We dedicate this work to our parents, Hattie and B. G. Fewox, and Chris and Jake Jacobs. We also offer a thousand thank-yous to Bob Horan and Janine Wilson, who always sent us what we needed as soon as we said that we needed it.

TO THE STUDENT:

We are delighted that you have purchased this resource manual and hope that it will help you in your quest for expertise in cost and management accounting. We wish to emphasize to you immediately that this manual is not a shortcut to success in the course. We recommend that you do the following in order to be successful in your studies: First and foremost, read your textbook; attend classes regularly and take good notes; faithfully do assigned homework; and use this resource manual.

The manual should help you to solidify your understanding of the concepts in a particular chapter. After you read the chapter in your textbook, review your class notes, and prepare your homework, we encourage you then to read the outline of the chapter in this manual and to work the Chapter Self-Test. The answers to the self-test questions are at the end of each chapter and give you immediate feedback. We have keyed each question to a chapter objective, and we provide you with the textbook page number reference in case you need further clarification of a question and its answer. All in all, this resource manual can be an important tool for you as you seek understanding of cost and management accounting concepts.

We wish you every success in your studies.

Ceil Fewox
Jerome Fewox

CHAPTER 1

AN INTRODUCTION TO TYPES OF ORGANIZATIONS AND THE MANAGEMENT ACCOUNTANT

CHAPTER OVERVIEW

Chapter 1 introduces you to a variety of management accounting topics. You will learn the difference between management accounting (with its internal user focus) and financial accounting (with its external user focus). You will learn how to become a professional management accountant and about the role of modern management accountants in the four types of organizations in which they serve. Seven major trends in the new manufacturing environment will also be discussed.

Review of Specific Chapter Objectives

1. Describe the four types of organizations that are served by management accounting (pgs. 5 - 13).

   ▲ **Financial accounting** focuses on providing information to people who are outside the organization, while **management accounting** focuses on improving the information provided to those people who run the organization's operations.

   ▲ A **MANUFACTURING ORGANIZATION** converts raw materials into finished products. There are four manufacturing cost elements:
   Direct materials are materials that can be easily traced to the finished product.
   Direct labor (touch labor) includes labor costs that are directly traceable to the finished product.
   Overhead, divided into fixed and variable components, includes all manufacturing costs that are not direct material or direct labor. Indirect materials (those not easily traceable to the finished product) and indirect labor (again, not easily traceable to the finished product) are part of overhead, as are all indirect costs of production.

   Conversion cost = Overhead + Direct labor
   Prime cost = Direct labor + Direct materials

   Direct technology is considered by some to be another manufacturing cost element. It includes computers, software, and telecommunications, as well as various pieces of equipment and robots.

   Two types of manufacturing systems are job order systems, which produce products as special orders, and process systems, which produce products in a continuous stream.

   ▲ A **MERCHANDISING FIRM** is a retailer or a wholesaler that buys products for resale.

▲ A **PROFIT-ORIENTED SERVICE FIRM** is an organization that sells knowledge, functions, or some other benefits, rather than products, to its customers.

▲ A **NOT-FOR-PROFIT SERVICE ORGANIZATION** is an organization which offers a benefit to its clients for free or for a minimal fee.

▲ The following is a comparison of the financial statements of a merchandising firm and a manufacturing organization:
BALANCE SHEET:
Manufacturing organization:
Raw materials inventory
Work-in-process or work-in-progress (WIP)
Finished goods inventory

Merchandising firm:
Merchandise inventory

INCOME STATEMENT:
Manufacturing organization:
Beginning finished goods inventory
+Cost of goods manufactured
Goods available for sale
-Ending finished goods inventory
Cost of goods sold

Merchandising firm:
Beginning inventory
+Purchases
Goods available for sale
-Ending inventory
Cost of goods sold

2. Explain the relationship of management accounting to financial and cost accounting (pgs. 13 - 16).

▲ **Cost accounting**, serving its financial accounting (external user) objective, provides inventory valuations and cost of goods manufactured and sold for financial statements. Serving its management accounting (internal user) objective, cost accounting provides detailed costs at the product or service level so that managers can make informed decisions about cost control and productivity improvement.

3. Present the major trends in the new manufacturing environment, and discuss the role of modern management accountants in organizations (pgs. 16 - 24).

▲ **The major trends in the new manufacturing environment** are the following:
High quality is an elevated level of excellence in product reliability and performance (build quality in; don't inspect it in).
Customer service gets the right product to the right customer at the right time and at the right cost.

Low inventory is the minimum amount of raw materials, work-in-process, and finished goods necessary to meet production and marketing needs.
Flexibility is the ready capability to adapt to new, different, or changing requirements.
Automation is implementation of highly technical machines that are designed to follow, with little human intervention, a predetermined sequence of operations or to respond to computer-generated instructions.
The team concept fosters an organization of people who work together in a coordinated, cooperative manner to ensure the enterprise's success.
An integrated computer-based information system (ICBIS) is an enterprisewide interconnection of computers and related information technology that provides a multilevel, cross-functional flow of information to all managers and workers in the enterprise.

- **Suboptimal behavior** results from a person who attempts to optimize his own goals rather than those of the organization. **Goal congruence**, the opposite of suboptimal behavior, involves making decisions that are for the greater good.

- The chief job of modern management accountants is to facilitate the trends in the new manufacturing environment and to assist managers to perform successfully. The key role is based on providing quality information for management to run enterprises in an optimum manner. **Quality information has five attributes:**
  Accuracy: Information must be free from mistakes and errors.
  Relevancy: Information must be applicable or pertinent to what is being considered.
  Timeliness: Information gets to managers within the needed time frame.
  Fairness: Information is impartial, free from self-interest, prejudice, or favoritism.
  Usability: Information can be understood instantly without any special instructions.

4. Explain how to become a professional management accountant (pgs. 24 - 29).

- **There are four characteristics of a profession:**
  Well-defined body of knowledge
  Competency in the knowledge area
  Restricted admission
  Adoption of standards of ethical conduct

- The **certified management accountant (CMA)** certification program was developed to give management accounting status and to provide a means for management accountants to demonstrate educational attainment and competency in specific areas of knowledge.

- Candidates must complete **four steps to become a CMA:**
  File an application for admission with the Institute of Certified Management Accountants (ICMA) and register for the CMA examination.
  Pass all four parts of the CMA examination within a three-year period.
  Meet the CMA experience requirement.
  Comply with the standards of ethical conduct for management accountants.

- The Standards of Ethical Conduct for Management Accountants is a written code of ethics that provides formal guidance to management accountants who must deal with ethical dilemmas in their work environments. The standards comprise four areas:
  Competence means that management accountants have requisite or adequate abilities to perform their work.
  Confidentiality means that management accountants do not disclose sensitive information with which they have been entrusted.
  Integrity means that management accountants are honest.
  Objectivity means that management accountants deal with data and conditions as perceived without distortion by personal feelings, prejudices, or interpretations.

CHAPTER SELF-TEST

Note: The notation (CO1) means that the question was drawn from chapter objective number one.

Matching

Please write the letters of the following terms in the spaces to the left of the definitions.

a.	Prime costs	l.	Traditional factory
b.	Conversion costs	m.	Automated factory
c.	Goal congruence	n.	Direct materials
d.	Indirect materials	o.	Purchases
e.	Direct technology	p.	Finished goods
f.	Indirect labor	q.	WIP inventories
g.	Variable costs	r.	Government
h.	Fixed costs	s.	Cycle time
i.	Suboptimal behavior	t.	Silo effect
j.	Process system	u.	Direct labor
k.	Overhead	v.	Job order system

_____ 1. (CO1) Touch labor.

_____ 2. (CO1) Overhead costs which increase as the number of units produced increases.

_____ 3. (CO1) A type of manufacturing environment that is labor intensive.

_____ 4. (CO1) Products acquired for resale.

_____ 5. (CO1) Materials not easily traced to the finished product.

_____ 6. (CO1) Overhead costs which remain the same regardless of the number of units produced.

_____ 7. (CO1) Overhead plus direct labor.

_____ 8. (CO1) A manufacturing system in which products are produced in a continuous stream.

_____ 9. (CO1) Materials easily traced to the finished product, such as the wood in a stereo cabinet.

_____ 10. (CO1) Labor such as that of cleaning staff or supervisors.

_____ 11. (CO1) A type of manufacturing environment in which laborers are increasingly engaged in setup.

_____ 12. (CO1) Direct materials plus direct labor.

_____ 13. (CO1) Not-for-profit service entity.

_____ 14. (CO1) A type of manufacturing system in which products are produced as special orders.

_____ 15. (CO1) Consists of partially completed goods.

_____ 16. (CO1) Includes computers, software, and telecommunications that control processes.

_____ 17. (CO1) Unsold manufactured products.

_____ 18. (CO1) Includes all indirect costs of production.

_____ 19. (CO2) Lead time.

_____ 20. (CO3) Occurs when each segment of an organization builds tall, cylindrical boundaries to seal themselves off from each other.

_____ 21. (CO3) Results when a person pursues his own goals rather than the goals of the organization.

_____ 22. (CO3) Occurs in an organization when decisions are made for the greater good.

Completion

Please write in the word or words which will complete the sentence.

1. (CO1) The management accountant will use a _____ _____ manufacturing system for the production of a cruise ship.

2. (CO1) In the construction of a house, nails are considered to be _____ materials.

3. (CO1) A department store is an example of a _____ _____.

4. (CO1) A _____ _____ _____ is an enterprise that sells knowledge, functions, or some other benefits, rather than products.

5. (CO1) If the ending finished goods inventory is $3,000; the beginning finished goods inventory is $1,000; and cost of goods manufactured is $16,000; then cost of goods sold must be _____.

6. (CO2) Financial accountants produce information for _____ users.

7. (CO3) Rather than _____ quality into the product, companies are _____ quality in.

8. (CO3) _____, _____, _____, and _____ are four of the major trends in the new manufacturing environment.

9. (CO3) _____, _____, _____, _____, and _____ are the five attributes of quality information.

10. (CO4) The Standards of Ethical Conduct for Management Accountants comprise four areas: _____, _____, _____, and _____.

True-False Statements

Please circle "T" if the sentence is true and "F" if it is false.

T F 1. (CO1) A soft-drink bottling plant will use a process manufacturing system.

T F 2. (CO1) Prime costs consist of overhead and direct labor.

T F 3. (CO1) In the manufacture of telephones, variable costs include the handset, the housing, push buttons, and the supervisor's salary.

T F 4. (CO1) If direct materials are $8,000; direct labor is $15,000; overhead costs are $6,000; beginning work-in-process inventory is $2,000; and ending work-in-process inventory is $3,000; then cost of goods manufactured is $28,000.

T F 5. (CO1) If cost of goods manufactured is $12,000; ending finished goods inventory is $4,000; and beginning finished goods inventory is $5,000; then cost of goods sold is $11,000.

T F 6. (CO1) Management accountants produce information for users external to the organization.

T F 7. (CO1) Finished goods inventories are found on the schedule of cost of goods manufactured.

T F 8. (CO2) Cost accounting will eventually cease to be useful to management accountants.

T F 9. (CO3) In the past, many companies believed that higher quality meant higher costs.

T F 10. (CO3) When information is applicable or pertinent to what is being considered, it is said to be accurate.

T F 11. (CO4) The standard of integrity means that management accountants have requisite or adequate abilities to perform their work.

Multiple Choice

Please circle the correct answer.

1. (CO1) What are the cost elements of a manufactured product?
   a. Direct materials, direct labor, variable overhead.
   b. Direct materials, direct labor, variable overhead, and fixed overhead.
   c. Conversion costs plus direct materials.
   d. Prime costs plus direct labor.

2. (CO1) Which of the following accounts will be found on the income statement of a merchandising firm?
   a. Finished goods.
   b. Raw materials.
   c. Purchases.
   d. Goods-in-process.

3. (CO1) Overhead costs will include which of the following?
   a. Indirect materials.
   b. Indirect labor.
   c. Utilities.
   d. All of the above.

4. (CO1) A job order manufacturing system would be most applicable to a:
   a. shipyard.
   b. refinery.
   c. steel mill.
   d. bakery.

5. (CO1) If cost of goods sold is $40,000; beginning finished goods inventory is $5,000; and ending finished goods inventory is $6,000; then cost of goods manufactured must be:
   a. $51,000.
   b. $41,000.
   c. $40,000.
   d. $39,000.

6. (CO2) Which of the following is a function provided by cost accounting?
   a. Valuation of ending inventories.
   b. Determination of cost of goods sold.
   c. Determination of product costs for management control.
   d. All of the above.

7. (CO3) Which of the following motivated purchasing managers in the past to buy raw materials at the lowest cost, which, in many cases, was at the expense of quality?
   a. Silo effect.
   b. Goal congruence.
   c. Materials quantity variance.
   d. Purchase price variance.

8. (CO4) Why was the certified management accountant (CMA) certification program developed?
   a. To give management accounting status and to provide a means for management accountants to demonstrate educational attainment and competency.
   b. To fulfill requirements of the Securities and Exchange Commission (SEC).
   c. To restrict admission to the Institute of Management Accountants (IMA).
   d. To assist the Institute of Management Accountants (IMA) in raising operating funds.

9. (CO4) The Standards of Ethical Conduct for Management Accountants comprise which of the following areas?
   a. Competence and confidentiality.
   b. Integrity and objectivity.
   c. Competence, integrity, and objectivity.
   d. Competence, confidentiality, integrity, and objectivity.

Demonstration Problem

Lightning Ridge Corporation manufactures components which it then sells to various buyers. The following data are taken from Lightning Ridge's records for the month of April 1995:

Work-in-process inventory, April 1	$ 20,000
Work-in-process inventory, April 30	15,000
Finished goods inventory, April 1	30,000
Finished goods inventory, April 30	25,000
Direct materials	125,000
Direct labor	250,000
Manufacturing overhead	220,000

REQUIRED: From the above data, please prepare for Lightning Ridge a schedule of cost of goods manufactured and the cost of goods sold section of the income statement for the month ended April 30, 1995.

SOLUTIONS TO SELF-TEST

Note: The notation (Pg. 1) means that information about the question and its answer can be found on page 1 of your textbook.

Matching

1.	(Pg. 6)	u	12.	(Pg. 6)	a
2.	(Pg. 6)	g	13.	(Pg. 11)	r
3.	(Pg. 6)	l	14.	(Pg. 8)	v
4.	(Pg. 8)	o	15.	(Pg. 8)	q
5.	(Pg. 6)	d	16.	(Pg. 7)	e
6.	(Pg. 6)	h	17.	(Pg. 8)	p
7.	(Pg. 6)	b	18.	(Pg. 6)	k
8.	(Pg. 8)	j	19.	(Pg. 14)	s
9.	(Pg. 6)	n	20.	(Pg. 19)	t
10.	(Pg. 6)	f	21.	(Pg. 19)	i
11.	(Pg. 6)	m	22.	(Pg. 19)	c

Completion

1.	(Pg. 8)	job order
2.	(Pg. 6)	indirect
3.	(Pg. 8)	merchandising firm
4.	(Pg. 11)	profit-oriented service firm
5.	(Pg. 10)	$14,000 ($1,000 + $16,000 - $3,000)
6.	(Pg. 14)	external
7.	(Pg. 17)	inspecting, building
8.	(Pg. 16)	High quality, customer service, low inventory, flexibility, automation, team concept, integrated computer-based information system (ICBIS)
9.	(Pg. 20)	Accuracy, relevancy, timeliness, fairness, usability
10.	(Pg. 26)	competence, confidentiality, integrity, objectivity

True-False Statements

1.	(Pg. 8)	T	
2.	(Pg. 6)	F	Prime costs consist of direct materials and direct labor.
3.	(Pg. 6)	F	The supervisor's salary is a fixed cost.
4.	(Pg. 10)	T	
5.	(Pg. 10)	F	$5,000 + $12,000 - $4,000 = $13,000
6.	(Pg. 16)	F	Management accountants produce information for internal users.
7.	(Pg. 10)	F	Finished goods inventories are found in the cost of goods sold section of the income statement.
8.	(Pg. 16)	F	Cost accounting will continue to provide inventory values and the cost of goods manufactured.
9.	(Pg. 17)	T	
10.	(Pg. 21)	F	That attribute is relevancy.

11. (Pg. 27) F Integrity means that management accountants are honest. The area described is competence.

Multiple Choice

1. (Pg. 6) b
2. (Pg. 10) c
3. (Pg. 6) d
4. (Pg. 8) a
5. (Pg. 10) b $5,000 + X - $6,000 = $40,000
6. (Pg. 15) d
7. (Pg. 17) d
8. (Pg. 25) a
9. (Pg. 26) d

Demonstration Problem

Lightning Ridge Corporation
Income Statement
For the month ended April 30, 1995

Cost of goods sold:	
Finished goods inventory, April 1	$ 30,000
Add: Cost of goods manufactured	600,000
Goods available for sale	630,000
Less: Finished goods inventory, April 30	25,000
Cost of goods sold	$605,000
Schedule of cost of goods manufactured:	
Direct materials	$125,000
Direct labor	250,000
Manufacturing overhead	220,000
Total manufacturing costs	595,000
Add: Work-in-process inventory, April 1	20,000
Deduct: Work-in-process inventory, Apr. 30	15,000
Cost of goods manufactured	$600,000

CHAPTER 2

MOVING FROM TRADITIONAL TO MODERN MANUFACTURING ENVIRONMENTS

CHAPTER OVERVIEW

Chapter 2 introduces you to several different manufacturing environments. You will learn the characteristics of a traditional batch manufacturing environment and of a world-class manufacturing (WCM) environment. Also discussed are just-in-time (JIT) manufacturing and computer-integrated manufacturing (CIM).

Review of Specific Chapter Objectives

1. Describe the traditional batch manufacturing environment (pgs. 47 - 50).

   - A **traditional batch manufacturing environment** is a PUSH system in which a subassembly or partially completed product is PUSHed to an area designated for work-in-process (WIP).

   - **Four problems** are apparent in batch manufacturing:
     Suboptimizing behavior between organizational areas (little integration and communication between areas)
     Producing and maintaining large inventories
     Producing products of subpar quality (products are inspected after production, often resulting in excessive scrap and rework)
     Striving for efficiency at the expense of effectiveness (efficiency means doing something right, while effectiveness is doing the right thing)

2. Define the world-class manufacturing (WCM) environment (pgs. 50 - 53).

   - The **world-class manufacturing (WCM) environment** is a culture of problem prevention, continuous improvement, efficiency and effectiveness, and manufacturing excellence.

   - **Four problems of United States manufacturing** are quality, customer satisfaction, responsiveness, and productivity.

   - **Continuous and simultaneous improvement in four areas** is the key to solving those problems:
     The lowest total cost (not lowest average cost per unit)
     The most consistent quality
     The most reliable delivery
     The most responsiveness to customers' needs

   - Japanese manufacturers use the tool of **kaizen**, or continuous improvement.

   - The **"father of world-class manufacturing"** is Dr. W. Edwards Deming.

- ▲ Modern management accountants need to participate in designing new management systems based on the following **"chain of causation"**:
  a. The production process must function efficiently and effectively.
  b. Appropriate responses must be taken as problems occur.
  c. Organizational members must be committed to their roles and have the necessary control skills.
  d. Commitment must be designed into the jobs and roles assigned to people.
  e. People must have the control skills required to identify and to perform necessary control actions when needed.

