead amounts applied throughout the year will vary from the amount actually incurred, which is only determinable once the job is complete. This **variance** is called **over- or underapplied overhead**.
- During times of **low production**, per-unit overhead charges will **skyrocket**. This leads to higher product costs during years of lower production and to distortions in the financial statements.
- To **prevent these distortions** in the financial statements, **normal costing** derives the overhead application rate by looking at several years at a time, not just one. **Extended normal costing** applies the use of a normalized rate to direct costs as well as to manufacturing overhead.

Allocation of Service Department Costs

- **Service (support) department** costs are considered part of overhead (indirect costs). Thus, they cannot feasibly be traced to cost objects and therefore **must be allocated** to the operating departments that use the services. When service departments also render services to each other, their costs may be allocated to each other before allocation to operating departments.
- **Three methods** of service department allocation are in general use.
  - The **direct method** is the simplest. The direct method allocates service department costs directly to the producing departments without regard for services rendered by service departments to each other. Service department costs are allocated to production departments based on an allocation base appropriate to each service department's function.
  - The **step** or **step-down method** allocates some of the costs of services rendered by service departments to each other. The step method derives its name from the procedure involved: The service departments are allocated in order, from the one that provides the most service to other service departments down to the one that provides the least.
  - The **reciprocal method** is the most complex and the most theoretically sound of the three methods. It is also known as the simultaneous solution method, cross allocation method, matrix allocation method, or double distribution method. The reciprocal method recognizes services rendered by all service departments to each other.

STUDY UNIT SIX
OPERATIONAL EFFICIENCY
AND BUSINESS PROCESS PERFORMANCE

This study unit is the **last of four** on **cost management**. The relative weight assigned to this major topic in Part 1 of the exam is **25%**. The four study units are:

Study Unit 3: Cost Management Terminology and Concepts
Study Unit 4: Cost Accumulation Systems
Study Unit 5: Cost Allocation Techniques
Study Unit 6: Operational Efficiency and Business Process Performance

After studying the outline and answering the questions in this study unit, you will have the skills necessary to address the following topics listed in the ICMA's Learning Outcome Statements:

Part 1 – Section C.4. Operational efficiency

The candidate should be able to:

a. define a just-in-time system and describe its central purpose
b. identify and describe the operational benefits of implementing a just-in-time system
c. define the term kanban and describe how kanban is used in a just-in-time system
d. demonstrate an understanding of work cells and how they relate to just-in-time processes
e. define material resource planning (MRP)
f. identify and describe the benefits of an MRP system
g. calculate subunits needed to complete an order for a finished product using MRP
h. explain the concept of outsourcing and identify the benefits and limitations of choosing this option
i. demonstrate a general understanding of the theory of constraints
j. identify the five steps involved in theory of constraints analysis
k. define throughput costing (supervariable costing) and calculate inventory costs using throughput costing
l. define and calculate throughput contribution
m. discuss how the theory of constraints and activity-based costing are complementary analytical tools
n. describe how capacity level affects product costing, capacity management, pricing decisions, and financial statements
o. explain how using practical capacity as the denominator for fixed costs rate enhances capacity management
p. calculate the financial impact of implementing the above-mentioned methods

Part 1 – Section C.5. Business process performance

The candidate should be able to:

a. define value chain analysis
b. identify the steps in value chain analysis
c. explain how value chain analysis is used to better understand a firm's competitive advantage
d. define, identify, and provide examples of a value-added activity and explain how the value-added concept is related to improving performance
e. demonstrate an understanding of process analysis and business process reengineering
f. demonstrate an understanding of benchmarking process performance
g. identify the benefits of benchmarking in creating a competitive advantage
h. apply activity-based management principles to recommend process performance improvements
i. explain the relationship among continuous improvement techniques, activity-based management, and quality performance
j. explain the concept of continuous improvement and how it relates to implementing ideal standards and quality improvements
k. define best practice analysis and discuss how it can be used by an organization to improve performance
l. describe and identify the components of the costs of quality, commonly referred to as prevention costs, appraisal costs, internal failure costs, and external failure costs
m. calculate the financial impact of implementing the above-mentioned processes

6.1 JUST-IN-TIME SYSTEMS

1. Modern inventory planning favors the **just-in-time (JIT)** model. Many companies have traditionally built parts and components for subsequent operations on a preset schedule. Such a schedule provides a cushion of inventory so that the next operation will always have parts to work with – a just-in-case method.
    a. In contrast, JIT limits output to the demand of the subsequent operation. Reductions in inventory levels result in **less money invested in idle assets**; reduction of storage space requirements; and lower inventory taxes, pilferage, and obsolescence risks.
        1) High inventory levels often mask production problems because defective parts can be overlooked when plenty of good parts are available. If only enough parts are made for the subsequent operation, however, any defects will immediately halt production.
        2) The **focus of quality control** under JIT shifts from the discovery of defective parts to the prevention of quality problems, so zero machine breakdowns (achieved through preventive maintenance) and zero defects are ultimate goals. Higher quality and lower inventory go together.
    b. **Objectives.** JIT is a reaction to the trends of global competition and rapid technological progress that have resulted in shorter product life-cycles and greater consumer demand for product diversity.
        1) Higher productivity, reduced order costs as well as carrying costs, faster and cheaper setups, shorter manufacturing cycle times, better due date performance, improved quality, and more flexible processes are objectives of JIT methods.
        2) The ultimate objectives are increased competitiveness and higher profits.

c. JIT systems are based on a **manufacturing philosophy** popularized by the Japanese that combines purchasing, production, and inventory control.

1) **Minimization of inventory** is a goal because many inventory-related activities are viewed as nonvalue-added. Indeed, carrying inventory is regarded as a symptom of correctable problems, such as poor quality, long cycle times, and lack of coordination with suppliers.

d. However, JIT also encompasses changes in the **production process** itself.

1) JIT is a **pull system**; items are pulled through production by current demand, not pushed through by anticipated demand.

2) Thus, one operation produces only what is needed by the next operation, and components and raw materials arrive just in time to be used.

e. One feature of the lower inventory levels in a JIT system is **elimination of the need for certain internal controls**.

1) Frequent receipt of deliveries from suppliers often means less need for a sophisticated inventory control system and for control personnel.

2) JIT also may eliminate central receiving areas, hard copy receiving reports, and storage areas. A central warehouse is not needed because deliveries are made by suppliers directly to the area of production.

3) The quality of parts provided by suppliers is verified by use of statistical controls rather than inspection of incoming goods. Storage, counting, and inspecting are eliminated in an effort to perform only value-adding work.

f. In a JIT system, the **suppliers' dependability** is crucial. Organizations that adopt JIT systems therefore develop close relationships with a few carefully chosen suppliers who are extensively involved in the buyer's processes.

1) Long-term contracts are typically negotiated to reduce order costs. Indeed, some major retailers have agreed to **continuous replenishment** arrangements whereby a supplier with superior demand forecasting ability essentially tells the buyer when and how much to reorder.

2) Buyer-supplier relationships are further facilitated by **electronic data interchange (EDI)**, a technology that allows the supplier access to the buyer's online inventory management system. Thus, electronic messages replace paper documents (purchase orders and sales invoices), and the production schedules and deliveries of the parties can be more readily coordinated.

2. The Japanese term **kanban** and JIT have often been confused. JIT is the total system of purchasing, production, and inventory control. Kanban is one of the many elements in the JIT system as it was developed by the Toyota Motor Corporation (kanban is not characteristic of Japanese industry as a whole).

a. Kanban means **ticket**. Tickets (also described as cards or markers) control the flow of production or parts so that they are produced or obtained in the needed amounts at the needed times.

b. A basic kanban system includes a **withdrawal kanban** that states the quantity that a later process should withdraw from its predecessor, a **production kanban** that states the output of the preceding process, and a **vendor kanban** that tells a vendor what, how much, where, and when to deliver.

c. U.S. companies have not been comfortable with controlling production using tickets on the production floor. **Computerized information systems** have been used for many years, and U.S. companies have been reluctant to give up their computers in favor of the essentially manual kanban system. Instead, U.S. companies have integrated their existing systems, which are complex computerized planning systems, with the JIT system.

3. To implement a JIT approach to inventory management and to eliminate waste of materials, labor, factory space, and machine usage, the **factory is reorganized** to permit what is often called **lean production**.
    a. **Plant layout** in a JIT-lean production environment is not arranged by functional department or process but by **manufacturing cells (work cells)**. Cells are sets of machines, often grouped in semicircles, that produce a given product or product type.
    b. Each worker in a cell must be able to operate all machines and, possibly, to perform support tasks, such as setup activities, preventive maintenance, movement of work-in-process within the cell, and quality inspection.
        1) In such a pull system, workers might often be idle if they are not multi-skilled.
    c. Central support departments are reduced or eliminated, space is saved, fewer and smaller factories may be required, and materials and tools are brought close to the point of use.
        1) **Manufacturing cycle time** and **setup time** are also reduced. As a result, **on-time delivery performance** and response to changes in markets are enhanced, and production of customized goods in small lots becomes feasible.
    d. A cellular organization requires workers to operate as effective teams, so **employee empowerment** is crucial in a JIT-lean production system.
        1) Greater participation by employees is needed to achieve the objectives of **continuous improvement** and **zero defects**, so they may, for example, have the power to stop production to correct a problem, be consulted about changes in processes, or become involved in hiring co-workers. Thus, managers in such a system usually play more of a facilitating than a support role.

6.2 MATERIALS REQUIREMENTS PLANNING AND OUTSOURCING

1. Short-range (tactical or operational) plans must be converted into **specific production targets** for finished goods. The **raw materials** going into the creation of these end products must be carefully scheduled for delivery.
    a. The yearly/quarterly/monthly numbers and styles of finished goods called for in the demand forecasts included in the operational plans must be turned into specific dates for completion and availability for shipment to the customer. This is the task of the **master production schedule (MPS)**.
    b. A **materials requirements planning (MRP)** system enables a company to efficiently fulfill the requirements of the MPS by coordinating both the manufacture of component parts for finished goods and the arrival of the raw materials necessary to create the intermediate components.
        1) As computers were introduced into manufacturing, it was common for firms to have a production scheduling system and an inventory control system. MRP joins the two into a single application.
        2) The three overriding goals of MRP are the arrival of the **right part** in the **right quantity** at the **right time**.

2. MRP is a **push system**, that is, the demand for raw materials is driven by the forecasted demand for the final product, which can be programmed into the computer.
   a. For example, an automobile manufacturer need only tell the computer how many autos of each type are to be manufactured.
   b. The MRP system consults the **bill of materials (BOM)**, a record of which (and how many) subassemblies go into the finished product. The system then generates a complete list of every part and component needed.
      1) EXAMPLE: A manufacturer has the following bill of materials for its product:

Subunit	Quantity
CM12	1
PR75	5

The bill of materials for the component subunits is as follows:

Subunit	Contains	Quantity
CM12	TT413	2
	XH511	3
PR75	LQ992	1

Current inventory quantities are as follows:

Subunit	On Hand
CM12	25
PR75	35
LQ992	30
TT413	40
XH511	50

The company has 20 units of the finished product in inventory and wishes to maintain this level throughout the year. Production of 40 units is scheduled for the upcoming month. The quantities of the principal subunits that must be produced are calculated below:

Subunit	Quantity per Finished Product		Production Run		Quantity Needed		Quantity On Hand		To Be Built
CM12	1	×	40	=	40	–	25	=	15
PR75	5	×	40	=	200	–	35	=	165

The parts that must be ordered from vendors can thus be calculated as follows:

Subunit	Components	Component Quantity		Subunits To Be Built		Quantity Needed		Quantity On Hand		To Be Purchased
CM12	TT413	2	×	15	=	30	–	30	=	0
	XH511	3	×	15	=	45	–	40	=	5
PR75	LQ992	1	×	165	=	165	–	50	=	115

   c. MRP, in effect, creates schedules of when items of inventory will be needed in the production departments.
      1) If parts are not in stock, the system automatically generates a purchase order on the proper date (considering lead times) so that deliveries will arrive on time.
      2) The **timing of deliveries** is vital to avoid both production delays AND a pileup of raw materials inventory that must be stored.
   d. Some **benefits** of MRP are
      1) Reduced idle time.
      2) Lower setup costs.
      3) Lower inventory carrying costs.
      4) Increased flexibility in responding to market changes.

3. **Manufacturing resource planning (MRP II)** is a closed-loop manufacturing system that integrates all facets of a manufacturing business, including production, sales, inventories, schedules, and cash flows. The same system is used for both the financial reporting and managing operations (both use the same transactions and numbers).
   a. Because manufacturing resource planning encompasses materials requirements planning, MRP is a component of an MRP II system.
4. **Outsourcing** is the management or day-to-day execution of an entire business function by a third-party service provider. Outsourced services may be provided on or off premises, in the same country, or in a separate country.
   a. Outsourcing enables a company to focus on its core business rather than having to be concerned with marginal activities. For example, payroll preparation is often outsourced because a company does not want to maintain a full-time staff to perform what is only a weekly or monthly activity.
   b. **Business process outsourcing** is the outsourcing of back office and front office functions typically performed by white collar and clerical workers. Examples of these functions include data processing, accounting, human resources, and medical coding and transcription.
      1) **Insourcing** is the transfer of an outsourced function to an internal department of a company to be managed entirely by company employees. The term has also been used to describe a foreign company's locating of facilities in a host country where it employs local workers.
      2) **Cosourcing** is performance of a business function by both internal staff and external resources, such as consultants or outsourcing vendors, who have specialized knowledge of the business function.
   c. **Benefits** of outsourcing include reliable service, reduced costs, avoidance of the risk of obsolescence, and access to technology. **Disadvantages** include dependence on an outside party and loss of control over a necessary function.

6.3 THEORY OF CONSTRAINTS AND THROUGHPUT COSTING

1. The **theory of constraints (TOC)**, devised by Israeli physicist and business consultant Eliyahu Goldratt (b. 1948), is a system to improve human thinking about problems. It has been greatly extended to include manufacturing operations.
   a. The basic premise of TOC as applied to business is that improving any process is best done not by trying to maximize efficiency in every part of the process, but by focusing on the **slowest part of the process**, called the **constraint**.
      1) EXAMPLE: During the early days of the American Civil War, several units calling themselves legions were formed, consisting of combined infantry, artillery, and cavalry. This arrangement did not last because the entire unit could only maneuver as fast as the slowest part. The artillery was the constraint.
      2) Increasing the efficiency of processes that are not constraints merely creates backup in the system.
2. The **steps in a TOC analysis** are as follows (they are described in more detail under item 3.):
   a. **Identify** the constraint.
   b. **Determine** the most profitable product mix given the constraint.
   c. **Maximize** the flow through the constraint.
   d. **Increase** capacity at the constraint.
   e. **Redesign** the manufacturing process for greater flexibility and speed.

3. The detailed steps in performing a TOC analysis are described below and on the next page:
   a. **Identify the constraint.**
      1) The **bottleneck operation** can usually be identified as the one where work-in-process backs up the most.
      2) A more sophisticated approach is to analyze available resources (number and skill level of employees, inventory levels, time spent in other phases of the process) and determine which phase has negative slack time, i.e., the phase **without enough resources** to keep up with input.
   b. **Determine the most profitable product mix** given the constraint.
      1) A basic principle of TOC analysis is that short-term profit maximization requires maximizing the contribution margin **through the constraint**, called the **throughput margin** or throughput contribution.
         a) TOC thus helps managers to recognize that the product they should produce the most of is not necessarily the one with the highest contribution margin per unit, but the one with the **highest throughput margin per unit**, i.e., managers must make the most profitable use of the bottleneck operation.
      2) **Throughput costing**, sometimes called **supervariable costing**, recognizes **only direct materials costs** as being truly variable and thus relevant to the calculation of throughput margin. All other manufacturing costs are ignored because they are considered fixed in the short run.

         Throughput margin = Sales – Direct materials

      3) EXAMPLE: (Note: This is the same example as that used in item 5. in Study Unit 5, Subunit 1, with a subtotal for supervariable costing added.)
         a) During its first month in business, a firm produced 100 units and sold 80 while incurring the following costs:

Direct materials	$1,000
Manufacturing costs used in supervariable costing	**$1,000**
Direct labor	2,000
Variable overhead	1,500
Manufacturing costs used in variable costing	**$4,500**
Fixed overhead	3,000
Manufacturing costs used in absorption costing	**$7,500**

         b) The impact on the financial statements of using one method over another can be seen in the following calculations. Note that, because throughput costing capitalizes so few costs as product costs, **ending inventory and cost of goods sold are lower** than under variable costing and much lower than under absorption costing.

Cost per unit:	
Absorption ($7,500 ÷ 100 units)	$75
Variable ($4,500 ÷ 100 units)	45
Supervariable ($1,000 ÷ 100 units)	10
Ending inventory:	
Absorption ($75 × 20 units)	$1,500
Variable ($45 × 20 units)	900
Supervariable ($10 × 20 units)	200

c) Below is a comparison of the calculation of operating income under two of the methods.

i) The units were sold at a price of $100 each.

ii) The company incurred $200 of variable selling and administrative expenses and $600 of fixed selling and administrative expenses.

iii) Note the drastic reduction in operating income resulting from the treatment of so many costs as period costs under throughput costing.

Variable Costing			Supervariable Costing		
Sales		**$ 8,000**	**Sales**		**$ 8,000**
Beginning inventory	$ 0		Beginning inventory	$ 0	
Variable manufacturing costs	4,500		Direct materials costs	1,000	
Goods available for sale	$ 4,500		Goods available for sale	$1,000	
Less: ending inventory	(900)		Less: ending inventory	(200)	
Variable cost of goods sold		**(3,600)**	**Supervariable cost of goods sold**		**(800)**
Variable S&A expenses		(200)			
Contribution margin		**$ 4,200**	**Throughput margin**		**$7,200**
			Direct labor		(2,000)
			Variable overhead		(1,500)
			Variable S&A expenses		(200)
Fixed overhead		(3,000)	Fixed overhead		(3,000)
Fixed S&A expenses		(600)	Fixed S&A expenses		(600)
Operating income		**$ 600**	**Operating loss**		**$ (100)**

4) To determine the most profitable use of the bottleneck operation, a manager next calculates the throughput margin **per unit of time spent in the constraint**.

a) **Profitability is maximized** by keeping the bottleneck operation busy with the product with the highest throughput margin per unit of time.

c. **Maximize the flow** through the constraint.

1) **Production flow** through a constraint is managed using the **drum-buffer-rope (DBR)** system.

a) The **drum** (i.e., the beat to which a production process marches) is the bottleneck operation. The constraint sets the pace for the entire process.

b) The **buffer** is a minimal amount of work-in-process input to the drum that is maintained to ensure that it is always in operation.

c) The **rope** is the sequence of activities preceding and including the bottleneck operation that must be coordinated to avoid inventory buildup.

d. **Increase capacity** at the constraint.

1) In the short-run, TOC encourages a manager to make the best use of the bottleneck operation. The medium-term step for improving the process is to increase the **bottleneck operation's capacity**.

e. **Redesign** the manufacturing process for greater flexibility and speed.

1) The **long-term solution** is to reengineer the entire process. The firm should take advantage of new technology, product lines requiring too much effort should be dropped, and remaining products should be redesigned to ease the manufacturing process.

a) **Value engineering** is useful for this purpose because it explicitly balances product cost and the needs of potential customers (product functions).

4. **Extended Example:**

   a. **Identify the constraint.**

      1) A company makes three products: an airborne radar unit, a seagoing sonar unit, and a ground sonar unit. Under the current setup, the hours spent by each product in the two phases of the manufacturing process are as follows:

Product	Assembly	Testing
Airborne Radar	3	4
Seagoing Sonar	8	10
Ground Sonar	5	5

      2) The company has 150 hours available every month for testing. Under the current setup, therefore, the testing phase is the constraint.

   b. **Determine the most profitable product mix** given the constraint.

      1) The company calculates the throughput margin on each product and divides by the hours spent in testing:

	Radar	Seagoing Sonar	Ground Sonar
Price	$200,000	$600,000	$300,000
Less: Materials costs	(100,000)	(400,000)	(250,000)
Throughput margin	$100,000	$200,000	$ 50,000
Divided by: Constraint time	÷ 4	÷ 10	÷ 5
Throughput margin per hour	**$ 25,000**	**$ 20,000**	**$ 10,000**

      2) The crucial factor in determining the optimal product mix is not which product is the most profitable product in terms of absolute throughput margin (the seagoing sonar), but which one generates the **highest margin per time spent** in the bottleneck operation (the radar).

      3) To derive the most profitable product mix given finite resources, **customer demand** must be taken into account. The company has determined that it can sell 12 units of radar, 6 units of seagoing sonar, and 22 units of ground sonar per month.

      4) The **available time in the bottleneck operation** is first devoted to the product with the highest throughput margin (TM), then in descending order until the company is unable to meet demand.

         a) In the calculation below, the hours remaining after assignment to each product are the hours which can be devoted to the next product.

	Highest TM: Radar	**2nd Highest TM:** Seagoing Sonar	**Lowest TM:** Ground Sonar
Demand in unit	12	6	22
Times: hours per unit in bottleneck	× 4	× 10	× 5
Hours needed to fulfill demand	48	60	110
Add: hours available	150	102	42
Hours remaining	102	42	(68)

      5) Applying the principles of TOC, the company will forgo some sales of the ground sonar in favor of products that are more profitable given the current constraint.

   c. **Maximize the flow** through the bottleneck operation.

      1) The company will apply a drum-buffer-rope system to ensure that the bottleneck operation stays busy on high-TM products while keeping work-in-process inventory to a minimum.

d. **Increase capacity** at the bottleneck operation.
   1) The company will hire and train more employees for the testing department.
e. **Redesign the manufacturing process** for greater flexibility and speed.
   1) The company will examine its markets and new manufacturing technology to determine which products it wants to continue selling, whether to add new ones, and whether to retool the production line.

5. **TOC analysis complements activity-based costing (ABC)** (see Study Unit 4, Subunit 3) because they focus on different aspects of process improvement.
   a. **TOC** has a **short-term focus** based on costs of materials and product mix; **ABC** has a **long-term focus** which considers all product costs and is concerned with strategic pricing and profit planning.
   b. TOC analysis, unlike ABC, addresses the issues of resource constraints and operational capacity.
   c. TOC ignores cost drivers, focusing mainly on process time; ABC requires defining cost drivers in every part of the organization.

6.4 CAPACITY PLANNING

1. **Capacity planning** is an element of strategic planning that is closely related to capital budgeting. Statement on Management Accounting (SMA) 4Y, *Measuring the Cost of Capacity* (issued by the IMA in March 1996), states that maximizing the value created within an organization starts with understanding the nature and capabilities of all of the company's resources. Thus, capacity should be defined from several different perspectives. Managing the cost of that capacity starts when a product or process is first envisioned. It continues through the subsequent disposal of resources downstream. Effective capacity cost management requires the following:
   a. In the short run, **optimizing capital decisions** and the effective and flexible use of investments that have already been made
   b. Maximizing the value delivered to **customers**
   c. Helping **minimize requirements** for future investment
   d. Supporting effective matching of a firm's **resources** with current and future market **opportunities**
   e. Closing any gap between **market demands** and a firm's capabilities
      1) At times, the firm may have excess capabilities; at others, shortages may exist. These capabilities may be physical, human, technological, or financial.
   f. **Eliminating waste** in the short, intermediate, and long run
   g. Providing useful **costing information** on current process costs versus those proposed in current or future investment proposals
   h. Supporting the establishment of capacity **usage measurements** that identify the cost of capacity and its impact on business cycles and overall company performance
   i. Identifying the capacity required to meet **strategic and operational objectives** and to estimate current available capacity
   j. Detailing the **opportunity cost** of unused capacity and suggesting ways to account for that cost
   k. Supporting **change efforts** by providing predecision information and analysis on the potential resource and cost implications of a planned change

l. Creating a **common language** for, and understanding of, capacity cost management

m. As mentioned on the previous page, capacity planning is part of the capital budgeting process. Estimating capacity levels for future periods allows for the acquisition of more capacity when needed, or disposal of capacity that is not expected to be utilized.

n. Capacity level influences product costing, pricing decisions, and financial statements. Excess capacity has a cost. Having excess capacity means that a company will either have to charge higher prices for its products or will report lower income on its financial statements.

o. Similarly, producing at full capacity can have a cost in the form of opportunity costs. A company that could generate additional sales if it had more capacity needs to address whether the acquisition of additional capacity is warranted.

2. **Capacity expansion.** According to business strategy theorist Michael E. Porter, whether to expand capacity is a major **strategic decision** because of the capital required, the difficulty of forming accurate expectations, and the long timeframe of the lead times and the commitment. The key forecasting problems are **long-term demand** and **behavior of competitors**. The key strategic issue is **avoidance of industry overcapacity**. Capacity expansion is also referred to as market penetration because it involves increasing the amount of an existing product in an existing market.

   a. **Undercapacity** in a profitable industry tends to be a short-term issue. Profits ordinarily lure additional investors. Overcapacity tends to be a long-term problem because firms are more likely to compete intensely rather than reverse their expansion.

   b. The formal **capital budgeting** process entails predicting future cash flows related to the expansion project, discounting them at an appropriate interest rate, and determining whether the **net present value** is positive. This process permits comparison with other uses of the firm's resources.

      1) The apparent simplicity of this process is deceptive because it depends upon, among many other things, which expansion method is chosen, developments in technology, and profitability. The latter factor in turn depends on such uncertainties as total long-term demand and the expansion plans of rival firms.

   c. **Porter's model** of the decision process for **capacity expansion** has the following interrelated steps:

      1) The firm must **identify the options** in relation to their size, type, degree of vertical integration (if any), and possible response by competitors.

      2) The second step is to **forecast demand, input costs, and technology developments**. The firm must be aware that its technology may become obsolete or that future design changes to allow expansion may or may not be possible. Moreover, the expansion itself may put upward pressure on input prices.

      3) The next step is **analysis of competitors** to determine when each will expand. The difficulty is that forecasting their behavior depends on knowing their expectations. Another difficulty is that each competitor's actions potentially affect all other competitors' actions, with the industry leader being most influential.

      4) Using the foregoing information, the firm predicts **total industry capacity and firms' market shares**. These estimates, together with the expected demand, permit the firm to predict **prices and cash flows**.

      5) The final step is **testing for inconsistencies**.

d. The extent of **uncertainty about future demand** is a crucial variable in determining the nature of industry expansion. For example, if uncertainty is great, firms willing to take greater risks because of their large cash resources or strategic stake in the industry will act first. Other firms will await events.

1) When demand uncertainty is low, firms will tend to adopt a strategy of **preemption**, usually with strong market signals, to forestall competitors' expansion plans. Excess preemption leads to excess industry capacity because firms overestimate their competitive strengths, misunderstand market signals, or fail to accurately assess competitors' intentions.

3. Using **practical capacity** as the denominator rate for **allocating fixed overhead** can enhance capacity management.

a. Practical capacity in the denominator aligns the allocation of fixed costs with normal production activity. Any variance can be a signal for a change in demand for the product.

b. A firm that allocates fixed costs based on maximum capacity will consistently underapply fixed overhead during times of normal production.

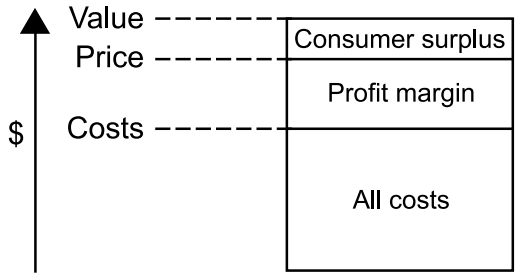
6.5 VALUE CHAIN ANALYSIS

1. To remain on the market, a product must provide **value to the customer** and a **profit to the seller**.

a. Customers assign value to a product. The producer can affect the customer's perception of value by **differentiating the product** and **lowering its price**.

b. The producer's profit is the difference between its costs and the price it charges for the product. Thus, by keeping costs low, the producer has more flexibility in pricing.

c. The relationship of these three aspects of value creation can be graphically depicted as follows:

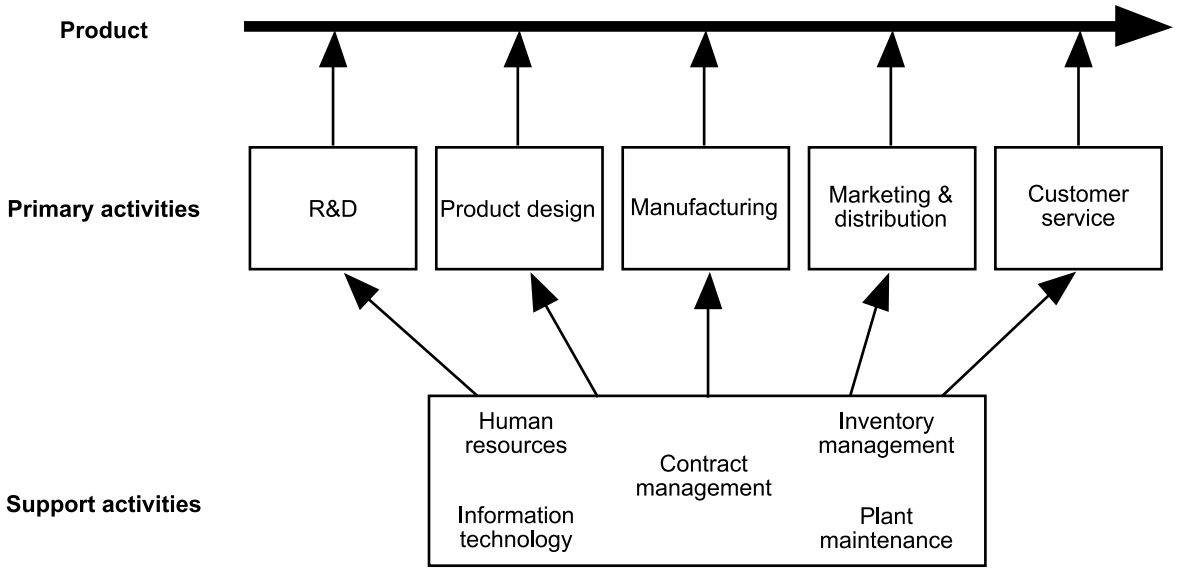


2. The **value chain** is a model for depicting the way in which every function in a company adds value to the final product. "The value chain approach for assessing competitive advantage is an integral part of the strategic planning process." (SMA 4X, *Value Chain Analysis for Assessing Competitive Advantage*, March 1996)

a. A value chain depicts how costs and customer value accumulate along a chain of activities that lead to an end product or service. A value chain consists of the internal processes or activities a company performs: R&D, design, production, marketing, distribution, and customer service.

b. Another view is that the value chain consists of all of the value-creating activities leading to the ultimate end-use product delivered into the final consumers' hands. In other words, a value chain is a firm's overall chain of value-creating (value-added) processes.

c. **Primary activities** deal with the product directly. **Support activities** lend aid to the primary activity functions. The value chain can be graphically depicted as follows:



d. **Value-chain analysis** is a strategic analysis tool that allows a firm to focus on those activities that are consistent with its overall strategy.