3. List and describe the characteristics of world-class manufacturing (WCM) (pgs. 53 - 64).

- ▲ The following **seven major trends** in new manufacturing environments are the characteristics of WCM:
  HIGH QUALITY: The aim is zero defects and begins with vendors of raw materials.
  CUSTOMER SERVICE: The customer is the final judge of whether or not a manufacturer has attained WCM status.
  LOW INVENTORY: High levels of inventory are generally due to poor management. Inventory carrying costs are high. Stockout costs are the costs of not having finished goods inventory available when it is needed or WIP to meet production schedules.
  FLEXIBILITY: This is the ability to respond to changing conditions. WCM enterprises can reduce setup times, lot sizes, and lead time (the time for conversion of raw materials into finished goods). WCM enterprises use the mushroom concept, which keeps processes and products standardized for as long as possible.
  AUTOMATION: Automation helps in achieving high quality, delivery of customized products on time, minimization of inventory, and increase in flexibility. The WCM era is characterized by less direct labor.
  TEAM CONCEPT: This is considered to be a fundamental requirement for changing to a WCM organization. It discourages suboptimal behavior. Workers are viewed as resources, not costs. The old-style management pyramid is inverted.
  INTEGRATED COMPUTER-BASED INFORMATION SYSTEMS (ICBISs): These consist of input, process, output, database, controls, and technology platform components. They can be a local area network (LAN) or a wide area network (WAN).

4. Describe just-in-time (JIT) manufacturing and computer-integrated manufacturing (CIM) (pgs. 64 - 80).

- ▲ **Just-in-time (JIT) manufacturing** means a PULL-THROUGH system of production unlike the traditional batch manufacturing PUSH-THROUGH system. Products are made in response to downstream (end of the line) needs.

- Suppliers deliver small batches of raw materials, sometimes directly to the appropriate department, just in time to meet production demands.

- Just-in-time pursues **six objectives:**
SYNCHRONIZED OPERATIONS exist when input equals output, and tasks are coordinated, or synchronized, to the rate that finished goods are withdrawn at the end of the pipeline. This is the foundation upon which JIT systems are built. Cellular manufacturing is used so that wait and move times can be minimized by the sequential arrangement of machines. Two significant features of cellular manufacturing are production families, each of which follows the same production flow path of a particular synchronized manufacturing cell, and cross training of workers. U-shaped production lines are preferred.
ZERO INVENTORIES. JIT reduces inventories in order to recouple sequential workcenters into cells, forcing workers to solve problems as they arise. A kanban, which translates as "visible signal," "card," or "sign," is used to reduce inventories. Used in manufacturing, the kanban is an order for additional material, or a part to be produced.
ZERO SETUP TIME. Setup time is the amount of time required to adjust equipment and to retool for the production of a different product. Reduction or elimination of WIP inventories is dependent on the reduction of setup times.
ZERO LEAD TIME. Also called cycle time, it is the length of time it takes to produce a product or to provide a service from start to finish. It is composed of value-added time (activities performed by machines and people who work directly on making a product or providing a service) and nonvalue-added time (activities performed by people and machines that do not work on the product). Nonvalue-added time is wasted time, such as move time, wait time, and final inspection time (lead time = process time + move time + wait time + inspection time). A useful ratio is the lead time efficiency (LTE) ratio:

$$\frac{\text{Processing time}}{\text{Processing time + Move time + Wait time + Inspection time}}$$

ZERO DEFECTS. This means that there are no rejected materials, parts, or finished products, and there is no rework. The journey toward zero defects is driven by total quality management (TQM), which focuses on prevention of problems and "getting it right the first time." The TQM program is supported by the following techniques: design of experiment, total preventive maintenance, statistical process control, and jidoka, a Japanese term which means "stop everything when something goes wrong."
THE VISUAL FACTORY. In this setting, problems, abnormalities, defects, and all types of waste are immediately recognized at a single glance. Andon, a visual control system which helps managers and workers

know the status of production, is the concept behind the visual factory. Fundamental to the visual factory are seiri (organization), seiton (orderliness), shitsuke (discipline), seiso (cleanliness), and seiketsu (standardization).

▲ The ultimate step toward full factory automation is **computer-integrated manufaturing (CIM)**, which uses groups of technologies that are integrated plantwide and controlled by an ICBIS. JIT is a prerequisite for CIM. Major users integrated into the CIM system are: stakeholders, office personnel, engineering, computer-aided manufacturing, and manufacturing cells.

CHAPTER SELF-TEST

Note: The notation (CO1) means that the question was drawn from chapter objective number one.

Matching

Please write the letters of the following terms in the spaces to the left of the definitions.

a. Andon
b. Mushroom concept
c. Effectiveness
d. Efficiency
e. Jidoka
f. Kaizen
g. Kanban
h. Local area network (LAN)
i. Nonvalue-added time
j. Traditional batch manufacturing
k. Value-added time
l. Visual factory
m. Wait time
n. Wide area network (WAN)
o. World-class manufacturing
p. Zero defects

_____ 1. (CO4) A computerized or a hard copy (a card or a sign) signal to produce the next product or subassembly, or to order the direct materials for the next product.

_____ 2. (CO4) A visual control system located on the factory floor in full view of workers and managers which helps them to know the status of production.

_____ 3. (CO1) A PUSH system in which a subassembly or partially completed product is pushed to an area designated for work-in-process.

_____ 4. (CO2) A culture of problem prevention, continuous improvement, efficiency and effectiveness, and manufacturing excellence.

_____ 5. (CO3) A telecommunications network located in a room or a building.

_____ 6. (CO3) A production process design that keeps processes and products standardized for as long as possible, creating a product structure that is diversified only at the final production stage.

_____ 7. (CO4) A term which means "stop everything when something goes wrong."

_____ 8. (CO1) A word which indicates doing the right thing.

_____ 9. (CO4) Activities performed by people and machines that do not work on the product.

_____ 10. (CO2) The elimination of waste in all parts of production, production support, worker involvement, and management practices.

_____ 11. (CO4) The concept that there are no rejected materials, parts, or finished products, and, thus, no rework.

_____ 12. (C04) In this setting, problems, abnormalities, defects, and all types of waste are recognized in a single glance.

_____ 13. (CO3) An ICBIS in which computer devices and auxiliary storage devices are distributed throughout a large area, possibly throughout the country or internationally.

_____ 14. (CO4) The time that a product sits around waiting for somebody to process it, move it, inspect it, or rework it, or the time that finished products spend in storage.

_____ 15. (CO1) A word which indicates doing something right.

_____ 16. (CO4) Activities performed by machines and people who work directly on making a product or providing a service.

Completion

Please write in the word or words which will complete the sentence.

1. (CO1) Stressing efficiency over effectiveness, or vice versa, results in _____ behavior.

2. (CO4) The _____ _____ enables all managers, including senior management, who may know very little about specific operations, to see the status of production by merely walking through the plant and observing the easy-to-understand displays of information.

3. (CO3) The costs of not having finished goods available when needed or work-in-process available to meet production schedules are called _____ costs.

4. (CO3) A network of computers distributed throughout a large area such as a state, a region, a country, or internationally is called a _____ _____ _____.

5. (CO4) _____ _____ _____ aims at extending equipment life and maximizing effectiveness throughout the machine's entire useful life.

6. (CO4) _____ means that rules are followed precisely, including coming to work on time and wearing safety equipment.

7. (CO3) The Japanese approach to achieving high quality and zero defects considers that a discovered defect is a _____.

8. (CO2) The key to solving problems in United States manufacturing consists of continuous and simultaneous improvement in four areas, two of which are _____ _____ _____ and _____ _____ _____.

9. (CO3) _____, _____, _____, and _____ are four of the seven characteristics of world-class manufacturing (WCM).

10. (CO2) "The father of world-class manufacturing" is _____.

True-False Statements

Please circle "T" if the sentence is true and "F" if it is false.

T F 1. (CO4) Value-added time consists of activities performed by machines and people who work directly on making a product.

T F 2. (CO4) Kanbans tend to increase inventories.

T F 3. (CO1) Quality control inspections on completed products result in excessive scrap and rework.

T F 4. (CO4) Seiso ensures that tools, equipment, and the entire workplace are spotless (all dirt, oil, and scrap are eliminated).

T F 5. (CO4) The ideal lead time efficiency (LTE) ratio is 1.0.

T F 6. (CO1) The traditional PUSH-type batch manufacturing environments drive products to higher average unit costs.

T F 7. (CO2) It has been shown that the success of world-class manufacturing (WCM) is far more dependent on the culture developed within the company than on the culture of the nation as a whole.

T F 8. (CO4) Unlike the PUSH manufacturing pipeline, just-in-time (JIT) can be viewed as a vacuum pipeline, or a PULL system (products are made in response to downstream needs).

T F 9. (CO4) Setup time is one of the worst forms of waste in production.

T F 10. (CO4) The ultimate step toward full factory automation is computer-integrated manufacturing (CIM).

Multiple Choice

Please circle the correct answer.

1. (CO4) Which of the following is a value-added time?
   a. Inspection time.
   b. Move time.
   c. Process time.
   d. Wait time.

2. (CO4) Which of the following is an advantage of the U-shaped production line, as compared with the straight-line arrangement?
   a. Maximum work-in-process inventory.
   b. Better coordination.
   c. More space required.
   d. Longer lead times.

3. (CO4) What is the process time for a product if the lead time is 4 hours, move time is 2 hours, inspection time is 30 minutes, and wait time is 30 minutes?
   a. 4 hours.
   b. 2 hours.
   c. 1 hour.
   d. 30 minutes.

4. (CO4) What is the lead time efficiency (LTE) ratio if the processing time is 15 hours; move time is 10 hours; wait time is 30 hours; and inspection time is 3 hours?
   a. 0.3488.
   b. 0.2586.
   c. 0.1765.
   d. 0.1724.

5. (CO4) Which of the following is <u>not</u> a stakeholder?
   a. Carrier.
   b. Customer.
   c. Manufacturing cell.
   d. Vendor.

6. (CO4) Two significant features of cellular manufacturing are:
   a. shorter lead times and better response times.
   b. less space and better coordination.
   c. less move time and material handling.
   d. production families and cross training.

7. (CO4) A total quality management (TQM) program is supported by which of the following techniques?
   a. Statistical process control (SPC).
   b. Computer-integrated manufacturing (CIM).
   c. The mushroom concept.
   d. The technology platform.

8. (CO4) Who of the following are major users of a CIM enterprise?
   a. Stakeholders.
   b. Office personnel.
   c. Engineering personnel.
   d. All of the above are users.

9. (CO3) Which of the following is a reason for having high levels of inventories?
   a. Uncertain customer demand.
   b. Minimal ordering costs.
   c. Production that is not subject to disruptions.
   d. Reliable vendors.

10. (CO3) Which of the following are stockout costs?
    a. Costs due to customers' ill will.
    b. Costs of back ordering and special handling.
    c. Costs incurred because of idle production capacity and schedule disruptions.
    d. All of the above are stockout costs.

Demonstration Problem

Charleston Company produces one product, the process time of which is 10 hours. Move time for the product is 2 hours, wait time is 35 hours, and inspection time is 3 hours.

REQUIRED: Please compute Charleston Company's lead time efficiency (LTE) ratio. Please assess this ratio.

SOLUTIONS TO SELF-TEST

Note: The notation (Pg. 1) means that information about the question and its answer can be found on page 1 of your textbook.

Matching

1.	(Pg. 71)	g	9.	(Pg. 74)	i
2.	(Pg. 78)	a	10.	(Pg. 51)	f
3.	(Pg. 47)	j	11.	(Pg. 77)	p
4.	(Pg. 50)	o	12.	(Pg. 78)	l
5.	(Pg. 63)	h	13.	(Pg. 63)	n
6.	(Pg. 58)	b	14.	(Pg. 74)	m
7.	(Pg. 77)	e	15.	(Pg. 49)	e
8.	(Pg. 49)	c	16.	(Pg. 74)	k

Completion

1. (Pg. 50) suboptimal
2. (Pg. 79) visual factory
3. (Pg. 58) stockout
4. (Pg. 63) wide area network
5. (Pg. 77) Total preventive maintenance
6. (Pg. 78) Shitsuke
7. (Pg. 55) gem
8. (Pg. 51) lowest total cost; most consistent quality; most reliable delivery; most responsiveness to customers' needs
9. (Pg. 53) High quality; customer service; low inventory; flexibility; automation; team concept; integrated computer-based information systems (ICBIS)
10. (Pg. 52) Dr. W. Edwards Deming

True-False Statements

1. (Pg. 74) T
2. (Pg. 71) F — The order for additional material, or a part to be produced, is not given until the downstream workers are ready.
3. (Pg. 49) T
4. (Pg. 78) T
5. (Pg. 76) T
6. (Pg. 49) F — The more products produced, the lower the average cost, but this results in large quantities of unsold inventories.
7. (Pg. 53) T
8. (Pg. 64) T
9. (Pg. 73) T
10. (Pg. 79) T

Multiple Choice

1.	(Pg. 74)	c	
2.	(Pg. 69)	b	
3.	(Pg. 74)	c	4 hrs - 2 hrs - 30 mins - 30 mins
4.	(Pg. 75)	b	15 hrs ÷ (15 hrs + 10 hrs + 30 hrs + 3 hrs)
5.	(Pg. 80)	c	
6.	(Pg. 67)	d	
7.	(Pg. 77)	a	
8.	(Pg. 80)	d	
9.	(Pg. 57)	a	
10.	(Pg. 58)	d	

Demonstration Problem

$$\text{LTE ratio} = \frac{\text{Process time}}{\text{Process time + Move time + Wait time + Inspection time}}$$

$$\text{LTE ratio} = \frac{10}{10 + 2 + 35 + 3} = \underline{\underline{20 \text{ percent}}}$$

The ideal LTE ratio is 100 percent, and many world-class manufacturers have increased their ratios to as much as 60 percent and 70 percent. Move time, wait time, and inspection time are nonvalue-added activities that decrease the ratio. For Charleston Company, serious consideration must be given to reduction of the 35 hours of wait time, with the goal of completely eliminating the wait time, as well as the move time and the inspection time.

CHAPTER 3

ENABLING TECHNOLOGIES FOR MODERN MANUFACTURING ENVIRONMENTS

CHAPTER OVERVIEW

Chapter 3 explains for you the different types of information technology that modern organizations are using to help coordinate operations and improve performance. You will learn how integrated computer-based information systems (ICBISs) are developed, how material requirements planning (MRP) and manufacturing resource planning (MRP II) are used, and how electronic data interchange (EDI) is used to form metacorporations.

Review of Specific Chapter Objectives

1. Describe how integrated computer-based information systems (ICBISs) are developed (pgs. 92 -99).

   - **DEVELOPING AN ICBIS** involves two tasks: enterprisewide modeling and implementing a technology platform.

   - **Enterprisewide models** show all major entities of a company and the relationships between these entities. An entity relationship diagram (ERD) is used to construct these models. An entity in an ERD is a person, place, object, event, activity, process, or concept about which data are recorded. Relationships can be one-to-one (1:1), one-to-many (1:M), or many-to-many (M:N). Financial accounting entities include: general ledger entity, sales order entity, accounts receivable entity, accounts payable entity, purchase order entity, and payroll entity. Management accounting entities include: cost accounting entity, inventory entity, plant and equipment entity, performance measurements entity, and various analyses and reporting entities. Engineering and manufacturing entities include: master scheduling entity, material requirements planning entity, capacity planning requirements entity, and bill of materials entity.

   - **Implementing a technology platform** requires computer processors and their peripherals, local area networks (LANs), and bar code scanners. Computer processors include: mainframes, microcomputers, and minicomputers. Peripherals include: high-volume printers and magnetic disk packs for mainframes and minicomputers; and video disks, magnetic disks, touch screens, mice, graphical user interfaces, and hand-held wands for microcomputers. Local area networks (LANs) connect processors and their peripherals for processing within each major function

serviced by the ICBIS. Major functions include financial accounting, management accounting, engineering, and factory floor. Data are stored in **optical file cabinets** (composed of optical disks and optical cards that are read by a low-power laser beam and useful for the storage of documents over a long period of time). Bar code scanners, called readers, are optical and electronic devices that scan bar code symbols and output the bar-coded data in the form of electrical signals suitable for computer processing. There are **five generic types of bar code-reading equipment** currently in use: hand-held light wands; stationary fixed-beam scanners; stationary moving-beam scanners; hand-held lasers; and imaging array readers.

2. Explain how material requirements planning (MRP) and manufacturing resource planning (MRP II) are used to integrate and improve operations (pgs. 99 - 108).

   ▲ **Materials requirements planning (MRP)** is a materials scheduling procedure geared toward maintaining adequate inventory levels and having items available at the time of usage. The primary inputs are: bill of materials (BOM), which contains a listing of all the subassemblies, parts, and raw materials that are needed to produce one use of a finished product; a master schedule, which states the finished products to be produced, when they are needed, and what quantities are needed; and an inventory records file, which tells how much raw materials inventory is on hand and how long it will take to receive it from vendors or suppliers. MRP helps managers in **capacity requirements planning**, a process of determining short-term capacity requirements.

   ▲ **Manufacturing resource planning (MRP II)** expands MRP into a broader approach for planning and scheduling the enterprise's resources. A major purpose is to integrate all areas to focus on and to achieve the enterprise's goals. MRP is the main element of MRP II. MRP II can be used as a key tool for implementing and supporting just-in-time (JIT) manufacturing.

   ▲ **MRP II can help solve the following problems:**
   Materials shortages
   Poor quality: The vendor quality performance rating = (Number of parts passing inspection ÷ Number of parts inspected) X 100%.
   Poor customer service: The available-to-promise (ATP) quantity for the current week = (On-hand balance + Master schedule) - Booked orders
   Poor productivity

3. Show how electronic data interchange (EDI) is used to form metacorporations (pgs. 108 - 113).

   ▲ **Electronic data interchange (EDI)** is a computer-to-computer communications system that enables a number of business transactions to be conducted between companies

electronically.

- A **metacorporation,** or hypercorporation or virtual company, is a comprehensive economic entity that is held together by relationships supported by the enabling technology of EDI. There is virtually no paper flow between entity components.

- The **benefits of EDI** include:
  Survival
  Reduction in paperwork
  Cost savings
  Better integration
  Improved inventory control
  Increased automation

- Combining EDI and bar coding technologies enables companies to increase the accuracy and the speed of the data collection process.

- **Groupware** is a term that describes how information technology supports the team concept. Some groupware applications are: electronic calendars and scheduling systems; videoconferencing and screen sharing; electronic mail; electronic bulletin boards and FAX messaging; voice mail; and online, integrated databases. Groupware permits people to work together even though they are geographically separated.

CHAPTER SELF-TEST

Note: The notation (CO1) means that the question was drawn from chapter objective number one.

Matching

Please write the letters of the following terms in the spaces to the left of the definitions.

a. Available-to-promise (ATP)
b. Bar codes
c. Bill of materials (BOM)
d. Electronic data interchange (EDI)
e. Entity relationship diagram (ERD)
f. Groupware
g. Inventory records file
h. Manufacturing resource planning (MRP II)
i. Metacorporation
j. Quality performance ratio

_____ 1. (CO2) A listing of all subassemblies, parts, and raw materials needed to produce one unit of a finished product.

_____ 2. (CO2) The number of parts passing inspection divided by the number of parts inspected, multiplied by 100%.

_____ 3. (CO1) The modeling tool used to create an enterprisewide model of an organization.

_____ 4. (CO3) A computer-to-computer communications system that enables a number of business transactions, such as ordering, shipping, billing, and paying, to be conducted electronically between components.

_____ 5. (CO1) Letters, numbers, and special characters encoded into a series of parallel bars and space patterns.

_____ 6. (CO3) Information technology, including both hardware and software, that supports the team concept by enabling team members to interact with one another regardless of time and location.

_____ 7. (CO3) Virtual company.

_____ 8. (CO2) Tells how much raw materials inventory is on hand and how long it will take to receive more raw materials from suppliers.