1) Value-chain analysis allows a firm to decide **which parts of the value chain** it wants to occupy and how each activity then contributes to the firm's competitive advantage by adding customer value or by reducing costs.
2) Because the value chain identifies and connects the organization's strategic activities, value chain analysis improves the firm's knowledge of its relations with customers, suppliers, and competitors.
    a) It also facilitates the strategic determination of the phase(s) of the industry's value chain in which the firm should operate.
3) The first step in a value-chain analysis is to **identify** the firm's **value-creating activities**.
4) The second step is to determine how each value-creating activity can **produce a competitive advantage** for the firm. This step has multiple substeps.
    a) Identify the firm's competitive advantage (e.g., cost reduction, product differentiation) so that the firm's position in the industry's value chain can be clarified.
    b) Identify the ways in which the firm's value-creating activities can generate additional customer value.
    c) Identify activities that are candidates for cost reduction or, in the case of non-core competencies, outsourcing.
    d) Identify value-adding ways in which the firm's remaining activities can be linked.
5) Value-chain analysis is a team effort. Management accountants need to collaborate with engineering, production, marketing, distribution, and customer service professionals to focus on the strengths, weaknesses, opportunities, and threats identified in the value-chain analysis results.
6) Value-chain analysis offers an excellent opportunity to integrate strategic planning and management accounting to guide the firm to survival and growth.

3. The **supply chain** is the flow of materials and services from their original sources to final consumers. Moreover, it usually encompasses more than one firm. Firms seeking to improve performance and reduce costs must analyze all phases of the supply chain as well as the value chain. Thus, a firm must reduce the cost of, and increase the value added by, its purchasing function.
    a. **Purchasing** is the management function that concerns the acquisition process. It includes choice of vendors, contract negotiation, the decision whether to purchase centrally or locally, and **value analysis**. The process is initiated by purchase requisitions issued by the production control function.
        1) Purchase requisitions ultimately result from **insourcing vs. outsourcing (make vs. buy)** decisions made when production processes were designed.
        2) For a retailer, the purchase decision is the same as the decision about what to sell.
        3) The choice of vendors depends on price, quality, delivery performance, shipping costs, credit terms, and service. Purchasers with a competitive orientation and considerable economic power may be able to extract very favorable terms from vendors.
        4) Purchasers with a cooperative orientation adopt a longer-term approach: **supply chain coordination**. The purchaser and the vendor are viewed as committed to a partnership involving joint efforts to improve quality.
            a) For example, in the case of a major manufacturer and one of its suppliers, this orientation may include the purchaser's willingness to help develop the vendor's managerial, technical, and productive capacities. Thus, it tends to result in minimizing the number of vendors.
            b) Supply chain analysis and coordination should extend to all parties in the chain, from initial sources of materials to retailers.
            c) Coordination has special relevance to **inventory management**. By sharing information among all parties, demand uncertainty is reduced at each level, with consequent decreases of inventory at each level, minimization of stockouts, and avoidance of overproduction and rush orders.
                i) For example, such cooperation counteracts what has been called the **bullwhip or backlash effect**. This phenomenon occurs when demand variability increases at each level of the supply chain. Thus, retailers face only customer demand variability, but the manufacturer must cope with retailer demand variability that is greater than customer demand variability because retailers' purchases vary with additional factors, such as batching of orders and trade promotions. Similarly, the variability of manufacturer demands on suppliers may be greater than the variability of retailer demands on manufacturers.
    b. **Critical success factors.** Value-chain and supply-chain analysis should be used to meet customer requirements for better performance regarding
        1) Cost reduction,
        2) Efficiency,
        3) Continuous improvement of quality to meet customer needs and wants,
        4) Minimization or elimination of defects,
        5) Faster product development and customer response times, and
        6) Constant innovation.

4. **Value engineering** is a means of reaching targeted cost levels. It is a systematic approach to assessing all aspects of the value chain cost buildup for a product. The purpose is to minimize costs without sacrificing customer satisfaction. Value engineering requires distinguishing between cost incurrence and **locked-in costs**.
   a. **Cost incurrence** is the actual use of resources, but **locked-in (designed-in)** costs will result in use of resources in the future as a result of past decisions. Thus, value engineering emphasizes controlling costs at the design stage, that is, before they are locked in.
   b. **Life-cycle costing** is sometimes used as a basis for cost planning and product pricing. Life-cycle costing estimates a product's revenues and expenses over its expected life cycle. The result is to highlight upstream and downstream costs in the cost planning process that often receive insufficient attention. Emphasis is on the need to price products to cover all costs, not just production costs.

6.6 OTHER PROCESS IMPROVEMENT TOOLS

1. **Process analysis** is a means of linking a firm's internal processes to its overall strategy.
   a. **Types of Process**
      1) **Continuous**, such as candy bars squirted out by machinery.
      2) **Batch**, such as beer brewing.
      3) **Hybrid**, in which both continuous and batch processes are used.
      4) **Make-to-stock**, such as automobile assembly.
      5) **Make-to-order**, such as deli sandwich making.
   b. **Process interdependence.** The degree of interdependence among the stages in a process is referred to as "tightness."
      1) A **tight process** is one in which a breakdown in one stage brings the succeeding stages to a halt. This is characteristic of continuous processes that do not have buffer work-in-process inventories.
      2) A **loose process** is one in which subsequent stages can continue working after a breakdown in a previous stage. This is characteristic of batch processes and any others with extensive work-in-process inventories.
   c. **Bottlenecks.** Very few processes run at the precise same speed in every stage.
      1) One part of the process is almost always the slowest, referred to as the "bottleneck." If capacity is added at that point, the bottleneck simply shifts to the next slowest operation.
         a) The theory of constraints was developed to deal with this challenge (see Subunit 6.3)
      2) The bottleneck issue only arises when demand for the firm's product is sufficient to absorb all of the output. When a production line is running at less than full capacity, bottlenecks can be avoided.

2. **Process value analysis** is a comprehensive understanding of how an organization generates its output. It involves a determination of which activities that use resources are **value-adding** or **nonvalue-adding** and how the latter may be reduced or eliminated.
    a. This linkage of **product costing** and **continuous improvement** of processes is **activity-based management (ABM)**. ABM redirects and improves the use of resources to increase the value created for customers and other stakeholders. It encompasses activity analysis, cost driver analysis, and quality performance measurement.
        1) **Kaizen** is the Japanese word for the continuous pursuit of improvement in every aspect of organizational operations.
            a) For example, a budget prepared on the kaizen principle projects costs based on future improvements. The possibility of such improvements must be determined, and the cost of implementation and the savings therefrom must be estimated.
    b. An **activity analysis** determines what is done, by whom, at what cost in time and other resources, and the value added by each activity.
        1) A **value-added activity** is necessary to remain in business. For example, a manufacturer would deem the conversion of raw materials into salable products a value-added activity.
            a) Such an activity may be mandated (e.g., a regulatory requirement) or discretionary. The latter produces some changes not otherwise achievable that enables other activities to occur.
        2) A **value-added cost** is incurred to perform a value-added activity without waste. Most types of direct labor would be considered value-added cost because the costs are being incurred to directly produce the product.
        3) A **nonvalue-added activity** is unnecessary and should be eliminated. The act of generating nonsalable final products is a nonvalue-added activity.
            a) An example of a nonvalue-added activity is where inventory has to be moved long distances from one work station to another in a production process. Similarly, inventory that has to wait in line before being processed is a waste. This is why just-in-time inventory systems have proved popular, because JIT eliminates much of the waste in a production process.
        4) A **nonvalue-added cost** is caused by a nonvalue-added activity or inefficient performance of a value-added activity. The costs of raw materials and direct labor expended on products that fail inspection would be considered nonvalue-added costs.
            a) Thus, **managing the causes of cost** results in elimination of unnecessary activities as well as greater efficiency of activities.
        5) Financial and nonfinancial **measures of activity performance** address efficiency, quality, and time. The purpose is to assess how well activities meet customer demands. To satisfy customer needs and wants, activities should be **efficient** (a favorable input-to-output ratio) so that customers are willing to pay the prices charged. Activities should produce defect-free output (high **quality**), and that output should be produced in a **timely** manner (with less resource usage and in response to customer requirements).
        6) The **selection of value-added activities** in each place of the value chain reflects the firm's determination of its **competitive advantage** and its choice of **competitive strategy**. For example, different design strategies require different activities and costs. A firm might choose to be the low-cost producer of an undifferentiated product rather than compete on the basis of superior product quality.

c. One aspect of process analysis is the management of **time**. Product development time is a crucial factor in the competitive equation. A company that is first in the market with a new product has obvious advantages.

1) Reducing development time is also important because product life cycles are becoming shorter.

2) Companies need to respond quickly and flexibly to new technology, changes in consumer tastes, and competitive challenges.

3. Technological advances have increased the popularity of business process reengineering.

a. **Business process reengineering (BPR)** is a complete rethinking of how business functions are performed to provide value to customers, that is, radical innovation instead of mere improvement, and a disregard for current jobs, hierarchies, and reporting relationships.

b. A **process** is how something is accomplished in a firm. It is a set of activities directed toward the same objective. Reengineering is process innovation and core process redesign. Instead of improving existing procedures, it finds new ways of doing things. Thus, reengineering should be contrasted with **process improvement**, which consists of incremental but constant changes that improve efficiency.

1) Accordingly, BPR techniques eliminate many traditional controls. They exploit modern technology to improve productivity and decrease the number of clerical workers. Thus, the emphasis is on developing controls that are automated and self-correcting and require minimal human intervention.

c. The emphasis therefore shifts to monitoring internal control so management can determine when an operation may be out of control and corrective action is needed.

1) Most BPR techniques also assume that humans will be motivated to work actively in improving operations when they are full participants in the process.

d. **Monitoring** assesses the quality of internal control over time. Management considers whether internal control is properly designed and operating as intended and modifies it to reflect changing conditions. Monitoring may be in the form of separate, periodic evaluations or of ongoing monitoring.

1) Ongoing monitoring occurs as part of routine operations. It includes management and supervisory review, comparisons, reconciliations, and other actions by personnel as part of their regular activities.

4. SMA 4V, *Practices and Techniques: Effective Benchmarking* (July 1995), describes techniques for improving the effectiveness of benchmarking, which is a means of helping companies with productivity management and business process reengineering.

a. "**Benchmarking** involves continuously evaluating the practices of best-in-class organizations and adapting company processes to incorporate the best of these practices." It "analyzes and measures the key outputs of a business process or function against the best and also identifies the underlying key actions and root causes that contribute to the performance difference."

1) Benchmarking is an ongoing process that entails quantitative and qualitative measurement of the difference between the company's performance of an activity and the performance by the best in the world. The benchmark organization need not be a competitor.

b. The first phase in the benchmarking process is to **select and prioritize benchmarking projects**.

1) An organization must understand its critical success factors and business environment to identify key business processes and drivers and to develop parameters defining what processes to benchmark. The criteria for selecting what to benchmark relate to the reasons for the existence of a process and its importance to the entity's mission, values, and strategy. These reasons relate in large part to satisfaction of end users or customer needs.

c. The next phase is to organize **benchmarking teams**. A team organization is appropriate because it permits an equitable division of labor, participation by those responsible for implementing changes, and inclusion of a variety of functional expertise and work experience. Team members should have knowledge of the function to be benchmarked, respected positions in the company, good communication skills, teaming skills, motivation to innovate and to support cross-functional problem solving, and project management skills.

d. The benchmarking team must thoroughly **investigate and document internal processes**. The organization should be seen as a series of processes, not as a fixed structure. A process is "a network of related and independent activities linked by the outputs they exchange." One way to determine the primary characteristics of a process is to trace the path a request for a product or service takes through the organization.

   1) The benchmarking team must also develop a **family of measures** that are true indicators of process performance and a process taxonomy, that is, a set of process elements, measures, and phrases that describes the process to be benchmarked.

e. **Researching and identifying best-in-class performance** is often the most difficult phase. The critical steps are setting up databases, choosing information-gathering methods (internal sources, external public domain sources, and original research are the possible approaches), formatting questionnaires (lists of questions prepared in advance), and selecting benchmarking partners.

f. The **data analysis phase** entails identifying performance gaps, understanding the reasons they exist, and prioritizing the key activities that will facilitate the behavioral and process changes needed to implement the benchmarking study's recommendations. Sophisticated statistical and other methods may be needed when the study involves many variables, testing of assumptions, or presentation of quantified results.

g. Leadership is most important in the **implementation phase** of the benchmarking process because the team must be able to justify its recommendations. Moreover, the process improvement teams must manage the implementation of approved changes.

5. The trend in managerial performance evaluation is the **balanced scorecard** approach. Multiple measures of performance permit a determination as to whether a manager is achieving certain objectives at the expense of others that may be equally or more important. For example, an improvement in operating results at the expense of new product development would be apparent using this approach.

   a. The scorecard is a **goal congruence tool** that informs managers about the nonfinancial factors that top management believes to be important.

   b. As mentioned previously, measures may be financial or nonfinancial, internal or external, and short term or long term.

   c. The balanced scorecard facilitates best practice analysis. **Best practice analysis** is a method of accomplishing a business function or process that is considered to be superior to all other known methods. A lesson learned from one area of a business can be passed on to another area of the business or between businesses. Thus, the whole concept of **benchmarking** is aimed at identifying best practices.

   d. A typical scorecard includes measures in four categories:

      1) Financial
      2) Customer
      3) Learning, growth, and innovation
      4) Internal business processes

6. SMA 4R lists four categories of **costs of quality**: prevention, appraisal, internal failure, and external failure. An organization should attempt to minimize its total cost of quality.
    a. **Conformance costs** include prevention and appraisal, which are both financial measures of internal performance.
        1) **Prevention** attempts to avoid defective output. These costs include preventive maintenance, employee training, review of equipment design, and evaluation of suppliers.
        2) **Appraisal** encompasses such activities as statistical quality control programs, inspection, and testing.
    b. **Nonconformance costs** include costs of internal failure (a financial measure of internal performance) and external failure costs (a financial measure of customer satisfaction).
        1) **Internal failure** costs occur when defective products are detected before shipment.
            a) Examples are scrap, rework, tooling changes, downtime, redesign of products or processes, lost output, reinspection and retesting, expediting of operations after delays, lost learning opportunities, and searching for and correcting problems.
        2) The costs of **external failure** or **lost opportunity** include lost profits from a decline in market share as dissatisfied customers make no repeat purchases, return products for refunds, cancel orders, and communicate their dissatisfaction to others.
            a) Thus, external failure costs are incurred for customer service complaints; rejection, return, repair, or recall of products or services; warranty obligations; products liability claims; and customer losses.
            b) **Environmental costs** are also external failure costs, e.g., fines for nonadherence to environmental law and loss of customer goodwill.
                i) To minimize environmental damage and its resulting costs, the International Organization for Standardization has issued **ISO 14000** standards to promote the reduction of environmental damage by an organization's products, services, and operations and to develop environmental auditing and performance evaluation systems.

6.7 CORE CONCEPTS

Just-in-Time Systems

- A just-in-time inventory management system **limits the output** of each function to the immediate demand of the next function. The accompanying **reductions in inventory levels** result in less money invested in idle assets.
- High inventory levels often **mask production problems** because defective parts can be overlooked when plenty of good parts are available.
- Higher productivity, reduced order costs as well as carrying costs, faster and cheaper setups, shorter manufacturing cycle times, better due date performance, improved quality, and more flexible processes are **objectives of JIT methods**.
- **Minimization of inventory** is a goal because many inventory-related activities are viewed as nonvalue-added. JIT is a **pull system**; items are pulled through production by current demand, not pushed through by anticipated demand.

- **Frequent receipt of deliveries** from suppliers often means less need for a sophisticated inventory control system and for control personnel. JIT also may **eliminate central receiving areas**, hard copy receiving reports, and storage areas. A central warehouse is not needed because deliveries are made by suppliers directly to the area of production.
- **Kanban**, a Japanese term meaning ticket, is one of the many elements in the JIT system as it was developed by the Toyota Motor Corporation. Tickets (also described as cards or markers) control the flow of production or parts so that they are **produced or obtained in the needed amounts** at the needed times.
- JIT also encompasses changes in the **production process** itself. To implement this approach and to eliminate waste of materials, labor, factory space, and machine usage, the **factory is reorganized** to permit what is often called **lean production**.

Materials Requirements Planning and Outsourcing

- A **materials requirements planning (MRP)** system enables a company to efficiently fulfill the requirements of the master production schedule by coordinating both the manufacture of component parts for finished goods and the arrival of the raw materials necessary to create the intermediate components.
- MRP is a **push system**, that is, the demand for raw materials is driven by the forecasted demand for the final product, which can be programmed into the computer.
- **Manufacturing resource planning (MRP II)** is a closed-loop manufacturing system that integrates all facets of a manufacturing business, including production, sales, inventories, schedules, and cash flows. The **same system** is used for both the **financial reporting and managing operations** (both use the same transactions and numbers).
- **Outsourcing** is the management or day-to-day execution of an entire business function by a third-party service provider. Outsourced services may be provided on or off premises, in the same country, or in a separate country.

Theory of Constraints and Throughput Costing

- The basic premise of the **theory of constraints (TOC)** as applied to business is that improving any process is best done not by trying to maximize efficiency in every part of the process, but by focusing on the **handful of factors** that are crucial, called **constraints**. Increasing the efficiency of processes that are not constraints merely creates backup in the system.
- The **steps in a TOC analysis** are: identify the bottleneck operation (the constraint); determine the most profitable profit mix given the constraint; maximize product flow through the bottleneck; increase capacity at the bottleneck; and redesign the manufacturing process.
- A basic principle of TOC analysis is that short-term profit maximization requires maximizing the **contribution margin through the constraint**, called the **throughput contribution** or throughput margin.
- **Throughput costing**, sometimes called **supervariable costing**, recognizes **only direct materials costs** as being truly variable and thus relevant to the calculation of throughput contribution. All other manufacturing costs are ignored because they are considered fixed in the short run.
- Production flow is managed using the **drum-buffer-rope** (DBR) system. The drum is the bottleneck operation, the buffer is the minimal amount of work-in-process input to the drum, and the rope is the sequence of activities preceding and including the bottleneck that must be coordinated.

Capacity Planning

- **Capacity planning** is an element of strategic planning that is closely related to capital budgeting. Maximizing the value created within an organization starts with understanding the nature and capabilities of **all of the company's resources**. Thus, capacity should be defined from several different perspectives.
- Whether to expand capacity is a major strategic decision because of the capital required, the difficulty of forming accurate expectations, and the long timeframe of the lead times and the commitment. The key forecasting problems are **long-term demand** and **behavior of competitors**.

Value Chain Analysis

- The **value chain** is a model for depicting the way in which every function in a company adds value to the final product. **Primary activities** (R&D, manufacturing, etc.) deal with the product directly. **Support activities** (human resources, inventory management, etc.) lend aid to the primary activity functions.
- The **supply chain** is the flow of materials and services from their original sources to final consumers. Moreover, it usually encompasses more than one firm.
- **Value engineering** is a means of reaching targeted cost levels. It is a systematic approach to assessing all aspects of the value chain cost buildup for a product. The purpose is to minimize costs without sacrificing customer satisfaction. Value engineering requires distinguishing between **cost incurrence** and **locked-in costs**.
- **Cost incurrence** is the actual use of resources, but **locked-in (designed-in)** costs will result in the use of resources in the future as a result of past decisions. Thus, value engineering emphasizes **controlling costs at the design stage**, that is, before they are locked in.
- **Life-cycle costing** is sometimes used as a basis for cost planning and product pricing. Life-cycle costing estimates a product's revenues and expenses over its expected life cycle. The result is to **highlight upstream and downstream costs** that often receive insufficient attention in the cost planning process.
- **Process value analysis** is a comprehensive understanding of how an organization generates its output. It involves a determination of which activities that use resources are **value-adding** or **nonvalue-adding** and how the latter may be reduced or eliminated.

Other Process Improvement Tools

- Technological advances have increased the popularity of **total quality management (TQM)** techniques and **business process reengineering**. Reengineering should be contrasted with **process improvement**, which consists of incremental but constant changes that improve efficiency.
- **Benchmarking** is an ongoing process that entails quantitative and qualitative measurement of the difference between the company's performance of an activity and the performance by the best in the world.
- **Kaizen** is the Japanese word for the continuous pursuit of improvement in every aspect of organizational operations.
- The trend in managerial performance evaluation is the **balanced scorecard** approach. Multiple measures of performance permit a determination as to whether a manager is achieving certain objectives at the expense of others that may be equally or more important. The scorecard is a **goal congruence tool** that informs managers about the nonfinancial factors that top management believes to be important.

STUDY UNIT SEVEN
COST AND VARIANCE MEASURES

Performance Management

Performance reporting is a major topic on the CMA exam. Factors to be analyzed for control and performance evaluation include revenues, costs, profits, and investment in assets. Variance analysis based on flexible budgets and standard costs is heavily tested, as is responsibility accounting for revenue, cost, contribution, and profit centers. The balanced scorecard is included in this coverage, as are quality considerations.

This study unit is the **first of two** on **performance management**. The relative weight assigned to this major topic in Part 1 of the exam is **25%**. The two study units are

Study Unit 7: Cost and Variance Measures
Study Unit 8: Responsibility Accounting and Performance Measures

After studying the outline and answering the questions in this study unit, you will have the skills necessary to address the following topics listed in the ICMA's Learning Outcome Statements:

Part 1 – Section B.1. Cost and variance measures

The candidate should be able to:

a. analyze performance against operational goals using methods based on revenue, manufacturing costs, non-manufacturing costs, and profit depending on the type of center or unit being measured
b. explain the reasons for variances within a performance monitoring system
c. prepare a performance analysis by comparing actual results to the master budget, calculate favorable and unfavorable variances from budget, and provide explanations for variances
d. identify the benefits and limitations of measuring performance by comparing actual results to the master budget
e. prepare a flexible budget based on actual sales (output) volume
f. calculate the sales-volume variance and the sales-price variance by comparing the flexible budget to the master (static) budget
g. calculate the flexible-budget variance by comparing actual results to the flexible budget
h. investigate the flexible-budget variance to determine individual differences between actual and budgeted input prices and input quantities
i. explain how budget variance reporting is utilized in a management by exception environment
j. define a standard cost system and identify the reasons for adopting a standard cost system

k. demonstrate an understanding of price (rate) variances and calculate the price variances related to direct material and direct labor inputs
l. demonstrate an understanding of efficiency (usage) variances and calculate the efficiency variances related to direct material and direct labor inputs
m. demonstrate an understanding of spending and efficiency variances as they relate to fixed and variable overhead
n. calculate a sales-mix variance and explain its impact on revenue and contribution margin
o. demonstrate an understanding that the efficiency (usage) variances can be further analyzed as mix and yield variances
p. explain how a mix variance results and calculate a mix variance
q. calculate and explain a yield variance
r. demonstrate how price, efficiency, spending, and mix variances can be applied in service companies as well as manufacturing companies
s. analyze factory overhead variances by calculating variable overhead spending variance, variable overhead efficiency variance, fixed overhead spending variance, and production volume variance
t. analyze variances, identify causes, and recommend corrective actions

7.1 STANDARD COSTS AND VARIANCES

1. **Standard costs** are budgeted unit costs established to motivate optimal productivity and efficiency. A standard-cost system is designed to alert management when the actual costs of production differ significantly from target or standard costs.
   a. Standard costs are monetary measures with which actual costs are compared. A standard cost, as used in cost accounting, is similar to par on a golf course.
   b. A standard cost is not just an average of past costs but an objectively determined estimate of what a cost should be. It may be based on accounting, engineering, or statistical quality control studies.
   c. A standard-cost system may be used with both job-order and process costing systems to isolate variances.
   d. The purpose of using a standard costing system is to control the actual costs incurred. Comparing actual and standard costs permits an evaluation of the effectiveness of managerial performance.
   e. Because of the impact of fixed costs in most businesses, a standard costing system is usually not effective unless the company also has a flexible budgeting system. **Flexible budgeting** uses standard costs to prepare budgets for multiple activity levels.
   f. Standard costs are an excellent example of the control loop in a performance monitoring system. The control loop consists of establishing standards, measuring actual performance, comparing actual performance with standards, investigating the cause of variances, taking corrective action when needed, and occasionally revising standards.

2. When actual costs and standard costs differ, the difference is a **variance**.
   a. A favorable variance arises when actual costs are less than standard costs.
   b. An unfavorable variance occurs when the actual costs are greater than standard.
   c. EXAMPLE: Management has calculated that, under efficient conditions, a worker should be able to complete one unit of product per hour. If workers are normally paid $6 per hour, the standard labor cost per unit is $6 per unit.
      1) If the actual per-unit amounts for a 1-week period were 1.1 hours at $6.25 per hour, or $6.88 per unit, the variance is $.88 per unit.
      2) The variance is unfavorable because the actual cost exceeded the standard cost.
      3) Management is signaled that corrective action may be needed.
   d. The purpose of identifying and assigning responsibility for variances is to determine who is likely to have information that will enable management to find solutions. The constructive approach is to promote learning and continuous improvement in manufacturing operations, not to assign blame. However, information about variances may be useful in evaluating managers' performance.
3. **Ideal (perfection, theoretical, or maximum efficiency) standards** are standard costs that are set for production under optimal conditions. They are based on the work of the most skilled workers with no allowance for waste, spoilage, machine breakdowns, or other downtime.
   a. These **tight standards** may have positive behavioral implications if workers are motivated to strive for excellence. However, they are not in wide use because they can have negative behavioral effects if the standards are impossible to attain.
   b. Ideal, or tight, standards are ordinarily replaced by **currently attainable standards** for cash budgeting, product costing, and budgeting departmental performance. Otherwise, accurate financial planning will be impossible.
   c. Ideal standards have been adopted by some companies that apply continuous improvement and other TQM principles.
4. **Practical (currently attainable) standards** may be defined as the performance that is reasonably expected to be achieved with an allowance for normal spoilage, waste, and downtime. An alternative interpretation is that practical standards represent possible but difficult to attain results.
5. Standard costs must be kept current. If prices have changed considerably for a particular material, a variance will always be reported if the standard cost is not changed. Much of the usefulness of standard costs is lost if a large variance is always expected. The primary reason for computing variances is to notify management whenever an unusual event has occurred.
6. **Management by exception.** Variance analysis is an important tool of the management accountant because it assigns responsibility. It also permits management by exception, which is the practice of giving attention primarily to significant variances, whether favorable or unfavorable. Thus, managers must use their judgment to determine the most efficient use of their limited time. Attending to operations not performing within expected limits is likely to yield the best ratio of the benefits of investigation to costs.
   a. The significance of variances depends not only on their amount but also on their direction, frequency, and trend. Moreover, variances may signify that standards need to be reevaluated.

7. **Overview of variances.** Standard costs are usually established for direct materials, direct labor, and overhead. These standards can then be used to calculate variances, some of which are listed below and defined in subsequent outlines.

   a. The **static budget variance** is the difference between the static or master budget amount and actual results. It has two components:

      1) The **flexible budget variance** is the difference between the actual results and the budgeted amount for the actual activity. It may be analyzed in terms of a variety of variances related to sales prices, input costs, and input quantities.
      2) The **sales volume variance** is the difference between the flexible budget and static budget amounts if selling prices and costs are constant.

   b. A **direct materials variance** includes a

      1) Price variance
      2) Quantity or usage variance (an efficiency variance for direct materials)

         a) Mix variance
         b) Yield variance

   c. A **direct labor variance** includes a(n)

      1) Rate variance (a price variance for direct labor)
      2) Efficiency variance

         a) Mix variance
         b) Yield variance

   d. **Overhead variances** have variable and fixed components. A four-way analysis includes two variable and two fixed components.

      1) Variable overhead spending variance
      2) Variable overhead efficiency variance
      3) Fixed overhead budget variance (also known as a spending variance)
      4) Fixed overhead production-volume variance

8. **Direct Materials Variances**

   a. Materials variances are divided into price and efficiency components. Part of a total materials variance may be attributed to using a different amount of raw materials than the standard quantity (the efficiency component) and part to a cost that was different from standard (the price component). These two sources of the total variance can be isolated.

      1) EXAMPLE: A local widget-producing company has determined that 3 pounds of direct materials are required to produce one widget. The standard cost is $2 per pound. Thus, the standard direct materials cost of producing one widget is $6. During the past month, 1,000 widgets were produced. The actual cost incurred for direct materials used was $2.10 per pound for 3,100 pounds, so that materials costing $6,510 were placed into production. The total materials variance can be calculated as follows:

Standard cost for month (3,000 lb. × $2.00)	$ 6,000
Actual cost for month (3,100 lb. × $2.10)	(6,510)
Total materials variance--unfavorable	$ (510)

   b. The **direct materials price** variance is the actual quantity times the standard price minus the actual price: AQ × (SP – AP).

      1) The price variance may be isolated at the time of purchase or when materials are transferred to work-in-process.
      2) An unfavorable materials price variance results when the actual price was greater than the standard price.

3) In the preceding example, the price variance is $310 unfavorable [($2.00 – $2.10) × 3,100 lb.]. Thus, $310 of the total variance is attributable to an increase in the cost of the materials.

c. The **direct materials quantity** variance (an efficiency or usage variance) is the standard quantity minus the actual quantity, times the standard price: (SQ – AQ) × SP.

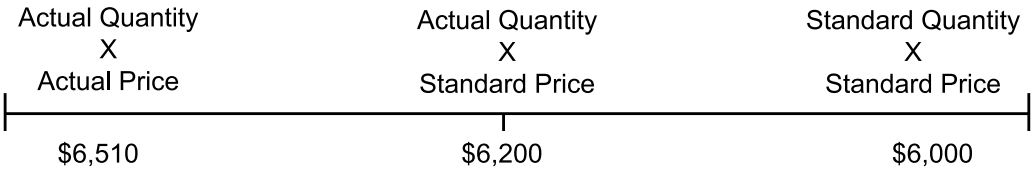
1) When determining the materials quantity variance, the actual cost of the materials is ignored because the only concern is the amount of variance that would have occurred given no price variance. Standard cost is multiplied times the difference in quantities in arriving at the quantity variance.