_____ 9. (CO2) Expands MRP into a broader approach for planning and scheduling resources of the enterprise.

_____ 10. (CO2) (On-hand balance + Master schedule) - Booked orders.

Completion

Please write in the word or words which will complete the sentence.

1. (CO2) A vendor's quality rating is stored in the _____ _____ _____ in the MRP II database.

2. (CO1) The ICBIS uses three types of processors: _____, _____, and _____.

3. (CO2) Vendors should be selected on the basis of _____, _____, and _____.

4. (CO3) Electronic mail (E-mail) and voice mail are _____ applications.

5. (CO2) Many companies are unable to provide customers with accurate delivery dates because they do not have real-time access to _____ _____ at the time of the order.

6. (CO2) _____, not MRP II, is totally contrary to JIT management philosophy.

7. (CO1) Three major areas of technology used to implement an enterprisewide technology platform, based on the enterprisewide model of a manufacturing firm, are computer processors, _____ _____, and _____ _____ _____.

8. (CO1) Bar coding fully complements JIT and CIM by helping to reduce _____ and by improving _____ _____.

9. (CO2) Many companies spend more time and money on identifying _____ _____ than on any other problem.

10. (CO2) Incoming materials inspections are at odds with the _____ philsophy because such inspections are nonvalue-added activities and should be eliminated.

True-False Statements

Please circle "T" if the sentence is true and "F" if it is false.

T F 1. (CO2) The perfect quality rating for a vendor is 100 percent.

T F 2. (CO3) Metacorporations turn adversaries into partners.

T F 3. (CO2) MRP begins with a schedule for subassemblies, parts, and raw materials that is converted into a schedule of finished goods.

T F 4. (CO2) MRP II comes into conflict with JIT when it is used to support traditional batch manufacturing environments.

T F 5. (CO2) A company uses an MRP II system to rate vendors.

T F 6. (CO3) A metacorporation formed through EDI creates large amounts of paper flow between the various entities.

T F 7. (CO3) Groupware elements permit people to work together even though they are geographically separated.

T F 8. (CO2) Managers in a traditional environment may say, "We will have so much scrap; so let's plan on it." Thus, scrap is factored into MRP II.

T F 9. (CO1) Bar coding effectively eliminates the need for source documents.

T F 10. (CO2) The low-price vendor will always be the low-cost vendor.

Multiple Choice

Please circle the correct answer.

1. (CO2) Which of the following is a primary input of materials requirements planning (MRP)?
   a. Bar codes.
   b. Entity relationship diagram (ERD).
   c. Groupware.
   d. Master production schedule.

2. (CO2) Which of the following problems is typically solved with MRP II?
   a. Labor turnover.
   b. Materials shortages.
   c. Safety stocks.
   d. Scrap forecasting.

3. (CO3) Which of the following is a benefit of electronic data interchange (EDI)?
   a. Paperwork reduction.
   b. Reduced advertising costs.
   c. Improved safety.
   d. Scrap savings.

4. (CO3) A metacorporation links together a company and its:
   a. carriers.
   b. customers.
   c. suppliers and bankers.
   d. all of the above.

5. (CO1) In general terms, developing an integrated computer-based information system (ICBIS) entails two broad tasks. One is implementing a technology platform, and the other is:
   a. bar coding.
   b. enterprisewide modeling.
   c. inventory records filing.
   d. master production scheduling (MRP).

SOLUTIONS TO SELF-TEST

Note: The notation (Pg. 1) means that information about the question and its answer can be found on page 1 of your textbook.

Matching

1. (Pg. 99) c
2. (Pg. 104) j
3. (Pg. 92) e
4. (Pg. 108) d
5. (Pg. 97) b
6. (Pg. 111) f
7. (Pg. 108) i
8. (Pg. 99) g
9. (Pg. 101) h
10. (Pg. 106) a

Completion

1. (Pg. 104) vendor master file
2. (Pg. 95) mainframes, minicomputers, microcomputers
3. (Pg. 103) price, quality, delivery
4. (Pg. 111) groupware
5. (Pg. 105) available-to-promise (ATP) information
6. (Pg. 101) Scrap
7. (Pg. 95) local area networks (LANs), bar code scanners
8. (Pg. 99) waste, data integrity
9. (Pg. 103) material shortages
10. (Pg. 104) just-in-time (JIT)

True-False Statements

1. (Pg. 104) T
2. (Pg. 109) T
3. (Pg. 99) F MRP begins with a schedule for finished goods.
4. (Pg. 101) T
5. (Pg. 103) T
6. (Pg. 108) F Elimination of paper is a characteristic of metacorporations.
7. (Pg. 112) T
8. (Pg. 101) T
9. (Pg. 98) T
10. (Pg. 103) F The low-price vendor may not be the low-cost vendor if late deliveries and poor quality increase costs.

Multiple Choice

1. (Pg. 99) d
2. (Pg. 102) b
3. (Pg. 110) a
4. (Pg. 108) d
5. (Pg. 92) b

CHAPTER 4

BUILDING A FRAMEWORK FOR COST ACCOUNTING

CHAPTER OVERVIEW

Chapter 4 introduces you to manufacturing cost elements and how they flow through a production process. You will learn about the basic journal entries to record direct materials, direct labor, and overhead, as well as about necessary records and procedures for these elements. Two types of cost accounting systems will be described, as will three ways of measuring a product's cost.

Review of Specific Chapter Objectives

1. Understand how manufacturing cost elements flow through a production process, and describe the nine basic journal entries used to record these cost flows (pgs. 131 - 138).

   - There are **four manufacturing cost elements:** direct materials, direct labor, variable overhead, and fixed overhead.

   - In a traditional enterprise, there are **three inventories:** raw materials (RMI), work-in-process (WIP), and finished goods (FGI).

   - The **two traditional manufacturing systems** are: job order and process. A job order cost accounting system (CAS) is used in organizations in which products or services are readily identified by individual jobs, units, or projects. An example is building an apartment building. A process CAS is used by organizations in which products or services are mass produced in a continuous flow of production. An example is refining petroleum. A hybrid costing system is used in organizations that blend custom-order production and continuous-flow production. It is used when relatively large batches of homogeneous products are made.

   - The **nine basic journal entries** to record the flow of the manufacturing cost elements are:

     1. Purchase of raw materials
        Raw Materials Inventory
            Accounts Payable

     2. Recording paychecks
        Gross Wages
            Wages and Payroll Withholdings Payable

     3. Employer's payroll burden
        Gross Wages
            Employer's Payroll Burden Payable

4. Incurring other overhead costs
   WIP-Manufacturing Overhead (Utilities)
   WIP-Manufacturing Overhead (Depreciation)
        Utilities Payable
        Accumulated Depreciation (Factory Equipment)

5. Requisition of raw materials
   WIP-Product Cost (DM)
   WIP-Manufacturing Overhead (IM)
        Raw Materials Inventory

6. Distributing gross wages
   WIP-Product Cost (DL)
   WIP-Product Cost (IL)
        Gross Wages

7. Applying overhead
   WIP-Product Cost (Applied OH)
        WIP-Manufacturing Overhead

8. Cost of goods manufactured and transferred to finished goods inventory
   Finished Goods Inventory
        WIP-Product Cost

9. Cost of goods sold
   Cost of Goods Sold
        WIP-Product Cost

- When a **cost element is purchased,** its holding account is debited; the credit is to the account where the element "came from." When a **cost element is used,** its holding account is credited and WIP is debited.

- WIP is a **control account,** an account which contains two or more **subsidiary general ledger accounts.** The two subsidiary ledger accounts within WIP are an account for the cost of the product and an account for the indirect factory costs (overhead).

2. Describe the main records and procedures necessary to account for and control materials (pgs. 139 - 143).

- **Direct materials** can be conveniently and economically assigned to products manufactured or services rendered. Costs include the invoice price plus other costs paid to the vendor, such as shipping and sales tax. Material-related costs (purchasing costs, receiving costs, incoming inspection costs, storage and handling costs prior to production, and issuing costs for materials entering production) should be included in the cost.

- **Indirect materials** include items that are not physically identifiable with, or conveniently or economically traceable to, products or services. Examples are glue and lubricating oil.

- A **receiving report** is used to record the quantity count of materials which have arrived at the receiving dock.

- Traditional enterprises use **purchase orders**, which authorize the supplier to ship raw materials and bill the company upon their delivery. The original is sent to the supplier along with a copy to use as a **shipping advice**. Both of these documents are source documents necessary for payment within the cost accounting system. (An enterprise using EDI seeks to eliminate this paper flow.) A **receiving log** summarizes receiving reports and is the primary record for identifying missing documents. A **rejected material report** identifies material to be returned to the vendor.

- A **materials requisition** is a document that requests raw materials to be transferred from RMI to production. These documents are used for both direct and indirect materials.

- The **RMI account is a control account**; a record for each type of materials is maintained in a **materials subsidiary ledger**, also called a materials inventory master file.

3. Illustrate the records and procedures used to account for labor (pgs. 143 - 149).

- **Direct laborers** are production workers who work directly on the product or service.

- **Indirect laborers** do not work directly on making a product but provide some type of support service. Examples are custodians and security guards.

- Basic compensation, individual and group production efficiency bonuses, health insurance, and vacation pay are several of the costs included in direct and indirect labor. Payroll and human resource department costs are not usually treated as direct labor costs.

- There are **two basic kinds of withholdings** deducted from employee paychecks: mandatory (federal, state, and local income taxes, and Social Security taxes) and voluntary, such as union dues and health insurance.

- The **employer's payroll burden** also consists of two types of items: mandatory (federal and state unemployment taxes, local employment taxes, and Social Security taxes) and voluntary, such as vacation time and retirement plans.

- In traditional enterprises, the employer's payroll burden is included in overhead. In modern world-class manufacturing, however, most overhead costs result from the direct technology cost elements. If overhead is allocated using something other than labor hours worked on the product, then an incorrect amount of the employer's payroll burden would be included in the cost

of the product.

- A **key activity in accounting for payroll is timekeeping.** Timekeeping may be performed manually using clock cards (time cards) and time tickets, which are used primarily to assign direct labor to a specific product or charge indirect labor to overhead. In an automated system, direct labor hours are recorded by bar code scanners.

4. Explain why overhead costs are accumulated and then applied to products and services (pgs. 149 - 151).

- Overhead costs are indirect costs because they are either "common costs" or not important enough to account for on a direct basis.

- A **two-step approach** is used for indirect production costs. First, overhead costs are accumulated in a special subsidiary WIP account. Second, the grouped costs are allocated or applied to the product's cost according to a formula, usually involving an overhead rate based on direct labor costs, direct labor hours, or machine hours.

- The two-step approach gives rise to **two related problems.** First, the cost accounting system needs the most accurate overhead rate possible. Second, the cost accounting system needs an overhead allocation basis that is accurate enough for management cost control needs.

5. Relate the two types of cost accounting systems to the two types of manufacturing systems identified in Chapter 1, and to the three ways of measuring a product's cost (pgs. 151 - 156).

- An **actual cost system** uses the actual costs of direct materials, direct labor, and total overhead. It is unsatisfactory for managers who need current cost information in product pricing decisions. A total overhead actual overhead rate is computed by dividing total actual annual overhead cost by total actual annual direct labor hours (if labor hours are the basis for allocation).

- **More timely information** can be provided by using an estimated overhead rate. A total overhead predetermined overhead rate (TOH POR) can be computed by dividing total budgeted annual overhead cost by total budgeted annual direct labor hours (if labor hours are the basis for allocation).

- A **normal cost system** uses actual direct materials and direct labor costs with an estimated applied overhead amount.

- **Predetermined overhead rates** are used for **four purposes:**
  1. To calculate an appropriate amount of overhead to be included in the cost of products or services.
  2. To enable overhead allocation to be made in a

timely manner.
3. To provide timely product cost information for journal entries.
4. To normalize the overhead charge by smoothing out uncontrollable fluctuations in actual overhead costs.

- A debit to the **WIP-Manufacturing Overhead** account indicates actual overhead costs. A credit indicates overhead that has been applied. At the end of the accounting period, an overall debit balance in the account represents underapplied overhead; an overall credit balance represents overapplied overhead. The management accountant must dispose of any existing balance in the account at the end of the accounting period. If the balance is insignificant, then it is closed to the cost of goods sold account. If the balance is significant, then it should be prorated among work-in-process inventory, finished goods inventory, and cost of goods sold.

- Normal cost systems have evolved into **standard cost systems**, in which budgeted rates and quantities are used to cost products for all cost elements, not just manufacturing overhead. It uses a budgeted (standard) rate or price (SP) times only the amount of each input that should have been used (SQA). An advantage is that cost variances (problems) can be identified and reported to management.

CHAPTER SELF-TEST

Note: The notation (CO1) means that the question was drawn from chapter objective number one.

Matching

Please write the letters of the following terms in the spaces to the left of the definitions.

a. Actual costing
b. Applied overhead
c. Hybrid cost accounting system
d. Job order cost accounting system (JOCAS)
e. Materials requisition
f. Materials subsidiary ledger
g. Normal costing
h. Overapplied overhead
i. Process cost accounting system (PCAS)
j. Purchase order
k. Receiving log
l. Standard cost accounting system (SCAS)
m. Time tickets
n. Total overhead (TOH)
o. Underapplied overhead

_____ 1. (CO2) Materials inventory master file.

_____ 2. (CO3) Used for assigning labor to a specific department, job, or overhead.

_____ 3. (CO1) The amount of overhead allocated to a product's cost.

_____ 4. (CO5) The amount by which the total actual overhead exceeds the applied overhead.

_____ 5. (CO1) A cost accounting system used in organizations in which products are produced in a continuous flow.

_____ 6. (CO5) A cost measurement method that bases a product's cost on the actual cost (AP x AQ) of all manufacturing cost elements.

_____ 7. (CO5) A cost measurement method that bases a product's cost on the actual cost (AP x AQ) of direct materials and direct labor but uses an estimated amount of applied overhead (POR x AQ).

_____ 8. (CO2) Authorizes materials to be transferred from raw materials inventory to work-in-process inventory.

_____ 9. (CO2) Summarizes receiving reports and is the primary record for identifying missing documents.

_____ 10. (CO5) The amount by which the total applied overhead exceeds the actual overhead.

_____ 11. (CO2) Authorizes the purchase and shipment of raw materials, specifying all the terms and conditions of the order.

_____ 12. (CO4) The combination of variable and fixed overhead within one general ledger account.

_____ 13. (CO5) Used in organizations in which products or services are readily identified by individual jobs, units, or products.

_____ 14. (CO5) Uses standard costs (SP x SQA) for all cost elements to measure the cost of the product.

_____ 15. (CO1) A CAS that combines the characteristics of a JOCAS and a PCAS.

Completion

Please write in the word or words which will complete the sentence.

1. (CO4) If a cost can be easily traced to a product or service using source documents such as material requisitions and time tickets, then it is a _____ cost.

2. (CO2) Indirect materials typically include items such as _____, _____, and _____.

3. (CO5) Most companies close out the underapplied or overapplied overhead to the cost of goods sold account. This approach offers the advantages of _____ and _____.

4. (CO1) The four manufacturing cost elements are _____ _____, _____ _____, _____ _____, and _____ _____.

5. (CO2) Direct materials include the invoice price plus other costs such as _____, _____, _____, and _____ and _____ (net of return refunds).

6. (CO2) A requisition for indirect materials is identical to one for direct materials except that it shows an _____ _____ number instead of a _____ _____ number or department name.

7. (CO1) When applying overhead, the account _____ is debited, and the account _____ is credited.

8. (CO1) When a product is completed, the management accountant debits _____ _____ _____ and credits _____.

9. (CO2) The _____ _____ and the _____ _____ are the source documents necessary for payment within the cost accounting system.

10. (CO5) If the amount of under- or overapplied overhead is significant, then the balance should be prorated among the following accounts: _____ _____, _____ _____ _____, and _____.

True-False Statements

Please circle "T" if the sentence is true and "F" if it is false.

T F 1. (CO1) Some managers regard overhead as a big "glob" of costs, or a "black hole," that swallows up everything.

T F 2. (CO1) When partially finished goods are completed, the journal entry to record this fact requires a debit to Finished Goods Inventory and a credit to WIP-Product Cost.

T F 3. (CO5) A significant difference between actual overhead costs and applied overhead costs signals a problem to management.

T F 4. (CO5) The proration approach to overapplied and underapplied costs applies overhead costs to where they would have gone in the first place had the predetermined overhead rate been totally accurate.

T F 5. (CO1) When a manufactured product is sold, it is removed from Finished Goods Inventory and added to Manufacturing Overhead.

T F 6. (CO2) When indirect materials are requisitioned, the journal entry requires a debit to WIP-Product Cost and a credit to Raw Materials Inventory.

T F 7. (CO2) When accounting for materials, the debit balance in each inventory account in the materials inventory master file represents the updated balance at any time during the year, thus eliminating the need for periodic physical counts.

T F 8. (CO5) When overhead is overapplied and the remaining balance is considered insignificant, the journal entry to close the overhead account requires a debit to Cost of Goods Sold.

T F 9. (CO2) If the overhead account has an overall credit balance, then overhead has been overapplied.

T F 10. (CO3) In an automated setting, time clocks, clock cards, and time tickets are eliminated; direct labor hours are recorded by bar code scanners; and the collection of data in the accounting procedure eliminates the flow of paper.

Multiple Choice

Please circle the correct answer.

1. (CO3) Which of the following is not withheld from an employee's paycheck?
   a. Federal income taxes.
   b. Social Security taxes.
   c. State income taxes.
   d. Unemployment taxes.

2. (CO3) Which of the following is a voluntary employer-paid payroll cost?
   a. Federal income taxes.
   b. Social Security taxes.
   c. Vacation time.
   d. Union dues.

3. (CO5) A standard cost accounting system (SCAS) uses which of the following cost measurements?
   a. AP x AQ.
   b. POR x AQ.
   c. SP x SQA.
   d. SP x AQ.

4. (CO3) Which of the following is considered part of direct labor costs?
   a. Company-sponsored cafeteria.
   b. Recreational facilities.
   c. Safety-related items.
   d. Vacation pay.

5. (CO5) What is the predetermined overhead rate for total overhead, based on direct labor hours, if total budgeted direct labor is $650,000; total budgeted annual overhead cost is $1,500,000; and the average pay for direct labor is $20 per hour?
   a. $ .43/DLHr.
   b. $ 2.31/DLHr.
   c. $ 8.67/DLHr.
   d. $46.15/DLHr.

6. (CO5) Which of the following is a purpose of predetermined overhead rates (PORs)?
   a. To decide whether to make or buy certain components.
   b. To enable overhead allocation to be made in a timely manner, rather than waiting until total actual overhead costs and hours worked become known at the end of the year.
   c. To facilitate continuous improvement.
   d. To value inventory for taxation.

7. (CO4) Indirect production costs include indirect materials, indirect labor, and other overhead items. Examples of other overhead items include:
   a. glue, nails, and welding rods.
   b. maintenance, supervision, and clerical work.
   c. inspections and materials handling.
   d. depreciation, rent, insurance, taxes, and utilities.

8. (CO1) With a just-in-time (JIT) system, the product may go from the supplier to:
   a. work-in-process inventory to the customer.
   b. work-in-process inventory to finished goods inventory to the customer.
   c. raw materials inventory to work-in-process inventory to finished goods inventory to the customer.
   d. raw materials inventory to work-in-process inventory to the customer.

9. (CO1) How many basic journal entries are used within the cost accounting system (CAS) framework?
   a. Ten.
   b. Nine.
   c. Eight.
   d. Seven.

10. (CO5) When the overall balance in the overhead account at the end of the accounting period is insignificant, it is:
   a. closed to Cost of Goods Sold.
   b. prorated between Finished Goods Inventory and Cost of Goods Sold.
   c. prorated among Raw Materials Inventory, Work-in-Process Inventory, and Finished Goods Inventory.
   d. prorated among Work-in-Process Inventory, Finished Goods Inventory, and Cost of Goods Sold.

Demonstration Problem

Please record in general journal entry form the following events for Jacobs Corporation:

1. Purchased $100,000 of raw materials on account.
2. Paid $175,000 for factory labor.
3. Recorded the employer's payroll burden of $60,000.
4. Incurred the following overhead costs: $20,000 of utilities, $40,000 of factory rent, and $70,000 of depreciation.
5. Issued $50,000 of direct materials and $10,000 of indirect materials into production.
6. Distributed gross wages as follows: $125,000 of direct labor and $50,000 of indirect labor.
7. Applied $200,000 of manufacturing overhead.
8. Completed goods costing $350,000 and transferred them to finished goods inventory.
9. Sold $275,000 of finished goods.
10. Closed the overhead account. The balance is considered to be insignificant.

Account Titles	Debit	Credit

SOLUTIONS TO SELF-TEST

Note: The notation (Pg. 1) means that information about the question and its answer can be found on page 1 of your textbook.

Matching

1. (Pg. 142) f
2. (Pg. 148) m
3. (Pg. 135) b
4. (Pg. 153) o
5. (Pg. 131) i
6. (Pg. 152) a
7. (Pg. 152) g
8. (Pg. 141) e
9. (Pg. 140) k
10. (Pg. 153) h
11. (Pg. 139) j
12. (Pg. 150) n
13. (Pg. 151) d
14. (Pg. 155) l
15. (Pg. 131) c

Completion

1. (Pg. 149) direct
2. (Pg. 139) staples, nails, glue
3. (Pg. 155) simplicity, expediency
4. (Pg. 132) direct materials, direct labor, variable overhead, fixed overhead
5. (Pg. 139) delivery, sales tax, duty, containers, pallets
6. (Pg. 141) overhead account, job order
7. (Pg. 135) WIP-Product Cost (Applied Overhead), WIP-Manufacturing Overhead
8. (Pg. 136) Finished Goods Inventory, WIP-Product Cost
9. (Pg. 140) purchase order, receiving report
10. (Pg. 154) WIP Inventory, Finished Goods Inventory, Cost of Goods Sold

True-False Statements

1. (Pg. 129) T
2. (Pg. 136) T
3. (Pg. 155) T
4. (Pg. 155) T
5. (Pg. 136) F It is added to Cost of Goods Sold.
6. (Pg. 134) F The debit is to WIP-Manufacturing Overhead.
7. (Pg. 143) F Physical counts are still necessary to adjust the perpetual records.
8. (Pg. 153) F Cost of Goods Sold will be credited.
9. (Pg. 153) T
10. (Pg. 149) T

Multiple Choice

1. (Pg. 144) d
2. (Pg. 146) c
3. (Pg. 156) c
4. (Pg. 144) d
5. (Pg. 152) d $1,500,000 ÷ ($650,0000 ÷ $20)
6. (Pg. 153) b

7. (Pg. 150) d
8. (Pg. 136) a
9. (Pg. 131) b
10. (Pg. 154) a

Demonstration Problem

1.	Raw Materials Inventory	100,000	
	Accounts Payable		100,000
2.	Gross Wages	175,000	
	Wages and Payroll Withholdings Payable		175,000
3.	Gross Wages	60,000	
	Employer's Payroll Burden Payable		60,000
4.	WIP-Manufacturing Overhead (Utilities)	20,000	
	WIP-Manufacturing Overhead (Rent)	40,000	
	WIP-Manufacturing Overhead (Depreciation)	70,000	
	Utilities Payable		20,000
	Cash		40,000
	Accumulated Depreciation-Factory Equip.		70,000
5.	WIP-Product Cost (DM)	50,000	
	WIP-Manufacturing Overhead (IM)	10,000	
	Raw Materials Inventory		60,000
6.	WIP-Product Cost (DL)	125,000	
	WIP-Manufacturing Overhead (IL)	50,000	
	Gross Wages		175,000
7.	WIP-Product Cost (Applied OH)	200,000	
	WIP-Manufacturing Overhead		200,000
8.	Finished Goods Inventory	350,000	
	WIP-Product Cost		350,000
9.	Cost of Goods Sold	275,000	
	Finished Goods Inventory		275,000
10.	WIP-Manufacturing Overhead	10,000	
	Cost of Goods Sold		10,000

CHAPTER 5

THE JOB ORDER COST ACCOUNTING SYSTEM

CHAPTER OVERVIEW

Chapter 5 introduces you to the job order cost accounting system. You will learn how to design such a system and to prepare journal entries for it. You will also learn how to account for scrap, reworked units, and spoilage. The use of an integrated computer-based information system (ICBIS) to support a job order cost accounting system will be discussed, and you will learn how costs are estimated for construction projects.

Review of Specific Chapter Objectives

1. Explain how to design a job order cost accounting system (JOCAS) (pgs. 171 -174).

   - **A job is an individual product, a small and unique batch of products, a project, a case, or a client.** Its distinguishing characteristic is that materials and labor can be directly traced to it, along with the basis used to allocate overhead. The basic purpose of a job order cost accounting system (JOCAS) is to provide information about the cost of a job.

   - A **world-class JOCAS** provides vital information to management for planning and estimating, monitoring and controlling daily shop floor operations, and evaluating performance.

   - **Three main information inputs** to the JOCAS are: materials requisitions, time tickets, and information on the volume of the predetermined overhead rate's basis. The latter input indicates that this type of JOCAS is a normal JOCAS, not an actual or standard cost accounting system.

   - **The key record that details the costs of each job is the job cost sheet.** A job cost sheet, or job order cost record, is used to accumulate and summarize all direct materials, direct labor, and applied overhead costs for each job order.

   - The WIP general ledger account remains a **control account,** while each job and overhead are accounted for as separate WIP **subsidiary ledger accounts.** The subsidiary ledger accounts are periodically reconciled to the control account to help ensure the proper recording of costs. The job cost sheet serves as the source record for the WIP subsidiary ledger accounts.

   - Completed job cost sheets are useful for planning and control purposes as well as for bidding on future jobs.

2. Illustrate the cost flows and prepare journal entries for a normal JOCAS (pgs. 174 - 182).

- **There is one major difference between journal entries in a basic CAS and a JOCAS.** The basic CAS uses a WIP-Product Cost account, while a JOCAS uses a WIP-Job # account for each job. Therefore, the journal entry to record the issuance of raw materials into production is:
  WIP-Job 101 (DM)
  WIP-Manufacturing Overhead (IM)
  Raw Materials Inventory

- The same will be true for the use of factory labor:
  WIP-Job 101 (DL)
  WIP-Manufacturing Overhead (IL)
  Gross Wages

- **There is no difference between a basic CAS and a JOCAS** in accounting for the incurrence of overhead costs. When overhead is applied, however, the following entry is required:
  WIP-JOB 101 (Applied OH)
  WIP-Manufacturing Overhead

- When Job 101 is completed, the following entry is required:
  Finished Goods Inventory-Job 101
  WIP-Job 101

  When Job 101 is sold, the following entry is required:
  Cost of Goods Sold-Job 101
  Finished Goods Inventory-Job 101

  Please note that in both these journal entries, FGI and COGS have subsidiary accounts to track which jobs have been completed and sold. Not all JOCASs follow this procedure.

- **Nonmanufacturing costs are expenses on the income statement.**

- There are **two common uses of spreadsheet software in JOCASs:** Programs can be created for journal entries, and WIP summary reports can be created to show the costs incurred on each job.

3. Demonstrate how to account for scrap, reworked units, and spoilage in a normal JOCAS (pgs. 182 - 189).

- **SCRAP represents fragments of material removed during the production or construction process.** It is sometimes collected, inventoried, and either reused or sold to scrap dealers. Scrap reports should be prepared and reported daily.

- The following journal entry removes the net realizable value of the scrap from the job's cost in WIP:

  RMI-Scrap Material
  WIP-Job 101

When the scrap is sold, the following entry is required:

Cash (or Accounts Receivable)
    RMI-Scrap Material

Proponents of this method argue that it is appropriate because to leave scrap in the job is to overstate the job's cost, thus understating its profitability.

▲ **Occasionally, no entry is made until the scrap is sold.** Then the following entry is made:

Cash (or Accounts Receivable)
    Scrap Sales

JIT proponents favor this method because it includes the cost of scrap in every job. By including it thus, management will be better aware of the costs of scrap.

▲ Management accountants should construct an effective scrap performance measurement system to keep scrap to a minimum, eliminate it entirely, or convert it to a profitable joint product. The key to reducing scrap and managing costs of scrap is timely scrap reports and performance measurements.

▲ **REWORKED UNITS are defective products that are fixed so that they can be sold as acceptable finished units through regular marketing channels.** Rework should be done only if incremental revenue is expected to exceed incremental costs.

▲ **Reasons for defective units include:**
Low-quality raw materials
Faulty and poorly maintained machinery
Poor workmanship
Inadequate training and poor supervision
Outdated methods and processes

▲ **Traditional manufacturing firms expect some level of rework.** Management believes that rework is common to all jobs; thus, rework costs are charged to the overhead account. If DM, DL, and OH are required in the rework, then the following journal entry is required:

WIP-Manufacturing Overhead (Rework)
    RMI
    Gross Wages
    WIP-Manufacturing Overhead

This method has the potentially serious problem of burying rework costs with other overhead items in the overhead account.

▲ **If rework is associated with a special order, then rework costs are chargeable to the job and billable to the customer.**

- **SPOILAGE refers to the rejection of a job or specific products within a job.** A spoiled job or unit is so defective that it is not reworked to bring it up to specifications. In a JOCAS, the treatment of spoilage is basically the same as for rework.

- **If normal spoilage is expected on all jobs, then the budgeted overhead includes an amount for it.** The following journal entry accounts for normal spoilage costs:

  WIP-Manufacturing Overhead (Spoilage)
  WIP-Job 101

- **If normal spoilage is caused by a specific job, then its estimated cost should not be included in the POR.** It will remain with the specific job's cost.

- **Abnormal spoilage is the amount of spoilage in excess of the expected level of spoilage.** It is treated as an expense of the current accounting period. The following entry shows this treatment:

  WIP-Manufacturing Overhead (Spoilage)
  Loss from Abnormal Spoilage
  WIP-Job 101

- **For a WCM, the cost of all rework and spoilage has to be measured and identified, and reported by the JOCAS.** Job cost reports are expanded to include budget and cost variance information about the job. Since rework and spoilage are left in the job, their costs are easily identified for immediate management attention.

4. Describe how an integrated computer-based information system (ICBIS) can support a JOCAS (pgs. 189 - 192).

- **The key to acquiring the best job order cost accounting software system is to match the needs of the enterprise with the capabilities of the software package.**

- **Software should have the following features:**
  User-friendly: It should be simple enough so that it will not overwhelm the average user.
  Internal controls: It should have controls, such as input, processing, output, and database controls.
  Flexibility: It should allow each job to be set up according to the work ordered by the customer.
  Break down by work areas: It should be able to break down a job into departments, workcenters, or cells.
  Integration: It should be easily integrated with other accounting tasks.
  WIP reporting: WIP reports keep management abreast of progress on jobs and can show at an early date when costs are getting out of control.
  Prebilling data: This allows management to review data before customer invoices are prepared and mailed.
  Job scheduling: This provides information on items such

as start and due dates and percent completion.
Job profitability: This feature computes costs incurred and profit margin for each job.
New-job estimating: This feature provides cost information that aids management in bidding for new jobs.

5. Discuss how costs are estimated for construction projects and how work item software is used (pgs. 192 -202).

▲ **Management has three fundamental decision-making functions: planning, monitoring and controlling daily operations, and performance evaluation.** Budgeting is the key to operations control and performance evaluation and is a critical skill for the management accountant.

▲ **Estimating construction skills requires three elements:**
Bid price = Target profit + Estimated costs

The bid price is the amount of money the owner must pay the general contractor to build the project. Cost estimates may be divided into at least two different types: preliminary cost estimates (ballpark estimates of what the costs could be to build the project, including the target profit) and detailed cost estimates (which determine costs for each cost element involved, contingencies, and target profit).

▲ The following equation can be used for **weighting cost data from previous projects:**

$$UC = \frac{A + 4B + C}{6}$$

UC = estimated unit cost
A = minimum unit cost of previous projects
B = average unit cost of previous projects
C = maximum unit cost of previous projects

▲ **Target profit must be adjusted for time, location, and size before it can be added to the preliminary cost estimate.**

1. The adjustment for time differences should represent the relative increase or decrease in costs due to factors such as labor rates and material costs. The change in value of an index between any two years can be used to calculate an equivalent compound interest rate by simply dividing the current year's index by a prior year's index.
2. The adjustment for location represents the relative difference in costs of materials, labor, and equipment with respect to the two locations. For example, a project was completed in City A at a cost of $200,000; City A has an index of 1,000. To estimate the cost of a similar project in City B, with an index of 1,015, the following equation is used:

$$\text{Estimated project cost} = \frac{1{,}015}{1{,}000} \times \$200{,}000$$

3. The adjustment for size is a simple ratio of the size of the proposed project to the size of the previous project. For example, if project A consisted of 60,000 square feet with a cost of $2,500,000, and the size of a proposed project is 80,000 square feet, then the following equation is used:

$$\text{Est. project cost} = \frac{80{,}000 \text{ sq. ft}}{60{,}000 \text{ sq. ft.}} \times \$2{,}500{,}000$$

▲ There are **eleven steps in preparing a detailed cost estimate:**

1. Review the scope of the project.
2. Review all bidding requirements, technical specifications, and conditions of the contract.
3. Prepare a checklist of all work items necessary.
4. Determine material quantities (extremely important because they often establish the quantities and costs for direct labor and equipment).
5. Estimate labor costs. The following equation is used:

$$\text{DL cost} = \frac{\text{Quantity}}{\text{Direct labor production rate} \times \text{DL rate}}$$

6. Estimate equipment costs. The following equation is used:

$$\text{Equip. costs} = \frac{\text{Quantity}}{\text{Equip. production rate} \times \text{Equip. rate}}$$

7. Obtain subcontractors' bids.
8. Estimate overhead costs. Project overhead includes costs that can be directly traced to a project, while general overhead is the percentage share of the costs incurred at the central office of the general contractor.
9. Estimate contingency costs.
10. Determine insurance and bond costs.
11. Determine the target profit.

▲ There are **two basic approaches for organizing work items for estimating:** the work breakdown structure (WBS), which identifies work items by their locations on a project, and the Construction Specification Institute (CSI) division of work items.

▲ Preparing cost estimates and bids is greatly facilitated by the use of computers and electronic spreadsheets. A work item software package, based on WBS or CSI, is an ideal tool for preparing cost estimates.

CHAPTER SELF-TEST

Note: The notation (CO1) means that the question was drawn from chapter objective number one.

Matching

Please write the letters of the following terms in the spaces to the left of the definitions.

a. Abnormal spoilage
b. Bid price
c. Detailed cost estimate
d. Direct labor cost
e. Job
f. Job cost sheet
g. Normal spoilage
h. Preliminary cost estimate
i. Rework
j. Scrap
k. Spoilage

_____ 1. (CO5) Target profit plus estimated costs.

_____ 2. (CO3) Rejected job or units within a job.

_____ 3. (CO5) A ballpark estimate.

_____ 4. (CO5) Usually prepared from a complete set of blueprints, technical specifications, and contract documents.

_____ 5. (CO5) (Quantity ÷ DL production rate) x DL rate.

_____ 6. (CO3) Rejected products that are expected, and budgeted for, under present conditions.

_____ 7. (CO3) Defective units that are fixed and sold as acceptable finished units.

_____ 8. (CO3) Fragments of material removed during production.

_____ 9. (CO1) An individual product, a small and unique batch of products, a project, a case, or a client.

_____ 10. (CO5) Amount of spoilage in excess of the expected level of spoilage.

_____ 11. (CO1) Subsidiary ledger accounts in WIP for product costs.

Completion

Please write in the word or words which will complete the sentence.

1. (CO1) A JOCAS has three main informational inputs: _____, _____, _____, and _____ information on the volume of the POR's basis.

2. (CO1) In a JOCAS, each job order is assigned a _____ _____ _____ to keep track of jobs and their costs as they progress toward completion.

3. (CO1) If a job's product is shipped directly or sold to the customer upon completion, then there is no _____ _____ _____ and the debit in the journal entry is to _____.

4. (CO2) If Job #5 is completed and transferred to the warehouse, then the journal entry would be a debit to _____ _____ _____ and a credit to _____.

5. (CO3) _____ should be done only if incremental revenue is expected to exceed incremental costs.

6. (CO3) In _____ manufacturing firms, management expects some level of rework within all the jobs.

7. (CO3) A _____ _____ _____ _____ is so defective that it is not reworked to bring it up to specifications.

8. (CO1) The key record that details the costs of each job is the _____ _____ _____.

9. (CO2) Nonmanufacturing costs appear as _____ on the company's _____ _____.

10. (CO4) JOCAS software should have the following features: _____, _____, _____, _____, and _____.

True-False Statements

Please circle "T" if the sentence is true and "F" if it is false.

T F 1. (CO1) The JOCAS's WIP general ledger account balance equals the sum of all actual manufacturing costs incurred.

T F 2. (CO1) In many JOCASs, the job cost sheet is the subsidiary ledger sheet.

T F 3. (CO2) Gemstones, Inc., budgeted a POR of $17 per machine hour. If 2,300 machine hours occurred on Job #3 and 1,700 hours occurred on Job #4 during June, then the applied overhead credited to WIP was $39,100 for Job #3 and $28,900 for Job #4.

T F 4. (CO2) Property taxes, rent, utilities, supervisor salaries, and insurance for the administrative and sales offices are charged to factory overhead.

T F 5. (CO2) A common application of spreadsheet software is in creating WIP summary reports showing the costs incurred on each job.

T F 6. (CO3) When the quantity and value of scrap are relatively high, often no entry is made until the scrap is sold. At that time, Cash or Accounts Receivable is debited, and Scrap Sales is credited.

T F 7. (CO3) JIT proponents argue that scrap is a nonvalue-added cost and that the production process should be changed to eliminate it.

T F 8. (CO3) WCM manufacturers bury the costs of rework and spoilage in overhead or in an isolated expense account.

T F 9. (CO3) Abnormal spoilage should be included in the WIP-Manufacturing Overhead (Spoilage) account.

T F 10. (CO2) There is no difference between journal entries in a basic CAS and in a JOCAS.

Multiple Choice

Please circle the correct answer.

1. (CO5) Before a target profit can be added to the preliminary cost estimate, it needs to be adjusted for:
   a. time.
   b. location.
   c. size.
   d. all of the above.

2. (CO3) Which of the following statements is true concerning world-class manufacturers?
   a. Normal spoilage is expected on all jobs.
   b. Spoilage is kept in the job until it is completed and sold.
   c. Abnormal spoilage costs are written off (debited) to a loss account.
   d. Rework and spoilage costs are spread evenly throughout the year to all jobs.

3. (CO2) If a company uses a JOCAS, then which of the following will be used to record factory equipment depreciation?
   a. A debit to Depreciation Expense.
   b. A debit to Accumulated Depreciation.
   c. A debit to WIP-Job #.
   d. A debit to WIP-Manufacturing Overhead (Depreciation).

4. (CO2) If a company uses a JOCAS, then which of the following will be used to allocate overhead?
   a. A debit to WIP-Manufacturing Overhead.
   b. A credit to WIP-Manufacturing Overhead.
   c. A credit to WIP-Job #.
   d. A credit to WIP-Product Cost.