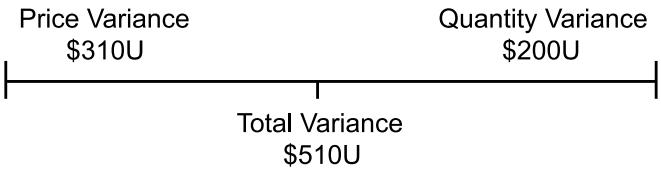
2) An unfavorable materials quantity variance is usually caused by waste, shrinkage, or theft. As a result, an unfavorable quantity variance may be the responsibility of the supervisor of the production department because the excess usage occurred while the materials were under that person's supervision.

3) A favorable materials quantity variance indicates that the workers either have been unusually efficient or are producing lower-quality products with less than the standard quantity of materials. Hence, a favorable variance is not always a good sign. A favorable variance may be as bad as or worse than an unfavorable variance. It may suggest that costs have been reduced at the expense of product quality.

4) In the previous example, the quantity variance is $200 unfavorable [(3,000 lb. – 3,100 lb.) × $2.00]. Thus, $200 of the total variance is attributable to using an excessive amount of materials.

d. The direct materials quantity variance plus the direct materials price variance equals the **total materials variance**. The components of the materials variance in the example can be diagrammed as follows:





1) The **purchase price variance** is a nonmanufacturing variance that measures the deviation of the amount paid to purchase raw materials during a period from the amount expected to be paid.

a) The general formula is ***PPV = AQ × (SP – AP)***. Stating the formula in this way produces a positive result when the variance is favorable.

9. **Direct Labor Variances**

a. The direct labor variance is similar to the direct materials variance in that it arises from two different sources. The total direct labor variance consists of the rate (price) variance and the efficiency (quantity) variance.

1) The **direct labor rate variance** is the standard rate minus the actual rate, times the actual quantity: AQ × (SP – AP).

2) The **direct labor efficiency variance** is the standard quantity minus the actual quantity, times the standard rate: (SQ – AQ) × SP.

b. Except for terminology, the labor and materials variances are similar. Their objective is to divide the total variance into a price (rate) component and a quantity (efficiency) component.

c. EXAMPLE: A widget manufacturer has established a standard of 3 hours of direct labor per widget produced, and the standard cost of labor is $5 per hour. Thus, the standard cost of direct labor included in each widget is $15. During a month when 1,000 widgets were produced, the company incurred direct labor costs of $16,000. The total direct labor variance for the period was $1,000 unfavorable [$16,000 – (1,000 × $15 units)]. To be meaningful, the variance should be divided into its components.

1) If only 2,800 hours of direct labor were used instead of the standard 3,000 (3 hours × 1,000 units) and actual labor rates varied from $4 to $6 per hour, the efficiency (quantity of labor used) variance would be $1,000 favorable (200 difference in hours × $5 standard rate). The $1,000 favorable efficiency variance would suggest that the workers in the department were extremely efficient.

a) However, a favorable efficiency variance might indicate that the workers did not give enough attention to some products and quality may have deteriorated. The reasons should be determined.

b) Sometimes an unfavorable efficiency variance may be caused by workers taking unauthorized work breaks. It may also be caused by production delays resulting from materials shortages or inferior materials.

2) The labor rate (price) variance for the period is

Standard cost at actual hours ($5 × 2,800 hours)	$ 14,000
Actual labor cost for the period	(16,000)
Labor rate variance--unfavorable	$ (2,000)

a) The unfavorable rate variance more than offsets the favorable efficiency variance.

b) Often, an unfavorable rate variance is the result of a renegotiated labor contract. Hence, it is outside the control of management, and the cost standards should be revised.

c) An unfavorable rate variance might also indicate that a supervisor is using the wrong workers for a particular job. Perhaps the job could have been performed by an unskilled worker at $6 per hour, but for some reason the supervisor may have assigned a more skilled worker at $10 per hour. The supervisor should always examine an unfavorable rate variance to be certain that workers are being allocated most efficiently.

10. **Overhead Variances**

a. The total overhead variance consists of variable and fixed overhead variances.

1) The total **variable overhead variance** is the difference between actual variable overhead and the amount applied based on the budgeted application rate and the standard input allowed for the actual output.

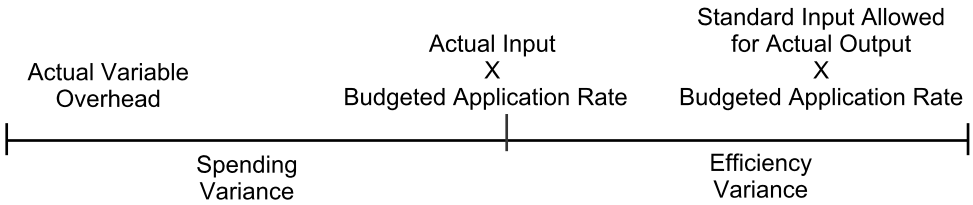
a) In **four-way analysis of variance**, it includes the

i) **Spending variance** -- the difference between actual variable overhead and the product of the budgeted application rate and the actual amount of the allocation base (activity level or amount of input)

ii) **Efficiency variance** -- the budgeted application rate times the difference between the actual input and the standard input allowed for the actual output

- Variable overhead applied equals the flexible-budget amount for the actual output level. The reason is that unit variable costs are assumed to be constant within the relevant range. The third column in the diagram below gives the flexible budget amount (also the amount applied).
- If variable overhead is applied on the basis of output, not inputs, no efficiency variance arises.

Variable Overhead Variances



2) The **total fixed overhead variance** is the difference between actual fixed overhead and the amount applied based on the budgeted application rate and the standard input allowed for the actual output.

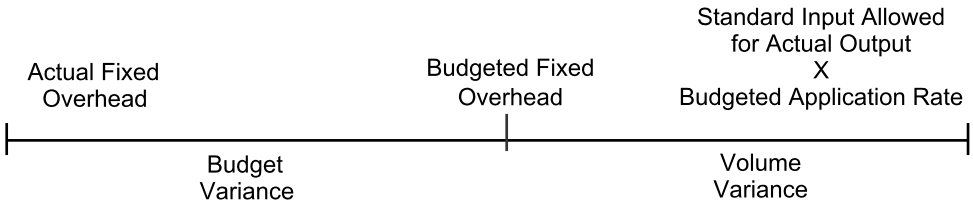
a) In **four-way analysis of variance**, it includes the

i) **Budget variance** (spending variance) -- the difference between actual fixed overhead and the amount budgeted

ii) **Production-volume variance** (idle capacity variance or denominator-level variance) -- the difference between budgeted fixed overhead and the product of the budgeted application rate and the standard input allowed for the actual output

- The amount of fixed overhead applied does not necessarily equal the flexible-budget amount for the actual output level. The reason is that the latter amount is assumed to be constant over the relevant range of output. Thus, the second column in the diagram below represents the flexible-budget amount, and the third column represents the amount applied.
- No efficiency variance is calculated because budgeted fixed overhead is a constant at all relevant output levels.

Variable Overhead Variances



b. One of the prerequisites for computing overhead variances is a flexible budget. A flexible budget can be adapted to any level of production.

c. **Two-Way and Three-Way Analysis of Variance**

1) The total overhead variance may be divided into **two variances**: volume and controllable (the latter is sometimes called the budget variance or the flexible-budget variance).

a) The variable overhead spending and efficiency variances are combined with the fixed overhead budget variance.

2) The total overhead variance also may be divided into **three variances**: volume, efficiency, and spending.

a) The spending variance combines the fixed overhead budget and variable overhead spending variances. It equals the difference between total overhead and the sum of the budgeted fixed overhead and the variable overhead for the actual input at the standard rate.

i) The efficiency and volume variances are the same as in four-way analysis.

d. EXAMPLE: Assume that a firm's standard cost system is based on a normal production level of 8,000 units per month at a budgeted overhead cost of $16,000, or $2 per unit. Half of this cost is fixed and half variable. The firm actually produced 6,000 units last month at an overhead cost of $14,300.

1) Budgeted fixed overhead is $8,000 (50% × $16,000), and budgeted unit variable overhead is $1 [(50% × $16,000) ÷ 8,000 units]. Thus, according to the flexible budget, costs should have been $14,000 at this activity level. However, the finished goods account would have been debited for only $12,000 during the month ($2 standard cost × 6,000 units produced).

2) The **total overhead variance** is $2,300 ($14,300 actual overhead – $12,000 overhead applied). In a **two-way analysis**, it can be divided into the portion attributable to not producing at the normal level (volume variance) and the portion controllable by first-line management (controllable variance).

3) The **volume variance** is a fixed overhead variance.

Budgeted fixed overhead at 6,000 units	$ 8,000	
Standard cost applied ($1 × 6,000 units)	(6,000)	
Volume variance	$ 2,000	unfavorable

a) The $2,000 volume variance is solely attributable to the firm's not producing at the previously selected normal level of production.

b) An unfavorable volume variance is often the result of labor strikes, major machine breakdowns, or lack of sales orders.

c) The volume variance is the least important variance for cost control because it does not measure a difference between actual and budgeted prices (rates) or actual and budgeted inputs.

d) The **controllable variance in two-way analysis** (a combination of two variable cost variances and one fixed cost variance) is the difference between the overhead that is budgeted at the actual level of production and the actual costs incurred. Thus, it equals the difference between the actual overhead incurred and the sum of the budgeted fixed overhead and the variable overhead applied based on the standard rate and the standard input allowed for the actual output. In the example, the budgeted overhead is $14,000 [$8,000 fixed + ($1 × 6,000 units) variable]. The controllable variance is

Budgeted fixed overhead at 6,000 units	$ 14,000	
Actual overhead costs incurred	(14,300)	
Controllable variance	$ (300)	unfavorable

4) Although the **total overhead variance** may be divided into two, three, or four components, one is always the volume variance.

   a) Assume that, of the $14,300 in overhead costs that were incurred in the example beginning on the previous page, $8,050 were for fixed costs. Assume also that $6,250 of variable overhead was incurred based on 6,100 activity units, e.g., labor hours. The standard activity units allowed for the actual output of 6,000 units of product was 6,000.

   b) For **two-way analysis of variance**, the controllable variance was $300 unfavorable. The volume variance as computed above was $2,000 unfavorable.

   c) For **three-way analysis of variance**, volume, efficiency, and spending variances are isolated.

      i) The fixed overhead volume variance remains $2,000 unfavorable.

      ii) The variable overhead efficiency variance is $100 unfavorable [(6,100 actual – 6,000 standard activity units) × $1 per activity unit].

      iii) The spending variance is $200 unfavorable [($8,050 actual FOH – $8,000 budgeted) + ($6,250 actual VOH – 6,100 actual activity units × $1 budgeted application rate)].

   d) **Four-way analysis of variance** restates the spending variance into variable ($150 unfavorable) and fixed ($50 unfavorable) components.

11. **Analyzing the reasons for variances.** Once a variance has been calculated, the next step is to analyze the reasons for the variance. In general, a favorable variance is considered a good situation, and an unfavorable variance is considered a bad situation, but that is not always true.

    a. **Direct materials variances**

       1) An unfavorable materials price variance means that the actual price paid for materials is higher than the standard price that had been estimated. This is usually an undesirable situation, and the fault is laid at the feet of the purchasing agent under the assumption that the purchasing agent bought materials that cost too much. In other words, an unfavorable price variance is not the fault of the production departments. Alternatively, the unfavorable price variance may simply indicate that prices in the industry have risen and the standard costs need to be updated, in which case no one is really at fault. It is simply a problem with the standard costing system.

       2) A favorable materials price variance means that the actual price is lower than the standard price. This may mean that the purchasing agent has performed admirably by finding a lower-cost source for the materials. Alternatively, it may mean that prices have fallen and the purchasing agent is simply buying at the market price and that standard costs should be updated. Another possibility is that the lower price may be attributable to lower quality materials. The purchasing agent may have discovered that lower quality materials sell for a lower price. Thus, before rewarding the purchasing agent for acquiring materials at a below-standard price, an analysis must be made to determine whether the lower quality materials will result in a lower quality end product. In actuality, the lower quality materials may lead to a need to use excessive quantities in the production process.

3) An unfavorable materials quantity variance is usually blamed on the excessive use of materials by the production departments. It may also indicate theft of materials or other waste or shrinkage. However, the excessive use might be attributable, as pointed out on the previous page, to using lower quality materials that were purchased at a lower price. Alternatively, the excessive material usage might have been caused by using unskilled (and thus lower cost) labor. Thus, there could be an interaction between a favorable labor rate variance and an unfavorable material quantity variance.

4) A favorable materials quantity variance is usually considered the result of efficiency in the production departments. A standard quantity should include a certain amount for normal spoilage. Thus, if the production workers can reduce normal spoilage, then there would be a savings on the quantity of materials used. Alternatively, the quality of the final product must be considered before rewarding production workers for using fewer materials; it could be that the favorable quantity variance was the result of putting fewer materials into each product and thus lowering the quality of the final product.

b. **Direct labor variances**

1) An unfavorable labor rate (price) variance is usually caused by the production foreman assigning over-skilled workers to a production process. The standard cost calculation may have assumed that unskilled (lowly paid) workers could complete a job, but for some reason, the foreman assigns more skilled workers to the job and the result is an unfavorable rate variance. Again, there could be an interaction in this case; the more skilled workers might be able to produce the product in a fewer number of hours, so there might be a favorable labor efficiency variance to offset the unfavorable labor rate variance. Another explanation for an unfavorable labor rate variance is that there might have been a new union contract that results in a higher wage to workers, in which case the standard costs should be updated.

2) A favorable labor rate variance is usually caused by assigning lower-skilled workers to a job. This may be a favorable situation in which the foreman has determined that a process can be handled by lower-skilled workers. Alternatively, those lower-skilled workers may be causing an unfavorable labor efficiency variance or lower quality final products.

3) An unfavorable labor efficiency variance means that workers are spending too much time on a production process. This is normally an undesirable situation, but it may be caused by using lower-skilled workers than anticipated in the standards (in which case there might be a favorable labor rate variance) or because raw materials are of low quality and require extra time in the production process (in which case, the unfavorable efficiency variance might be offset by a favorable material price variance).

4) A favorable labor efficiency variance is almost always a good thing. It means that employees are truly working efficiently and have been able to complete production in fewer hours than anticipated. It is considered a production department efficiency and is reason to reward the foreman and workers in the production departments.

c. **Overhead variances**

1) The meaning of a variable overhead spending variance is implied by the name of the variance. A favorable variance means that the production department was able to accomplish its tasks while spending less than the standards anticipated. An unfavorable spending variance is attributable to spending more than the budgeted standards expected to be spent.

2) The overhead efficiency variance is related to the labor efficiency variance if overhead is applied to production on the basis of direct labor hours. For example, if the labor efficiency variance is unfavorable, the overhead efficiency variance will also be unfavorable, since both would be based on the same number of input hours.

3) The fixed overhead budget variance (sometimes called the fixed overhead spending variance) is the difference between actual costs incurred and those anticipated in the flexible budget. Basically, the unfavorable fixed overhead budget variance is attributable to overspending and thus would be considered the fault of the production departments. A favorable variance would be the result of spending less than anticipated in the standards, which would be a reason to reward the production department.

4) The overhead volume variance is the result of production capacity differing from actual production levels. A favorable volume variance indicates that more overhead was charged to production than the standards would have expected. This is attributable to actual production exceeded planned production. Some textbooks call this a case of actual production exceeding the denominator level of production.

   a) For example, if a fixed cost was expected to be $10,000, and the expected (denominator) level was 1,000 hours, that would indicate a standard cost of $10 per hour. If actual production was 1,100 hours, it would result in $11,000 be charged to production (1,100 x $10), or a $1,000 favorable volume variance.

   b) Alternatively, if actual production was lower than the level anticipated when the standards were set, then there would be an unfavorable volume variance.

   c) The volume variance is typically not the fault of the production departments. Many times, the sales staff is blamed, or rewarded, for a volume variance. If sales are greater than expected, then production increases and there is a favorable volume variance. An unfavorable volume variance may be caused by low sales (the fault of the sales staff) or by some production shutdown, perhaps due to a labor strike or bad weather that causes an entire plant to shut down. In these latter cases, the volume variance would be essentially attributable to actions of the general administration of the company.

7.2 STATIC AND FLEXIBLE BUDGETING

1. **Standard costing** is a system designed to alert management when the actual costs of production differ significantly from target ("standard") costs.
   a. **Standard costs** are predetermined, attainable unit costs.
      1) Standard costs are usually established for direct materials, direct labor, manufacturing overhead, and nonmanufacturing (selling and administrative) costs. See item 4.a. in Study Unit 3, Subunit 4.
2. Standard costs are compared to actual results and the differences are calculated. These differences are referred to as **variances**.
   a. A **favorable variance** occurs when actual costs are less than standard costs. An **unfavorable variance** occurs when the actual costs are greater than standard.
   b. Variance analysis is an important tool of the management accountant because it assigns responsibility.
      1) Variance analysis enables **management by exception**, the practice of giving attention primarily to significant deviations from expectations (whether favorable or unfavorable).
         a) Attending to operations not performing within expected limits is likely to yield the best ratio of the benefits of investigation to costs.
   c. The significance of variances depends not only on their amount but also on their direction, frequency, and trend. Moreover, variances may signify that standards need to be reevaluated.
      1) Management is signaled that corrective action may be needed.
   d. The purpose of identifying and assigning responsibility for variances is to determine who is likely to have information that will enable management to find solutions.
      1) The constructive approach is to promote learning and continuous improvement in manufacturing operations, not to assign blame. However, information about variances may be useful in evaluating managers' performance.
3. The starting point for variance analysis is the **static budget variance**.
   a. The static budget variance measures the difference between the static (master) budget amount and the actual results. It constitutes the **total variance to be explained**.
   b. The static budget variance consists of two components:
      1) The **flexible budget variance** measures the difference between the actual results and the amount expected for the achieved level of activity (the flexible budget).
      2) The **sales volume variance** measures the difference between the static budget and the amount expected for the achieved level of activity (the flexible budget).

c. This **three-way variance analysis** can be computed for any of the elements of operating income except fixed overhead.

Revenue		$X,XXX
Variable costs:		
Direct materials	$XXX	
Direct labor	XXX	
Variable manufacturing overhead	XXX	
Variable nonmanufacturing costs	XXX	
Total variable costs		(X,XXX)
Contribution margin		$X,XXX
Fixed costs:		
Fixed manufacturing overhead*	$XXX	
Fixed nonmanufacturing costs	XXX	
Total fixed costs		(X,XXX)
Operating income		$X,XXX

*The treatment of fixed manufacturing overhead variances is different from that of the other variances. See item 3. in Subunit 6.

4. The following steps are executed in the calculation of variances:
   a. The **static budget** is prepared before the budget period begins and is left unchanged.
      1) The static budget reflects the **expected levels** of production, input prices, labor costs, overhead costs, selling and administrative costs, etc.
      2) Each element of the static budget is calculated using the appropriate driver.
   b. The **actual results** are prepared after the budget period ends.
      1) The actual results reflect the revenues that were **actually earned** and the costs that were **actually incurred**.
      2) The drivers are therefore adjusted to the amounts actually encountered.
   c. The **middle budget** activity level is determined after the budget period ends.
      1) The middle budget combines the drivers used in the actual results with the standard prices used in setting the static budget.
   d. The variances are calculated by comparing the three reports.
5. **Comprehensive example of variance calculation:**
   a. A manufacturer whose sole product is a line of dog food has selected the following drivers for the elements of operating income:

Element	Driver	Budgeted Units for Month
--	Tons manufactured	800
Revenues	Tons sold	700
Direct materials	Input tons consumed	1,000
Direct labor	Direct labor hours	900
Manufacturing overhead	Machine hours	200
Nonmanufacturing costs	Tons sold	700

b. The static budget is prepared as follows:

			Static Budget
Revenues	700 tons sold @ $220 per ton		$154,000
Less variable costs:			
Direct materials	1,000 tons used @ $54.00 per ton	$54,000	
Direct labor	900 labor hours @ $17.20 per hour	15,480	
Variable mfg. overhead	200 machine hours @ $48.00 per hour	9,600	
Variable S&A	700 tons sold @ $6.00 per ton	4,200	
Total variable costs			(83,280)
Contribution margin			$ 70,720
Less fixed costs:			
Fixed mfg. overhead	200 machine hours @ $40.00 per hour	$ 8,000	
Fixed S&A	700 tons sold @ $5.00 per ton	3,500	
Total fixed costs			(11,500)
Operating income			$ 59,220

c. During the month, the company experienced different market conditions from what was expected. Actual results are reported as follows:

			Actual Results
Revenues	660 tons sold @ $240 per ton		$158,400
Less variable costs:			
Direct materials	1,078 tons used @ $50.00 per ton	$53,900	
Direct labor	932 labor hours @ $17.30 per hour	16,124	
Variable mfg. overhead	195 machine hours @ $48.00 per hour	9,360	
Variable S&A	660 tons sold @ $6.00 per ton	3,960	
Total variable costs			(83,344)
Contribution margin			$ 75,056
Less fixed costs:			
Fixed mfg. overhead	Actual costs incurred	$ 9,496	
Fixed S&A	Actual costs incurred	4,000	
Total fixed costs			(13,496)
Operating income			$ 61,560

d. The static budget variances can now be calculated. Positive variances are favorable.

	Actual Results	**Static Budget Variances**	Static Budget
Revenues	$158,400	**$ 4,400**	$154,000
Less variable costs:			
Direct materials	$ 53,900	**$ 100**	$ 54,000
Direct labor	16,124	**(644)**	15,480
Variable mfg. overhead	9,360	**240**	9,600
Variable S&A	3,960	**240**	4,200
Total variable costs	$ 83,344	**$ (64)**	$ 83,280
Contribution margin	$ 75,056	**$ 4,336**	$ 70,720
Less fixed costs:			
Fixed mfg. overhead	$ 9,496	**$(1,496)**	$ 8,000
Fixed S&A	4,000	**(500)**	3,500
Total fixed costs	$ 13,496	**$(1,996)**	$ 11,500
Operating income	$ 61,560	**$ 2,340**	$ 59,220

e. These static budget variances are not very informative. The next step is therefore to prepare the middle budget using actual drivers with budgeted revenues and costs. Note that standard costs and prices are used.

			Middle Budget
Revenues	660 tons sold @ $220 (standard) per ton		$145,200
Less variable costs:			
Direct materials	1,078 tons used @ $54.00 per ton	$58,212	
Direct labor	932 labor hours @ $17.20 per hour	16,030	
Variable mfg. overhead	195 machine hours @ $48.00 per hour	9,360	
Variable S&A	660 tons sold @ $6.00 per ton	3,960	
Total variable costs			(87,562)
Contribution margin			$ 57,638
Less fixed costs:			
Fixed mfg. overhead	Same as static budget	$ 8,000	
Fixed S&A	Same as static budget	3,500	
Total fixed costs			(11,500)
Operating income			$ 46,138

f. The price and quantity variances can now be calculated.

	Actual Results	**Price/ Rate Variances**	Middle Budget	**Quantity/ Efficiency Variances**	Static Budget
Revenues	$158,400	**$ 13,200**	$145,200	**$ (8,800)**	$154,000
Less variable costs:					
Direct materials	$ 53,900	**$ 4,312**	$ 58,212	**$ (4,212)**	$ 54,000
Direct labor	16,124	**(94)**	16,030	**(550)**	15,480
Variable mfg. overhead	9,360	**0**	9,360	**240**	9,600
Variable S&A	3,960	**0**	3,960	**240**	4,200
Total variable costs	$ 83,344	**$ 4,218**	$ 87,562	**$ (4,282)**	$ 83,280
Contribution margin	$ 75,056	**$17,418**	$ 57,638	**$(13,082)**	$ 70,720
Less fixed costs:					
Fixed mfg. overhead	$ 9,496	**$ (1,496)**	$ 8,000	**$ --**	$ 8,000
Fixed S&A	4,000	**(500)**	3,500	**--**	3,500
Total fixed costs	$ 13,496	**$ (1,996)**	$ 11,500	**$ --**	$ 11,500
Operating income	$ 61,560	**$15,422**	$ 46,138	**$(13,082)**	$ 59,220

g. Note that the sum of the price/rate variance and quantity/efficiency variances for any of the elements equals the static budget variance for that element.

1) This example uses direct materials:

Price variance	$ 4,312	Static budget	$ 54,000
Quantity variance	(4,212)	Less: actual results	(53,900)
Static budget variance	**$ 100 F**	**Static budget variance**	**$ 100 F**

7.3 DIRECT MATERIALS VARIANCES

1. The variances calculated above for direct materials can be combined as follows to produce a single **total direct materials variance**.

   a. EXAMPLE:

Actual Results	Middle Budget	Static Budget
AQ × AP	AQ × SP	SQ × SP
1,078 × $50.00	1,078 × $54.00	1,000 × $54.00
$53,900	$58,212	$54,000

DM Price Variance	DM Quantity Variance
$4,312 F	$4,212 U

Direct Materials Variance
$100 F

2. The unit costs were derived as follows:

   a. EXAMPLE:

      1) The company's production process involves combining horse meat, beef by-products, and cereal. Within certain limits, any of these raw materials can be substituted for one of the others.
      2) The month's production is budgeted for the following inputs, mix percentages, and costs:

	Budgeted Total Input Tons	Budgeted Mix	Budgeted Input Portion Tons	Budgeted Input Price per Ton	Total Standard Cost per Production Run
Horse meat	1,000	30%	300	$50	$15,000
Beef	1,000	50%	500	$70	35,000
Cereal	1,000	20%	200	$20	4,000
Totals		100%	1,000		$54,000

      3) The standard direct materials cost per ton of input is therefore $54.00 ($54,000 ÷ 1,000 tons). Note that this was the standard cost used in preparing the static budget.
      4) At month end, the following actual price and usage data were compiled:

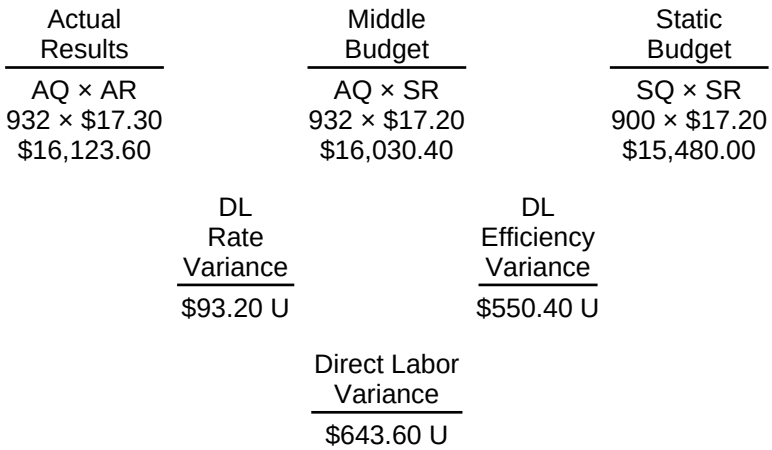
	Actual Input Tons	Actual Input Price per Ton	Total Actual Cost of Inputs	Actual Mix
Horse meat	360	$48	$17,280	33.40%
Beef	530	$62	32,860	49.17%
Cereal	188	$20	3,760	17.44%
Totals	1,078		$53,900	100.00%

      5) The actual direct materials cost per ton of input is therefore $50.00 rounded ($53,900 ÷ 1,078 tons). Note that this was the cost used in preparing the actual results report.
      6) The total materials variance for the month is therefore $100 F ($54,000 – $53,900). Note that this is the same total variance as the one derived in item 1. above.

3. The breakdown presented on the previous page subdivides the total variance for direct materials into a materials price variance and a materials quantity (or efficiency) variance.
   a. The **materials price variance** measures the deviation of the actual price incurred for raw materials from the price expected (holding quantity constant).
      1) Note that, when determining a price variance, the standard quantity of the materials is ignored because the only concern is the amount of variance that would have occurred given no quantity variance.
   b. The **materials quantity variance** measures the deviation of the actual amount of raw materials used from the amount expected (holding price constant).
      1) Note that, when determining a quantity variance, the actual cost of the materials is ignored because the only concern is the amount of variance that would have occurred given no price variance.
   c. A **favorable** materials quantity variance indicates that the workers are using less than the standard quantity of materials.
      1) A favorable quantity variance may therefore result from workers being unusually efficient or from the production of lower quality products.
   d. An **unfavorable** materials quantity variance is usually caused by waste, shrinkage, or theft.
      1) An unfavorable quantity variance may be the responsibility of the production department supervisor because the excess usage occurred while the materials were under that person's supervision.

7.4 DIRECT LABOR VARIANCES

1. Except for terminology, the labor and materials variances are identical.
   a. EXAMPLE:



2. Most production processes require labor of various skill levels.
   a. EXAMPLE:
      1) The dog food production line involves workers at the apprentice, technician, and master levels.
      2) The month's production run is budgeted for the following labor inputs:

	Budgeted Total Labor Hours	Budgeted Mix	Budgeted Labor Portion Hours	Budgeted Labor Rate per Hour	Total Standard Cost per Production Run
Master	900	10%	90	$22	$ 1,980
Technician	900	70%	630	$18	11,340
Apprentice	900	20%	180	$12	2,160
Totals		100%	900		$15,480

      3) The standard direct labor cost per ton of input is therefore $17.20 ($15,480 ÷ 900 tons). Note that this was the standard cost used in preparing the static budget.
      4) At month end, the following actual wage and hour data were compiled:

	Actual Labor Hours	Actual Input Wage per Hour	Total Actual Cost of Direct Labor	Actual Mix
Master	86	$22	$ 1,892	9.23%
Technician	680	$18	12,240	72.96%
Apprentice	166	$12	1,992	17.81%
Totals	932		$16,124	100.00%

      5) The actual direct labor cost per hour is therefore $17.30 rounded ($16,124 ÷ 932 hours). Note that this was the cost used in preparing the actual results report.
      6) The total labor variance for the month is therefore $644 U rounded ($15,480 – $16,124). Note that this is the same total variance as the one derived in item 1. on the previous page.