5. (CO3) In a traditional manufacturing firm using a JOCAS, when rework (considered normal) is done on defective units, the journal entry to record the rework requires a:
   a. debit to Raw Materials Inventory.
   b. debit to WIP-Job #.
   c. debit to Gross Wages.
   d. debit to WIP-Manufacturing Overhead (Rework).

6. (CO3) In a traditional manufacturing firm using a JOCAS, which of the following is required to account for actual normal spoilage on a job?
   a. A credit to WIP-Manufacturing Overhead (Spoilage).
   b. A credit to WIP-Product Cost.
   c. A debit to WIP-Manufacturing Overhead (Spoilage).
   d. A debit to WIP-Job #.

7. (CO5) A utility company must have 3,000 meters read for the billing period. A meter reader can cover 15 meters in an hour. The direct labor rate for meter readers is $12 per hour. What is the estimated direct labor cost?
   a. $ 2,400.
   b. $ 3,750.
   c. $36,000.
   d. $45,000.

8. (CO5) A contractor needs to fill an area with 60,000 cubic yards of dirt. A tractor can fill 15 cubic yards of dirt per hour, and the cost to operate the tractor is $30 per hour. What is the estimated equipment cost for this work item?
   a. $1,800,000.
   b. $ 900,000.
   c. $ 120,000.
   d. $ 30,000.

9. (CO5) What is the estimated unit cost for constructing a 30-stall barn for horses if data from 10 previously constructed barns show an average of $499.80 per stall, with the maximum cost per stall being $550 and the minimum cost per stall being $400?
   a. $14,994.00.
   b. $14,745.80.
   c. $14,498.00.
   d. $14,250.00.

10. (CO5) What is the estimated cost of a project two years from now if a $216,250 project completed last year is used to prepare the estimate and the compound interest rate is 1.83%?
   a. $228,341.
   b. $224,237.
   c. $220,207.
   d. $118,169.

Demonstration Problems

1. (CO5) What should be the cost of a proposed project in City B if data are used from a $2,761,400 project completed in City E? Please use the following exhibit:

Location Indices for Construction Costs

Location	Index
City A	1.015
City B	1.120
City C	1.210
City D	1.135
City E	1.140

2. (CO5) Please adjust the preliminary cost estimate for a proposed baseball stadium that seats 7,000, using a previous project for a baseball stadium seating 20,000 at a cost of $30,000,000.

SOLUTIONS TO SELF-TEST

Note: The notation (Pg. 1) means that information about the question and its answer can be found on page 1 of your textbook.

Matching

1. (Pg. 193) b
2. (Pg. 185) k
3. (Pg. 194) h
4. (Pg. 196) c
5. (Pg. 197) d
6. (Pg. 185) g
7. (Pg. 183) i
8. (Pg. 182) j
9. (Pg. 171) e
10. (Pg. 188) a
11. (Pg. 171) f

Completion

1. (Pg. 171) materials requisitions, time tickets
2. (Pg. 172) unique job number
3. (Pg. 173) finished goods inventory, Cost of Goods Sold
4. (Pg. 180) Finished Goods Inventory-Job #5, WIP-Job #5
5. (Pg. 183) Rework
6. (Pg. 184) traditional
7. (Pg. 185) spoiled job or unit
8. (Pg. 171) job cost sheet
9. (Pg. 180) expenses, income statement
10. (Pg. 189) user-friendly, internal controls, flexibility, break down by work areas, integration, WIP reporting, prebilling data, job scheduling, job profitability, new-job estimating

True-False

1. (Pg. 171) T
2. (Pg. 173) T
3. (Pg. 178) F — The numbers are correct, but the statement should say "debited to WIP."
4. (Pg. 180) F — These costs appear as expenses on the income statement.
5. (Pg. 182) T
6. (Pg. 183) F — A journal entry removes the market value of the scrap from the job's cost and puts it into RMI-Scrap Material. When the scrap is sold, Cash or Accounts Receivable is debited and RMI-Scrap Material is credited.
7. (Pg. 183) T
8. (Pg. 188) F — WCMs specifically identify, measure, and report the cost of all rework and spoilage.
9. (Pg. 188) F — It appears as an expense of the current period.
10. (Pg. 176) F — A basic CAS uses a WIP-Product Cost account, while a JOCAS uses a WIP-Job # account.

Multiple Choice

1. (Pg. 195) d
2. (Pg. 188) b
3. (Pg. 177) d
4. (Pg. 178) b
5. (Pg. 184) d
6. (Pg. 185) c
7. (Pg. 197) a
8. (Pg. 198) c
9. (Pg. 194) b UC = [$400 + 4($499.80) + $550] ÷ 6 = $491.53 per stall
   PCE = $491.53 x 30 stalls = $14,745.90
10. (Pg. 195) a $216,250 x $(1 + 0.0183)^3$ = $228,341

Demonstration Problems

1. Est. project cost = $2,761,400 x (Proposed city ÷ Base city)
   Est. project cost = $2,761,400 x (1.120 ÷ 1.140) =
   $2,712,954

2. Est. project cost = $30,000,000 x (Proposed size ÷ Base size)
   Est. project cost = $30,000,000 x (7,000 ÷ 20,000) =
   $10,500,000

CHAPTER 6

THE PROCESS COST ACCOUNTING SYSTEM

CHAPTER OVERVIEW

Chapter 6 introduces you to process cost accounting and the journal entries necessary to record events in such a system. Equivalent units of production (EUP) will be explained for each cost element and for spoilage. You will learn the six-step approach to departmental cost accounting and will be shown the differences in calculating product costs depending on whether the FIFO or the weighted-average method is used.

Review of Specific Chapter Objectives

1. Describe the flow of products and their cost elements through continuous processing systems, and prepare the journal entries to record these events (pgs. 222 - 227).

   - **Process cost accounting systems (PCASs) are used in mass production environments where homogeneous products flow continuously through processes (departments).** Examples are beer, cement, and flour. Product costs are accumulated within each process (or department) and transferred with the goods from process to process (or department to department). The PCAS objective is to determine the departmental costs of products so that these costs can be combined to yield the total COGM.

   - Perpetual inventory systems with subsidiary ledgers for RMI, WIP, and FGI are used. The WIP subsidiary ledgers are created for each process or department.

   - **Unit cost is computed by dividing total department costs by total units produced.** A department production cost report is used to provide a summary of the number of units moving through the department during the period along with their unit costs.

   - There are **two basic configurations for process production flows.** In a sequential configuration, products flow from one processing department to another in a serial fashion. In a parallel configuration, two or more products go through two or more processing departments or centers. These processes may be carried out simultaneously, or one may run for a while, and then another starts.

   - **The journal entries to record events in a PCAS follow:**

     1. Purchase of raw materials
        Raw Materials Inventory
            Accounts Payable

     2. Recording paychecks
        Gross Wages
            Wages and Payroll Withholdings Payable

3. Employer's payroll burden
   Gross Wages
   Employer's Payroll Burden Payable

4. Incurring other overhead costs
   WIP-Manufacturing Overhead (Utilities)
   Utilities Payable

5. Requisition of raw materials
   WIP-Department 1 (DM)
   WIP-Manufacturing Overhead (IM)
   Raw Materials Inventory

6. Distributing gross wages
   WIP-Department 1 (DL)
   WIP-Manufacturing Overhead (IL)
   Gross Wages

7. Applying overhead
   WIP-Department 1 (Applied Overhead)
   WIP-Manufacturing Overhead

8. WIP transfer from Department 1 to Department 2
   WIP-Department 2 (DM from Dept. 1)
   WIP-Department 1

9. Products completed
   Finished Goods Inventory
   WIP-Department 2

10. Products sold
    Cost of Goods Sold
    Finished Goods Inventory

▲ The **only fundamental difference in assigning product costs between a PCAS and a JOCAS** is that WIP subsidiary accounts are departments, not jobs.

2. Explain equivalent units of production (EUP), and calculate EUP for each cost element in beginning and ending inventories and in the spoilage (pgs. 228 - 230).

▲ **Equivalent units of production (EUP)** represents the amount of completed output that could have been produced if all the work performed during the period had been for units both started and completed. It is how many units could have been started, fully processed, and completed with the amount of inputs (costs) used during the month.

▲ The **basic formula for calculating unit cost now changes to:**

$$\text{Unit cost} = \frac{\text{Total department costs}}{\text{EUP}}$$

▲ If 10,000 units are 80 percent complete at the end of the accounting period, then the EUP is 8,000 (EUP = Units x percentage complete).

- The **EUP calculation is needed for:**
  the partially completed products in beginning WIP;
  the partially completed products in ending WIP; and
  the partially completed products that are rejected during the month (spoilage).
  It is **also needed for** each cost element that is input into the process at a different time, or in different amounts, from the other inputs.

3. Describe the six steps for departmental cost accounting in a PCAS (pgs. 230 - 232).

- The **six steps** are:
  1. Journalize the acquisition and use of the cost elements.
  2. Summarize the flow of cost elements and calculate the inputs' percentage complete. Units "to account for" must be "accounted for."
  3. Compute equivalent units of production. EUP = Units x Percentage complete.
  4. Compute unit production costs (Total department costs ÷ EUP).
  5. Calculate the costs of completed and transferred output, ending WIP, and spoilage. Costs "to account for" must be "accounted for."
  6. Prepare cost management reports analyzing whether department costs were within budget.

- Most PCASs are based on one of **two types of product flows: FIFO and weighted-average.** The only differences occur when beginning WIP exists. With FIFO, beginning WIP is separately accounted for; with weighted-average, beginning WIP is averaged in with the current period's work.

MORE ON OBJECTIVE 2.

2. Explain equivalent units of production (EUP), and calculate EUP for each cost element in the beginning and ending inventories and in the spoilage (pgs. 232 -241).

- An **input usage flow diagram** is a line chart which maps how and when inputs are added into a process or department. Preparation of this diagram is step 2 of the six steps in process costing. The diagram can be used to calculate: 1) how much of each cost element is in beginning WIP; 2) how much of each cost element is in spoiled units; and 3) how much of each cost element is in ending WIP.

- For step 3, if FIFO is used, then beginning WIP is subtracted from completed units because FIFO accounts for last period's work and costs separately from this period's.

- For step 4, if FIFO is used, then beginning WIP cost is not considered in the cost per unit calculation.

- For step 5, the following formula is used:
  Total cost of an input item for a particular subset of units = EUP x Cost per unit.

  To compute the costs to complete the beginning WIP units, the following formula is used:
  Units x (1 - % Complete last month) x Cost per unit

  Thus, if 1,000 units of beginning WIP were 40% complete as to direct labor, then 60% more labor must be added. If the direct labor unit cost is $2.00, then the cost to complete the beginning WIP is $1,200 (600 units x $2).

4. Demonstrate the differences in calculating product costs between FIFO and weighted-average methods (pgs. 241 - 248).

- As mentioned earlier, using **FIFO**, beginning WIP is separately accounted for, while in a **weighted-average flow**, beginning inventory units and their costs cannot be separated from the units worked on in the current period.

- In a **traditional PCAS**, normal spoilage is allocated to all the good units manufactured. When a transfer is made from one department to another, WIP-Manufacturing Overhead (Spoilage) is debited. In such a transfer, abnormal spoilage is debited to a loss account, such as Loss From Abnormal Spoilage.

- When both normal and abnormal spoilage occur, the costs must be allocated between the two types of spoilage. The following formulas are helpful:
  Normal spoilage cost = (Normal output loss units ÷ Total spoilage) x Output loss cost
  Abnormal spoilage cost = (Abnormal output loss units ÷ Total spoilage) x Output loss cost

- There is a **second method of dealing with normal spoilage.** Instead of including it in the overhead budget and the POR, it is allocated over the good units manufactured each period. The normal spoilage must be allocated between ending WIP and good units transferred to the next department. In the journal entry to record the transfer, the receiving department's WIP account is debited to include the normal spoilage.

- In a **WCM accounting system,** all spoilage is debited to a WIP-Dept. Name-Spoilage Cost Variance account.

- **Joint costs** are costs incurred in a single operation that yields two or more products or services simultaneously. **Joint products** are two or more products or services that have relatively significant sales value and are not separately identifiable as individual products until their split-off point. The **split-off point** is the point at which joint products and by-products become individually identifiable. **By-products** are incidental products of a joint process that have minor sales value and are not separately identifiable as individual

products until their split-off point.

- **Joint costs** are incurred up to the split-off point and receive a pro rata share of the department's joint production costs prior to split-off. **By-products** receive none of the prior joint costs.

- **One allocation method for joint costs** is the physical measure method. If there are 5,000 pounds of product A and 10,000 pounds of product B, and if joint costs are $60,000, then product A will receive $20,000 and product B will receive $40,000, computed as follows:

Product A	5,000 pounds	33.33% x $60,000 =	$20,000
Product B	10,000 pounds	66.67% x $60,000 =	40,000
	15,000 pounds		$60,000

- **Another allocation method for joint costs** is the relative sales value method. Consider the following data where "Price" is the market price at the split-off point:

Product	Pounds	Price	Sales Value	Ratio
A	5,000	$20	$100,000	66.67%
B	10,000	$ 5	$ 50,000	33.33%
	15,000		$150,000	

If joint costs are $60,000, then product A will receive $40,000 (66.67% x $60,000) and product B will receive $20,000 (33.33% x $60,000). Please note that it is the sales value, not the physical measure of pounds, that is used to compute the ratio.

CHAPTER SELF-TEST

Note: The notation (CO1) means that the question was drawn from chapter objective number one.

Matching

a. By-products
b. Cost per equivalent unit produced
c. Department production cost report
d. Equivalent units of production
e. First-in, first-out (FIFO) cost flow method
f. Input usage flows
g. Joint costs
h. Joint products
i. Parallel processing
j. Physical measure method
k. Relative sales value method
l. Sequential process
m. Split-off point
n. Weighted-average cost flow method

_____ 1. (CO4) Two or more products that are not separately identifiable until their split-off point.

_____ 2. (CO4) Incidental products of a joint process.

_____ 3. (CO3) Cost production flow which allows the PCAS to separate last month's production effort and costs from this month's.

_____ 4. (CO1) A method of arranging processing departments in which all units flow serially from one department to another.

_____ 5. (CO2) Represents the amount of completed output that could have been produced if all the work performed during the period had been for units both started and completed.

_____ 6. (CO4) A method to allocate joint product costs in proportion to their physical output measurement.

_____ 7. (CO2) Total department costs ÷ EUP.

_____ 8. (CO1) Used in a PCAS instead of a job cost sheet.

_____ 9. (CO4) A method in which joint costs are allocated in proportion to anticipated sales values.

_____ 10. (CO2) When and how much of direct materials, direct labor, and overhead are added to a process.

_____ 11. (CO4) Where joint products and by-products are individually identifiable.

_____ 12. (CO4) Accounts for cost flows in a PCAS at an average cost per EUP.

_____ 13. (CO4) Costs incurred in a single operation yielding two or more products simultaneously.

_____ 14. (CO1) A method of arranging processing departments in which, after a certain point, some units may go through different processing departments.

Completion

Please write in the word or words which will complete the sentence.

1. (CO1) Normally, most process production flows follow either a _____ configuration or a _____ configuration.

2. (CO2) When _____ and _____ _____ and spoilage exist, a calculation known as equivalent units of production (EUP) must be performed to measure how much production was really done during the period.

3. (CO3) Most PCASs are based on two types of product flows: FIFO and weighted-average. Differences occur only when _____ _____ _____ exists.

4. (CO2) Many traditional production processes have quality control inspection points throughout the process, but in a JIT system, quality control is the responsibility of _____ _____ _____.

5. (CO4) In the WCM environment, the goal is to drive spoilage or rework to _____ levels in the short run and to _____ these items in the long run.

6. (CO2) If there are 30,000 units in ending WIP inventory, all 60 percent complete with respect to direct labor, then the EUP for direct labor is _____ _____.

7. (CO2) If there are 25,000 units in beginning WIP inventory, all 80 percent complete with respect to direct materials, then the EUP to complete the beginning inventory is _____ _____.

8. (CO2) If there are 50,000 units in beginning WIP, all 75 percent complete with respect to direct labor, and if the unit cost for direct labor is $4.00, then the cost to complete the beginning inventory is _____.

9. (CO4) In a WCM accounting system, all spoilage is debited to a _____ account.

10. (CO4) If product X has a total sales value of $250,000 and product Y has a total sales value of $150,000; and if joint costs are $80,000; then product Y's share of the joint costs is _____.

True-False Statements

Please circle "T" if the sentence is true and "F" if it is false.

T F 1. (CO1) In a PCAS, costs are accumulated by department.

T F 2. (CO1) In JIT processes, where a cell produces the same subassembly over and over again, using kanbans, there are no beginning and ending inventories within the cell, thus making it unnecessary to calculate EUP.

T F 3. (CO2) The cost to complete the ending WIP inventory (units) in a department for July is calculated by multiplying the number of units in the inventory by the cost per unit by 100 percent less the percent completed last month.

T F 4. (CO4) The physical measure method of allocating joint costs is probably the most widely used method.

T F 5. (CO4) When products are sold at the split-off point without further processing, the relative sales value at split-off is the market price.

T F 6. (CO1) The only fundamental difference between a PCAS and a JOCAS in assigning product costs is that WIP subsidiary accounts are departments rather than jobs.

T F 7. (CO2) EUP is the number of units that could have been started, fully processed, and completed with the amount of inputs (costs) used during the month.

T F 8. (CO2) The calculation of EUP or unit costs is the same for sequential and parallel processes.

T F 9. (CO2) Some production processes within a department do not work on one product after another; therefore, an oil refinery should use a FIFO cost flow method in its PCAS.

T F 10. (CO4) In traditional PCASs and in a JOCAS, normal spoilage is allocated to all good units produced, so that the costs of rejected units can be averaged into the cost of the salable units.

Multiple Choice Questions

Please circle the correct answer.

1. (CO2) Department A's ending WIP in June was 35 percent complete with respect to overhead. What was the EUP?
   a. 560.
   b. 1,040.
   c. 2,462.
   d. 4,571.

2. (CO2) The Forging Department's July beginning WIP inventory of 4,500 units was 45 percent complete with respect to direct labor. EUP to complete the beginning inventory is:
   a. 2,025.
   b. 2,475.
   c. 4,091.
   d. 4,500.

3. (CO4) Which of the following industries commonly produce joint products?
   a. Construction.
   b. Soft-drink bottling.
   c. Aerospace.
   d. Lumber.

4. (CO4) A company's total output loss due to spoilage during the month was $175, which represented 15 units of production. If the company considers anything over 12 units to be abnormal, then what is the company's normal spoilage cost?
   a. $140.
   b. $100.
   c. $ 75.
   d. $ 35.

5. (CO4) Joint products are:
   a. two or more products that have relatively significant sales value.
   b. two or more products that have relatively insignificant sales value.
   c. two or more products that are separately identifiable as individual products prior to their split-off point.
   d. those products whose costs are incurred in dual operations that yield a single product.

6. (CO4) By-products are:
   a. products with a relatively significant sales value.
   b. separately identifiable as individual products before their split-off point.
   c. products with minor sales value as compared with the sales value of the major product or products.
   d. none of the above.

7. (CO1) Janine Company uses a production process that involves two departments. When Department R transfers its WIP to Department S, the journal entry to record the transfer requires a:
   a. debit to WIP-Department R.
   b. debit to WIP-Department S.
   c. credit to WIP-Department S.
   d. credit to Raw Materials Inventory.

8. (CO1) In a PCAS, a _____ is used to provide a summary of units moving through the department during the period, along with their costs.
   a. job cost sheet
   b. sequential processing report
   c. department production cost report
   d. job cost card

9. (CO3) Which of the following methods is used to allow the PCAS to separate last month's production effort and costs from this month's?
   a. Weighted-average cost flow.
   b. Physical measure.
   c. Relative sales value.
   d. FIFO.

10. (CO2) A line chart which maps how and when inputs are added into a process or department is called a/an:
    a. input usage flow diagram.
    b. job cost card.
    c. department production cost report.
    d. department production flow diagram.

Demonstration Problem

Assume that products F and G are jointly processed. At the split-off point, product F can be sold for $35 per unit and product G can be sold for $15 per unit. During the month, 2,500 units of F and 4,000 units of G were processed to the split-off point. Total joint costs for the month were $100,000.

REQUIRED:

a. Use the relative sales value method to allocate the joint costs, including in your answer the cost per unit for products F and G.

b. Use the physical measure method to allocate the joint costs, including in your answer the cost per unit for products F and G.

SOLUTIONS TO SELF-TEST

Note: The notation (Pg. 1) means that information about the question and its answer can be found on page 1 of your textbook.

Matching

1. (Pg. 246) h
2. (Pg. 246) a
3. (Pg. 232) e
4. (Pg. 223) l
5. (Pg. 228) d
6. (Pg. 247) j
7. (Pg. 228) b
8. (Pg. 222) c
9. (Pg. 247) k
10. (Pg. 232) f
11. (Pg. 246) m
12. (Pg. 241) n
13. (Pg. 246) g
14. (Pg. 224) i

Completion

1. (Pg. 223) sequential, parallel
2. (Pg. 228) beginning, ending inventories
3. (Pg. 232) beginning WIP inventory
4. (Pg. 235) each cell worker
5. (Pg. 246) insignificant, eliminate
6. (Pg. 229) 18,000 units
7. (Pg. 239) 5,000 units
8. (Pg. 239) $50,000 (50,000 units x 25 percent x $4.00)
9. (Pg. 245) WIP-Dept. Name-Spoilage Cost Variance
10. (Pg. 248) $30,000 [$80,000 x ($150,000 ÷ $400,000)]

True-False Statements

1. (Pg. 223) T
2. (Pg. 227) T
3. (Pg. 239) F — This is the method of calculating the beginning WIP inventory cost.
4. (Pg. 247) F — Relative sales value is the most widely used method.
5. (Pg. 247) T
6. (Pg. 227) T
7. (Pg. 228) T
8. (Pg. 231) T

9. (Pg. 232) F A weighted-average cost flow method should be used if products are not processed one after another.

10. (Pg. 243) T

Multiple Choice

1. (Pg. 228) a
2. (Pg. 239) b 4,500 units x (1 - 45 percent)
3. (Pg. 246) d
4. (Pg. 244) a $175 x (12 units ÷ 15 units)
5. (Pg. 246) a
6. (Pg. 246) c
7. (Pg. 227) b
8. (Pg. 222) c
9. (Pg. 232) d
10. (Pg. 232) a

Demonstration Problem

a.

Product	Units	Market Price	Sales Value	Ratio	Joint Costs	Cost/ Unit
F	2,500	$35	$ 87,500	59.32%	$ 59,320	$23.73*
G	4,500	15	60,000	40.68%	40,680	10.17
	6,500		$147,500	100.00%	$100,000	

*$59,320 ÷ 2,500 units = $23.73

b.

Product	Units	Market Price	Sales Value	Ratio	Joint Costs	Cost/ Unit
F	2,500	$35	$ 87,500	38.46%	$ 38,460	$15.38
G	4,500	15	60,000	61.54%	61,540	15.39
	6,500		$147,500	100.00%	$100,000	

CHAPTER 7

THE STANDARD COST ACCOUNTING SYSTEM
PART I: SETTING STANDARDS

CHAPTER OVERVIEW

Chapter 7 introduces you to the standard cost accounting system. You will learn how to calculate the standard price and quantity for direct materials and direct labor and for variable and fixed overhead. The need for a manufacturing cost equation is also discussed.

Review of Specific Chapter Objectives

1. Describe the role of the modern management accountant and the CAS in cost management (pgs. 276 - 281).

   ▲ In an enterprise using new types of manufacturing technologies, such as JIT and quality circles, both workers and managers make decisions. There are **two decision-making objectives:** 1) Each person in an organization needs to make good decisions individually; and 2) Each person needs to communicate and coordinate actions with others in the organization who might be affected.

   ▲ A **decision** is a choice of actions between two or more problem solution alternatives. A **problem** is the difference between what a person wants and what that person has (called a **cost variance** in cost management). **Cost variance reports** are reports about the problems of a department or JIT cell. **Management-by-exception** focuses attention on one's problems.

   ▲ Measuring the improvement in standards over time is just as important as short-run reporting about cost variances. The **long-run focus** is necessary in planning, while the **short-run focus** is important in operational control and performance evaluation.

   ▲ A good decision is a **rational decision**, which is a goal-directed decision. **Goals** are short-run targets, while **objectives** are long-range statements of what is wanted.

   ▲ Choices are called **suboptimal or dysfunctional** if they lead to an individual's goals but not to the organization's goals. This is the key problem for the management accountant in designing a CAS for cost management. The management accountant must provide enough flexibility and detail in performance reports so that suboptimal behavior does not occur.

   ▲ There are **three decision-making functions:** planning, monitoring and controlling, and evaluating.

   ▲ **From the functional perspective, responsibility accounting** is concerned with measuring how well

organizational members are achieving the organization's goals. There are three basic responsibility levels: cost centers (in which employees are responsible for planning, controlling, and evaluating activities that create costs); profit centers (in which managers have cost center responsibilities, as well as responsibility for generating revenues); and investment centers (in which managers have cost and revenue responsibilities, as well as responsibility for investment decisions).

- **From the behavioral perspective, responsibility accounting systems** are a subset of the organizational control system. There are five criteria:
  1. The planning criterion: participative budgeting.
  2. The operational control criterion: decision usefulness.
  3. The short-run performance evaluation criterion: management-by-exception.
  4. The long-run performance evaluation criterion: continuous improvement.
  5. The performance evaluation criterion: controllability.

2. Define the components of a standard cost card, and list its benefits for cost management (pgs. 281 -282).

- A **standard cost** is the budgeted cost of a particular input item (cost element) used in making one unit of a product.

- **Components of a standard cost card** are: standard price (the amount of money budgeted for one unit of an input item) and standard quantity (the budgeted amount of an input item needed to make one unit of output). **STANDARD PRICE x STANDARD QUANTITY = STANDARD COST.** The standard absorptive manufacturing cost (SMAC) for a product is the sum of all inputs' standard costs.

- The use of a standard cost card provides benefits for individual and group decision-making objectives of a cost center manager, as well as benefits for the three decision-making functions (planning, controlling, and evaluating). It also provides benefits for a profit center manager.

3. Calculate the standard price and quantity for direct materials and direct labor, and understand the issues involved in these calculations (pgs. 282 - 290).

- The **direct material standard price** is its budgeted net delivered purchase price. Direct material standard prices can be important in service enterprises as well as in merchandising and manufacturing firms.

- The **direct labor standard price** includes the budgeted gross wage rate as well as payroll taxes and fringe benefits.

- The **direct material standard quantity** is the amount of input that must be placed into the production process at the beginning, so that salable output can result. The **formula to calculate standard quantity is:** Output specification ÷ (1 - Normal scrap percentage). **Output specification** (also called an engineering or marketing specification) is the amount of an input that must be in the completed product for it to be salable.

- The **direct labor standard quantity** must take into account "downtime," or normal input loss. The **formula to calculate standard quantity is:** Output specification ÷ (1 - Normal input loss percentage). The standard labor quantity is the amount of time that should be purchased and input into the production process so that enough productive time is available to make one unit of product. Paid time = Downtime + Productive time.

- **Tightness** refers to the degree of difficulty in achieving a standard. **Theoretical standards (or ideal standards)** are based on the best performance possible under existing operating conditions and with existing equipment. People and equipment are assumed to work at peak efficiency 100 percent of the time, and it is assumed that it is possible to produce with no waste. **Practical standards (or currently attainable standards)** are tight but achievable standards. They allow for normal machine downtime, employee rest periods, and currently necessary, but nonvalue-added activities. They do not tolerate abnormal scrap and downtime.

- Nonvalue-added activities and costs in the direct materials standard quantity are in the inefficiencies in production that cause a normal scrap rate. Nonvalue-added activities and costs in the direct labor standard quantity are potentially in the output specification and the downtime. One avenue for labor productivity improvement is redesigning the production process. Another avenue for labor productivity improvement is in the output specification (as worker experience increases, the amount of productive time needed decreases).

- **Standards must be revised periodically.** In many traditional enterprises, goals are set and budgets prepared annually.

4. Calculate the standard costs for variable and fixed overhead, and understand the issues involved in setting these standards (pgs. 290 - 306).

   - Because variable and fixed overhead costs are caused by different activities, they should be accounted for separately.

   - In a standard cost system, **the standard price for overhead is the POR.** For variable overhead, the following formula is used:
     VOH POR = Estimated VOH costs ÷ Estimated base

Typical bases include: direct labor cost, direct labor hours, machine hours, units of product on a basis of weight or volume, and direct materials weight or volume.
Direct labor dollar base: Dividing VOH costs by DL dollars yields a percentage. VOH is then applied as that percentage of the direct labor cost. If more VOH is incurred by the more highly skilled and paid employees, the VOH POR should be based on direct labor dollars.
Direct labor hour base: This base is used when overhead is caused uniformly by all types of employees.
Machine hour base: This base is used when machinery is the major factor of production. A drawback is that machine hours expected and actually used may not be readily available.
Unit of product base: This is the simplest method for applying overhead, and weight base and volume base are two popular variations of the unit of product base.
Direct materials cost base: The formula is as follows: Overhead cost per some unit of measure = Estimated direct materials handling overhead costs ÷ Estimated weight or volume of direct materials.

▲ **Cost behavior** is the movement of a total cost in response to changes in volume or activity. **Four types of patterns exist:** variable cost, fixed cost, mixed cost, and step cost. Assumptions about cost behavior patterns are valid within the relevant range, a narrow band of volume or level of activity.

▲ **Variable costs** increase in total in direct proportion to increases in volume or level of activity but stay constant on a per unit basis. For example, if direct labor costs $20 per hour and if 10 hours are worked, then the total variable costs are $200, while the per unit cost is still $20 per hour.

▲ **Fixed costs** remain constant in total for a period of time regardless of volume or level of activity but increase or decrease on a per unit basis with changes in volume or level of activity. For example, total factory rent is $200,000 per year, regardless of how many units are produced. If 10,000 units are produced, however, then the per unit cost is $20; if 20,000 units are produced, then the per unit cost is $10.

▲ **Mixed costs** have both variable and fixed cost components. The following formula is used:
Total cost = Total fixed costs + (Variable cost per unit x Volume or activity level in units).

▲ **Step costs** are costs that are constant in total only over small ranges of volume within the relevant range.

▲ The following methods can be used **to estimate the relationship between volume or level of activity and overhead costs:**
SCATTERGRAPH METHOD (or scatterplot or scatter diagram). Data are plotted on a graph, and a line is drawn by

visual inspection. Where the line intersects the vertical cost axis, that amount represents the fixed cost element in total overhead. The variable cost element is calculated as follows:
Total cost at some level of activity
Less: the fixed cost element
Total estimated variable cost

If the total estimated variable cost is divided by the number of units, then that will yield a per unit amount.

HIGH-LOW METHOD. This method uses only two observations from data, at the high and low levels of volume or activity. The **variable rate** is calculated as follows:

High observation cost - Low observation cost
High observation volume - Low observation volume

The **fixed cost element** = Total cost - Variable cost element.
The type of cost is the dependent variable, while the volume or level of activity is the independent variable.

LEAST SQUARES METHOD. This is the most statistically precise method of fitting the data to a linear equation. While the calculations can be done manually, the use of a business calculator is preferred for the time savings it will provide.

▲ **Correlation analysis** measures how well production volume predicts a monthly cost. If monthly cost rises as production volume rises, then there is a positive correlation. If monthly cost falls as production rises, then there is a negative correlation. When there is no discernible pattern, there is no correlation. -1 denotes perfect negative correlation, while +1 denotes perfect positive correlation. Values close to zero denote no correlation. The **coefficient of determination** ranges from zero (no variation is explained) to 1 (all variations in the dependent variable are explained by the independent variable).

▲ **Multiple regression analysis** is a statistical method that creates cost equations containing multiple predictor variables. The regression equation is based on a relational situation, not necessarily a causal one. Data sampling is critical to the effective use of estimating methods.

▲ There are **two opposing costing methods with respect to fixed overhead:**
Absorption costing (also called full costing) treats all costs of production as product costs, regardless of whether they are variable or fixed. It is currently required for tax purposes and for external reporting under GAAP.
Variable costing (also called direct costing) is a management accounting tool used to provide management

with information about cost, volume, and profit relationships in a form that is easy to understand. Only variable costs are included in the product's standard cost. Fixed production costs are written off to COGS in total.

▲ **A standard cost card has the following advantages:**
1. The fact that separate standard prices and quantities are required for each cost element emphasizes the need for coordination in the standard-setting process.
2. Separate standard prices and quantities provide information for daily operational control.
3. Standard prices and quantities are needed for cost variance calculations used in performance evaluation.
4. The SAMC is useful in setting sales prices by profit center managers.
5. The SAMC is useful in making journal entries in the SCAS.

5. Discuss the need for a manufacturing cost equation (pgs. 306 - 309).

▲ **Absorption costing has two problems:** 1) The SAMC cannot be used to budget total production costs; and 2) there are four commonly used production volumes.

▲ The **four commonly used production volumes** are:
Theoretical capacity (or ideal capacity). This is the production volume that could be achieved under 100 percent operating efficiency. It is seldom used but has been recommended as a target of kaizen in WCM enterprises.
Practical capacity. This is a feasible level of output, the theoretical capacity less ordinary, regular, and unavoidable operating interruptions.
Normal capacity. This is the long-term (three to ten years) average output of the enterprise. It is the practical capacity less the estimated idle capacity.
Expected annual capacity. This is the level of activity budgeted for the upcoming year.

▲ The management accountant should select the capacity measure that best motivates management to achieve the goals of the company.

CHAPTER SELF-TEST

Note: The notation (CO1) means that the question was drawn from chapter objective number one.

Matching

Please write the letters of the following terms in the spaces to the left of the definitions.

a. Absorption costing
b. Cost variance
c. Cost variance report
d. Fixed costs
e. High-low method
f. Least squares method
g. Mixed costs
h. Responsibility accounting
i. Scattergraph method
j. Standard cost
k. Standard cost card
l. Standard price
m. Standard quantity
n. Variable costs
o. Variable costing

_____ 1. (CO4) A utility cost.

_____ 2. (CO4) Treats all costs of production as product costs, regardless of whether they are variable or fixed.

_____ 3. (CO1) Measures how well organizational members are achieving the organization's goals.

_____ 4. (CO2) The budgeted amount of a cost element to make one product or render a service.

_____ 5. (CO4) Costs that increase in total in direct proportion to increases in volume or level of activity.

_____ 6. (CO4) Uses only two observations to predict cost.

_____ 7. (CO4) The most statistically precise method of fitting the data to a linear equation.

_____ 8. (CO1) Reports problems of a department or a JIT cell.

_____ 9. (CO4) Consists of plotting data on a graph and fitting a line by visual inspection.

_____ 10. (CO2) A budgeted cost.

_____ 11. (CO4) Does not include fixed costs in the cost of a product.

_____ 12. (CO1) The difference between budgeted costs and actual costs.

_____ 13. (CO2) Budgeted delivered purchase price.

_____ 14. (CO2) Reports the individual standard costs in making a product.

_____ 15. (CO4) Remains constant in total for a period of time regardless of volume or level of activity.

Completion

Please write in the word or words which will complete the sentence.

1. (CO2) If the standard price is $8.25 per direct labor hour and the standard quantity is 2 direct labor hours to put on 100 square feet of roofing, then the standard cost is _____ per 100 square feet.

2. (CO1) Management-by-exception involves focusing attention on one's _____.

3. (CO1) Rational decisions are _____ decisions.

4. (CO3) The degree of difficulty in achieving a standard is known as _____.

5. (CO4) A crane rents for a base amount (fixed cost) plus $50 per hour (variable cost per hour). If the crane was used 30 hours and the customer paid $1,900, then the base amount was _____.

6. (CO4) Costs that are constant in total only over small ranges of volume within the relevant range are _____ costs.

7. (CO4) Unit fixed costs will _____ as production increases.

8. (CO1) A problem is simply the difference between goals and reality. In cost management, it is called a cost _____.

9. (CO1) _____ center managers control costs and are responsible for generating revenues.

10. (CO4) _____ _____ analysis is a statistical method that creates cost equations containing multiple predictor variables.

True-False Statements

Please circle "T" if the sentence is true and "F" if it is false.

T F 1. (CO4) Ideal standards will almost always result in unfavorable usage variances.

T F 2. (CO4) The least squares method is a less precise method than the scattergraph method.

T F 3. (CO4) When using the high-low method, a deviation in cost behavior is easily spotted and can be ignored.

T F 4. (CO5) Normal capacity is the level of activity budgeted for the upcoming year.

T F 5. (CO5) Generally, the use of theoretical (ideal) and practical capacity production volumes for fixed overhead standard cost may result in underpricing products.

T F 6. (CO4) A dependent variable can be used to predict something else, such as a cost, that depends upon its occurrence.

T F 7. (CO4) On a scattergraph, the total fixed costs are represented by the point where the fitted line intersects the cost (vertical) axis.

T F 8. (CO4) Union contracts, company policies, government regulations, implementation of JIT, and cellular manufacturing are factors tending to make direct labor a fixed cost.

T F 9. (CO4) Variable costing is currently required for tax purposes and for external reporting under GAAP.

T F 10. (CO4) When fitting a line on a scattergraph by visual inspection, the line is generally placed so that the number of points falling above and below it are approximately equal.

Multiple Choice

Please circle the correct answer.

1. (CO3) If Pilot Company pays its direct labor force an average of $8.00 per hour, then what is the standard price for direct labor if payroll taxes are 7.65 percent and fringe benefits are 25 percent?
   a. $ 8.00.
   b. $10.00.
   c. $10.61.
   d. $10.77.

2. (CO1) _____ center managers can be considered the top management in a firm.
   a. Cost
   b. Investment
   c. Profit
   d. Responsibility

3. (CO3) Practical (currently attainable) standards are tight but achievable standards which do not tolerate:
   a. abnormal scrap and downtime.
   b. employee rest periods.
   c. normal machine downtime.
   d. currently necessary, but nonvalue-added activities.

4. (CO3) Theoretical (ideal) standards may include allowances for:
   a. cleanup time.
   b. personal time and rest periods.
   c. normal scrap.
   d. setup time.

5. (CO4) A cost whose per unit amount remains constant but whose total changes in direct proportion to changes in volume or level of activity is a:
   a. step cost.
   b. fixed cost.
   c. mixed cost.
   d. variable cost.

6. (CO4) Which of the following can be a disadvantage of the least squares method?
   a. Different people, given the same data, will probably draw different lines and, thus, have different estimates of variable and fixed costs.
   b. It only uses two data points.
   c. Only one independent variable is considered.
   d. If the calculations are done manually, then the method can be timeconsuming.

7. (CO5) Which of the following is not one of the four commonly used production volumes?
   a. Expected annual capacity.
   b. Normal capacity.
   c. Practical capacity.
   d. Standard capacity.

8. (CO2) Which of the following is a benefit of the standard cost card?
   a. It provides the benchmarks for measuring cost overruns.
   b. It is relatively quick and easy to develop.
   c. Deviations in cost behavior are easily spotted.
   d. It is easy to understand.