3. The breakdown presented above subdivides the total variance for direct labor into a labor rate variance and a labor efficiency variance.
   a. The **labor rate variance** measures the deviation of the actual wages incurred for direct labor from the wages expected. In concept, it is similar to the materials price variance.
   b. The **labor efficiency variance** measures the deviation of the actual amount of labor consumed from the amount expected.
   c. A **favorable** labor efficiency variance indicates that the workers have been expending less than the standard number of labor hours.
      1) A favorable variance may therefore result from workers being unusually efficient or from the production of lower quality products.
   d. An **unfavorable** labor efficiency variance may be caused by workers' taking unauthorized work breaks. It may also be caused by production delays resulting from materials shortages or inferior materials.

7.5 MIX AND YIELD VARIANCES

1. In some production processes, inputs are **substitutable**, e.g., a baker of pecan pies may use pecans from Florida rather than from Georgia as market conditions shift.
   a. Whenever inputs are substitutable, the direct materials quantity variance can be split into two component variances:
      1) The **direct materials mix variance** measures the deviation of the cost of the actual mix of raw materials used from the mix expected (holding quantity constant).
      2) The **direct materials yield variance** measures the deviation of the cost of the actual amount of raw materials used from the amount expected (holding price constant).
   b. First, the actual mix of each input must be determined.
      1) EXAMPLE:

	Actual Input Tons	Actual Input Price per Ton	Total Actual Cost of Inputs	Actual Mix
Horse meat	360	$48	$17,280	33.40%
Beef	530	$62	32,860	49.17%
Cereal	188	$20	3,760	17.44%
Totals	1,078		$53,900	100.00%

   c. Now the mix and yield variances for direct materials can be derived.
      1) EXAMPLE:

	Actual Total Input	Budgeted Mix	Budgeted Input Price per Ton	AQ × S% × SP	Actual Total Input	Actual Mix	Budgeted Input Price per Ton	AQ × A% × SP	Budgeted Total Input	Budgeted Mix	Budgeted Input Price per Ton	SQ × S% × SP
Horse meat:	1,078	30%	$50	$16,170	1,078	33.40%	$50	$18,000	1,000	30%	$50	$15,000
Beef:	1,078	50%	$70	37,730	1,078	49.16%	$70	37,100	1,000	50%	$70	35,000
Cereal:	1,078	20%	$20	4,312	1,078	17.44%	$20	3,760	1,000	20%	$20	4,000
Totals				$58,212				$58,860				$54,000

DM Mix Variance	DM Yield Variance
$648 F	$4,860 U

DM Quantity Variance
$4,212 U

   d. Shortcut formulas

      Mix variance: AQ × (A% – S%) × SP
      Yield variance: (SQ × S% × SP) – (AQ × A% × SP)

      1) Note that the actual price plays no role in calculating the mix and yield variances.
2. The actual mix of labor skill levels can vary just as the mix of direct materials can vary.
   a. The direct labor efficiency variance can be split into two component variances:
      1) The **direct labor mix variance** measures the deviation of the cost of the actual mix of wage rates used from the mix expected.
      2) The **direct labor yield variance** measures the deviation of the cost of the actual amount of labor expended from the amount expected.

b. First, the actual mix of each rate must be determined.

1) EXAMPLE:

	Actual Labor Hours	Actual Input Wage per Hour	Total Actual Cost of Direct Labor	Actual Mix
Master	86	$22	$ 1,892	9.23%
Technician	680	$18	12,240	72.96%
Apprentice	166	$12	1,992	17.81%
Totals	932		$16,124	100.00%

c. Now the mix and yield variances for direct labor can be calculated.

1) EXAMPLE:

	Actual Total Hours	Budgeted Mix	Budgeted Wage per Hour	AQ × S% × SR	Actual Total Hours	Actual Mix	Budgeted Wage per Hour	AQ × A% × SR	Budgeted Total Hours	Budgeted Mix	Budgeted Wage per Hour	SQ × S% × SR
Master:	932	10%	$22	$ 2,050	932	9.23%	$22	$ 1,892	900	10%	$22	$ 1,980
Technician:	932	70%	$18	11,743	932	72.96%	$18	12,240	900	70%	$18	11,340
Apprentice:	932	20%	$12	2,237	932	17.81%	$12	1,992	900	20%	$12	2,160
Totals				$16,030				$16,124				$15,480

DL Mix Variance	DL Yield Variance
$94 F	$644 U

DL Efficiency Variance
$550 U

d. Shortcut formulas

Mix variance: AQ × (A% – S%) × SR
Yield variance: (SQ × S% × SR) – (AQ × A% × SR)

1) Note that the actual rate plays no role in calculating the mix and yield variances.

7.6 OVERHEAD VARIANCES

1. A manufacturing concern's **total overhead variance** is composed of variable and fixed portions.

a. EXAMPLE:

1) The company has determined that it incurs $48 of variable overhead and $40 of fixed overhead for every machine hour.

2) Thus, the company has budgeted for $9,600 of variable overhead (200 machine hours × $48) and $8,000 of fixed overhead (200 machine hours × $40). Note that these were the amounts used in preparing the static budget report.

2. The **variable portion** of the total overhead variance can be calculated the same way as direct materials and direct labor.
   a. Note that these variances are not referred to as "flexible-budget" and "sales-volume" variances. There is no need for two separate breakdowns because there is no "mix" aspect to variable overhead.
      1) EXAMPLE:

Actual Results	Middle Budget	Static Budget
AQ × AR	AQ × SR	SQ × SR
195 × $48	195 × $48	200 × $48
$9,360	$9,360	$9,600

VOH Spending Variance	VOH Efficiency Variance
$0	$240 F

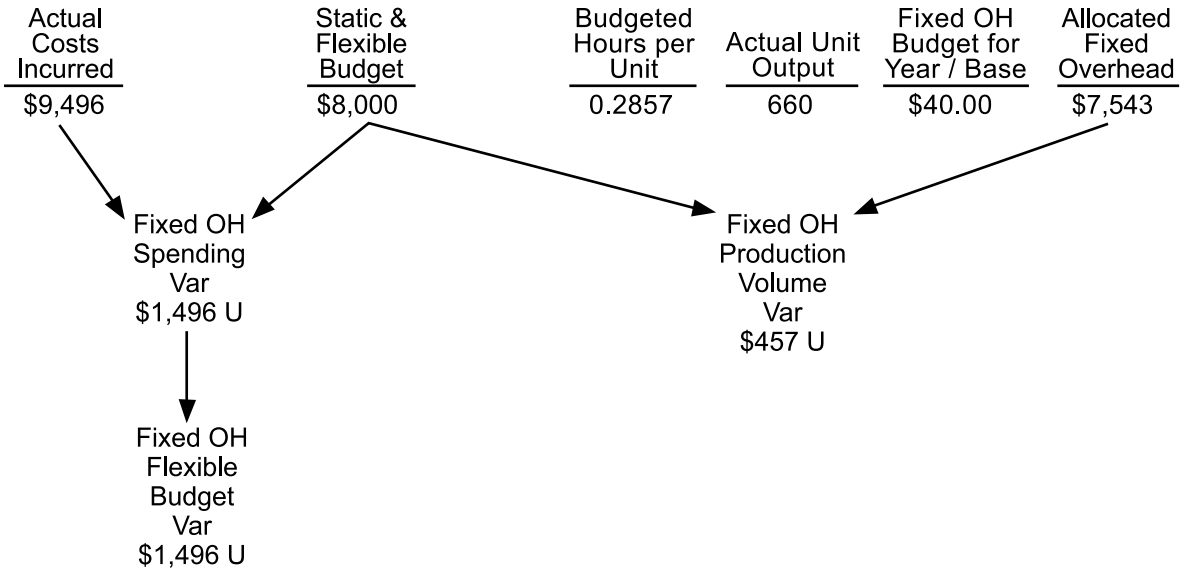
Variable OH Variance
$240 F

3. The **fixed portion** of the total overhead variance has two components, but they are not combined.
   a. Just as with variable overhead, the fixed overhead **spending variance** is derived by comparing the actual costs incurred with the flexible budget.
      1) Note that for fixed overhead, the **flexible and static budgets are the same**. This is because fixed costs are by their nature unchanging within the relevant range of the budgeting cycle. The same amount of fixed costs must be covered regardless of machine usage or output level.
   b. For the same reason, fixed overhead lacks an efficiency component.
      1) Instead, a **production volume variance** is calculated.
         a) EXAMPLE: First, the budgeted machine hours per budgeted unit of output is calculated (200 hours ÷ 700 tons = 0.2857 hours per ton).
         b) This figure is then multiplied by the actual unit output and the fixed overhead application rate.

            0.2857 hours per ton × 660 tons × $40 per hour = $7,543

c) The flexible/static budget amount is then subtracted from the result to arrive at the production volume variance.

Production volume variance = $7,543 – $8,000 = $457 U



4. Integrated overhead variance analysis combines the variable and fixed portions of the overhead variance to allow simplified scrutiny.

   a. **Four-way overhead variance analysis** includes all four component variances calculated above and on the previous page.

      1) EXAMPLE:

4-Way Analysis	Spending Variance	Efficiency Variance	Production Volume Variance
Variable OH	$0	$240 F	--
Fixed OH	$1,496 U	--	$457 U

   b. **Three-way overhead variance analysis** combines the variable spending and fixed budget variances into a single spending variance and reports the other two variances separately.

      1) EXAMPLE:

3-Way Analysis	Spending Variance	Efficiency Variance	Production Volume Variance
Total OH	$1,496 U	$240 F	$457 U

   c. **Two-way overhead variance analysis** combines the spending and efficiency variances into a single flexible variance and reports the volume variance separately.

      1) EXAMPLE:

2-Way Analysis	Flexible Budget Variance	Production Volume Variance
Total OH	$1,256 U	$457 U

2) The flexible variance in 2-way analysis is also called the **controllable variance**. It is the portion of the total not attributable to the volume variance.

7.7 COMPREHENSIVE EXAMPLE

	STANDARD COSTS	ACTUAL COSTS
DIRECT MATERIALS	600,000 units of materials at $2.00 each	700,000 units at $1.90
DIRECT LABOR	60,000 hours allowed for actual output at $7 per hour	65,000 hours at $7.20
OVERHEAD	$8.00 per direct labor hour on normal capacity of 50,000 direct labor hours:	
	$6.00 for variable overhead	$396,000 variable
	$2.00 for fixed overhead	$130,000 fixed

MATERIALS VARIANCES

Price

AQ × (SP – AP) = Actual quantity × (Standard price – Actual price)
= 700,000 units × ($2.00 – $1.90)
= 700,000 × $0.10
= $70,000 F

Quantity

(SQ – AQ) × SP = (Standard quantity – Actual quantity) × Standard price
= (600,000 units – 700,000 units) × $2.00
= –100,000 × $2.00
= $200,000 U

LABOR VARIANCES

Rate

AQ × (SP – AP) = Actual hours × (Standard rate – Actual rate)
= 65,000 hours × ($7.00 – $7.20)
= 65,000 × –$0.20
= $13,000 U

Efficiency

(SQ – AQ) × SP = (Standard hours – Actual hours) × Standard rate
= (65,000 hours – 60,000 hours) × $7.00
= –5,000 × $7.00
= $35,000 U

VARIABLE OVERHEAD VARIANCES

Spending

(AQ × SP) – AC = (Actual hours × Standard rate) – Actual costs incurred
= (65,000 × $6.00) – $396,000
= $390,000 – $396,000
= $6,000 U

Efficiency

(SQ – AQ) × SP = (Standard hours – Actual hours) × Standard rate
= (60,000 – 65,000) × $6.00
= –5,000 × $6.00
= $30,000 U

FIXED OVERHEAD VARIANCES

Spending

Flexible/Static budget – Actual costs incurred = (50,000 hours × $2.00) – $130,000
= $30,000 U

Production-Volume

(Standard hours allowed for actual output × Standard rate) –
Flexible/Static budget = (60,000 hours × $2.00) – (50,000 hours × $2.00)
= $120,000 – $100,000
= $20,000 F

NET MANUFACTURING VARIANCE $224,000

	Actual Output at Actual Input and Cost	Actual Output at Standard Input and Cost
Materials	$1,330,000	$1,200,000
Labor	468,000	420,000
Variable overhead	396,000	360,000
Fixed overhead	130,000	120,000
Net unfavorable variance		224,000
	$2,324,000	$2,324,000

7.8 SALES VARIANCES

1. Variance analysis is not only a tool of the manufacturing divisions, but also a method used to judge the effectiveness of the selling departments.
   a. If a firm's sales differ from the amount budgeted, the difference could be attributable to either the **sales price variance** or the **sales volume variance** (sum of the sales quantity and mix variances).
   b. The analysis of these variances concentrates on **contribution margins** because fixed costs are assumed to be constant.
   c. EXAMPLE: A firm has budgeted sales of 10,000 units of its sole product at $17 per unit. Variable costs are expected to be $10 per unit and fixed costs are budgeted at $50,000. A comparison of budgeted to actual results is as follows:

	Budget Computation	Budget Amount	Actual Computation	Actual Amount
Sales	10,000 units @ $17/unit	$170,000	11,000 units @ $16/unit	$176,000
Variable costs	10,000 units @ $10/unit	(100,000)	11,000 units @ $10/unit	(110,000)
Contribution margin		$ 70,000		$ 66,000
Fixed costs		(50,000)		(50,000)
Operating income		$ 20,000		$ 16,000
Unit contribution margin	$70,000/10,000 units	= $7	$66,000/11,000 units	= $6

      1) Although sales were greater than predicted, the contribution margin is less than expected.
         a) The discrepancy can be analyzed in terms of the sales price variance and the sales volume variance.
      2) For a single-product firm, the **sales price variance** is the change in the contribution margin attributable solely to the change in selling price (holding quantity constant).
         a) In the example, the actual selling price of $16 per unit is $1 less than expected. Thus, the sales price variance is $11,000 U (11,000 actual units sold × $1).

3) For the single product, the **sales volume variance** is the change in contribution margin caused by the difference between the actual and budgeted volume (holding price constant).

a) In the example, it equals $7,000 F (1,000-unit increase in volume × $7 budgeted UCM).

4) The sales mix variance is zero because the firm sells only one product. Hence, the sales volume variance equals the sales quantity variance.

5) The sales price variance ($11,000 U) combined with the sales volume variance ($7,000 F) equals the total change in the contribution margin ($4,000 U).

d. A similar analysis may be done for **cost of goods sold**.

1) The average production cost per unit is used instead of the average unit selling price, but the quantities for production volume are the same.

2) Accordingly, the overall variation in gross profit is the sum of the variation in revenue plus the variation in cost of goods sold.

2. If a company produces two or more products, the **multiproduct sales variances** reflect not only the effects of the change in total unit sales, but also any difference in the mix of products sold.

a. The **multiproduct sales price variance** may be calculated as in the single-product case for each product. The results are then added.

1) An alternative is to multiply the actual total units sold times the difference between the following:

a) The weighted-average price based on actual units sold at actual unit prices.

b) The weighted-average price based on actual units sold at budgeted prices.

b. The **multiproduct sales volume variance** may be calculated the same as the single-product case for each product. The results are then added.

1) An alternative is to determine the difference between the following:

a) Actual total unit sales times the budgeted weighted-average UCM for the actual mix.

b) Budgeted total unit sales times the budgeted weighted-average UCM for the planned mix.

c. The multiproduct sales volume variance may be broken down into the sales quantity and sales mix variances.

1) The **sales quantity variance**, which equals the sales volume variance for a single-product company, is the difference between the budgeted contribution margin based on actual unit sales and the budgeted contribution margin based on expected sales, assuming that the budgeted sales mix is constant.

a) One way to calculate this variance is to multiply the budgeted UCM for each product times the difference between the budgeted unit sales of the product and its budgeted percentage of actual total unit sales. The results are then added.

i) An alternative is to multiply the difference between total actual unit sales and the total expected unit sales by the budgeted weighted-average UCM based on the expected mix.

2) The **sales mix variance** is the difference between the budgeted contribution margin for the actual mix and actual total quantity of products sold and the budgeted contribution margin for the expected mix and actual total quantity of products sold.

a) One way to calculate this variance is to multiply the budgeted UCM for each product times the difference between actual unit sales of the product and its budgeted percentage of actual total unit sales. The results are then added.

i) An alternative is to multiply total actual unit sales times the difference between the budgeted weighted-average UCM for the expected mix and the budgeted weighted-average UCM for the actual mix.

d. **Comprehensive example**:

	Plastic	Metal	Total
Budgeted selling price per unit	$6.00	$10.00	
Budgeted variable cost per unit	3.00	7.50	
Budgeted contribution margin per unit	$3.00	$ 2.50	
Budgeted unit sales	300	200	500
Budgeted mix percentage	60%	40%	100%
Actual units sold	260	260	520
Actual selling price per unit	$6.00	$9.50	

1) As shown below (000 omitted), the **total contribution margin variance** was $100 unfavorable ($130 unfavorable sales price variance – $30 favorable sales volume variance).

Sales price variance:			
Plastic 260 × ($6.00 – $6.00)	$ 0		
Metal 260 × ($10 – $9.50)	(130)	$130	unfavorable
Sales volume variance:			
Plastic (260 – 300) × $3.00	$(120)		
Metal (260 – 200) × $2.50	150	$ 30	favorable
Total contribution margin variance		$100	unfavorable

2) The sales volume variance may be broken down as follows:

Sales quantity variance:			
Plastic [(520 × .6) – 300] × $3.00	$ 36		
Metal [(520 × .4) – 200] × $2.50	20	$ 56	favorable
Sales mix variance:			
Plastic [260 – (520 × .6)] × $3.00	$(156)		
Metal [260 – (520 × .4)] × $2.50	130	$ 26	unfavorable
Sales volume variance		$ 30	favorable

e. The sales quantity variance may be broken down into the market size and market share variances.

1) The **market size variance** measures the effect on the contribution margin of the difference between the actual market size in units and the budgeted market size in units, assuming the market share percentage and the budgeted weighted-average UCM are constant.

a) It equals the budgeted market share percentage, times the difference between the actual market size in units and the budgeted market size in units, times the budgeted weighted-average UCM.

2) The **market share variance** measures the effect on the contribution margin of the difference between the actual and budgeted market share percentages, assuming the actual market size in units and the budgeted weighted-average UCM are constant.

   a) It equals the difference between the actual market share percentage and the budgeted market share percentage, times the actual market size in units, times the budgeted weighted-average UCM.

3) EXAMPLE: Assume that a company's budgeted and actual market sizes and market shares are as follows:

	Budget	Actual
Market size in units	60,000	50,000
Market share	9%	10%

   a) Assuming a budgeted weighted-average UCM of $3, the market size variance is $2,700 U [(60,000 units – 50,000 units) × 9% × $3]. The variance is unfavorable because market size diminished.

   b) The market share variance is $1,500 F [50,000 units × $3 × (10% – 9%)]. The variance is favorable because market share increased. Thus, the sales quantity variance is $1,200 U ($2,700 U – $1,500 F).

7.9 CORE CONCEPTS

Standard Costs and Variances

- **Standard costs** are budgeted unit costs established to motivate optimal productivity and efficiency. When actual costs and standard costs differ, the difference is a variance. A favorable variance arises when actual costs are less than standard costs. An unfavorable variance occurs when the actual costs are greater than standard.
- **Ideal standards** are standard costs that are set for production under optimal conditions. **Practical standards** may be defined as the performance that is reasonably expected to be achieved with an allowance for normal spoilage, waste, and downtime.
- Variance analysis enables **management by exception**, the practice of giving attention primarily to significant deviations from expectations (whether favorable or unfavorable).

Direct Materials Variances

- The **total variance** for direct materials can be stated as follows:

$$\begin{aligned}\text{Direct materials variance} &= \text{Static budget} - \text{Actual results}\\ &= (SQ \times SP) - (AQ \times AP)\end{aligned}$$

- This total can be broken down into a **price variance** and a **quantity variance**:

$$\begin{aligned}\text{Direct materials price variance} &= \text{Middle budget} - \text{Actual results}\\ &= (AQ \times SP) - (AQ \times AP)\\ &= AQ \times (SP - AP)\end{aligned}$$

$$\begin{aligned}\text{Direct materials quantity variance} &= \text{Static budget} - \text{Middle budget}\\ &= (SQ \times SP) - (AQ \times SP)\\ &= (SQ - AQ) \times SP\end{aligned}$$

- A **favorable materials quantity variance** indicates that the workers are using less than the standard quantity of materials. A favorable quantity variance may therefore result from workers being unusually efficient or from the production of lower quality products. An **unfavorable materials quantity variance** is usually caused by waste, shrinkage, or theft.

Direct Labor Variances

- The **total variance** for direct labor can be stated as follows:

$$\begin{aligned}\text{Direct labor variance} &= \text{Static budget} - \text{Actual results}\\ &= (SQ \times SP) - (AQ \times AP)\end{aligned}$$

- Like direct materials, this total can be broken down into a **rate variance** and an **efficiency variance**:

$$\begin{aligned}\text{Direct labor rate variance} &= \text{Middle budget} - \text{Actual results}\\ &= (AQ \times SP) - (AQ \times AP)\\ &= AQ \times (SP - AP)\end{aligned}$$

$$\begin{aligned}\text{Direct labor efficiency variance} &= \text{Static budget} - \text{Middle budget}\\ &= (SQ \times SP) - (AQ \times SP)\\ &= (SQ - AQ) \times SP\end{aligned}$$

- A **favorable labor efficiency variance** indicates that the workers have been expending less than the standard number of labor hours. A favorable variance may therefore result from workers being unusually efficient or from the production of lower quality products. An **unfavorable labor efficiency variance** may be caused by workers taking unauthorized work breaks. It may also be caused by production delays resulting from materials shortages or inferior materials.

Mix and Yield Varances

- The quantity variance for materials and the efficiency variance for labor can be further subdivided into mix and yield variances:

$$\begin{aligned}\text{Mix variance} &= AQ \times (A\% - S\%) \times SP\\ \text{Yield variance} &= (SQ \times S\% \times SP) - (AQ \times A\% \times SP)\end{aligned}$$

Overhead Variances

- A manufacturing concern's total overhead variance is composed of **variable and fixed portions**.
- Besides the three-way breakdown (static budget variance/flexible budget variance/sales volume variance), the **variable overhead variance** can also be decomposed into the **variable overhead spending variance** and the **variable overhead efficiency variance**.
- In the standard three-way breakdown, the **sales volume variance component** of the **fixed overhead variance** is **always $0** because fixed costs are by their nature unchanging within the relevant range of the budgeting cycle.
- The flexible budget variance component can be decomposed into a **fixed overhead spending variance** and a **fixed overhead volume variance**.

Sales Variances

- If a firm's **sales differ from the amount budgeted**, the difference could be attributable to either the sales price variance or the sale volume variance.
- For a single-product firm, the **sales price variance** is the change in the contribution margin attributable solely to the change in selling price.
- For a single-product firm, the **sales volume variance** is the change in the contribution margin caused by the difference between the actual and budgeted volume.
- If a company produces two or more products, the **multiproduct sales variances** reflect not only the effects of the change in total unit sales but also any difference in the mix of products sold.

STUDY UNIT EIGHT
RESPONSIBILITY ACCOUNTING AND PERFORMANCE MEASURES

This study unit is the **second of two** on **performance management**. The relative weight assigned to this major topic in Part 1 of the exam is **25%**. The two study units are

Study Unit 7: Cost and Variance Measures
Study Unit 8: Responsibility Accounting and Performance Measures

After studying the outline and answering the questions in this study unit, you will have the skills necessary to address the following topics listed in the ICMA's Learning Outcome Statements:

Part 1 – Section B.2. Responsibility centers and reporting segments

The candidate should be able to:

a. identify and explain the different types of responsibility centers
b. recommend appropriate responsibility centers given a business scenario
c. demonstrate an understanding of contribution margin reporting as used for performance evaluation and calculate a contribution margin
d. analyze a contribution margin report and evaluate performance
e. identify segments that organizations evaluate, including product lines, geographical areas, or other meaningful segments
f. explain why the allocation of common costs among segments can be an issue in performance evaluation
g. identify methods for allocating common costs, such as stand-alone cost allocation and incremental cost allocation
h. define transfer pricing and identify the objectives of transfer pricing
i. identify the methods for determining transfer prices and list and explain the advantages and disadvantages of each method
j. identify and/or calculate transfer prices using variable cost, full cost, market price, negotiated price, and dual-rate pricing
k. explain how transfer pricing is affected by business issues such as the presence of outside suppliers and the opportunity costs associated with capacity usage
l. describe how special issues such as tariffs, exchange rates, taxes, currency restrictions, expropriation risk, and the availability of materials and skills affect performance evaluation in multinational companies

Part 1 – Section B.3. Performance measures

The candidate should be able to:

a. explain why performance evaluation measures should be directly related to strategic and operational goals and objectives; why timely feedback is critical; and why performance measures should be related to the factors that drive the element being measured, e.g., cost drivers and revenue drivers
b. explain the issues involved in determining product profitability, business unit profitability, and customer profitability, including cost measurement, cost allocation, investment measurement, and valuation
c. calculate product-line profitability, business unit profitability, and customer profitability given a set of data and assumptions
d. evaluate customers and products on the basis of profitability and recommend ways to improve profitability and/or drop unprofitable customers and products
e. define and calculate return on investment (ROI)
f. analyze and interpret ROI calculations and evaluate performance on the basis of the analysis
g. define and calculate residual income (RI)
h. analyze and interpret RI calculations and evaluate performance on the basis of the analysis
i. compare and contrast the benefits and limitations of ROI and RI as measures of performance
j. explain how revenue and expense recognition policies may affect the measurement of income and reduce comparability among business units
k. explain how inventory measurement policies, joint asset sharing, and overall asset measurement may affect the measurement of investment and reduce comparability among business units
l. demonstrate an understanding of the effect international operations can have on performance measurement
m. define critical success factors and discuss the importance of these factors in evaluating a firm
n. define the concept of a balanced scorecard and identify its components
o. identify and describe financial measures, customer satisfaction measures, internal business process measures, innovation and learning measures, and evaluate their relevance for a specific organization using the balanced scorecard
p. identify and describe the characteristics of successful implementation and use of a balanced scorecard
q. analyze and interpret a balanced scorecard and evaluate performance on the basis of the analysis
r. recommend performance measures and a periodic reporting methodology given operational goals and actual results

8.1 RESPONSIBILITY CENTERS

1. The primary distinction between **centralized and decentralized organizations** is in the degree of **freedom of decision making** by managers at many levels.
    a. Centralization assumes decision making must be consolidated so that activities throughout the organization may be more effectively coordinated.
        1) In decentralization, decision making is at as low a level as possible. The premise is that the local manager can make more informed decisions than a centralized manager.

2) Decentralization typically reflects larger companies that are divided into multiple segments.
3) In most organizations, a mixture of these approaches is used.

b. **Controllability** is the extent to which a manager can influence activities and related revenues, costs, or other items.

1) In principle, controllability is proportionate to, but not coextensive with, **responsibility**.
2) Managerial performance ordinarily should be evaluated based on factors **that can be influenced by the manager**, such as revenues, costs, or investments.

a) For example, a **controllable cost** may be defined as one directly regulated by a specific manager at a given level of production within a given time span or one that the manager can significantly influence.

2. A well-designed **responsibility accounting system** establishes **responsibility centers** (also called **strategic business units**) for the purpose of encouraging managerial effort to attain organizational objectives, motivating managers to make decisions consistent with those objectives, and providing a basis for determining managerial compensation.

a. A **cost center**, e.g., a maintenance department, is responsible for costs only.

1) Cost drivers are the relevant performance measures.
2) A disadvantage of a cost center is the potential for cost shifting, for example, replacement of variable costs for which a manager is responsible with fixed costs for which (s)he is not.

a) Another disadvantage is that long-term issues may be disregarded when the emphasis is on, for example, annual cost amounts.
b) Yet another issue is allocation of service department costs to cost centers.

3) Service centers exist primarily and sometimes solely to provide specialized support to other organizational subunits. They are usually operated as cost centers.

b. A **revenue center**, e.g., a sales department, is responsible for revenues only.

1) Revenue drivers are the relevant performance measures. They are factors that influence unit sales, such as changes in prices and products, customer service, marketing efforts, and delivery terms.

c. A **profit center**, e.g., an appliance department in a retail store, is responsible for revenues and expenses.

d. An **investment center**, e.g., a branch office, is responsible for revenues, expenses, and invested capital.

1) The advantage of an investment center is that it permits an evaluation of performance that can be compared with that of other responsibility centers or other potential investments on a return on investment basis, i.e., on the basis of the effectiveness of asset usage.

3. **Controllability is not the only basis** for responsibility.

a. More than one manager may influence a cost, and responsibility may be assigned based on knowledge about its incurrence rather than ability to control it directly.
b. Accordingly, a successful system is dependent upon the proper delegation of responsibility and the commensurate authority.

4. The purpose of a responsibility system is to **motivate management performance** that adheres to overall company objectives (goal congruence).
   a. **Goal congruence** is promoted by encouraging cooperation among organizational functions (production, marketing, and support) by influencing managers to think of their products or services as salable outside the firm, and by encouraging managers to find new methods of earning profits.
   b. **Suboptimization** occurs when one segment of a firm takes action that is in its own best interests but is detrimental to the firm as a whole.

8.2 CONTRIBUTION AND SEGMENT REPORTING

1. The **contribution margin approach** to performance evaluation is emphasized in responsibility accounting because it focuses on **controllability**.
   a. Fixed costs are much less controllable than variable costs.
   b. Thus, contribution margin may be a fairer basis for evaluation than gross margin (also called gross profit).
   c. The following comparison illustrates this difference:

GAAP Approach		
Sales		**$xxx,xxx**
Production costs only:		
Variable production costs	$xx,xxx	
Fixed production costs	xx,xxx	(xx,xxx)
Gross margin		**$ xx,xxx**

Contribution Margin Approach		
Sales		**$xxx,xxx**
Variable costs only:		
Variable production costs	$xx,xxx	
Variable S&A expenses	xx,xxx	(xx,xxx)
Contribution margin		**$ xx,xxx**

2. The following is an example of a contribution margin income statement:

Sales		**$150,000**
Variable production costs		(40,000)
Manufacturing contribution margin		**$110,000**
Variable S&A expenses		(20,000)
Contribution margin		**$ 90,000**
Controllable fixed costs:		
Fixed production costs	$30,000	
Fixed S&A expenses	25,000	(55,000)
Short-run performance margin		**$ 35,000**
Traceable fixed costs:		
Depreciation	$10,000	
Insurance	5,000	(15,000)
Segment margin		**$ 20,000**
Allocated common costs		(10,000)
Segment operating income		**$ 10,000**

3. A **segment** is a product line, geographical area, or other meaningful subunit of the organization.
   a. Controllable (discretionary) costs are characterized by uncertainty about the relationship between input (the costs) and the value of the related output. Examples are advertising and research costs.
   b. Committed costs result when a going concern holds fixed assets (property, plant, and equipment). Examples are insurance, long-term lease payments, and depreciation.
   c. Profit margin is net income divided by sales. It shows the percentage of sales dollars resulting in net income (return on investment).