9. (CO4) Correlation analysis measures how well the cost driver (X axis) predicts the total cost (Y axis) for a period. If the total cost falls as the cost driver increases, then there is:
   a. a positive correlation.
   b. a negative correlation.
   c. no correlation.
   d. a nonlinear correlation.

10. (CO4) For internal reporting, the pervasive view is that product costs should not include:
    a. direct materials.
    b. direct labor.
    c. fixed overhead.
    d. variable overhead.

Demonstration Problem

Apex Company has ten cars in its sales fleet. The following information pertaining to maintenance costs for part of 1995 is presented below:

	Miles Driven	Total Maintenance Costs
January	14,000	$3,100
February	20,000	4,300
March	18,000	3,800
April	13,600	3,000
May	19,000	4,000
June	16,000	3,500
July	21,500	4,500
August	21,000	4,400

REQUIRED:

a. Use the high-low method to determine monthly total fixed costs and the variable cost per 1,000 miles driven.

b. Write the cost formula.

c. Forecast the total maintenance cost for September if 25,000 miles are expected to be driven by the sales fleet.

SOLUTIONS TO SELF-TEST

Note: The notation (Pg. 1) means that information about the question and its answer can be found on page 1 of your textbook.

Matching

1. (Pg. 295) g
2. (Pg. 305) a
3. (Pg. 278) h
4. (Pg. 281) m
5. (Pg. 293) n
6. (Pg. 299) e
7. (Pg. 300) f
8. (Pg. 277) c
9. (Pg. 296) i
10. (Pg. 281) j
11. (Pg. 305) o
12. (Pg. 277) b
13. (Pg. 281) l
14. (Pg. 281) k
15. (Pg. 293) d

Completion

1. (Pg. 281) $16.50 $8.25 per DL hour x 2 DL hours
2. (Pg. 277) problems
3. (Pg. 278) goal-directed
4. (Pg. 286) tightness
5. (Pg. 295) $400 $1,900 - ($50 x 30 hours)
6. (Pg. 295) step
7. (Pg. 294) decrease
8. (Pg. 277) variance
9. (Pg. 279) Profit
10. (Pg. 302) Multiple regression

True-False Statements

1. (Pg. 288) T
2. (Pg. 300) F Least squares is far more precise.
3. (Pg. 298) F This is an advantage of the scattergraph method.
4. (Pg. 308) F This is the long-term (usually three to ten years) average output of the company.
5. (Pg. 309) T
6. (Pg. 299) F This is the definition of an independent variable.
7. (Pg. 297) T
8. (Pg. 303) T
9. (Pg. 305) F Absorption costing is required for these purposes.
10. (Pg. 298) T

Multiple Choice

1. (Pg. 283) c $8.00 + (7.65% x $8.00) + (25% x $8.00)
2. (Pg. 279) b
3. (Pg. 287) a
4. (Pg. 286) b
5. (Pg. 293) d
6. (Pg. 300) d
7. (Pg. 308) d

8. (Pg. 282) a
9. (Pg. 301) b
10. (Pg. 305) c

Demonstration Problem

a.

Observation	Miles Driven	Maintenance Costs
High (July)	21,500	$4,500
Low (April)	13,600	3,000
Difference	7,900	$1,500

VCU = $1,500 ÷ 7,900 miles = $.1899 per mile

Choose the low month (April) to calculate the fixed cost. (Note: Either the high or the low observation will give the same fixed cost.)

TC = FC + VC
FC = TC - VC
FC = $3,000 - ($.1899 x 13,600 miles)
FC = $3,000 - $2,583
FC = $417

b. Y = $417 + $.1899X
or TC = $417 + ($.1899 x Miles driven)

c. TC = $417 + ($.1899 x 25,000 miles)
TC = $417 + $4,748
TC = $5,165

CHAPTER 8

THE STANDARD COST ACCOUNTING SYSTEM
PART 2: JOURNAL ENTRIES, COST VARIANCES, AND REPORTS

CHAPTER OVERVIEW

Chapter 8 continues to look at a standard cost accounting system. The meaning of a cost variance will be explained, and you will be shown how to calculate the variable costs' spending and usage variances. Then, after learning how to calculate the fixed overhead variances, you will learn how to prepare the journal entries for an SCAS. Last, you will learn how to design a high-quality SCAS with useful management reports.

Review of Specific Chapter Objectives

1. Discuss the role of a standard cost accounting system (SCAS) in responsibility accounting (pgs. 330 -334).

   - A **favorable cost variance** results when actual costs are less than standard costs. An **unfavorable cost variance** occurs when actual costs are greater than standard costs.

   - A standard cost developed jointly by management and employees responsible for the costs can be a motivating influence for employees and result in higher productivity. Using cost variances as fault-finding devices and placing too much reliance on them in evaluations may motivate people to engage in counterproductive acts.

   - Cost management is an important component in a firm's success and profitability, but an SCAS should not be used to conduct "witch hunts."

   - **Standards** can be based on ideal or practical operating conditions. Variances from ideal or theoretical standards will usually be unfavorable, but continuous improvement will cause the variances to become smaller over time. Practical standards, tight but achievable, will result in both favorable and unfavorable variances.

   - The **best standard for today's competitive environment** is one that seeks to improve future performance. Long-run continuous improvement is measured by the movement toward ideal standards.

   - The use of standard costs makes possible the concept of **management-by-exception.** Whether a variance is favorable or unfavorable, it should be investigated if it falls outside upper and lower limits of acceptable variances from standard. Management may still want a report on a variance if it consistently comes close to the limits. In addition, managers may view some variances as more significant than others.

   - The **key objective of variance analysis and reporting** is

to isolate off-standard performance quickly and correct it.

- The **operational control loop** to accomplish this key objective consists of **eight steps:**
  1. Set standards; prepare the standard cost card; develop the budgeted manufacturing cost equation.
  2. Collect operating data; measure actual performance.
  3. Process operating data; calculate variances.
  4. Report variances to managers and workers who are responsible for them.
  5. Determine the significance of each variance.
  6. Take appropriate corrective actions.
  7. Change performance, if possible, to bring actual performance in line with standard performance.
  8. Revise standards if they are no longer relevant.

- **Reducing record-keeping costs increases information-processing efficiency.** Use of a standard cost system allows costs to be assigned to various accounts based on standard prices and quantities, thus eliminating the need for continuously recalculating changing actual unit costs.

2. Explain the meaning of a cost variance, and calculate and interpret the variable costs' spending variances (pgs. 334 - 340).

- There are basically only **two types of cost variances:** spending (price) variances and efficiency (usage) variances.

- The **basic formula for a VARIABLE COST SPENDING VARIANCE** is:
  Actual quantity purchased x (Stand. price - Actual price)
  or AQp x (SP - AP)

- The **direct materials price variance** measures what is paid with what should have been paid for materials.

  Direct materials price variance = AQp x (SP - AP)

  If 10,000 pounds are purchased at an actual price of $2.00 per pound, and if the standard price is $1.90 per pound, then the variance is computed as follows:
  10,000 pounds x ($1.90 - $2.00) = $1,000 unfavorable

  Generally, the purchasing agent has control over prices paid for materials and, therefore, is responsible for the purchase price variance. It is necessary to make sure that the agent is not purchasing lower-price, poor-quality materials to realize a favorable purchase price variance.

- The **direct labor rate variance** measures any deviation from standard in the average hourly rate paid to workers plus the average hourly payroll taxes and fringe benefits paid for them.

DL rate variance = Actual DLhr worked x (SR - AR)

If 15,000 direct labor hours are worked at an average rate of $12.00 per hour, and if the standard rate is $12.05 per hour, then the variance is computed as follows:
15,000 DLhr x ($12.05 - $12.00) = $750 favorable

Rate variances can be caused by the way workers are used. Poor scheduling of work may cause unfavorable variances, as can the use of highly paid, skilled workers to do tasks that require little skill and call for low hourly pay rates.

▲ The **variable overhead spending variance** is the amount budgeted for the number of direct labor hours worked minus the actual VOH costs incurred.

If 10,000 direct labor hours are worked; the VOH standard price is $2.00 per direct labor hour; and actual variable costs are $19,000; then the VOH spending variance is computed as follows:
(10,000 DLhr x $2.00/DLhr) - $19,000 = $1,000 favorable

The VOH spending variance is usually the responsibility of the person or persons in charge of such VOH cost items as indirect labor, utilities, and maintenance.
The management accountant should break down the variance into its component elements.

3. Calculate and interpret the variable costs' usage variances (pgs. 340 - 344).

▲ The **basic formula for a VARIABLE COST EFFICIENCY VARIANCE** is:
Standard price x (Standard quantity allowed - Actual quantity used) or SP x (SQA - AQu)

The standard quantity allowed is the total amount of an input item that should have been used for the actual production volume.

▲ The **direct materials usage variance** measures the difference between the actual quantity of materials used in production and the quantity that should have been used (SQA).

Direct materials usage variance = SP x (SQA -AQu)

If the standard price for direct materials is $3.00 per pound; the standard quantity allowed is 5,000 pounds; and the actual quantity used is 4,950 pounds; then the direct materials usage variance is computed as follows:
$3.00/lb. x (5,000 pounds - 4,950 pounds) = $150 favorable

Generally, the production manager is responsible for this variance because he or she is in charge of how direct

materials are used.

- The **direct labor efficiency variance** measures the productivity of direct labor.

  Direct labor efficiency variance = SP x (SQA - AQu)

  If the standard direct labor rate is $12.00 per hour; the standard quantity allowed is 2,000 hours; and the actual hours worked are 2,100 hours; then the direct labor efficiency variance is computed as follows:
  $12/DLhr x (2,000 DLhr - 2,100 DLhr) = $1,200 unfavorable

  Generally, this variance is the responsibility of supervisors and workers. It is vital for management's review because increasing productivity in labor-intensive processes is a key to reducing production costs. This variance may have little relevance in a highly automated plant that has few employees.

- The **variable overhead efficiency variance** measures the excess VOH used solely because the actual direct labor hours worked differed from the standard hours allowed.

  VOH efficiency variance = SP x (SQA - AQu)

  If the VOH standard price is $2.00 per direct labor hours; the standard quantity of direct labor allowed is 2,000 hours; and the actual hours worked are 2,100 hours; then the VOH efficiency variance is computed as follows:
  $2.00/DLhr x (2,000 DLhr - 2,100 DLhr) = $200 unfavorable

  The responsibility for this variance lies with the manager in charge of labor for the period (if labor causes VOH usage).

4. Calculate and interpret the fixed overhead variances (pgs. 344 - 349).

- The **fixed overhead budget variance** is the difference between budgeted fixed overhead costs and actual fixed overhead costs.

  Fixed OH budget variance = Budgeted FOH - Actual FOH

  If budgeted FOH is $18,000 and actual FOH is $18,250, then the FOH budget variance is computed as follows:
  $18,000 - $18,250 = $250 unfavorable

  This variance is the responsibility of the various people who have control over the different items that comprise the total budgeted FOH costs.

- The **fixed overhead production volume variance** is usually called the fixed overhead volume variance, or just the volume variance. It measures how well the factory as a whole was used.

FOH volume variance = FOH standard cost x (Actual output - Production quota)
or FOH standard price x (SQA - Budgeted basis)

If the FOH standard cost is $1 per unit; if the actual output is 13,000 units; and if the production quota is 12,000 units; then the FOH volume variance is computed as follows:
$1/unit x (13,000 units - 12,000 units) = $1,000 favorable

▲ **Presenting all four overhead variances is called "four-way analysis of overhead."** There is also "three-way" analysis, "two-way" analysis, and "one-way" analysis. If any of the latter three methods is performed, then one "trick" to remember is that four overhead variances have already been calculated. A second "trick" is to know which variances to calculate first: The total overhead variance is first computed, and then the FOH volume variance is computed.

5. Prepare the journal entries for an SCAS, and the cost variance report (pgs. 349 - 366).

▲ In a SCAS, jobs, departments, or cells (in a JIT) are still debited with the costs of the manufacturing inputs used, but there are **two basic differences** between the entries in an SCAS and in a JOCAS or PCAS:
1. The cost amounts used are not the same. All inputs' costs are recorded at standard cost allowed (SCA). SCA is the standard cost for each input multiplied by production volume. There are two formulas for SCA:
   SCA = Standard cost x Actual output OR
   SCA = Stand. price x Actual quantity allowed (SQA)
2. The difference between SCA and actual cost is journalized.

▲ The following are entries for a **standard PCAS:**
▲ **Journal entry 1** records the purchase of raw materials:
RMI (SP x AQp)
RMI-Price Variance (if unfavorable)
Accounts Payable (AP x AQp)

OR:
RMI (SP x AQp)
RMI- Price Variance (if favorable)
Accounts Payable (AP x AQp)

▲ **Journal entries 2 and 3,** to record payroll and the employer's related liabilities are the same in all CASs.

▲ **Journal entry 4** records other overhead costs incurred. There is a WIP-VOH account and a WIP-FOH account.

▲ **Journal entry 5,** requisitions of direct materials, requires a separate entry for each department:

WIP-Department A (DM) (SP x SQA)
WIP-Department A DM Usage Variance (if unfavorable)
RMI (SP x AQu)

OR:
WIP-Department A (DM) (SP x SQA)
WIP-Department A DM Usage Variance (if favorable)
RMI (SP x AQu)

▲ **Journal entry 6,** direct labor distribution, again requires a separate entry for each department:

WIP-Department A (DL) (SP x SQA)
WIP-Department A DL Rate Variance (if unfavorable)
WIP-Department A DL Efficiency Variance (if unfavorable)
Gross Wages (AP x AQ)

OR:
WIP-Department A (DL) (SP x SQA)
WIP-Dept. A DL Rate Variance (if favorable)
WIP-Dept. A DL Efficiency Variance (if favorable)
Gross Wages (AP x AQ)

▲ **Journal entry 7a,** for applied VOH, follows:

WIP-Department A (VOH Applied) (SP x SQA)
WIP-Department A VOH Spending Variance (if unfavorable)
WIP-Department A VOH Efficiency Variance (if unfavorable)
WIP-VOH (Actual cost)

OR:
WIP-Department A (VOH Applied) (SP x SQA)
WIP-Dept. A VOH Spending Variance (if favorable)
WIP-Dept. A VOH Efficiency Variance (if favorable)
WIP-VOH (Actual cost)

▲ **Journal entry 7b,** for applied FOH, follows:

WIP-Department A (FOH Applied) (SP x SQA)
WIP-Department A FOH Budget Variance (if unfavorable)
WIP-Department A FOH Volume Variance (if unfavorable)
WIP-FOH (Actual cost)

OR:
WIP-Department A (FOH Applied) (SP x SQA)
WIP-Dept. A FOH Budget Variance (if favorable)
WIP-Dept. A FOH Volume Variance (if favorable)
WIP-FOH (Actual cost)

▲ **PLEASE NOTE: An unfavorable variance appears as a debit in the journal entry, while a favorable variance appears as a credit.** In an entry such as 7b above, the two variances can certainly have opposite balances; that is, the budget variance can be unfavorable, while the volume variance is favorable. They have both been shown as either favorable or unfavorable for convenience's sake.

▲ **Journal entry 8** shows the transfer of completed output to Department B:
WIP-Department B (SAMC x Actual output)
WIP-Department A

▲ **Journal entry 9**, to transfer WIP to Finished Goods Inventory, and **journal entry 10**, to record COGS, are the same as in all CASs.

▲ If a **standard JOCAS is used**, the amounts calculated are the same and there are only two differences in the general ledger account titles:
1. The WIP subsidiary accounts for product costs are organized by jobs instead of by departments.
2. The department cost variance accounts have posting references for cost variances caused within specific jobs.

▲ The **balances in the subsidiary ledger cost variance accounts** can be disposed of in one of three ways:
1. Transferred with the products to FGI and/or COGS.
2. Closed to COGS at year-end.
3. Closed to COGS, FGI, and WIP accounts at year-end.

▲ A **high-quality SCAS** possesses the following characteristics:
1. Information is timely.
2. Relevant information is reported.
3. The reports and screen displays present information in a usable format.

▲ A company can use more than one material in a product and can also combine direct labor in many different ways to produce the same product. To better understand the net total usage variance from substitutions, the usage variances for direct materials, as well as for direct labor, need to be combined and reorganized into **two summary variances: MIX VARIANCE** and **YIELD VARIANCE.**

▲ The **direct materials mix variance** results when direct materials are mixed in a ratio different from the standard direct materials formula.

Direct materials mix variance = AQ x (SP - WAP)
SP = Weighted-average standard price
WAP = Weighted-average standard price for the pounds input

▲ The **direct materials yield variance** is the result of obtaining an output different from the one expected based on the total quantities of direct materials placed in process.

Direct materials yield variance = SP x (SQA x AQu)

▲ **Direct materials usage variance = Direct materials mix variance + Direct materials yield variance**

- ▲ The **direct labor mix variance** shows the change in the average standard labor rate from changing the combination of higher- and lower-paid workers.

  Direct labor mix variance = AQ x (SP - WAP)
  SP = Weighted-average standard price
  WAP = Weighted-average standard price for the hours worked

- ▲ The **direct labor yield variance** presents the results of using more or fewer total direct labor hours than the standard allowed.

  Direct labor yield variance = SP x (SQA - AQu)

- ▲ **Direct labor efficiency variance = Direct labor mix variance + Direct labor yield variance**

6. Design a high-quality SCAS with management reports useful for operational control and performance evaluation (pgs. 366 - 375).

   - ▲ Management accountants must decide whether the SCAS should be designed as a process, job order, or hybrid cost system.

   - ▲ One type of cost system is the **backflush cost accounting system (BCAS)**. The WIP account is replaced with a raw-in-process (RIP) account which includes only the raw materials purchased. Direct labor and overhead costs are journalized into a "Conversion Costs" account. Costs are taken out of these accounts only when the product is completed. Another difference is that cost variances are journalized in this type of system. A BCAS focuses first on the output of an organization and then works backward when assigning costs to FGI or units sold.

   - ▲ An **advantage of a BCAS** is that it simplifies cost accounting by eliminating many nonvalue-added activities. **Disadvantages** include the following:
     1. A BCAS may only work well in production processes with extremely low levels of inventories.
     2. By not tracking input costs and WIP movement, certain audit trails are lost.
     3. The reconciliation process can be complicated if RIP and Conversion Costs do not contain separate subsidiary ledger accounts for the different products.
     4. Information about production problems and the cost variances they may create is still needed.
     5. Spoilage and the cost variances it creates require separate accounting.

CHAPTER SELF-TEST

Note: The notation (CO1) means that the question was drawn from chapter objective number one.

Matching

a. Backflush cost accounting system
b. Direct labor efficiency variance
c. Direct labor mix variance
d. Direct labor yield variance
e. Direct materials price variance
f. Direct materials usage variance
g. Direct materials yield variance
h. Favorable cost variance
i. Fixed overhead budget variance
j. Flexible budget
k. Raw-in-process
l. Standard cost allowed
m. Standard quantity allowed
n. Unfavorable cost variance
o. Variable overhead spending variance

_____ 1. (CO4) The difference between budgeted fixed overhead costs and actual fixed overhead costs.

_____ 2. (CO6) An SCAS that records input acquisitions at actual cost and output at standard cost.

_____ 3. (CO3) Measures the productivity of direct labor.

_____ 4. (CO2) The difference between what is paid for a given quantity of materials and what should have been paid.

_____ 5. (CO6) The general ledger account for raw materials purchased in a backflush cost accounting system.

_____ 6. (CO5) Shows the change in the average standard labor rate from changing the combination of higher- and lower-paid workers.