4. The contribution margin approach is also useful for making **disinvestment decisions** about whether product lines and business units should be continued or whether particular customers or geographic areas should continue to be served.
   a. This approach lends itself to the **relevant revenue and relevant cost analysis** required for disinvestment decisions.
   b. Relevant revenues and costs are all expected future amounts that will vary among the possible decision choices.
      1) For example, the allocated common costs and other fixed costs that will not be affected by disinvestment would be excluded from the analysis.
   c. The relevant revenues and costs analysis must address all the ramifications of the decision to disinvest.
      1) For example, discontinuing one product may affect sales of other products, and currently nonprofitable service to certain customers may be justified by their future profit potential.
   d. Still another issue is **opportunity cost**. Disinvestment is often justified when alternative uses of resources are more profitable but not when idle capacity may result.
5. The responsibility for internal reports is management's. Management may direct the accountant to provide a report in any format deemed suitable for the decision process.

8.3 COMMON COSTS

1. **Common costs** are the costs of products, activities, facilities, services, or operations shared by two or more cost objects.
   a. The term **joint costs** is frequently used to describe the common costs of a single process that yields two or more joint products.
2. The difficulty with common costs is that they are **indirect costs** whose allocation may be arbitrary.
   a. A direct **cause-and-effect relationship** between a common cost and the actions of the cost object to which it is allocated is desirable.
      1) Such a relationship promotes acceptance of the allocation by managers who perceive the fairness of the procedure, but identification of cause and effect may not be feasible.
   b. An alternative allocation criterion is the **benefit received**.
      1) For example, advertising costs that do not relate to particular products may increase sales of all products.
      2) Allocation based on the increase in sales by organizational subunits is likely to be accepted as equitable despite the absence of clear cause-and-effect relationships.

c. Two specific approaches to common cost allocation are in general use.

1) EXAMPLE: The proportionate costs of servicing three customers are presented in the table below. The common cost of providing service to these customers is $8,000.

	Cost of Servicing	%
Luciano	$ 7,000	70%
Ratzinger	2,000	20%
Wojtyla	1,000	10%
Total	$10,000	100%

2) The **stand-alone method** allocates a common cost to each cost object on a proportionate basis:

	Total Cost to Be Allocated	Allocation %	Allocated Cost
Luciano	$8,000	70%	$5,600
Ratzinger	8,000	20%	1,600
Wojtyla	8,000	10%	800
Total		100%	$8,000

3) The **incremental method** allocates the common cost up to the amount of each cost object's traceable cost total:

	Traceable Cost	Allocated Cost
Luciano	$ 7,000	$7,000
Ratzinger	2,000	1,000
Wojtyla	1,000	0
Total	$10,000	$8,000

3. Cost allocation is necessary for making economic decisions, e.g., the price to charge for a product, whether to make or buy a part, or whether to divest a segment.

a. Cost allocation is also necessary for external financial reporting and for calculation of reimbursements, such as those involved in governmental contracting.

b. Furthermore, cost allocation serves as a **motivator**.

1) For example, designers of products may be required to include downstream costs, such as servicing and distribution, in their cost projections to fix their attention on how their efforts affect the total costs of the company.

2) Another typical example of the motivational effects of cost allocation is that it tends to encourage marketing personnel to emphasize products with large contribution margins.

4. A persistent problem in large organizations is the treatment of the costs of headquarters and other **central support costs**. Such costs are frequently allocated.

a. Research has shown that central support costs are allocated to departments or divisions for the following reasons:

1) The allocation reminds managers that support costs exist and that the managers would incur these costs if their operations were independent.

2) The allocation reminds managers that profit center earnings must cover some amount of support costs.

3) Departments or divisions should be motivated to use central support services appropriately.

4) Managers who must bear the costs of central support services that they do not control may be encouraged to exert pressure on those who do. Thus, they may be able to restrain such costs indirectly.

5. Allocation of **central administration costs** is a fundamental issue in responsibility accounting. It is usually made based on budgeted revenue or contribution margin.
    a. If allocation is based on actual sales or contribution margin, responsibility centers that increase their sales (or contribution margin) will be charged with increased overhead.
    b. If central administrative or other fixed costs are not allocated, responsibility centers might reach their revenue (or contribution margin) goals without covering all fixed costs (which is necessary to operate in the long run).
    c. Allocation of overhead, however, is motivationally negative; central administrative or other fixed costs may appear noncontrollable and be unproductive.
    d. A much preferred alternative is to budget a certain amount of contribution margin earned by each responsibility center to the central administration based on negotiation.
        1) The intended result is for each unit to see itself as contributing to the success of the overall entity rather than carrying the weight (cost) of central administration.
        2) Central administration can then make the decision whether to expand, divest, or close responsibility centers.
6. Negative behavioral effects may arise from arbitrary cost allocations.
    a. Managers' morale may suffer when allocations depress operating results.
    b. Dysfunctional conflict may arise among managers when costs controlled by one are allocated to others.
    c. Resentment may result if cost allocation is perceived to be arbitrary or unfair.
        1) For example, an allocation on an ability-to-bear basis, such as operating income, penalizes successful managers and rewards underachievers and may therefore have a demotivating effect.

8.4 TRANSFER PRICING

1. **Transfer prices** are the amounts charged by one segment of an organization for goods and services it provides to **another segment of the same organization**.
    a. Transfer prices are used by profit and investment centers (a cost center's costs are allocated to producing departments).
        1) The problem is the determination of the transfer price when one responsibility center purchases from another.
        2) In a decentralized system, each responsibility center theoretically may be completely separate.
            a) Thus, Division A should charge the same price to Division B as would be charged to an outside buyer.
            b) The reason for decentralization is to motivate managers, and the best interests of Division A may not be served by giving a special discount to Division B if the goods can be sold at the regular price to outside buyers. However, having A sell at a special price to B may be to the company's advantage.

2. A transfer price should permit a segment to operate as an independent entity and achieve its goals while functioning in the best interests of the company. Hence, transfer pricing should motivate managers by encouraging goal congruence and managerial effort.
   a. **Motivation** is the desire of managers to attain a specific goal and the commitment to accomplish the goal. Managerial motivation is therefore a combination of goal congruence and managerial effort.
   b. **Goal congruence** takes place when a manager's individual goals align with those of the organization.
      1) Performance is assumed to be optimized when the parties understand that personal and segmental goals should be consistent with those of the organization.
   c. **Managerial effort** is the extent to which a manager attempts to accomplish a goal.
      1) Managerial effort may include psychological as well as physical commitment to a goal.
3. Transfer prices can be determined in a number of ways. They may be based on
   a. A **market price**, assuming that a market exists
      1) A market price is the best transfer price to use in many situations. For example, if the producing department is operating at full capacity and can sell all of its output at the market price, then there is no justification to use a lower price as the transfer price for intracompany transfers.
      2) Alternatively, if a producing department is not producing at full capacity, the use of market prices for internal transfers is not justified. A lower price might be more motivational to either the buyer or the seller.
   b. **Differential outlay cost plus opportunity cost to the seller**
      1) For example, if a good costing $4 can be sold for $10, the outlay cost is $4 and the seller's opportunity cost is $6 (given no idle capacity).
   c. **Full absorption cost**
      1) Full-cost price includes materials, labor, and full allocation of manufacturing overhead.
      2) The use of full absorption cost ensures that the selling department will not incur a loss and provides more incentive to the buying department to buy internally than do market price or cost plus. However, there is no motivation for the seller to minimize costs since all costs can be passed along to the buying department.
   d. **Variable costs**, which should only be used when the selling division has excess capacity
      1) By allowing the buyer to purchase at variable costs, unused production capacity will be utilized.
      2) However, there is no incentive for the production department, since it will be producing the products at a loss (even though the company as a whole will benefit from the arrangement).
         a) In practice, companies who wish to follow this philosophy actually adopt a negotiation policy wherein the transfer price will be something greater than variable costs but less than full costs. At least the seller would have a positive contribution margin if the price is set slightly above variable costs.
      3) The advantage of using variable costs is that the buyer is motivated to solve the company's excess capacity problem, even though that excess capacity is not in the buyer's department.

e. **Cost plus a lump sum or a markup percentage**

1) Cost may be either the standard or the actual cost. The former has the advantage of isolating variances. Actual costs give the selling division little incentive to control costs.
2) A cost-based price ignores market prices and may not promote long-term efficiencies.

f. **Negotiation**

1) A negotiated price may result when organizational subunits are free to determine the prices at which they buy and sell internally. Hence, a transfer price may simply reflect the best bargain that the parties can strike between themselves.
2) The transfer price need not be based directly on particular market or cost information.
3) A negotiated price may be especially appropriate when market prices are subject to rapid fluctuation.

4. The **choice of a transfer pricing policy** (which type of transfer price to use) is normally decided by top management at the corporate level. The decision will typically include consideration of the following:

a. **Goal congruence factors**

1) The transfer price should promote the goals of the company as a whole.

b. **Segmental performance factors**

1) The segment making the transfer should be allowed to recover its incremental cost plus its opportunity cost of the transfer. The opportunity cost is the benefit forgone by not selling to an outsider.

a) For this purpose, the transfer should be at market price.
b) The selling manager should not lose income by selling within the company.

2) Properly allocating revenues and expenses through appropriate transfer pricing also facilitates evaluation of the performance of the various segments.

c. **Negotiation factors**

1) If the purchasing segment could purchase the product or service outside the company, it should be permitted to negotiate the transfer price.
2) The purchasing manager should not have to incur greater costs by purchasing within the company.

d. **Capacity factors**

1) If Division A has excess capacity, it should be used for producing products for Division B. If Division A is operating at full capacity and selling its products at the full market price, profitable work should not be abandoned to produce for Division B.

e. **Cost structure factors**

1) If Division A has excess capacity and an opportunity arises to sell to Division B at a price in excess of the variable cost, the work should be performed for Division B because a contribution to cover the fixed costs will result.

f. **Tax factors**

1) A wide range of tax issues on the interstate and international levels may arise, e.g., income taxes, sales taxes, value-added taxes, inventory and payroll taxes, and other governmental charges.

2) In the international context, exchange rate fluctuations, threats of expropriation, and limits on transfers of profits outside the host country are additional concerns.

a) Thus, because the best transfer price may be a low one because of the existence of tariffs or a high one because of the existence of foreign exchange controls, the effect may be to skew the performance statistics of management.

b) The high transfer price may result in foreign management appearing to show a lower return on investment than domestic management, but the ratio differences may be negated by the fact that a different transfer pricing formula is used.

5. EXAMPLE:

a. Division A produces a small part at a cost of $6 per unit. The regular selling price is $10 per unit. If Division B can use the part in its production, the cost to the company (as a whole) will be $6.

b. Division B has another supplier who will sell the item to B at $9.50 per part. Division B wants to buy the $9.50 part from the outside supplier instead of the $10 part from Division A, but making the part for $6 is in the company's best interest.

c. What amount should Division A charge Division B?

1) The answer is complicated by many factors. For example, if Division A has excess capacity, B should be charged a lower price. If it is operating at full capacity, B should be charged $10.

2) Also consider what portion of Division A's costs is fixed. For example, if a competitor offered to sell the part to B at $5 each, can Division A advantageously sell to B at a price lower than $5? If Division A's $6 total cost is composed of $4 of variable costs and $2 of fixed costs, it is beneficial for all concerned for A to sell to B at a price less than $5. Even at a price of $4.01, the parts would be providing a contribution margin to cover some of A's fixed costs.

6. **Dual pricing** is another internal price-setting alternative.

a. For example, the seller could record the transfer to another segment at the usual market price that would be paid by an outsider. The buyer, however, would record a purchase at the variable cost of production.

1) Each segment's reported performance is improved by the use of a dual-pricing scheme.

2) The company would benefit because variable costs would be used for decision-making purposes. In a sense, variable costs would be the relevant price for decision-making purposes, but the regular market price would be used for evaluation of production divisions.

b. However, under a dual-pricing system, the profit for the company will be less than the sum of the profits of the individual segments.

1) In effect, the seller is given a corporate subsidy under the dual-pricing system.

2) The dual-pricing system is rarely used because the incentive to control costs is reduced.

a) The seller is assured of a high price, and the buyer is assured of an artificially low price. Thus, neither manager must exert much effort to show a profit on segmental performance reports.

8.5 FINANCIAL MEASURES

1. **Product profitability analysis** allows management to determine whether a product is providing any coverage of fixed costs.
   a. EXAMPLE:
      1) At first glance, a dairy operation appears to be comfortably profitable.

Sales	**$540,000**
Variable costs	312,000
Contribution margin	**$228,000**
Other traceable costs:	
Marketing	116,000
R&D	18,000
Product line margin	**$ 94,000**
Fixed costs	24,000
Operating income	**$ 70,000**

      2) A product profitability analysis shows an entirely different picture. Two product lines are losing money, and one is not even covering its own variable costs.

	Milk	Cream	Cottage Cheese	Total
Sales	**$300,000**	**$ 60,000**	**$180,000**	**$540,000**
Variable costs	110,000	62,000	140,000	312,000
Contribution margin	**$190,000**	**$ (2,000)**	**$ 40,000**	**$228,000**
Other traceable costs:				
Marketing	66,000	10,000	40,000	116,000
R&D	8,000	4,000	6,000	18,000
Product line margin	**$116,000**	**$(16,000)**	**$ (6,000)**	**$ 94,000**
Fixed costs				24,000
Operating income				**$ 70,000**

2. **Area office profitability analysis** performs the same function on the segment level.
   a. EXAMPLE: A geographic profitability analysis for a company that provides research services allows management to see which branch offices are the most profitable.

	Cartagena	Riyadh	Mumbai	Osaka	Total
Sales	**$1,200,000**	**$800,000**	**$2,000,000**	**$4,600,000**	**$8,600,000**
Variable costs of sales	800,000	460,000	1,400,000	3,200,000	5,860,000
Other variable costs	256,000	176,000	320,000	544,000	1,296,000
Contribution margin	**$ 144,000**	**$164,000**	**$ 280,000**	**$ 856,000**	**$1,444,000**
Traceable fixed costs	150,000	100,000	160,000	220,000	630,000
Area office margin	**$ (6,000)**	**$ 64,000**	**$ 120,000**	**$ 636,000**	**$ 814,000**
Nontraceable fixed costs					200,000
Operating income					**$ 614,000**

3. **Customer profitability analysis** enables a firm to make decisions about whether to continue servicing a given customer.
   a. EXAMPLE: At first glance, it appears that the two unprofitable customers should be dropped.

	Gonzales	Abdullah	Patel	Kawanishi	Total
Sales	**$10,000**	**$40,000**	**$62,000**	**$22,000**	**$134,000**
Cost of goods sold	7,200	26,000	41,000	18,100	92,300
Other relevant costs	1,000	2,200	4,400	4,100	11,700
Customer margin	**$ 1,800**	**$11,800**	**$16,600**	**$ (200)**	**$ 30,000**
Allocated fixed costs	2,000	6,000	8,800	4,000	20,800
Operating income	**$ (200)**	**$ 5,800**	**$ 7,800**	**$(4,200)**	**$ 9,200**

b. Dropping Kawanishi makes sense. However, Gonzales is contributing to the coverage of fixed costs, costs which would have to be shifted to the other customers if Gonzales were dropped.

4. **Performance measures** are means of revealing **how efficiently an investment center is deploying the capital** that has been invested in it to produce income for the owners.

   a. Thus, most performance measures relate a firm's resources (balance sheet) to its income (income statement).

5. **Return on investment (ROI)** is the most widely used performance measure of an investment center.

   a. The basic formula for ROI is

$$\frac{\textit{Net income}}{\textit{Average total assets}}$$

      1) EXAMPLE: A company has the following information:

	Current Year-End	Prior Year-End
Net sales	$1,800,000	$1,400,000
Net income	42,000	21,000
Total assets	1,800,000	1,600,000

      2) ROI = $42,000 ÷ [($1,800,000 + $1,600,000) ÷ 2]
         = $42,000 ÷ $1,700,000
         = 2.47%

      3) In other words, the company employed its assets during the year just ended to generate a return equal to 2.47% of those assets.

   b. A major **problem with the application of ROI** is that an investment center with a high ROI may not accept a profitable investment even though the investment's return is higher than the center's target ROI.

      1) EXAMPLE: An investment center has an 18% ROI and its investors expect 12%. If the decision makers look only at current ROI, they will reject a project earning 16%, even though that return exceeds the target.

6. **Residual income** is a variation of ROI that measures performance in dollar terms rather than as a percentage return.

   Net income – (Average total assets × Target rate of return)

   a. The target rate is ordinarily the weighted-average cost of capital, but it may be an arbitrary hurdle rate.

   b. Projects with a positive residual income should be accepted, and projects with a negative residual income should be rejected.

   c. Residual income is often touted as superior to ROI. It may be more consistent with maximizing profits.

      1) EXAMPLE: The company's managers have a 4% target rate of return.

      2) Residual income = $42,000 – ($1,700,000 × 4%)
                         = $42,000 – $68,000
                         = $(26,000)

      3) The firm had negative residual income during the year just ended.

d. The residual income method is often considered preferable to the ROI method because it deals in absolute dollars rather than percentages.

1) A manager with a 20% ROI would be reluctant to invest in a project with only an 18% return because his/her average overall return would decline. However, under the residual income method, the manager would invest in any project with a return greater than the cost of capital or the hurdle rate that (s)he has been assigned. Thus, overall the company would be better off even though the individual manager's ROI declined.

7. **Investment bases** must be compared to ensure comparability of the results of entities of different sizes.

a. Different **attributes** of financial information may be used to measure the elements of the investment base.

1) Historical cost
2) Replacement cost
3) Market value
4) Present value

b. **Alternative income measurements** are

1) Net income
2) Net income adjusted for price level changes
3) Cash flow
4) Earnings before interest and taxes (EBIT)

c. **Invested capital** may be defined in various ways, for example, as

1) Total assets available
2) Total assets employed, which excludes assets that are idle, such as vacant land
3) Working capital plus other assets, which excludes current liabilities (i.e., capital provided by short-term creditors)

a) This investment base assumes that the manager controls short-term credit.

4) Equity, which includes an allocated portion of long-term liabilities

a) One problem with this investment base is that, although it has the advantage of emphasizing return to owners, it reflects decisions at different levels of the entity: short-term liabilities incurred by the responsibility center and long-term liabilities controlled at the corporate level.

8. The comparability of performance measures may be affected by differences in the **accounting policies** used by different business units.

a. For example, policies regarding depreciation, decisions to capitalize or expense, inventory flow assumptions, and revenue recognition can lead to comparability issues for performance measures.

1) These differences may be heightened for the business units of a **multinational enterprise**.

b. **Issues other than accounting policy** may also affect comparability.

1) Differences in the tax systems in the jurisdictions where business units operate
2) The presence of extraordinary items of profit or loss
3) Allocation of common costs
4) The varying availability of resources

c. Other issues face business units operating in **foreign countries**:
   1) Changes in foreign currency exchange rates and inflation rates
   2) Limitations on repatriation of earnings and investments imposed by the government of a foreign operation's host country
   3) Threats of expropriation of assets held in foreign countries
   4) The imposition of tariffs, import-export duties, and price controls

d. In addition, **nonfinancial performance measures** are important for day-to-day control in assessing the quality of processes and products.
   1) Some nonfinancial performance indicators include rework, outgoing quality level, returned merchandise, total setup time, customer report card, competitive rank, and on-time delivery.

8.6 THE BALANCED SCORECARD

1. The trend in performance evaluation is the **balanced scorecard** approach to managing the implementation of the firm's strategy.
   a. The balanced scorecard is an accounting report that connects the firm's critical success factors to measurements of its performance.
      1) **Critical success factors (CSFs)** are specific, measurable financial and nonfinancial elements of a firm's performance that are vital to its competitive advantage.
      2) Multiple measures of performance permit a determination as to whether a manager is achieving certain objectives at the expense of others that may be equally or more important. For example, an improvement in operating results at the expense of new product development would be apparent using a balanced scorecard approach.
      3) The balanced scorecard is a goal congruence tool that informs managers about the nonfinancial factors that top management believes to be important.
      4) Measures on the balanced scorecard may be financial or nonfinancial, internal or external, and short term or long term.
      5) The balanced scorecard facilitates best practice analysis. Best practice analysis determines a method of carrying on a business function or process that is considered to be superior to all other known methods. A lesson learned from one area of a business can be passed on to another area of the business or between businesses.
   b. A firm identifies its CSFs by means of a **SWOT analysis** that addresses internal factors (its strengths and weaknesses) and external factors (its opportunities and threats).
      1) The firm's greatest strengths are its **core competencies**, which are functions the company performs especially well. These are the basis for its competitive advantages and strategy.
      2) **Strengths and weaknesses** are internal resources or a lack thereof, for example, technologically advanced products, a broad product mix, capable management, leadership in R&D, modern production facilities, and a strong marketing organization.

3) **Opportunities and threats** arise from such externalities as government regulation, advances in technology, and demographic changes. They may be reflected in such competitive conditions as

a) Raising or lowering of barriers to entry into the firm's industry by competitors

b) Changes in the intensity of rivalry within the industry, for example, because of overcapacity or high exit barriers

c) The relative availability of substitutes for the firm's products or services

d) Bargaining power of customers, which tends to be greater when switching costs are low and products are not highly differentiated

e) Bargaining power of suppliers, which tends to be higher when suppliers are few

4) The SWOT analysis tends to highlight the basic factors of cost, quality, and the speed of product development and delivery.

c. Once the firm has identified its CSFs, it must establish specific, measurable ways for each CSF that are both relevant to the success of the firm and reliably stated.

1) Thus, the balanced scorecard varies with the strategy adopted by the firm.

a) For example, product differentiation or cost leadership either in a broad market or a narrowly focused market (a focus strategy). These measures provide a basis for implementing the firm's competitive strategy.

2) The scorecard should include **lagging indicators** (such as output and financial measures) and **leading indicators** (such as many types of nonfinancial measures).

a) The latter should be used only if they are predictors of ultimate financial performance.

3) The scorecard should permit a determination of whether certain objectives are being achieved at the expense of others.

a) For example, reduced spending on customer service may improve short-term financial results at a significant cost that is revealed by a long-term decline in customer satisfaction measures.

4) By providing measures that are **nonfinancial** as well as financial, long term as well as short term, and internal as well as external, the balanced scorecard de-emphasizes short term financial results and focuses attention on CSFs.

2. A typical balanced scorecard classifies objectives into one of four perspectives on the business:

a. **Financial**

1) **CSFs** may be sales, fair value of the firm's stock, profits, and liquidity.

2) **Measures** may include sales, projected sales, accuracy of sales projections, new product sales, stock prices, operating earnings, earnings trend, revenue growth, gross margin percentage, cost reductions, economic value added (EVA®), return on investment (or any of its variants), residual income, cash flow coverage and trends, turnover (assets, receivables, and inventory), and interest coverage.

b. **Customer Satisfaction**

1) **CSFs** may be customer satisfaction, dealer and distributor relationships, marketing and selling performance, prompt delivery, and quality.
2) **Measures** may include customer retention rate, returns, complaints, defects, lead time, survey results, coverage and strength of distribution channels, market research results, training of marketing people, sales trends, market share and its trend, on-time delivery rate, service response time and effectiveness, and warranty expense.

c. **Internal Business Processes**

1) **CSFs** may be quality, productivity (an input-output relationship), flexibility of response to changing conditions, operating readiness, and safety.
2) **Measures** may include new products marketed, technological capabilities, rate of defects, amounts of scrap and rework, returns, survey results, field service reports, warranty costs, vendor defect rate, cycle time, labor and machine efficiency, setup time, scheduling effectiveness, downtime, capacity usage, maintenance, and accidents and their results.

d. **Learning and Growth**

1) **CSFs** may be development of new products, promptness of their introduction, human resource development, morale, and competence of the work force.
2) **Measures** may include number of design changes, patents and copyrights registered, R&D personnel qualifications, actual versus planned shipping dates, hours of training, skill set levels attained, personnel turnover, personnel complaints and survey results, financial and operating results, organizational learning, and industry leadership.

3. EXAMPLE of a balanced scorecard:

a. Each **objective** is associated with one or more **measures** that permit the organization to gauge progress toward the objective.

b. Note that achievement of the objectives in each **perspective** makes it possible to achieve the objectives in the next higher perspective.

Financial Perspective	
Objective: Increase shareholder value	**Measures:** Increase in common stock price Reliability of dividend payment
Customer Perspective	
Objective: Increase customer satisfaction	**Measures:** Greater market share Higher customer retention rate Positive responses to surveys
Internal Business Process Perspective	
Objective: Improve product quality	**Measures:** Achievement of zero defects
Objective: Improve internal processes	**Measures:** Reduction in delivery cycle time Smaller cost variances
Learning and Growth Perspective	
Objective: Increase employee confidence	**Measures:** Number of suggestions to improve processes Positive responses to surveys
Objective: Increase employee competence	**Measures:** Attendance at internal and external training seminars

4. The **development and implementation** of a comprehensive balanced scorecard requires active support and participation by senior management. This involvement will in turn ensure the cooperation of lower-level managers in the identification of objectives, appropriate measures, targeted results, and methods of achieving the results.
   a. The scorecard should contain measures at the detail level that permits everyone to understand how his/her efforts affect the firm's results.
   b. The scorecard and the strategy it represents must be communicated to all managers and used as a basis for compensation decisions.
   c. The following are **problems in implementation** of the balanced scorecard approach:
      1) Using too many measures, with a consequent loss of focus on CSFs
      2) Failing to evaluate personnel on nonfinancial as well as financial measures
      3) Including measures that will not have long-term financial benefits
      4) Not understanding that subjective measures (such as customer satisfaction) are imprecise
      5) Trying to achieve improvements in all areas at all times
      6) Not being aware that the hypothesized connection between nonfinancial measures and ultimate financial success may not continue to be true

8.7 CORE CONCEPTS

Responsibility Centers

- A well-designed responsibility accounting system establishes **responsibility centers** (also called **strategic business units**).
  - A **cost center**, e.g., a maintenance department, is responsible for costs only.
  - A **revenue center**, e.g., a sales department, is responsible for revenues only.
  - A **profit center**, e.g., an appliance department in a retail store, is responsible for revenues and expenses.
  - An **investment center**, e.g., a branch office, is responsible for revenues, expenses, and invested capital.
- **Goal congruence** is promoted by encouraging cooperation among organizational functions (production, marketing, and support). **Suboptimization** occurs when one segment of a firm takes action that is in its own best interests but is detrimental to the firm as a whole.

Contribution and Segment Reporting

- The **contribution margin approach** to performance evaluation is emphasized in responsibility accounting because it focuses on controllability, as opposed to the gross margin approach which is used for external reporting. The contribution margin approach lends itself to relevant revenue and relevant cost analysis.
  - **Contribution margin** = Revenues – Variable costs, both manufacturing and S&A
  - **Gross margin** = Revenues – Manufacturing costs, both variable and fixed
- A **segment** is a product line, geographical area, or other meaningful subunit of the organization.
- **Allocation of central administration costs** is a fundamental issue in responsibility accounting. It is usually made based on budgeted revenue or contribution margin. If central administrative or other fixed costs are not allocated, responsibility centers might reach their revenue or contribution goals without covering all fixed costs.

Common Costs

- **Common costs** are the costs of products, activities, facilities, services, or operations shared by two or more cost objects. The difficulty with common costs is that they are indirect costs whose allocation may be arbitrary. **Two specific approaches** to common cost allocation are in general use:
  - The **stand-alone method** allocates a common cost to each cost object on a proportionate basis.
  - The **incremental method** allocates the common cost up to the amount of each cost object's traceable cost total.
- A persistent problem in large organizations is the treatment of the **costs of headquarters** and other central support costs. Such costs are frequently allocated.

Transfer Pricing

- **Transfer prices** are the amounts charged by one segment of an organization for goods and services it provides to another segment of the same organization. Transfer pricing should motivate managers by encouraging goal congruence and managerial effort. **Three basic methods** for determining transfer prices are in common use:
  - **Cost plus pricing** sets price at the selling division's full cost of production plus a reasonable markup.
  - **Market pricing** uses the price the selling division could obtain on the open market.
  - **Negotiated pricing** gives the divisions the freedom to bargain between themselves and come to their own agreement regarding price.
- The **minimum price** that a selling division is willing to accept is the sum of the incremental cost of producing the unit so far plus the opportunity cost of selling the unit internally. The **opportunity cost of selling internally** varies depending on two factors: the existence of an external market for the product and whether the selling division has excess capacity.

Financial Measures

- **Performance measures** are means of revealing how efficiently an investment center is deploying the capital that has been invested in it to produce income for the owners.
  - **Return on investment (ROI)** is the key performance measure of an investment center.

    Net income ÷ Average total assets
  - **Residual income** is a dollar measure rather than a percentage rate. The target rate is ordinarily the weighted-average cost of capital, but it may be an arbitrary hurdle rate.

    Net income − (Total investment × Target rate of return)

The Balanced Scorecard

- **Critical success factors (CSFs)** are specific, measurable financial and nonfinancial elements of a firm's performance that are vital to its competitive advantage. A firm identifies its CSFs by means of a **SWOT analysis** that addresses internal factors (its strengths and weaknesses) and external factors (its opportunities and threats).
- Once the firm has identified its CSFs, it must establish **specific, measurable ways** for each CSF that are both relevant to the success of the firm and reliably stated. Measures must be both financial and nonfinancial, short-term and long-term.
- A typical balanced scorecard classifies objectives into one of four perspectives on the business: **financial, customer satisfaction, internal business processes, and learning and growth**.

- Each **objective** is **associated with** one or more **measures** that permit the organization to gauge progress toward the objective.
- Achievement of the objectives in each perspective makes it possible to achieve the objectives in the **next higher perspective**.

STUDY UNIT NINE
INTERNAL CONTROLS I

Internal Controls

Management accountants are expected to have a thorough understanding of the risks inherent to, and the internal controls within, a business. Internal controls have always been a good idea in a well-run business, but with the passage of the Foreign Corrupt Practices Act in 1977, an effective internal control system became a legal requirement. The Sarbanes-Oxley Act of 2002 further enhanced the legal requirements for internal controls.

This study unit and most of the following study unit are on **internal controls**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**.

After studying the outline and answering the questions in this study unit, you will have the skills necessary to address the following topics listed in the ICMA's Learning Outcome Statements:

Part 1 – Section D.1. Risk assessment, controls, and risk management

The candidate should be able to:

a. demonstrate an understanding of internal control risk and the management of internal control risk
b. identify and describe internal control objectives
c. explain how a company's organizational structure, policies, objectives, and goals, as well as its management philosophy and style, influence the scope and effectiveness of the control environment
d. identify the board of directors' responsibilities with respect to ensuring that the company is operated in the best interest of shareholders
e. describe how internal controls are designed to provide reasonable (but not absolute) assurance regarding achievement of an entity's objectives involving (i) effectiveness and efficiency of operations, (ii) reliability of financial reporting, and (iii) compliance with applicable laws and regulations
f. explain why personnel policies and procedures are integral to an efficient control environment
g. define and give examples of segregation of duties
h. explain why the following four types of functional responsibilities should be performed by different departments or different people within the same function: (i) authority to execute transactions, (ii) recording transactions, (iii) custody of assets involved in the transactions, and (iv) periodic reconciliations of the existing assets to recorded amounts
i. demonstrate an understanding of the importance of independent checks and verification
j. list examples of safeguarding controls
k. explain how the use of pre-numbered forms, as well as specific policies and procedures detailing who is authorized to receive specific documents, is a means of control
l. define inherent risk, control risk, and detection risk

m. describe the major internal control provisions of the Sarbanes-Oxley Act (Sections 302 and 404)
n. identify the role of the PCAOB in providing guidance on the auditing of internal controls
o. differentiate between a top-down (risk-based) approach and a bottom-up approach to auditing internal controls
p. identify the PCAOB preferred approach to auditing internal controls as outlined in Auditing Standard #5
q. identify and describe the major internal control provisions of the Foreign Corrupt Practices Act
r. identify and describe the five major components of COSO's Internal Control Framework (the 92 model)
s. assess the level of internal control risk within an organization and recommend risk mitigation strategies
t. define and distinguish between preventive controls and detective controls

Part 1 – Section D.2. Internal auditing

The candidate should be able to:

a. define the internal audit function and identify its functions and scope
b. identify how internal auditors can test compliance with controls and evaluate the effectiveness of controls
c. explain how internal auditors determine what controls to audit, when to audit, and why
d. identify and describe control breakdowns and related risks that internal auditors should report to management or to the board of directors
e. identify and define the objectives of a compliance audit and an operational audit

9.1 RISK AND THE CONTROL ENVIRONMENT

1. **The Assessment and Management of Risk**

a. Every organization faces **risks**, that is, unforeseen obstacles to the pursuit of its objectives. Risks take many forms and can originate from within or from outside the organization. Examples include the following:

1) A hacker may break into a university's information systems, changing grades and awarding unearned degrees.
2) The CEO may bribe a member of Congress to introduce legislation favorable to the firm's business.
3) A foreign government may be overthrown in a *coup d'etat*, followed by the expropriation of the firm's assets in that country.
4) An accounts payable clerk may establish fictitious vendors in the company's information systems and receive checks in payment for nonexistent goods or services.
5) A spike in interest rates may make the firm's long-term capital projects unprofitable.
6) The introduction of a new technology may make one of the firm's premier products obsolete.
7) A reduction in government regulation brings a flood of new competitors into the firm's markets.

b. **Risk assessment** is the process whereby management identifies the organization's vulnerabilities.

1) All systems of internal control involve **tradeoffs between cost and benefit**. For this reason, no system of internal control can be said to be "100% effective." Organizations accept the fact that risk can only be **mitigated, not eliminated**.

2) **Risk management** is the ongoing process of designing and operating internal controls that mitigate the risks identified in the organization's risk assessment.

c. **Risk can be quantified** as a combination of two factors: the severity of consequences and the likelihood of occurrence. The **expected value** of a loss due to a risk exposure can thus be stated numerically as the product of the two factors.

1) Risk can also be assessed in **qualitative terms**.

2) EXAMPLE: A company is assessing the risks of its systems being penetrated by hackers.

Event	Consequences	Likelihood
Minor penetration	Annoyance	90%
Unauthorized viewing of internal databases	Public embarrassment, Loss of customer confidence	8%
Unauthorized alteration of internal databases	PR crisis, Customer defection	2%

a) Although the occurrence of the annoyance level of incident is viewed as almost inevitable, the company will not find it worthwhile to institute the level of control necessary to prevent it.

b) By contrast, the occurrence of a disastrous level of incident is seen as remote, but the consequences are so severe that the company is willing to institute the costly internal controls that will assure its prevention.

d. **The AICPA audit risk model** can be **adapted** to the system of internal control as follows:

1) **Inherent risk (IR)** is the susceptibility of one of the company's objectives to obstacles arising from the nature of the objective. For example, a uranium mine is inherently riskier than a strip mall.

2) **Control risk (CR)** is the risk that the controls put in place will fail to prevent an obstacle from interfering with the achievement of the objective. For example, a policy requiring two approvals for expenditures over a certain dollar amount could be bypassed by collusion.

3) **Detection risk (DR)** is the risk that an obstacle to an objective will not be detected before a loss has occurred. For example, an embezzlement that continues for a year before detection is much costlier than one that is discovered after one month.

4) **Total risk (TR)** may thus be stated as follows:

$$TR = IR \times CR \times DR$$

2. **The System of Internal Control**

a. An organization establishes a **system of internal control** to help it manage many of the risks it faces. **SMA 2A**, *Management Accounting Glossary*, defines internal control as follows:

> *The whole system of controls (financial and otherwise) established by management to carry on the business of the enterprise in an orderly and efficient manner, to ensure adherence to management policies, safeguard the assets, and ensure as far as possible the completeness and accuracy of the records.*

b. The proper design and operation of an organization's system of internal controls is the **responsibility of management**.

1) Section 404 of the **Sarbanes-Oxley Act of 2002** requires publicly traded companies to issue a report stating that

a) Management takes responsibility for establishing and maintaining the firm's system of internal controls, and

b) The system has been functioning effectively over the reporting period.

3. **PCAOB Approach**

   a. One of the requirements of the Sarbanes-Oxley Act is that the **annual financial statement audit** also address the firm's **system of internal control**.

      1) The PCAOB issued its Auditing Standard (AS) No. 5, "An Audit of Internal Control Over Financial Reporting That Is Integrated with An Audit of Financial Statements," to provide guidance when these two audits are integrated.

      2) AS 5 requires the external auditor to **express an opinion on both** the system of internal control and the fair presentation of financial statements.

   b. AS 5 focuses on the existence of **material weaknesses** in internal control:

      Because a company's internal control cannot be considered effective if one or more material weaknesses exist, to form a basis for expressing an opinion, the auditor must plan and perform the audit to obtain competent evidence that is sufficient to obtain reasonable assurance about whether material weaknesses exist as of the date specified in management's assessment. A material weakness in internal control over financial reporting may exist even when financial statements are not materially misstated.

      1) The AICPA's auditing standards define material weakness as follows:

         *A **material weakness** is a deficiency, or combination of deficiencies, in internal control that results in a reasonable possibility that a material misstatement of the financial statements will not be prevented or timely detected and corrected.*

      2) This financial reporting-oriented focus for internal controls stands in contrast with the broader view that internal controls are processes to aid the organization in achieving its goals.

4. **Components of Internal Control**

   a. The COSO's internal control framework consists of the following five interrelated components:

      1) **Control environment** sets the tone of an organization, influencing the control consciousness of its people.

         a) This component is the foundation for the other components. It provides discipline and structure. To understand the control environment, the auditor considers programs and controls addressing **fraud risk** that have been implemented by management and those charged with governance. Their absence or inadequacy may be a material weakness.

      2) **Risk assessment** is the entity's identification and analysis of relevant risks as a basis for their management.

         a) Relevant risks include events and circumstances that may adversely affect an entity's ability to initiate, authorize, record, process, and report financial data consistent with financial statement assertions.

      3) **Control activities** are the policies and procedures that help ensure that management directives are carried out.

         a) These are the policies and procedures helping to ensure that actions are taken to address risks to achievement of objectives. Whether automated or manual, they have various objectives and are applied at various levels.

4) **Information and communication** systems support the identification, capture, and exchange of information in a form and time frame that enable people to carry out their responsibilities.

a) An information system consists of physical and hardware elements (infrastructure), software, data, manual and automated procedures, and people that interrelate to achieve a business goal.

b) **Communication** includes providing an understanding to employees about their roles and responsibilities. For example, communication may be through policy manuals, financial reporting manuals, and memoranda. It also may be by electronic and oral means or by management actions.

5) **Monitoring** is a process that assesses the quality of internal control performance over time.

a) Monitoring is management's timely assessment of internal control and the taking of corrective action so that controls operate as intended and are modified for changes in conditions. Establishing and maintaining internal control is management's responsibility.

5. **The Control Environment**

a. An organization's control environment encompasses the **attitudes and actions** of the board of directors and upper management regarding the significance of control, i.e., the "tone at the top." The components include

1) **Organizational structure.** An organization that is serious about internal control will design its lines of reporting and authority such that incompatible duties are not combined in the same job function and independent checks on performance are facilitated.

a) EXAMPLE: The organization's accountants, responsible for keeping the books, report to the controller, while the daily bank deposits are prepared by employees who report to the treasurer.

2) **Policies** are stated principles that require, guide, or restrict action. Policies should be designed to promote the conduct of authorized activities in an effective, efficient, and economical manner and to provide a satisfactory degree of assurance that the resources of the enterprise are suitably safeguarded. **Procedures** are the detailed steps that provide a guide for carrying out a policy.

a) EXAMPLE: A policy can simply state, "All bank statements will be reconciled to the company's records on a monthly basis." A procedure consists of the detailed steps to be carried out in performing the reconciliation.

3) **Objectives and goals.** An organization should set realistic, achievable goals that do not tempt managers to cross ethical boundaries.

a) EXAMPLE: Pegging divisional vice-presidents' bonus schedules to a 25% growth in revenues in all product segments can lead managers to engage in unethical accounting practices.

4) **Management philosophy and operating style.** Management's attitude toward sound risk management manifests itself in everyday actions in areas such as financial reporting, accounting estimates, and the selection of accounting principles.

a) **Integrity and ethical values** are essential because they affect all aspects of control. Ethical behavior results from the entity's standards, the way they are transmitted, and how they are reinforced. Management creates an atmosphere conducive to better risk management by (1) removing incentives for dishonest, illegal, or unethical behavior, and (2) setting an example in its own behavior.

b) EXAMPLE: When management routinely bypasses standing policies toward document approval, stretches accounting estimates, and encourages disregard of the principle of conservatism in financial reporting, risk is increased.

5) **Assignment of authority and responsibility.** Management can improve the control environment by proper design of the organizational structure. Even when the number of personnel available is limited, lines of reporting can reinforce proper internal control.

a) EXAMPLE: The internal audit activity can report directly to the CEO and be viewed as an important tool for helping maintain a proper control environment. A less satisfactory position is for the internal audit to be viewed simply as an adjunct of the financial accounting function and be placed under the controller.

b) EXAMPLE: Management defines key areas of authority and responsibility by placing the information technology, financial accounting, and treasury functions under separate officers.

6. **Board of Directors' Role**

a. Most publicly held corporations are required to have a **board of directors**, consisting of both **inside** members (officers and employees) and **outside** members (nonemployees who hold the company's stock).

1) The board is the **governing authority** of the corporation and is therefore responsible for establishing overall corporate policy. Day-to-day operations are delegated to management.

b. The directors have a **fiduciary duty** to the organization and its shareholders. They must exercise **reasonable care** in the performance of their duties, which entails being informed about and conversant with pertinent corporate information, attending meetings, analyzing corporate financial statements, etc.

1) Directors also owe a **duty of loyalty**, which prohibits dealing with the corporation unless full disclosure is made or usurping any corporate opportunity without giving the entity the right of first refusal.

2) Under the **business judgment rule**, however, a director will not have personal liability for his/her conduct if (s)he acts in good faith; is not motivated by fraud, conflict of interest, or illegality; and is not guilty of gross negligence.

a) Thus, honest errors of judgment do not result in liability. Moreover, a director may rely on information provided by an officer or an expert if the reliance is reasonable.

c. Directors typically

1) Select and remove officers
2) Determine the capital structure
3) Add, amend, or repeal bylaws
4) Initiate fundamental changes, such as mergers and divestitures
5) Declare dividends
6) Set the compensation of officers and management

7. **Audit Committee's Role**

a. The **audit committee** is a subcommittee of the board of directors whose purpose is to help keep the external auditors **independent of management**. This is accomplished by assigning the selection, compensation, and oversight of the external auditors to the audit committee.

1) Many stock exchanges require a listed organization to have an audit committee.

2) A crucial aspect of the audit committee is that it be made up of **outside directors**, i.e., only stockholders who are not employed by the company. This custom was made compulsory by the Sarbanes-Oxley Act of 2002 (see item 2.a. in Subunit 9.3).

3) The audit committee also plays an important role in maintaining the control environment by approving the charter and overseeing the work of the **internal audit activity**.

b. A strong audit committee insulates both external and internal auditors from influences that may compromise their independence and objectivity.

8. **Objectives of Internal Control**

a. In its 1992 publication *Internal Control – Integrated Framework*, the Committee of Sponsoring Organizations of the Treadway Commission (COSO) defined internal control this way:

> *Internal control is broadly defined as a process, effected by an entity's board of directors, management, and other personnel, designed to provide reasonable assurance regarding the achievement of objectives in the following categories:*
>
> - *Effectiveness and efficiency of operations*
> - *Reliability of financial reporting*
> - *Compliance with applicable laws and regulation*

1) Note that the Framework specifically cites **reasonable, not absolute, assurance** about the achievement of management's objectives. The benefits of internal controls must always exceed the costs of implementing them. A system of absolute assurance could only be implemented at prohibitively great expense [see item 1.b.1)].

9. **The Importance of Human Resources**

a. **Human Resources policies and practices**

1) **Hiring standards** should emphasize education, prior experience, past achievements, evidence of integrity and ethical behavior, and display a commitment to employing people who are competent and trustworthy.

2) **Training policies** should impart to employees a knowledge of their roles and responsibilities and expectations about their conduct and performance.

a) Human resource, or personnel, policies and procedures are an example of directive controls. Their objective is to cause a good event to occur rather than to stop a bad event from occurring.

b) Essentially, personnel policies and other directive controls are a special form of preventive controls in that errors are prevented through the proper selection and training of employees.

b. **Commitment to competence**

1) **Competence** consists of the knowledge and abilities necessary to complete required tasks. Simply having personnel in place who know what to do in a given situation is a crucial aspect of sound internal control.

2) **Promotions** based on periodic performance appraisals should reflect a commitment to rewarding competence.

9.2 CONTROL PROCEDURES

1. Preventive vs. Detective Controls
   a. A **preventive control** is one that prevents an error from entering the system. The input controls described in item 6.a. of Subunit 1 in Study Unit 10 are examples.
      1) Other examples of preventive controls include fences, locked doors, security guards, and a separation of duties policy.
      2) Preventive controls are often highly visible and are considered better than other forms of control because they stop problems before they occur.
   b. A **detective control** is one that calls attention to an error that has already entered the system before the error causes a negative outcome. An example is a petty cash count.
2. **Control activities** are designed and placed in operation to **ensure that management's directives are executed**. Hence, they should include the requisite steps to respond to the risks that threaten the attainment of organizational objectives.
   a. For this purpose, controls should be suitably designed to prevent or detect unfavorable conditions arising from **particular risk exposures**. They also should be placed in operation and operate effectively. If controls are not always in force, they cannot operate effectively, no matter how effective their design.
   b. Control procedures are implemented to **manage or limit risk** in accordance with the entity's risk assessments whenever risk exposures exist that threaten loss of assets or misstatements of accounting or management information.
   c. Controls can be identified in these areas:
      1) Segregation of duties, including four basic functional responsibilities
      2) Independent checks and verification
      3) Safeguarding controls
      4) Prenumbered forms
      5) Specific document flow
3. **Segregation of duties** involves assigning different employees to perform functions such that an employee acting alone is prevented from committing an error or concealing a fraud in the normal course of his/her duties.
   a. Four types of **functional responsibilities** should be segregated:
      1) The **authority to execute transactions**
      2) The **recording of transactions**
      3) **Custody of the assets** affected by the transactions
      4) **Periodic reconciliation** of the existing assets to recorded amounts
   b. EXAMPLE in the purchases-payables cycle:
      1) The authority to execute transactions is vested in the purchasing department, not, for example, the treasurer.
      2) The recording of transactions is done by accounts payable, not purchasing.
      3) Custody of the assets involved is vested in the warehouse, not inventory control.
      4) Periodic reconciliation of the existing assets to recorded amounts is performed by inventory control, not the warehouse.

c. EXAMPLE in the sales-receivables cycle:

1) The authority to execute transactions is vested in the sales department, not, for example, the treasurer.
2) The recording of transactions is done by accounts receivable, not sales.
3) Custody of the assets involved is vested in the warehouse (in the case of the merchandise) and the treasurer (in the case of the cash).
4) Periodic reconciliation of the existing assets to recorded amounts is performed by the general ledger accounting group, not the treasurer.

d. EXAMPLE in the payroll cycle:

1) The authority to execute transactions is vested in the human resources department, which authorizes the hiring and termination of employees and their rates of pay and deductions.
2) The recording of transactions is done by the payroll department.
3) Custody of the assets involved is vested in the treasurer.
4) Periodic reconciliation of the existing assets to recorded amounts is performed by the general ledger accounting group.

4. **Independent Checks and Verification**

a. The **reconciliation of recorded accountability with the assets** must be performed by a part of the organization either (1) unconnected with the original transaction or (2) without custody of the assets involved.

1) A comparison revealing that the assets do not agree with the recorded accountability provides evidence of unrecorded or improperly recorded transactions.

a) The converse, however, does not necessarily follow. For example, agreement of a cash count with the recorded balance does not provide evidence that all cash received has been properly recorded.

2) The frequency of such comparisons for the purpose of safeguarding assets depends on the nature and amount of the assets involved and the cost of making the comparison.

a) For example, cash may be counted daily but raw materials inventory only annually.

b. EXAMPLE: The general ledger group performs monthly reconciliations of bank statements to the company's records. This is an independent check on the work of the treasury function.

5. **Safeguarding controls** limit access to an organization's assets to authorized personnel. Access includes both **direct physical access** and **indirect access** through the preparation or processing of documents that authorize the use or disposition of assets.

a. EXAMPLES:

1) A lockbox system for collecting cash receipts from customers
2) Daily, intact deposit of cash receipts after preparation and verification by two treasury employees
3) Approval of credit memos by the credit department, not sales
4) Writeoffs of uncollectible accounts by the supervisor of the credit department manager
5) Unescorted access to computer operations center prohibited to (a) all non-information systems personnel and (b) all non-operations information system personnel, such as developers

6) Online access to production application libraries prohibited to developers; online access to production databases prohibited to all users except the organizational "owners" of the data elements
7) Direct deposit of pay in lieu of distribution of physical paychecks; unclaimed paychecks held by the treasurer, not payroll
8) Holding of securities in safe deposit box; two employees always present when box is accessed
9) Physical measures taken to protect assets from natural disasters, e.g., floods, wind damage, earthquakes

6. **Sequentially prenumbered forms** are the basis for a strong set of internal controls. Receiving reports in the warehouse and purchase orders in the sales department are common examples.
   a. When every hardcopy form is prenumbered, all can be accounted for, e.g., the date of their use and the person who filled them out can be ascertained. Any document in the sequence that is missing can be flagged for special scrutiny when it is processed.
      1) During the periodic reconciliation, the verifying party can detect unrecorded and unauthorized transactions.
   b. This functionality can be achieved even in a paperless environment. Applications can be coded to sequentially number initiated transactions, and proper review and approval can be verified online.
   c. In addition to prenumbered forms, procedures ensuring that personnel do not receive **documents inappropriate to their duties** enhance internal control.
      1) For example, documents authorizing the writeoff of uncollectible receivables should not be routed to cashiers. These cashiers could later pocket the money if a written-off account was subsequently paid.
7. **Compensating controls** replace the normal controls, such as segregation of duties, when the latter cannot feasibly be implemented.
   a. For example, in the finance and investment cycle, top management may authorize and execute investments and have access to the records, stock certificates, etc. The compensating control in this case is for at least two people to perform each function.
      1) An alternative to performance of each function by at least two people is to provide oversight. Thus, the board may authorize an investment, with other functions (custody of stock certificates, management of the portfolio, and oversight of record keeping) performed by a top manager.
   b. Other compensating controls in the finance and investment cycle include periodic communications with the board, oversight by a committee of the board, and internal auditing's reconciliation of the securities portfolio with the recorded information.
8. **Fraud** differs from error because it is intentional. It typically involves pressures or incentives to engage in wrongdoing and a perceived opportunity to do so. Examples are fraudulent financial reporting and misappropriation of assets.
   a. Internal controls are designed to, among other things, prevent fraud. However, because of the concealment aspects of fraudulent activity (e.g., collusion or falsification of documents), the controls cannot give absolute assurance that material fraud will be prevented or detected.

9.3 LEGAL ASPECTS OF INTERNAL CONTROL

1. The **Foreign Corrupt Practices Act (FCPA)**, enacted in 1977, had its origins in the Watergate investigations. The FCPA is designed to prevent secret payments of corporate funds for purposes that Congress has determined to be contrary to public policy.
    a. The Act amends the Securities Exchange Act of 1934 to prohibit a domestic concern, including any person acting on its behalf, whether or not doing business overseas and whether or not registered with the SEC, from offering or authorizing corrupt payments to any
        1) Foreign official
        2) Foreign political party or official thereof
        3) Candidate for political office in a foreign country
    b. Only political payments to foreign officials are prohibited. Payments to foreign business owners or corporate officers are not addressed by the FCPA.
    c. **Corrupt payments** are payments for the purpose of inducing the recipient to act or refrain from acting so that the domestic concern might obtain or retain business.
        1) The FCPA prohibits a mere offer or promise of a bribe, even if it is not consummated.
        2) The FCPA prohibits payment of anything of value. De minimis gifts and tokens of hospitality are acceptable.
        3) Payments are prohibited if the person making them knew or should have known that some or all of them would be used to influence a governmental official.
    d. Foreign officials do not include clerical or ministerial employees.
        1) EXAMPLE: Payments made to a clerk to expedite the processing of goods through customs may not be prohibited by the Act.
        2) Such payments are not prohibited as long as the recipient has no discretion in carrying out a governmental function.
        3) Payments that are allowed under the written law of the foreign country are also not prohibited.
    e. Regardless of whether they have foreign operations, all public companies must make and keep **books, records, and accounts in reasonable detail** that accurately and fairly reflect transactions and dispositions of assets.
    f. All public companies must devise and **maintain a system of internal accounting control** sufficient to provide reasonable assurance that
        1) Transactions are executed in accordance with management's general or specific authorization.
        2) Transactions are recorded as necessary to
            a) Permit preparation of financial statements in conformity with generally accepted accounting principles (GAAP) or any other criteria applicable to such statements and
            b) Maintain accountability for assets.
        3) Access to assets is permitted only in accordance with management's general or specific authorization.
        4) The recorded accountability for assets is compared with the existing assets at reasonable intervals, and appropriate action is taken with respect to any differences.

g. The penalties for an individual for each criminal violation of the corrupt practices provisions are a fine of up to $100,000 or imprisonment for up to 5 years, or both. A corporation may be assessed a fine of up to $2,000,000 for violation of the same section.

1) Fines imposed upon individuals may not be paid directly or indirectly by an employer.

h. The implications of the Foreign Corrupt Practices Act of 1977 extend well beyond its anti-bribery provisions.

1) All American businesses and business people are involved. Management is particularly affected. The responsibility for internal control is not new, but the potential for civil and criminal liabilities represents an added burden.

2) The impact of the law and the threat its ambiguities pose may alter business operations. Management might decide to abandon direct selling operations in foreign countries in favor of the use of foreign agents in hopes that this might lessen their "reason to know."

i. A written code of ethics and conduct is a necessity. This code should be communicated and monitored by internal auditors for compliance.

1) The code might include an explanation of the Foreign Corrupt Practices Act and its penalties. A firm may require written representations from employees that they have read and understood the provisions of the code.

2) Written representations regarding compliance might also be requested at future times. Foreign agents should be made aware of the prohibitions of indirect payments.

2. The **Sarbanes-Oxley Act of 2002**, a response to numerous financial reporting scandals involving large public companies, contains provisions that impose new responsibilities on public companies and their auditors. The Act applies to issuers of publicly traded securities subject to federal securities laws.

a. The Act requires that each member of the **audit committee**, including at least one who is a **financial expert**, be an **independent** member of the issuer's **board of directors**. An independent director is not affiliated with, and receives no compensation (other than for service on the board) from, the issuer.

1) The audit committee must be directly responsible for **appointing**, **compensating**, **and overseeing** the work of the public accounting firm employed by the issuer. In addition, this audit firm must **report directly** to the audit committee, not to management.

2) Another function of the audit committee is to implement procedures for the receipt, retention, and treatment of **complaints about accounting and auditing matters**.

3) The audit committee also must be appropriately funded by the issuer and may hire independent counsel or other advisors.

b. **Internal control report. Section 404** of the Act requires management to establish and document internal control procedures and to include in the annual report a report on the company's internal control over financial reporting.

1) This report is to include

a) A statement of management's responsibility for internal control;

b) Management's assessment of the effectiveness of internal control as of the end of the most recent fiscal year;

c) Identification of the framework used to evaluate the effectiveness of internal control (such as the report of the Committee of Sponsoring Organizations);

d) A statement about whether significant changes in controls were made after their evaluation, including any corrective actions; and

e) A statement that the external auditor has issued an attestation report on management's assessment.

i) Because of this requirement, two audit opinions are expressed: one on internal control and one on the financial statements.

2) The **external auditor must attest to and report on management's assessment**.

a) The auditor must evaluate whether the structure and procedures

i) Include records accurately and fairly reflecting the firm's transactions.

ii) Provide reasonable assurance that transactions are recorded so as to permit statements to be prepared in accordance with GAAP.

b) The auditor's report also must describe any **material weaknesses in internal controls**.

c) The evaluation is not to be the subject of a separate engagement but be in conjunction with the audit of the financial statements.

3. **Sarbanes-Oxley Section 302. CORPORATE RESPONSIBILITY FOR FINANCIAL REPORTS**

(a) ***REGULATIONS REQUIRED*** *- The SEC shall require, for each company filing periodic reports under the Securities Exchange Act of 1934, that the principal executive officer or officers and the principal financial officer or officers, or persons performing similar functions, certify in each annual or quarterly report filed or submitted under the Act that--*

(1) the signing officer has reviewed the report;

(2) based on the officer's knowledge, the report does not contain any untrue statement of a material fact or omit to state a material fact necessary in order to make the statements made, in light of the circumstances under which such statements were made, not misleading;

(3) based on such officer's knowledge, the financial statements, and other financial information included in the report, fairly present in all material respects the financial condition and results of operations of the issuer as of, and for, the periods presented in the report;

(4) the signing officers--

(A) are responsible for establishing and maintaining internal controls;

(B) have designed such internal controls to ensure that material information relating to the issuer and its consolidated subsidiaries is made known to such officers by others within those entities, particularly during the period in which the periodic reports are being prepared;

(C) have evaluated the effectiveness of the issuer's internal controls as of a date within 90 days prior to the report; and

(D) have presented in the report their conclusions about the effectiveness of their internal controls based on their evaluation as of that date;

(5) the signing officers have disclosed to the issuer's auditors and the audit committee of the board of directors (or persons fulfilling the equivalent function)--

(A) all significant deficiencies in the design or operation of internal controls which could adversely affect the issuer's ability to record, process, summarize, and report financial data and have identified for the issuer's auditors any material weaknesses in internal controls; and

(B) any fraud, whether or not material, that involves management or other employees who have a significant role in the issuer's internal controls; and

(6) the signing officers have indicated in the report whether or not there were significant changes in internal controls or in other factors that could significantly affect internal controls subsequent to the date of their evaluation, including any corrective actions with regard to significant deficiencies and material weaknesses.

(b) ***FOREIGN REINCORPORATIONS HAVE NO EFFECT****- Nothing in this section 302 shall be interpreted or applied in any way to allow any issuer to lessen the legal force of the statement required under this section 302, by an issuer having reincorporated or having engaged in any other transaction that resulted in the transfer of the corporate domicile or offices of the issuer from inside the United States to outside of the United States.*

4. PCAOB was vested with the authority to promulgate standards for the practice of auditing. **PCAOB Auditing Standard 2** (issued in 2004) required that an audit of internal control be integrated with the audit of the financial statements. Although auditors are allowed to issue separate reports on the audits of financial statements and internal controls, in practice they are most often combined into a single report. In 2007, Auditing Standard 2 was superseded by **PCAOB Auditing Standard 5**, which had similar requirements.

5. Standard No. 5 is principles-based. It is designed to increase the likelihood that material weaknesses in internal control will be found before they result in material misstatement of a company's financial statements and, at the same time, eliminate procedures that are unnecessary.

   a. The final standard also focuses the auditor on the procedures necessary to perform a high quality audit tailored to the company's facts and circumstances. The new standard is more risk-based and scalable, which will better meet the needs of investors, public companies and auditors alike.

   b. The new auditing standard, by focusing the auditor's attention on those matters that are most important to effective internal control, presents another significant opportunity to strengthen the financial reporting process.

6. The Board's new standard is designed to achieve four objectives:

   a. **Focus the Internal Control Audit on the Most Important Matters**

      1) The new standard focuses auditors on those areas that present the greatest risk that a company's internal control will fail to prevent or detect a material misstatement in the financial statements. It does so by incorporating certain best practices designed to focus the scope of the audit on identifying material weaknesses in internal control, before they result in material misstatements of financial statements, such as using a **top-down (risk-based) approach** to plan the audit. It also emphasizes the importance of auditing higher risk areas, such as the financial statement closing process and controls designed to prevent fraud by management.

2) At the same time, it provides auditors a range of alternatives for addressing lower risk areas, such as by more clearly demonstrating how to calibrate the nature, timing, and extent of testing based on risk, as well as how to incorporate knowledge accumulated in previous years' audits into the auditors' assessment of risk and use the work performed by companies' own personnel, when appropriate.

b. **Eliminate Procedures that Are Unnecessary to Achieve the Intended Benefits**

1) The Board examined every area of the internal control audit to determine whether the previous standard encouraged auditors to perform procedures that are not necessary to achieve the intended benefits of the audit. As a result, the new standard does not include the previous standard's detailed requirements to evaluate management's own evaluation process and clarifies that an internal control audit does not require an opinion on the adequacy of management's process.

2) As another example, the new standard refocuses the multi-location direction on risk rather than coverage by removing the requirement that auditors test a "large portion" of the company's operations or financial position.

c. **Make the Audit Clearly Scalable to Fit the Size and the Complexity of Any Company**

1) In coordination with the Board's ongoing project to develop guidance for auditors of smaller, less complex companies, Standard 5 explains how to tailor internal control audits to fit the size and complexity of the company being audited. Standard 5 does so by including notes throughout the standard on how to apply the principles in the standard to smaller, less complex companies, and by including a discussion of the relevant attributes of smaller, less complex companies as well as less complex units of larger companies.

d. **Simplify the Text of the Standard**

1) The Board's new standard is shorter and easier to read. This is in part because it uses simpler terms to describe procedures and definitions. It is also because the standard has been streamlined and reorganized to begin with the audit itself, to move definitions and background information to appendices, and to avoid duplication by cross-referencing to existing concepts and requirements that appear elsewhere in the Board's standards and relevant laws and SEC rules.

2) For example, the new standard eliminates the previous standard's discussion of materiality, thus clarifying that the auditor's evaluation of materiality for purposes of an internal control audit is based on the same longstanding principles applicable to financial statement audits.

3) Also, in order to better coordinate the final standard and the SEC's new rules and management guidance, the new standard conforms certain terms to the SEC's rules and guidance, such as the definition of "material weakness" and use of the term "entity-level controls" instead of "company-level controls."

7. **Audit Approaches**

a. Essentially there are four different audit approaches:

1) The substantive procedures approach
2) The balance sheet approach
3) The systems-based approach
4) The risk-based approach

b. **The substantive procedures approach** is also referred to as the vouching approach or the direct verification approach. In this approach, audit resources are targeted on testing large volumes of transactions and account balances without any particular focus on specified areas of the financial statements.

c. Under **the balance sheet approach**, substantive procedures are focused on balance sheet accounts, with only limited procedures being carried out on income statement/profit and loss accounts. The justification for this approach is the notion that if the relevant management assertions for all balance sheet accounts are tested and verified, then the income figure reported for the accounting period will not be materially misstated.

d. **The systems-based approach** requires auditors to assess the effectiveness of the internal controls, and then to direct substantive procedures primarily to those areas where it is considered that systems objectives will not be met. Reduced testing is carried out in those areas where it is considered systems objectives will be met.

e. With **the risk-based approach**, audit resources are directed towards those areas of the financial statements that may contain misstatements (either by error or omission) as a consequence of the risks faced by the business.

1) Under a risk-based approach, every audit assignment presents a different challenge to an auditor, with no two audits being the same. For example, no two entities are the same in terms of business sector, location, size, employees, governance issues, ethos, and complexity of operations. There is no one single approach to auditing that ensures the performance of a perfect audit. However, it is generally accepted that for most entities, the risk-based audit approach will minimize the possibility of audit objectives not being met.

2) Auditors are required to make risk assessments of material misstatements at the financial statement and assertion levels, based on an appropriate understanding of the entity and its environment, including internal controls. As the auditor is required to focus on the entity and its environment when making risk assessments, this is known as the 'top down' approach to identifying risks. The word 'top' refers to the day-to-day operations of the entity and the environment in which it operates; 'down' refers to the financial statements of the entity.

3) In summary, this approach requires auditors to identify the key day-to-day risks faced by a business, to consider the impact these risks could have on the financial statements, and then to plan their audit procedures accordingly. For this reason, the approach is often referred to as the 'business risk approach.' When adopting this approach, to facilitate the identification of risks and the assessment of their effect on the financial statements, risks are categorized as financial risks, such as cash flow risks, compliance risks, such as breaching of laws and regulations risk, and operational risks, such as loss of key employee risk and loss of data risk.

9.4 INTERNAL AUDITING

1. The Internal Audit Function

a. The **growth and complexity** of modern organizations has led to an accompanying growth in the field of internal auditing.

1) An adequate internal audit activity (IAA) is now considered to be so basic to the governance of a modern corporation that **some stock exchanges require** all companies registering to trade their stock to have one.

2) Under the **Foreign Corrupt Practices Act**, organizations are expected to maintain reasonably detailed and accurate accounting records and a **reasonably effective system of internal control**. Maintaining an effective internal audit activity is an integral part of achieving this goal.

b. **The Institute of Internal Auditors (The IIA)**, headquartered in Altamonte Springs, Florida, is the organization devoted to maintaining professional standards for the practice of internal auditing worldwide.

1) The IIA defines internal auditing as follows:

> *Internal auditing is an independent, objective assurance and consulting activity designed to add value and improve an organization's operations. It helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes.*

2) The IIA's *International Standards for the Professional Practice of Internal Auditing* **(the Standards)** "provide guidance for the conduct of internal auditing at both the organizational and individual auditor levels."

3) In addition, The IIA has issued numerous **Practice Advisories**, which it refers to as "concise and timely guidance to assist internal auditors in applying Code of Ethics and *Standards* and promoting good practices."

c. The internal audit activity must be **organizationally independent** of the activities under audit. In addition, individual internal auditors must maintain an **attitude of objectivity** in carrying out their duties.

1) Independence, therefore, is an attribute of the internal audit department as a whole, while objectivity is an attribute of the auditors themselves.

2) Generally, the internal audit function is headed by the chief audit executive (CAE) who reports **directly to the chief executive officer (CEO)**. The CAE also should have direct, unhindered **access to the board of directors**.

3) The purpose, authority, and responsibility of the IAA should be defined in a **written charter**. The charter should establish the IAA's position within the organization; authorize access to records, personnel, and physical properties; and define the scope of internal audit activities.

2. **The Scope of Internal Auditing**

a. The **three principal functions** of internal auditing within a modern organization are to aid

1) Upper management in the maintenance of the firm's system of internal control
2) Upper management in improving the efficiency of the firm's operations
3) The external auditors in the conduct of the audit of financial statements

b. The scope of work performed by an internal audit department is much broader than that performed by the independent external auditor. In carrying out its basic functions, the internal audit activity can perform a wide variety of **specific tasks**, such as

1) Identifying and evaluating significant exposures to risk and contributing to the **improvement of risk management** and control systems
2) Evaluating the **adequacy and effectiveness of controls** encompassing the organization's governance, operations, and information systems and the promotion of their continuous improvement
3) Evaluating the **reliability and integrity** of financial and operational information
4) Evaluating the **effectiveness and efficiency** of operations
5) Evaluating the **safeguarding of assets**
6) Evaluating **compliance** with laws, regulations, and contracts
7) Ascertaining whether management has established **adequate control criteria** to evaluate the accomplishment of objectives and goals
8) Preventing and detecting **fraud**
9) Coordinating activities and sharing information with the **external auditor**

3. **Incidents That Should Be Reported**

   a. The internal audit activity must report certain types of incidents that come to its attention to upper management and the board of directors. These include

      1) Fraud
      2) Illegal acts
      3) Material weaknesses and significant deficiencies in internal control
      4) Significant penetrations of information security systems

4. **Compliance Auditing**

   a. Internal auditors should **assess compliance in specific areas** as part of their role in organizational governance.

      1) They also should conduct follow-up and report on **management's response to regulatory body reviews**. Given the ever-expanding scope of governmental regulation, these duties of internal auditors have assumed increased importance.

   b. The IIA's Practice Advisory 2100-5, *Legal Considerations in Evaluating Regulatory Compliance Programs*, describes the objectives of compliance auditing this way:

      > *Compliance programs assist organizations in preventing inadvertent employee violations, detecting illegal activities, and discouraging intentional employee violations. They can also help prove insurance claims, determine director and officer liability, create or enhance corporate identity, and decide the appropriateness of punitive damages. Internal auditors should evaluate an organization's regulatory compliance programs...*

5. **Operational Auditing**

   a. *The Practice of Modern Internal Auditing* (Sawyer, Dittenhofer, and Scheiner, 5th ed., The Institute of Internal Auditors, 2003, p. 30) defines operational auditing as

      > *The comprehensive review of the varied functions within an enterprise to appraise the efficiency and economy of operations and the effectiveness with which those functions achieve their objectives.*

      NOTE: Current pronouncements of The IIA no longer use the term "operational auditing." However, the term is included in the IMA's Learning Outcome Statements for Part 1 of the CMA exam.

   b. An operational audit is thus a **thorough examination of a department, division, function, etc.** Its purpose is to appraise managerial organization, performance, and techniques.

      1) An operational audit attempts to determine the extent to which **organizational objectives have been achieved**. It is a control technique that provides management with a method for evaluating the effectiveness of operating procedures and internal controls.

         a) The focus is on **efficiency, effectiveness, and economy** (these terms are sometimes called the "three Es of operational auditing").

      2) The report resulting from an operational audit consists primarily of specifying where problems exist or emphasizing the absence of problems.

      3) The internal auditor compares a department's operations with company policies and procedures, industry averages, and departmental trends.

         a) The **basic tools** of the internal auditor for operational auditing include

            i) Financial analysis
            ii) Observation of departmental activities
            iii) Questionnaire interviews of departmental employees

4) The operational audit evolved as an extension of the typical financial audit in that it goes beyond what is ordinarily considered to be the accounting function, e.g.,

a) Reviewing purchasing policies
b) Appraising compliance with company policies and procedures
c) Appraising safety standards and maintenance of equipment
d) Reviewing production controls and scrap reporting
e) Reviewing adequacy of facilities

c. Internal auditors **should not assume operating responsibilities**. If senior management directs internal auditors to perform nonaudit work, they are not functioning as internal auditors.

d. An operational audit is essentially a **benchmarking** activity. The auditor determines the standards in the form of industry averages, or information from competitors, and even common business sense, and assesses whether the department is operating efficiently, effectively, and economically.

6. **Internal Control According to The IIA**

a. The **purpose of control** is to support risk management and achievement of objectives. Control ensures

1) The reliability and integrity of information;
2) Efficient and effective performance;
3) Safeguarding of assets; and
4) Compliance with laws, regulations, contracts.

b. **Senior management** oversees the establishment, administration, and assessment of risk management and control processes.

c. **Line managers** assess control in their areas. **Internal auditors** provide assurance about the effectiveness of risk management and control.

d. **The Chief Audit Executive (CAE)** obtains sufficient audit evidence to form an **overall opinion** on the **adequacy and effectiveness** of control. This opinion is communicated to senior management and the board.

e. The CAE develops the **proposed internal audit plan** to provide sufficient evidence to evaluate control. The plan should be flexible enough to permit adjustments during the year. It covers all major operations and functions. It also gives special consideration to operations most affected by **recent or expected changes**.

1) Furthermore, the plan considers **relevant work** performed **by others**, including (a) management's assessments of risk management, control, and quality processes and (b) the work completed by external auditors.

f. The CAE evaluates the plan's **coverage**. If the **scope** of the plan is insufficient to permit **expression of an opinion** about risk management and control, the CAE informs senior management and the board about gaps in audit coverage.

g. The evaluation of control combines **many individual assessments**. Communication of **findings** to appropriate managers needs to be timely.

h. The **overall evaluation** of control considers whether

1) Significant weaknesses or discrepancies exist,
2) Corrections or improvements were made, and
3) A **pervasive condition** leading to unacceptable risk exists.

i. Whether **unacceptable risk** exists depends on the nature and extent of risk exposure and level of consequences.

j. The CAE's **report** on control processes is presented, **usually once a year**, to senior management and the board. It describes

1) The role of control processes,
2) The work performed, and
3) Any reliance on other assurance providers.

k. **Control criteria.** The first element of the control process is to establish standards for the program or operation to be controlled. Acceptable industry standards, standards developed by professional associations, standards in law and government regulations, and other sound business practices are usually deemed to be appropriate criteria. The IIA has addressed this subject as follows:

1) Internal auditors should ascertain the extent to which operating and program goals and objectives have been established and conform to those of the organization.
2) Internal auditors should review operations and programs to ascertain the extent to which results are consistent with established goals and objectives to determine whether operations and programs are being implemented or performed as intended.
3) **Adequate criteria** are needed to evaluate controls. Internal auditors must ascertain the extent to which management has established adequate criteria to determine whether objectives and goals have been accomplished. If adequate, internal auditors must use such criteria in their evaluation. If inadequate, internal auditors must work with management to develop appropriate evaluation criteria.
4) During **consulting engagements**, internal auditors must address controls consistent with the engagement's objectives and be alert to significant control issues.

a) Internal auditors must incorporate knowledge of controls gained from consulting engagements into evaluation of the organization's control processes.

l. Once the relevant internal controls have been identified, the internal auditor applies four types of **procedures**:

1) Make **inquiries** of appropriate personnel

a) While simple answers to verbal questions are not considered a strong form of evidence, they can nonetheless be very informative, especially when employees describe their ordinary duties or when they admit that a given control procedure is often not followed.

2) Examine **documentation**

a) Even in a computerized environment, some control procedures leave a paper trail. For example, purchases of capital equipment may require the signature of a regional vice president.

b) In some computerized environments, signatures and other approvals can be tracked electronically. The internal auditor may require specialized knowledge to determine whether these controls are functioning properly.

3) **Observe** control-related activities

a) Because some control procedures may leave no audit trail of any kind, the internal auditor may need to watch them being performed to gain assurance about them functioning properly.

4) **Reperform** client procedures

a) Some types of control procedures can be effectively tested simply by the internal auditor reperforming the activity. For example, the extended price of a line item on an invoice should equal the quantity shipped times the unit price. The auditor can reperform this multiplication on a sample of invoices to check for a computer error or unauthorized overrides.

9.5 CORE CONCEPTS

Risk and the Control Environment

- All systems of internal control involve **tradeoffs between cost and benefit.** For this reason, no system of internal control can be said to be "100% effective." Organizations accept the fact that risk can only be **mitigated, not eliminated**.
- **Risk can be quantified** as a combination of two factors: the severity of consequences and the likelihood of occurrence. The expected value of a loss due to a risk exposure can thus be stated numerically as the product of the two factors.
- An organization establishes a **system of internal control** to help it manage many of the risks it faces. The IMA refers to internal control as "the whole system of controls (financial and otherwise) ..." The proper design and operation of an organization's system of internal controls is the **responsibility of management**.
- An organization's **control environment** encompasses the **attitudes and actions** of the board of directors and upper management regarding the significance of control, i.e., the "tone at the top." The components include organizational structure, policies, objectives and goals, management philosophy and operating style, and assignment of authority and responsibility.
- The **audit committee** is a subcommittee of the board of directors whose purpose is to help keep the external auditors independent of management. This is accomplished by assigning the selection, compensation, and oversight of the external auditors to the audit committee. Many stock exchanges require a listed organization to have an audit committee.
- In its 1992 publication *Internal Control – Integrated Framework*, the Committee of Sponsoring Organizations of the Treadway Commission **(COSO)** defined internal control as providing reasonable assurance about the achievement of objectives in the areas of **effectiveness and efficiency** of operations, **reliability** of financial reporting, and **compliance** with applicable laws and regulation. Note that the Framework specifically cites reasonable, not absolute, assurance about the achievement of management's objectives.

Control Procedures

- **Control activities** are designed and placed in operation to ensure that management's directives are executed. **Control procedures** are implemented to manage or limit risk in accordance with the entity's risk assessments whenever risk exposures exist that threaten loss of assets or misstatements of accounting or management information.
- Controls can be identified in **these areas**: segregation of duties, including the four basic functional responsibilities; independent checks and verification; safeguarding controls; prenumbered forms; and specific document flow.
- **Segregation of duties** involves assigning different employees to perform functions such that an employee acting alone is prevented from committing an error or concealing a fraud in the normal course of his/her duties. **Four types** of functional responsibilities should be segregated: the authority to execute transactions, the recording of transactions, custody of the assets affected by the transactions, and periodic reconciliation of the existing assets to recorded amounts.
- **Compensating controls** replace the normal controls, such as segregation of duties, when the latter cannot feasibly be implemented. For example, in the finance and investment cycle, top management may authorize and execute investments and have access to the records, stock certificates, etc. The compensating control in this case is for at least two people to perform each function.
- **Fraud** differs from error because it is intentional. It typically involves pressures or incentives to engage in wrongdoing and a perceived opportunity to do so. Examples are fraudulent financial reporting and misappropriation of assets. Internal controls are designed to, among other things, prevent fraud. However, because of the concealment aspects of fraudulent activity (e.g., collusion or falsification of documents), the controls cannot give absolute assurance that material fraud will be prevented or detected.

Legal Aspects of Internal Control

- The **Foreign Corrupt Practices Act (FCPA)** is designed to prevent secret payments of corporate funds for purposes that Congress has determined to be contrary to public policy. The Act prohibits bribery of any foreign **official**, foreign **political party** or official thereof, or **candidate for political office** in a foreign country. Only political payments to foreign officials are prohibited. Payment to foreign business owners or corporate officers are not addressed by the FCPA.
- Regardless of whether they have foreign operations, the FCPA requires all public companies to make and keep **books, records, and accounts in reasonable detail** that accurately and fairly reflect transactions and dispositions of assets. All public companies must devise and maintain a **system of internal accounting control** sufficient to provide reasonable assurance that the basic goals of transaction authorization, financial reporting, and safeguarding of assets are achieved.
- The **Sarbanes-Oxley Act of 2002** applies to issuers of publicly traded securities subject to federal securities laws. The Act requires that each member of the **audit committee**, including at least one who is a financial expert, be an **independent** member of the issuer's board of directors. An independent director is not affiliated with, and receives no compensation (other than for service on the board) from, the issuer.
- **Section 404** of the Act requires management to **establish and document internal control procedures** and to include in the annual report a report on the company's internal control over financial reporting. The **external auditor must attest** to and report on management's assessment.
- **Section 302** of the Act requires periodic statutory financial reports to include certifications that:
  - The signing officers have reviewed the report
  - The report does not contain any material untrue statements or material omission or be considered misleading
  - The financial statements and related information fairly present the financial condition and the results of operations in all material respects
  - The signing officers are responsible for internal controls and have evaluated these internal controls within the previous 90 days and have reported on their findings
  - A list of all deficiencies in the internal controls and information on any fraud that involves employees who are involved with internal activities
  - Any significant changes in internal controls or related factors that could have a negative impact on the internal controls

  Organizations may not attempt to avoid these requirements by reincorporating their activities or transferring their activities outside of the United States

Internal Auditing

- An adequate **internal audit activity (IAA)** is now considered to be so basic to the governance of a modern corporation that some stock exchanges require all companies registering to trade their stock to have one.
- The Institute of Internal Auditors (The IIA) provides the following definition: "Internal auditing is an **independent, objective assurance and consulting activity** designed to add value and improve an organization's operations."
- The internal audit activity must be **organizationally independent** of the activities under audit. In addition, individual internal auditors must maintain an **attitude of objectivity** in carrying out their duties. Independence, therefore, is an attribute of the internal audit department as a whole, while objectivity is an attribute of the auditors themselves.
- Generally, the internal audit function is headed by the **chief audit executive (CAE)** who reports directly to the chief executive officer (CEO). The CAE also should have direct, unhindered access to the board of directors. The purpose, authority, and responsibility of the IAA should be defined in a **written charter**.

- The **three principal functions** of internal auditing within a modern organization are to aid (1) upper management in the maintenance of the firm's system of internal control, (2) upper management in improving the efficiency of the firm's operations, and (3) the external auditors in the conduct of the audit of financial statements.
- The internal audit activity **must report** certain types of **incidents** that come to its attention to upper management and the board of directors. They include fraud, illegal acts, material weaknesses and significant deficiencies in internal control, and significant penetrations of information security systems.
- Internal auditors should **assess compliance** in specific areas as part of their role in organizational governance. They also should conduct follow-up and report on management's response to **regulatory body reviews**. Given the ever-expanding scope of governmental regulation, these duties of internal auditors have assumed increased importance.
- **Operational auditing** is a review of a function within an enterprise to appraise the **efficiency** and economy of operations and the **effectiveness** with which those functions achieve their objectives.
- **Senior management** oversees establishment, administration, and assessment of the system of risk management and control. **Line managers** assess control in their areas.
- The **internal auditors** provide assurance about the effectiveness of risk management and control.
- The CAE obtains sufficient evidence to assess the adequacy and effectiveness of control. This assessment is communicated to management and the board.

STUDY UNIT TEN
INTERNAL CONTROLS II AND ETHICS FOR MANAGEMENT ACCOUNTANTS

Ethics

Questions containing ethical issues will appear on every examination, presented within the context of specific subject areas. Candidates should be familiar with:

Statement on Management Accounting Number 1C (Revised), *IMA Statement of Ethical Professional Practice*, Institute of Management Accountants, Montvale, N.J., August 2005.

Current references to business ethics are also found in recent periodicals and newspapers.

This study unit concludes the material on **internal control** (**15%** of Part 1) and also covers **ethical considerations** for the individual management accountant (**5%** of Part 1).

Ethical issues and considerations are tested in both Parts 1 and 2 of the CMA exam. In Part 1, ethics will be tested from the perspective of the individual, and in Part 2, they will be tested from the perspective of the organization.

After studying the outline and answering the questions in this study unit, you will have the skills necessary to address the following topics listed in the ICMA's Learning Outcome Statements:

Part 1 – Section D.3. Systems controls and security measures

The candidate should be able to:

a. describe how the segregation of accounting duties can enhance systems security
b. identify threats to information systems, including input manipulation, program alteration, direct file alteration, data theft, sabotage, viruses, Trojan horses, and theft
c. demonstrate an understanding of how systems development controls are used to enhance the accuracy, validity, safety, security, and adaptability of systems input, processing, output, and storage functions
d. identify procedures to limit access to physical hardware
e. identify means by which management can protect programs and databases from unauthorized use
f. identify input controls, processing controls, and output controls and describe why each of these controls is necessary
g. identify and describe the types of storage controls and demonstrate an understanding of when and why they are used
h. identify and describe the inherent risks of using the Internet as compared to data transmissions over secured transmission lines
i. define data encryption and describe why there is a much greater need for data encryption methods when using the Internet
j. identify a firewall and its uses
k. demonstrate an understanding of how flowcharts of activities are used to assess controls

l. explain the importance of backing up all program and data files regularly, and frequently storing the backups at a secure remote site
m. define the objective of a disaster recovery plan and identify the components of such a plan

Part 1 - Section E. Ethical considerations for management accounting and financial management professionals

Ethics may be tested in conjunction with any topic area.

1. Provisions of the *IMA Statement of Ethical Professional Practice*
2. Evaluation and resolution of ethical issues

Using the standards outlined in the *IMA Statement of Ethical Professional Practice*, the candidate should be able to:

a. identify and describe the four overarching ethical principles
b. evaluate a given business situation for its ethical implications
c. identify and describe relevant standards that may have been violated in a given business situation and explain why the specific standards are applicable
d. recommend a course of action for management accountants or financial managers to take when confronted with an ethical dilemma in the business environment
e. evaluate and propose resolutions for ethical issues such as fraudulent reporting, manipulation of analyses, results, and budgets

10.1 SYSTEMS CONTROLS

1. The **segregation of accounting duties** can enhance systems security.
   a. Segregation of duties involves the separation of the functions of authorization, record keeping, and asset custody so as to minimize the opportunities for a person to be able to perpetrate and conceal errors or fraud in the normal course of his/her duties.
2. **Three Goals of Information Security**
   a. **Availability** is the ability of the intended and authorized users to access computer resources to meet organizational goals.
   b. **Confidentiality** is assurance of the secrecy of information that could adversely affect the organization if revealed to the public or competitors.
   c. **Integrity** is maintained by preventing the unauthorized or accidental modification of programs or data.
3. **Threats to Information Systems**
   a. **Input manipulation** is an intrusion into a system by exploiting a vulnerability in a legitimate electronic portal, such as the input boxes on a web page. An input box may call, for instance, for the user's address, but a knowledgeable hacker can implant HTML code in the input box that runs a system command giving him or her access to the organization's data.
   b. **Program alteration** is the deliberate changing of the processing routines of an application program. A famous, if apocryphal, example of long standing is a piece of code that directs all amounts less than one dollar to be directed to the malicious programmer's bank account.
   c. **Direct file alteration** is the deliberate changing of data in a database to the intruder's advantage. A common example is a hacker who uses unauthorized access to change his/her course grades while bypassing the normal audit trail.
   d. **Data theft** is the surreptitious copying of critical data elements from an organization's databases. Social Security and credit card numbers are common targets of this type of attack.

e. **Sabotage** is the disruption of an organization's systems not for personal gain but simply for revenge or in the spirit of vandalism. Changing a company's website to include unflattering information that is not immediately noticeable is an example. Another example is a disgruntled programmer who injects a logic bomb (see item 3.g. below) into an application that will disrupt processing long after the programmer's departure from the company.

f. **Viruses** are computer programs that propagate themselves from one computer to another without the user's knowledge. Some are written only for the programmer's amusement and are relatively harmless. This type of virus may cause a clever or annoying message to appear on the user's screen. Others are malicious and can cause great inconvenience and even loss of data to the user. A common way of spreading a virus is by email attachments and downloads.

g. **Logic bombs** also destroy data but, unlike viruses, they remain on a single computer and do not replicate. Often they lie dormant until triggered by some occurrence, such as the arrival of a certain date.

h. **Worms** are pieces of code that do not threaten the data on a computer (unlike viruses and logic bombs) but are destructive because of the rapidity with which they replicate themselves. A worm released onto the Internet will propagate from network to network, eventually overwhelming one or more servers with traffic.

i. **Trojan horses** are voluntarily installed on a computer by the user because they are masquerading as programs the user wants. While the program may present the user with, for instance, an entertaining video game, behind the scenes, it contains codes that a hacker can activate later to take over the computer, retrieving sensitive data from it or using it to launch proxy attacks on other computers.

   1) Viruses, worms, Trojan horses, etc., are often collectively referred to as **malicious software**, or **malware**.

j. **Back doors** are a means of obtaining access to a system while bypassing the usual password controls. IT personnel often deliberately design back doors into systems to allow system management during unusual circumstances. Hackers search for vulnerabilities in systems to exploit back doors for their own purposes.

k. **Theft** becomes increasingly problematic with the higher portability of laptop and palmtop computers. All organizations must establish policies for the proper physical protection of computing infrastructure assets.

4. **Systems Development Controls**

   a. All information systems, automated or manual, perform **four basic functions** on information: input, processing, output, and storage.

      1) Proper management of the systems development process can enhance the **accuracy, validity, safety, security, and adaptability of the controls** over these functions.

   b. Effective systems development requires the **setting of priorities**. This can be achieved through a steering committee composed of managers from both the IT function and the end-user functions. The committee approves development projects, assigns resources, and reviews their progress.

      1) The steering committee also ensures that requests for new systems are **aligned with the overall strategic plan** of the organization.

      2) All newly developed systems should conform to **established organizational standards** for coding and documentation.

   c. **Changes to existing systems** should be subject to the same strict controls. Requests for changes should be initiated by an end user and authorized by management or the steering committee.

      1) All changes should be made to a **working copy** of the program. Production code should never be directly alterable by a programmer.

2) All changes should be adequately **tested** before being placed in production. The test results should be demonstrated for and accepted by the user who requested the change.

a) Adequate testing must involve the **use of incorrect data**. The program must be able to appropriately handle data that do not conform to the ideal.

3) The changed program code should be **stored in a secure library** during testing and while awaiting migration into production.

d. Unauthorized changes to programs can be detected by **code comparison**. The version in use compared electronically to an archived version known to be "clean."

5. **Physical Controls**

a. Physical controls limit physical access and environmental damage to computer equipment and important documents.

1) **Physical access.** Only operators should be allowed unmonitored access to the computer center. This can be accomplished through the use of a guard desk, a keypad, or a magnetic card reader.

2) **Environmental controls.** The computer center should be equipped with a cooling and heating system to maintain a year-round constant level of temperature and humidity, and a fire-suppression system.

6. **Logical Controls**

a. Logical controls are established to limit system access in accordance with the principle that all persons should have access only to those elements of the organization's information systems that are necessary to perform their job duties. Logical controls have a double focus, authentication and authorization.

1) **Authentication** is the act of assuring that the person attempting to access the system is in fact who (s)he says (s)he is. The most widespread means of achieving this is through the use of **IDs and passwords**.

a) Anyone attempting access to one of the organization's systems must supply a **unique identifier** (e.g., the person's name or other series of characters) **and a password** that is known only to that person and is not stored anywhere in the system in unencrypted format.

i) Not even information security personnel should be able to view unencrypted passwords. Security personnel can change passwords, but the policy should require that the user immediately changes it to something secret.

b) **Password optimization**

i) Passwords should be **difficult to guess**.

- A **dialog** can be designed to query the user for **common names** in his/her life (children, pets, sports teams) so that these words can be stored and never permitted by the system to be used as that person's password.
- **Ideally**, passwords are at least eight characters long and contain both uppercase and lowercase letters and numerals.

ii) The system should **force** passwords to be **changed periodically**, e.g., every 90 days.

c) **Password fatigue** results when users must log on to several systems in the course of a day. Users are likely to write down their IDs and passwords in such cases, defeating the purpose of automated authentication.

i) **Single sign-on** can be the solution in well-managed systems environments. A single ID and password combination is required to allow a user access to all IT resources (s)he needs. A high level of maintenance and security consciousness is required to make single sign-on successful.

2) **Authorization** is the practice of ensuring that, once in the system, the user can only access those programs and data elements necessary to his/her job duties.

a) In many cases, users should be able to **view** the contents of some data fields but not be able to **change** them.

b) An example is an accounts receivable clerk who can view customers' credit limits but cannot change them. This same clerk can, however, change a customer's outstanding balance by entering or adjusting an invoice.

c) To extend the example, only the head of the accounts receivable department should be able to execute the program that updates the accounts receivable master balance file. An individual clerk should have no such power.

7. **Input, Processing, and Output Controls**

a. **Input controls** provide reasonable assurance that data submitted for processing are (1) authorized, (2) complete, and (3) accurate. These controls vary depending on whether input is entered in online or batch mode.

1) **Online input controls** can be used when data are keyed into an input screen.

a) **Preformatting.** The data entry screen mimics the old hardcopy document, forcing data entry in all necessary fields.

b) **Edit checks.** The data entry screen prevents certain types of incorrect data from entering the system. For example, the system rejects any attempt to enter numerals in the Name box or letters in the Amount box. Dropdown menus can restrict the user's choices to only valid selections.

c) **Limit (reasonableness) checks.** Certain amounts can be restricted to appropriate ranges, such as hours worked < 20 per day, or invoices over $100,000 requiring supervisor approval.

d) **Check digits.** An algorithm is applied to any kind of serial identifier to derive a check digit. During data entry, the check digit is recomputed by the system to ensure proper entry. Requiring the full number including check digit to be keyed in all future data entry operations eliminates the possibility of dropped or transposed digits, etc.

2) **Batch input controls** can be used when data are grouped for processing in "batches."

a) **Management release.** A batch is not released for processing until a manager reviews and approves it.

b) **Record count.** A batch is not released for processing unless the number of records in the batch, as reported by the system, matches the number calculated by the user.

c) **Financial total.** A batch is not released for processing unless the sum of the dollar amounts of the individual items as reported by the system matches the amount calculated by the user.

d) **Hash total.** The arithmetic sum of a numeric field, that has no meaning by itself, can serve as a check that the same records that should have been processed were processed. An example is the sum of all Social Security numbers.

i) This number is much too unwieldy to be calculated by the user, but once it is calculated by the system, it can follow the batch through subsequent stages of processing.

b. **Processing controls** provide reasonable assurance that (1) all data submitted for processing are processed and (2) only approved data are processed. These controls are built into the application code by programmers during the systems development process.

1) Some processing controls repeat the steps performed by the **input controls**, such as limit checks and control totals.
2) **Validation.** Identifiers are matched against master files to determine existence. For example, any accounts payable transaction in which the vendor number does not match a number on the vendor master file is rejected.
3) **Completeness.** Any record with missing data is rejected.
4) **Arithmetic controls.** Cross-footing compares an amount to the sum of its components. Zero-balance checking adds the debits and credits in a transaction or batch to assure they sum to zero.
5) **Sequence check.** Computer effort is expended most efficiently when data are processed in a logical order, such as by customer number. This check ensures the batch is sorted in this order before processing begins.
6) **Run-to-run control totals.** The controls associated with a given batch are checked after each stage of processing to ensure all transactions have been processed.
7) **Key integrity.** A record's "key" is the group of values in designated fields that uniquely identify the record. No application process should be able to alter the data in these key fields.

c. **Output controls** provide assurance that processing was complete and accurate.

1) A complete **audit trail** should be generated by each process: batch number, time of submission, time of completion, number of records in batch, total dollars in batch, number of records rejected, total dollars rejected, etc.

a) The audit trail is immediately submitted to a **reasonableness check** by the user, who is most qualified to judge the adequacy of processing and the proper treatment of erroneous transactions.

2) **Error listings** report all transactions rejected by the system. These should be corrected and resubmitted by the user.

8. **Storage Controls**

a. **Dual write routines.** The data can be stored on two separate physical devices (usually magnetic hard drives) so that a mishap to one does not destroy the organization's data set.

1) Especially important in this regard is the technology known as **RAID** (redundant array of inexpensive discs), a grouping of multiple hard drives with special software that allows for data delivery along multiple paths. If one drive fails, the other discs can compensate for the loss.

b. **Validity checks.** Hardware that transmits or receives data compares the bits in each byte to the permissible combinations in order to determine whether they constitute a valid structure.

c. **Physical controls.** Mounting hard drives in physically secure rooms and storing portable media (CD-ROMs, etc.) in locked storage areas are vital to preventing the compromise of confidential data.

10.2 SECURITY MEASURES

1. **Inherent Risks of the Internet**
   a. **Password Attacks**
      1) A **brute-force attack** uses password cracking software to try large numbers of letter and number combinations to access a network. A simple variation is the use of password cracking software that tries all the words in a dictionary.
      2) Passwords also may be compromised by Trojan horses, IP spoofing, and packet sniffers. **Spoofing** is identity misrepresentation in cyberspace, for example, by using a false website to obtain information about visitors. **Sniffing** is the use of software to eavesdrop on information sent by a user to the host computer of a website.
   b. A **man-in-the-middle attack** takes advantage of networking packet sniffing and routing and transport protocols.
      1) These attacks may be used to steal data, obtain access to the network during a rightful user's active session, analyze the traffic on the network to learn about its operations and users, insert new data or modify the data being transmitted, and deny service.
      2) Cryptography is the effective response to man-in-the-middle attacks. The encrypted data will be useless to the attacker unless it can be decrypted.
   c. A **denial-of-service (DoS) attack** is an attempt to overload an organization's network with so many messages so that it cannot function (i.e., induce a system crash).
      1) A distributed denial-of-service (DDoS) attack comes from multiple sources, for example, the machines of several innocent parties infected by Trojan horses. When activated, these programs send messages to the target and leave the connection open.
      2) A DoS attack may establish as many network connections as possible to exclude other users, thus overloading primary memory or corrupting file systems.
2. **Use of Data Encryption**
   a. **Encryption** technology converts data into a code. Unauthorized users may still be able to access the data but, without the encryption key, they will be unable to decode the information. Encryption technology may be either hardware- or software-based. Two major types of encryption software exist.
      1) **Public-key**, or asymmetric, encryption is the more secure of the two because it requires two keys: The public key for coding messages is widely known, but the private key for decoding messages is kept secret by the recipient.
         a) The parties who wish to transmit coded messages must use **algorithmically-related pairs** of public and private keys.
         b) The sender searches a directory for the recipient's public key, uses it to encode the message, and transmits the message to the recipient. The recipient then uses the public key and the related private (secret) key to decode the message.
         c) Neither party knows the other's private key. The related public key and private key pair is issued by a **certificate authority** (a third-party fiduciary, e.g., VeriSign or Thawte). However, the private key is issued only to one party.
            i) **RSA**, named for its developers (Rivest, Shamir, and Adelman), is the most commonly used public-key method.

2) **Private-key**, or symmetric, encryption is less secure because it requires only a single key for each pair of parties that want to send each other coded messages.

a) **Data Encryption Standard (DES)**, a shared private-key method developed by the U.S. government, is the most prevalent secret-key method. It is based on numbers with 56 binary digits.

b) The **Advanced Encryption Standard (AES)** is a recently adopted cryptographic algorithm for use by U.S. government organizations to protect sensitive information. The AES will be widely used on a voluntary basis by organizations, institutions, and individuals as well as by the U.S. government.

3. **Firewalls**

a. A firewall is a **combination of hardware and software** that separates an internal network from an external network, such as the Internet, and prevents passage of specific types of traffic.

1) Firewall systems ordinarily produce reports on organization-wide Internet use, exception reports for unusual usage patterns, and system penetration-attempt reports. These reports are very helpful as a method of continuous monitoring, or logging, of the system.

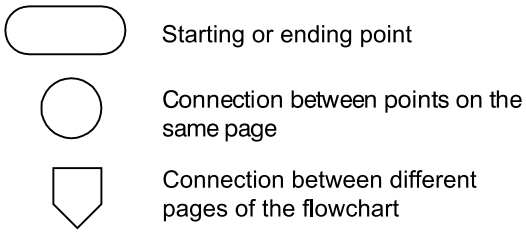
2) A firewall alone is not an adequate defense against computer viruses. Specialized anti-virus software is a must.

4. **Flowcharting**

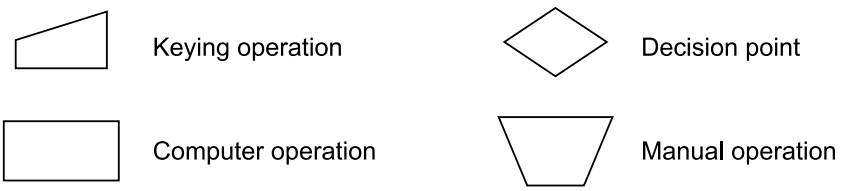
a. Flowcharting is the representation of a process using **pictorial symbols**. Flowcharts can be useful in obtaining an understanding of internal control and in systems development.

1) Flowcharting symbols have been **standardized** by both the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO).

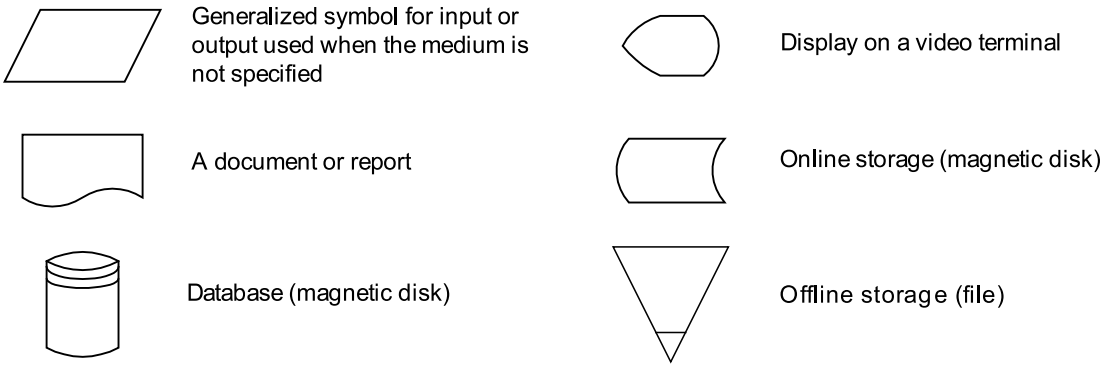
2) Below are some standard flowcharting symbols representing process **endpoints and connectors**:



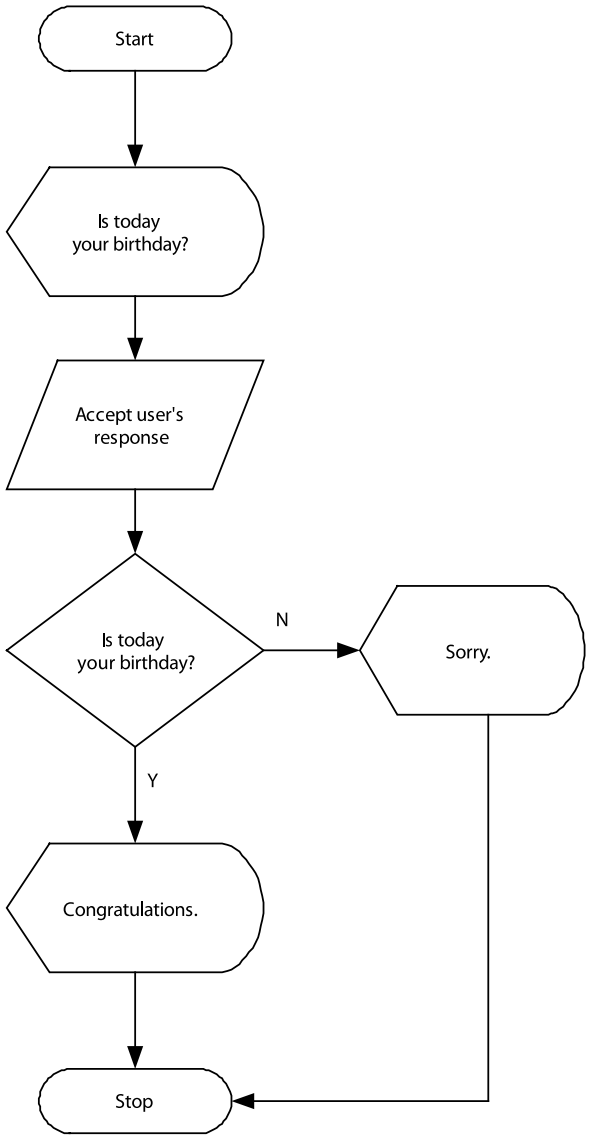
3) Below are some standard flowcharting symbols representing **processes:**



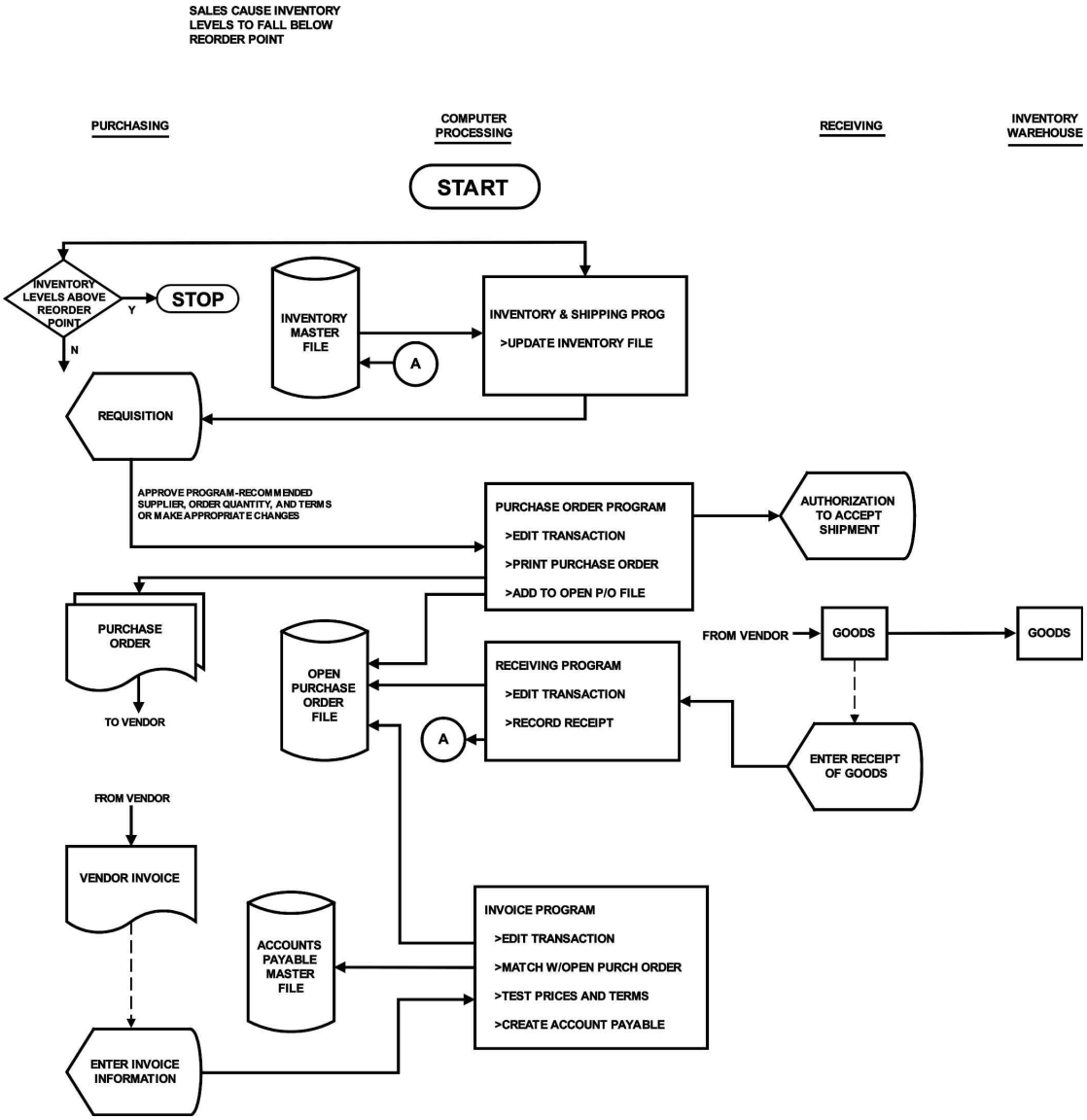
4) Below are some standard flowcharting symbols representing **input and output**:



b. **Vertical flowcharts** present successive **steps** in a top-to-bottom format. Before the advent of object-oriented programming, flowcharts were a very common tool for computer programmers to design the flow of a new system. Below is an example of a simple vertical flowchart.



c. **Horizontal flowcharts**, also called systems flowcharts, depict **areas of responsibility** (departments or functions) in vertical columns. Activities and documents flow back and forth between departments across the page.



5. **Routine Backup and Offsite Rotation**
   a. It is a truth seldom grasped by those who are not computer professionals that an organization's data is more valuable than its hardware.
      1) **Hardware can be replaced** for a price, but each organization's **data bundle is unique** and is indispensable to carrying on business. If it is ever destroyed, it cannot be replaced. For this reason, periodic backup and rotation are essential.
   b. The **offsite location** must be temperature- and humidity-controlled and guarded against physical intrusion.
      1) Just as important, it must be **geographically remote** enough from the site of the organization's main operations that it would not be affected by the same natural disaster. It does the organization no good to have sound backup procedures if the files are not accessible or have been destroyed.
   c. A typical backup routine involves duplicating **all data files and application programs** once a month. (Application files must be backed up as well as data since programs change too.)
      1) **Incremental changes**, that is, only those data elements and programs that have changed since the last full monthly backup, are backed up every week and kept at the main processing center. (Transporting the weekly backups to the offsite location is generally not cost-effective.)
   d. In case of an **interruption of normal processing**, the organization's systems can be restored such that, at most, 3 weeks of business information is lost. This is not an ideal situation, but it is a far cry from a complete loss of a company's files, which could essentially put it out of business.

6. **Disaster Recovery Planning**
   a. **Contingency planning** is the name commonly given to this activity.
      1) **Disaster recovery** is the process of resuming normal information processing operations after the occurrence of a major interruption.
      2) **Business continuity** is the continuation of business by other means during the period in which computer processing is unavailable or less than normal.
   b. **Two major types of contingencies** must be planned for: those in which the data center is physically available and those in which it is not.
      1) Examples of the first type of contingency are power failure, random intrusions such as viruses, and deliberate intrusions such as hacking incidents. The organization's physical facilities are sound, but immediate action is required to keep normal processing going.
      2) The second type of contingency is much more serious. This type is caused by disasters such as floods, fires, hurricanes, earthquakes, etc. An occurrence of this type necessitates the existence of an alternate processing facility.
   c. **Dealing with Specific Types of Contingencies**
      1) **Power failures** can be guarded against by the purchase of backup electrical generators. These can be programmed to automatically begin running as soon as a dip in the level of electric current is detected. This is a widespread practice in settings such as hospitals where 24-hour system availability is crucial.
      2) Attacks such as **viruses** and denials-of-service call for a completely different response. The system must be brought down "gracefully" to halt the spread of the infection. The IT staff must be well trained in the nature of the latest virus threats to know how to isolate the damage and bring the system back to full operation.

3) The most extreme contingency is when the organization's main facility is rendered uninhabitable by **flood, fire, earthquake, etc**. It is to prepare for these cases that organizations contract for alternate processing facilities.

a) An **alternate processing facility** is a physical location maintained by an outside contractor for the express purpose of providing processing facilities for customers in case of disaster.

b) The recovery center, like the offsite storage location for backup files, must be far enough away that it will likely be unaffected by the same natural disaster that forced the abandonment of the main facility. Usually, companies contract for backup facilities in another city.

c) Once the determination is made that processing is no longer possible at the principal site, the backup files are retrieved from the secure storage location and taken to the recovery center.

d) Recovery centers can take many forms. Organizations determine which facility is best by calculating the tradeoff between the cost of the contract and the cost of downtime.

i) A **hot site** is a fully operational processing facility that is immediately available. A flying-start site is a hot site with the latest data and software that permit startup within a few minutes or even a few seconds.

ii) A **warm site** is a facility with limited hardware, such as communications and networking equipment, already installed but lacking the necessary servers and client terminals.

iii) A **cold site** is a shell facility lacking most infrastructure but readily available for the quick installation of hardware.

10.3 *IMA STATEMENT OF ETHICAL PROFESSIONAL PRACTICE*

1. The Institute of Management Accountants (IMA) published its Statement on Management Accounting 1C (Revised), *IMA Statement of Ethical Professional Practice*, in August 2005. The Statement contains four overarching principles, four specific standards, and a section of guidance on the resolution of ethical conflicts.

a. The four **principles** can be remembered with the mnemonic HFOR (honesty, fairness, objectivity, and responsibility).

b. The four **standards** can be remembered with the mnemonic CCIC (competence, confidentiality, integrity, and credibility).

c. The final section, **Resolution** of Ethical Conflict, is especially significant and has been the subject of many CMA examination questions over the years. One of the most common questions asked deals with the individual to whom a problem should be reported.

d. CMA candidates should essentially memorize the entire contents of the *IMA Statement of Ethical Professional Practice* and be able to apply its provisions in evaluating and proposing resolutions for ethical issues, such as fraudulent reporting, manipulation of financial analyses, financial statement results, and/or budgets.

e. Adherence to these provisions is integral to achieving the objectives of management accounting. Management accountants shall not commit acts contrary to the *Statement* nor shall they condone the commission of such acts by others within their organization.

2. NOTE: The IMA has an ethics hotline for members who wish to discuss ethical conflicts. It is reached at 1-800-245-1383.
3. The Statement is printed below and on the following page in its entirety.

IMA STATEMENT OF ETHICAL PROFESSIONAL PRACTICE

Members of IMA shall behave ethically. A commitment to ethical professional practice includes overarching principles that express our values, and standards that guide our conduct.

Principles

IMA's overarching ethical principles include: Honesty, Fairness, Objectivity, and Responsibility. Members shall act in accordance with these principles and shall encourage others within their organizations to adhere to them.

Standards

A member's failure to comply with the following standards may result in disciplinary action.

Section I. COMPETENCE

Each member has a responsibility to:

1. *Maintain an appropriate level of professional expertise by continually developing knowledge and skills.*
2. *Perform professional duties in accordance with relevant laws, regulations, and technical standards.*
3. *Provide decision support information and recommendations that are accurate, clear, concise, and timely.*
4. *Recognize and communicate professional limitations or other constraints that would preclude responsible judgment or successful performance of an activity.*

Section II. CONFIDENTIALITY

Each member has a responsibility to:

1. *Keep information confidential except when disclosure is authorized or legally required.*
2. *Inform all relevant parties regarding appropriate use of confidential information. Monitor subordinates' activities to ensure compliance.*
3. *Refrain from using confidential information for unethical or illegal advantage.*

Section III. INTEGRITY

Each member has a responsibility to:

1. *Mitigate actual conflicts of interest. Regularly communicate with business associates to avoid apparent conflicts of interest. Advise all parties of any potential conflicts.*
2. *Refrain from engaging in any conduct that would prejudice carrying out duties ethically.*
3. *Abstain from engaging in or supporting any activity that might discredit the profession.*

Section IV. CREDIBILITY

Each member has a responsibility to:

1. *Communicate information fairly and objectively.*
2. *Disclose all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, analyses, or recommendations.*
3. *Disclose delays or deficiencies in information, timeliness, processing, or internal controls in conformance with organization policy and/or applicable law.*

RESOLUTION OF ETHICAL CONFLICT

In applying the Standards of Ethical Professional Practice, you may encounter problems in identifying unethical behavior or in resolving an ethical conflict. When faced with ethical issues, you should follow your organization's established policies on the resolution of such conflict. If these policies do not resolve the ethical conflict, you should consider the following courses of action:

1. *Discuss the issue with your immediate superior except when it appears that the supervisor is involved. In that case, present the issue to the next level. If you cannot achieve a satisfactory resolution, submit the issue to the next management level. If your immediate superior is the chief executive officer or equivalent, the acceptable reviewing authority may be a group such as the audit committee, executive committee, board of directors, board of trustees, or owners. Contact with levels above the immediate superior should be initiated only with your superior's knowledge, assuming he or she is not involved. Communication of such problems to authorities or individuals not employed or engaged by the organization is not considered appropriate, unless you believe there is a clear violation of the law.*
2. *Clarify relevant ethical issues by initiating a confidential discussion with an IMA Ethics Counselor or other impartial advisor to obtain a better understanding of possible courses of action.*
3. *Consult your own attorney as to legal obligations and rights concerning the ethical conflict.*

4. One of the provisions of the IMA *Statement* enjoins members to mitigate actual and to avoid apparent conflicts of interest. A conflict of interest is a conflict between the personal and the official responsibilities of a person in a position of trust, sufficient to affect judgment, independence, or objectivity in conducting the affairs of the business.
   a. Examples of a conflict of interest include
      1) Having a substantial financial interest in a supplier, customer, or distributor; and
      2) Using privileged information gained from one's official position to enter transactions for personal gain.
   b. Methods for control of a conflict of interest include the following:
      1) Provide a code of conduct provision applying to conflicts of interest. The code of conduct should say that employees are to refrain from engaging in any activity that would prejudice their ability to carry out their duties ethically.
      2) Require full financial disclosure by all managers.
      3) Require prior notification of any transaction that may raise a question about a possible conflict of interest. The Code says that all parties should be notified of the potential conflict.
      4) Prohibit financial ties to any supplier, customer, or distributor.
      5) Encourage adherence to strong ethical behavior in corporate actions, policies, and public communications.
      6) Employees should refuse any gift, favor, or hospitality that would influence or would appear to influence their actions.
         a) For example, in one case, an auditor accepted a loan from an auditee. The auditee was not trying to influence the auditor, but when it later was discovered that the auditee had committed a fraud and the auditor had not caught the fraud, the court's conclusion was that the auditor was guilty. To have refused the favor would have kept the auditor out of prison, but once he accepted the favor, there was a perception that he had allowed his judgment to be influenced.
5. CMA candidates should be able to apply the provisions of the *IMA Statement of Ethical Professional Practice* in recommending a course of action for management accountants to follow when confronted with an ethical dilemma in the business environment. A memorization of the "resolution" section of the *Statement* will enable the candidate to answer questions of this nature.

10.4 CORE CONCEPTS

Systems Controls

- The three **goals** of information security are **availability, confidentiality, and integrity**.
- **Threats** to information systems include input manipulation, program alteration, direct file alteration, data theft, sabotage, viruses / logic bombs / worms / Trojan horses (known collectively as malware), back doors, and theft.
- **Physical controls** limit physical access and environmental damage to computer equipment and important documents. They consist of
  - **Physical access** (i.e., who can get into a room with computer equipment), and
  - **Environmental controls** (i.e., maintaining the computer equipment room with a constant level of temperature and humidity, and a fire-suppression system).
- **Logical controls** are established to limit access in accordance with the principle that all persons should have access only to those elements of the organization's information systems that are necessary to perform their job duties. Logical controls have a double focus:
  - **Authentication** is the act of ensuring that the person attempting to access the system is in fact who (s)he says (s)he is. The most widespread means of achieving this is through the use of IDs and passwords.
  - **Authorization** is the practice of ensuring that, once in the system, the user can only access those programs and data elements necessary to his/her job duties. In many cases, users should be able to view the contents of some data fields but not be able to change them.
- **Input, Processing, and Output Controls**
  - **Input controls** vary depending on whether input is entered in online or batch mode. **Online input controls** can be used when data are keyed into an input screen. Among them are preformatting, edit checks, limit (reasonableness) checks, and check digits. **Batch input controls** can be used when data are grouped for processing in "batches." Commonly used ones are management release, record counts, financial totals, and hash totals.
  - **Processing controls** include validation, completeness, arithmetic controls, sequence checks, run-to-run control totals, and key integrity.
  - **Output controls** include a complete audit trail and error listings.
- **Storage controls** consist of dual write routines, validity checks, and physical controls.

Security Measures

- Certain security **risks are inherent** in use of the **Internet**. Listed here are some of the forms that attacks over the Internet can take.
  - **Password attacks.** A brute-force attack uses password cracking software to try large numbers of letter and number combinations to access a network. Passwords also may be compromised by Trojan horses, IP spoofing, and packet sniffers.
  - A **man-in-the-middle attack** takes advantage of networking packet sniffing and routing and transport protocols.
  - A **denial-of-service (DoS)** attack is an attempt to overload an organization's network with so many messages that it cannot function (i.e., induce a system crash).

- **Data encryption** is a very powerful tool in counteracting Internet attacks. Encryption technology converts data into a code. Two major types of encryption software exist.
  - **Public-key**, or **asymmetric**, encryption is the more secure of the two because it requires two keys: The public key for coding messages is widely known, but the private key for decoding messages is kept secret by the recipient. The parties who wish to transmit coded messages must use algorithmically-related pairs of public and private keys. Neither party knows the other's private key. The related public key and private key pair is issued by a certificate authority; the private key is issued only to one party.
  - **Private-key**, or **symmetric**, encryption is less secure because it requires only a single key for each pair of parties that want to send each other coded messages.
- A **firewall** is a combination of hardware and software that separates an internal network from an external network, such as the Internet, and prevents passage of specific types of traffic. A firewall alone is not an adequate defense against computer viruses. Specialized anti-virus software is a must.
- **Flowcharting** is the representation of a process using pictorial symbols.
  - **Vertical flowcharts** present successive steps in a top-to-bottom format.
  - **Horizontal flowcharts**, also called systems flowcharts, depict areas of responsibility (departments or functions) in vertical columns. Activities and documents flow back and forth between departments across the page.
- **Periodic backup and rotation** are essential. The offsite location must be temperature- and humidity-controlled and guarded against physical intrusion. Just as important, it must be geographically remote enough from the site of the organization's main operations that it would not be affected by the same natural disaster.
- A typical **backup routine** involves duplicating all data files and application programs once a month. Incremental changes, that is, only those data elements and programs that have changed since the last full monthly backup, are backed up every week and kept at the main processing center.
- **Disaster recovery** planning is also called **contingency** planning. Disaster recovery is the process of resuming normal information processing operations after the occurrence of a major interruption. Business continuity is the continuation of business by other means during the period in which computer processing is unavailable or less than normal. **Two major types** of contingencies must be planned for: those in which the data center is physically available (power failure, viruses, hacking) and those in which it is not (floods, fires, hurricanes, earthquakes).
- An **alternate processing facility** is a physical location maintained by an outside contractor for the express purpose of providing processing facilities for customers in case of disaster. The recovery center, like the offsite storage location for backup files, must be far enough away that it will likely be unaffected by the same natural disaster that forced the abandonment of the main facility. Usually, companies contract for backup facilities in another city.