_____ 7. (CO1) Occurs when actual costs are greater than standard costs.

_____ 8. (CO2) The amount budgeted for the number of direct labor hours worked minus the actual VOH costs incurred.

_____ 9. (CO5) Presents the results of using more or fewer total direct labor hours than the standard allowed.

_____ 10. (CO5) The standard cost for each input multiplied by production volume.

_____ 11. (CO3) Measures the difference between the actual quantity of materials used in production and the quantity that should have been used.

_____ 12. (CO5) The result of obtaining an output different from the one expected based on the total quantities of direct materials placed in process.

_____ 13. (CO3) The total amount of an input item that should have been used for the actual production volume.

_____ 14. (CO1) Results when actual costs are less than standard costs.

_____ 15. (CO2) An "after-the-fact" budget prepared by using the cost equation and the actual hours worked.

Completion

Please write in the word or words which will complete the sentence.

1. (CO5) The _____ _____ variance and the _____ _____ variance together make up the direct materials usage variance.

2. (CO4) The total overhead variance is the sum of the _____ variance, the _____ _____ variance, the _____ variance, and the _____ _____ variance.

3. (CO1) Ideal standards are set as goals toward which employees work for continuous improvement, a concept of _____ manufacturing.

4. (CO2) The _____ is the first person who should be consulted in attempting to identify the cause of the direct materials price variance.

5. (CO2) Five reasons why actual direct materials prices may differ from standard direct materials prices are changes in _____, _____, _____, _____, _____ and the _____.

6. (CO3) The responsibility for substandard direct materials may lie with the _____.

7. (CO6) The term _____ comes from the technique of delaying journal entries until products are completed, when costs finally are _____ through the accounting system.

8. (CO1) The use of standard costs makes possible the concept of _____.

9. (CO1) The key objective of variance analysis and reporting is to _____ off-standard performance and _____ it.

10. (CO3) Labor operations such as bending, lifting, and turning should be evaluated to determine which are adding _____ and which can be _____ or _____.

True-False Statements

Please circle "T" if the sentence is true and "F" if it is false.

T F 1. (CO6) In a backflush cost accounting system (BCAS), raw materials are debited to Raw-in-Process (RIP) instead of to Raw Materials Iinventory (RMI).

T F 2. (CO5) The sum of the direct labor mix variance and the direct labor yield variance equals the direct labor efficiency variance.

T F 3. (CO2) The direct labor rate variance measures the average hourly rate paid to employees plus the average hourly payroll taxes and fringe benefits paid for them.

T F 4. (CO4) The volume variance can be calculated by any of three formulas.

T F 5. (CO4) The total overhead variance is the sum of the four overhead cost variances; it is also the difference between the total overhead costs applied and the total overhead costs actually incurred.

T F 6. (CO1) If a variance is favorable, then it should never be investigated.

T F 7. (CO2) Generally speaking, there are only two types of cost variances: spending (price) variances and efficiency (usage) variances.

T F 8. (CO3) The purchasing manager is generally responsible for the direct materials usage variance.

T F 9. (CO4) When performing three-way, two-way, or one-way overhead analysis, it is important to know that four overhead variances have already been calculated and to know which variance to calculate first.

T F 10. (CO6) In a backflush cost accounting system (BCAS), there is no work-in-process account in the general ledger.

Multiple Choice

Please circle the correct answer.

1. (CO2) If a purchasing department paid $.25 per pound for 75,000 pounds of direct materials, and the standard price is $.22 per pound, then what is the direct materials price variance?
   a. $ 2,250 (F).
   b. $ 2,250 (U).
   c. $16,500 (F).
   d. $18,750 (U).

2. (CO2) The direct materials standard cost is $2.00 per unit, while the direct labor standard cost is $2.80 per unit. The standard variable overhead cost is $.50 per unit, and the standard fixed overhead cost is $.20 per unit, based on a production quota of 50,000 units per month. What is the monthly manufacturing cost equation?
   a. $35,000 + $4.80 per unit.
   b. $10,000 + $5.00 per unit.
   c. $10,000 + $5.30 per unit.
   d. $10,000 + $5.50 per unit.

3. (CO2) The standard rate per direct labor hour is $9.25, and the standard quantity allowed (SQA) is 56,000 direct labor hours. What is the direct labor rate variance when 55,000 direct labor hours were worked at an average pay rate of $9.27 per direct labor hour?
   a. $1,120 (F).
   b. $1,120 (U).
   c. $1,100 (F).
   d. $1,100 (U).

4. (CO3) Of the following, who is/are responsible for the direct labor efficiency variance?
   a. Purchasing manager.
   b. Production manager.
   c. Supervisors and workers.
   d. Human resources manager.

5. (CO2) If the VOH standard price is $1.10 per direct labor hour; actual VOH costs for August were $18,000; actual direct labor hours worked in August were 16,000; and the standard quantity allowed (SQA) is 17,000 direct labor hours; then what is the VOH spending variance?
   a. $400 (F).
   b. $400 (U).
   c. $700 (F).
   d. $700 (U).

6. (CO3) If the standard price per pound is $.15; the standard quantity (SQA) is 8,000 pounds; and the actual usage is 8,250 pounds; then what is the direct materials usage variance?
   a. $ 37.50 (F).
   b. $ 37.50 (U).
   c. $2,437.50 (F).
   d. $2,427.50 (U).

7. (CO3) If the standard quantity is 3 direct labor hours per unit; equivalent units of production is 8,000; and 23,000 direct labor hours are used at an average rate of $8.25 per hour (standard rate is $8); then what is the direct labor efficiency variance?
   a. $8,250 (U).
   b. $8,250 (F).
   c. $8,000 (U).
   d. $8,000 (F).

8. (CO3) The standard price is $2.15 per direct labor hour. EUP is 11,000 units. The standard quantity is 2 direct labor hours per unit, and 21,000 direct labor hours are used. What is the variable overhead efficiency variance?
   a. $2,150 (F).
   b. $2,150 (U).
   c. 22,000 DLHr (F).
   d. 22,000 DLHr (U).

9. (CO4) How is the fixed overhead budget variance calculated?
   a. Budgeted FOH - Actual FOH.
   b. Budgeted FOH + Actual FOH.
   c. FOH std cost x (Actual Output - Production quota).
   d. FOH std price x (SQA - Budgeted DLHr).

10. (CO5) In a standard PCAS, the journal entry to record the purchase of raw materials requires a debit to Raw Materials Inventory for:
    a. SP x SQA.
    b. SP x AQp.
    c. AP x AQp.
    d. none of the above.

Demonstration Problem

The Meow Cat Food Company produces the nation's foremost premium cat food. The following data, for the month of April, pertain to standard costs of direct materials, direct labor, and overhead to produce one bag of the top-quality hard food, plus other actual production and cost data:

Standard Prices:	
Direct materials	$ .20 per lb.
Direct labor	$7.00 per DLHr
VOH	$1.30 per DLHr
FOH	$ .50 per DLHr

Standard Quantities:

Direct materials	10 lbs. per bag
Direct labor	.4 DLHr per bag

April's FOH was based on a production quota of 75,000 bags.

Actual production data and costs for April:

Items	Actual Costs	Actual Quantities
DM	$ .18/lb.	800,000 lbs. purchased
		775,000 lbs. requisitioned
DL	$7.05/DLHr	31,000 hours worked
VOH	$39,500	
FOH	$15,200	

Actual output (EUP): 70,000 bags

REQUIRED:

a. Construct the standard cost card for one bag of hard cat food.

b. Cite the manufacturing cost equation for April.

c. Calculate the direct materials price variance.

d. Calculate the direct labor rate variance.

e. Calculate the variable overhead spending variance.

f. Calculate the standard quantities allowed for direct materials, direct labor, and variable overhead.

g. Calculate the direct materials usage variance.

h. Calculate the direct labor efficiency variance.

i. Calculate the variable overhead efficiency rate.

j. Calculate the fixed overhead budget variance.

k. Calculate the fixed overhead production volume variance.

l. Calculate the total fixed overhead variance.

m. Calculate the total variable overhead variance.

n. Calculate the total overhead variance.

SOLUTIONS TO SELF-TEST

Note: The notation (Pg. 1) means that information about the question and its answer can be found on page 1 of your textbook.

Matching

1. (Pg. 344) i
2. (Pg. 367) a
3. (Pg. 342) b
4. (Pg. 336) e
5. (Pg. 367) k
6. (Pg. 365) c
7. (Pg. 330) n
8. (Pg. 338) o
9. (Pg. 365) d
10. (Pg. 349) l
11. (Pg. 341) f
12. (Pg. 363) g
13. (Pg. 340) m
14. (Pg. 330) h
15. (Pg. 339) j

Completion

1. (Pg. 363) direct materials mix, direct materials yield
2. (Pg. 347) VOH spending, VOH efficiency, FOH budget, FOH volume
3. (Pg. 331) world-class
4. (Pg. 336) purchasing agent
5. (Pg. 337) vendors, lot size, purchase price, specifications, marketplace
6. (Pg. 341) purchasing department
7. (Pg. 368) backflush, flushed
8. (Pg. 331) management-by-exception
9. (Pg. 332) isolate, correct
10. (Pg. 343) value, eliminated, reduced

True-False Statements

1. (Pg. 367) T
2. (Pg. 365) T
3. (Pg. 337) F It measures deviations from standard in the average hourly rate plus taxes and fringe benefits.
4. (Pg. 345) F It can be calculated by either of two formulas.
5. (Pg. 347) T
6. (Pg. 332) F All variances should be investigated if they fall outside predetermined limits.
7. (Pg. 334) T
8. (Pg. 341) F The production manager is responsible because he or she is in charge of how materials are used.
9. (Pg. 347) T
10. (Pg. 367) T

Multiple Choice

1. (Pg. 336) b 75,000 lbs. x ($.22 - $.25)
2. (Pg. 335) c
3. (Pg. 337) d 55,000 DLhr x ($9.25 - $9.27)

4. (Pg. 343) c
5. (Pg. 338) b 16,000 DLhr x $1.10 = $17,600
   $17,600 - $18,000 = $400 (U)
6. (Pg. 341) b $.15 x (8,000 - 8,250)
7. (Pg. 342) d 8,000 EUP x 3 DLHr per unit = 24,000 DLHr
   $8 x (24,000 DLHr - 23,000 DLHr)
8. (Pg. 343) a 11,000 EUP x 2 DLHr per unit = 22,000 DLHr
   $2.15 x (22,000 DLHr - 21,000 DLHr)
9. (Pg. 344) a
10. (Pg. 353) b

Demonstration Problem

a.

Items	Standard Price	Standard Quantity	Standard Cost
DM	$ .20/lb	10 lbs/bag	$2.00/bag
DL	$7.00/DLHr	.4 DLHr/bag	$2.80/bag
VOH	$1.30/DLHr	.4 DLHr/bag	$ .52/bag
FOH	$ .50/DLHr	.4 DLHr/bag	$ .20/bag
SAMC			$5.52/bag

FOH is based on a quota of 75,000 bags per month.

b. 75,000 bags x $.20/bag = $15,000

DM $2.00/bag
DL $2.80/bag
VOH $ .52/bag
$5.32/bag

Mfg. cost equation = $15,000 + $5.32/bag

c. DM price variance = AQp x (SP - AP).
= 800,000 lbs. x ($.20 - $.18)
= 800,000 lbs. x $.02
= $16,000 (F)

d. DL rate variance = Actual DLHr x (Std rate - Act. rate)
= 31,000 DLHr x ($7.00 - $7.05)
= 31,000 DLHr x -$.05
= $1,550 (U)

e. Budgeted costs based on actual hours worked
(31,000 DLHr x $1.30/DLHr) $40,300
Less: Actual VOH costs 39,500
Variable spending variance $ 800 (F)

f. SQA DM = 70,000 bags x 10 lbs./bag = 700,000 lbs.
SQA DL = 70,000 bags x .4 DLHr/bag = 28,000 DLHr
SQA VOH = 70,000 bags x .4 DLHr/bag = 28,000 DLHr

g. DM usage variance = SP x (SQA - AQu)
= $.20/lb. x (700,000 lbs. - 775,000 lbs.)
= $.20/lb. x -75,000 lbs.
= $15,000 (U)

h. DL eff. variance = SP x (SQA -AQu)
= $7.00/DLHr x (28,000 DLHr - 31,000 DLHr)
= $7.00/DLHr x -3,000 DLHr
= $21,000 (U)

i. VOH eff. variance = SP X (SQA x AQu)
= $1.30 x (28,000 DLHr - 31,000 DLHr)
= $1.30 x -3,000 DLHr
= $3,900 (U)

j. FOH bud. variance = Budgeted FOH - Actual overhead
= $15,000 - $15,200
= $200 (U)

k. FOH vol. variance = FOH std. cost x (Act. out. - Prod. quota)
= $.20 X (70,000 bags - 75,000 bags)
= $.20 X -5,000 bags
= $1,000 (U)

l. TFOH variance = FOH budget variance + FOH volume variance
= $200 (U) + $1,000 (U)
= $1,200 (U)

m. TVOH variance = VOH spending var. + VOH efficiency var.
= $800 (F) + $3,900 (U)
= $3,100 (U)

n. TOH variance = TVOH variance + TFOH variance
= $3,100 (U) + $1,200 (U)
= $4,300 (U)

CHAPTER 9

THE NEED FOR MULTIPLE OVERHEAD ACCOUNTS

CHAPTER OVERVIEW

Chapter 9 addresses the need for multiple overhead accounts within WIP. You will learn how to design the general ledger system for WIP so that more accurate product cost information and cost management information can be provided. You will also learn different methods of allocating service department costs to production departments. Finally, you will learn how to design an SCAS that includes cost variances for both production and service departments.

Review of Specific Chapter Objectives

1. Discuss the need for multiple overhead accounts within WIP (pgs. 401 - 404).

   - As manufacturers become more automated, the proportion of indirect costs (overhead) increases. Therefore, more sophisticated CASs are needed in order to account adequately for overhead.

   - The management accountant can develop a **single plantwide TOH POR.** This is computed by adding total estimated VOH and FOH costs and then dividing that total by the estimated level of activity.

   - If a company is greatly diversified, a single plantwide TOH POR rate may result in misinformation. **Subdividing the TOH POR** provides more useful information. This will especially be true for enterprises in which: there are important differences in the nature of the work performed in different areas of the plant; there are significantly different products or services using resources in different ways; or products differ substantially in their relative use of direct materials.

   - Normally, **the best way** to begin designing the OH accounting system is to **set up separate PORs for production departments.** The management accountant seeks the most accurate basis for applying overhead costs to products or services. Each company must decide for itself how many overhead rates to use.

   - It is usually desirable to **calculate two PORs, a variable overhead (VOH) rate and a fixed overhead (FOH) rate.** This separation is important for standard cost card calculations and overhead budgeting, as well as in cost control through four-way overhead cost variance analysis.

2. Describe how the general ledger system for WIP can be designed to provide more accurate product cost information and cost management information (pgs. 405 - 406).

   - **Production departments (also called operating**

departments, cells, or workcenters) are where the central purposes of the organization are carried out. An example is the surgery department in a hospital.

- **Service departments** provide assistance and support that facilitate the activities of the production departments. An example is the human resources department of a hospital. Service department costs must be allocated to the production departments' overhead accounts. In this way, service department costs become part of the budgeted overhead costs of the production departments.

- This type of CAS design results in a **three-stage overhead allocation process.**
  Stage one: overhead cost assignments. As overhead costs are incurred, they are debited to the proper service and production department overhead accounts. This is called **primary cost assignment.**
  Stage two: service department overhead cost allocation. Service department costs are allocated to the production department overhead accounts so that they can be included in the departmental TOH PORs. This is called **secondary cost allocation.**
  Stage three: overhead cost application. Departmental PORs are developed, and the PORs are used to apply overhead from the production department overhead accounts to the products produced or services rendered by the company.

3. Explain how to allocate service department costs to production departments, and describe the different methods that can be used (pgs. 406 - 414).

   - There are **four commonly used methods for allocating service department costs to production department overhead accounts.** The first three will be discussed next, assuming that each service and each production department uses one total overhead account. The methods are discussed in order of increasing complexity.

   - The **DIRECT METHOD** allocates each service department's total costs directly to the production departments' overhead accounts. This method's **major weakness** is that it ignores any service rendered by one service department to another, but it is the simplest and quickest way to allocate service costs. An appropriate base, such as square feet or budgeted payroll, must be used. An example follows:

     There are two service departments and two production departments within an enterprise. Service Department 1 has a budgeted cost of $100,000. Production Department 1 occupies 8,000 square feet, while Production Department 2 occupies 12,000 square feet. Production Department 1 will be allocated $40,000 ([8,000 square feet ÷ 20,000 total square feet] x $100,000), while Production Department 2 will be allocated $60,000 ([12,000 square feet ÷ 20,000 total square feet] x $100,000). **Note:**

Services rendered by Service Department 1 to Service Department 2, and by Service Department 2 to Service Department 1, are ignored.

▲ The **STEP METHOD** allows for limited recognition of services rendered by service departments to other service departments. The sequence often begins with the department that renders the most services to other service departments and ends with the allocation of the costs of the service department that renders the lowest percentage of its services to other service departments. This method's **weakness** is that it recognizes only one-way inter-service department use.

Consider the example above with two service departments and two production departments. Once again, an appropriate basis of allocation is chosen. Assume that Service Department 1 provides more service to Service Department 2 than it receives from Service Department 2. Using the step method, Service Department 1's service cost is allocated to Service Department 2 and then to the two production departments. Next, Service Department 2's costs are allocated to the two production departments. **Note: Service Department 1 receives none of Service Department 2's costs because costs are not allocated "backward" using the step method.**

▲ The **RECIPROCAL METHOD** recognizes that services rendered by certain service departments are used, in part, by other service departments. It allocates services back and forth among all departments using the services. It recognizes all interrelationships among departments and, therefore, produces more accurate service department cost allocations.

The first step is to determine the share of each service department's costs that is to be allocated to the other service departments and to the production departments. Then, simultaneous equations are derived for calculating the costs of the services rendered. The relationships among departments are expressed in the form of a system of linear equations, with one equation for each department. When a large number of variables is present, the equations will be too complex to solve without the help of a computer.

4. Design an SCAS that includes cost variances for both production and service departments (pgs. 414 - 428).

▲ **Overhead applied during a period rarely equals the actual overhead costs of that period** because the actual level of activity is above or below the budgeted level, and/or actual overhead costs are different from estimated overhead costs. The following are **factors which can produce under- or overapplied overhead:** 1) actual and estimated variable overhead cost per unit difference; 2) actual and estimated total fixed overhead costs difference; and 3) actual activity and expected capacity

difference.

- **For the above reasons, overhead cost variances for service departments, as well as for production departments, are needed.** A high-quality CAS will separate VOH and FOH, creating separate accounts and overhead allocations for each department's VOH and FOH. A high-quality CAS also recognizes that VOH and FOH are caused by different activities, even for the same department.

- **An SCAS can be used.** When service departments are present, each will have its own cost variance accounts, just as do the production departments. The important attribute of a high-quality overhead accounting system is that the cost variances are reported to the proper responsibility centers. The reporting must be timely enough to allow corrective actions and operational control.

CHAPTER SELF-TEST

Note: The notation (CO1) means that the question was drawn from chapter objective number one.

Matching

Please write the letters of the following terms in the spaces to the left of the definitions.

a.	Direct method	f.	Secondary cost allocation
b.	Multiple PORs	g.	Service departments
c.	Primary cost assignment	h.	Single plantwide POR
d.	Production departments	i.	Step method
e.	Reciprocal method		

_____ 1. (CO2) Assignment of initial overhead costs to service and production departments' VOH and FOH accounts.

_____ 2. (CO3) Method of allocating service department costs to production departments without making any inter-service department allocations.

_____ 3. (CO3) Cost allocation method that considers all interrelationships of the departments and reflects them in simultaneous equations.

_____ 4. (CO1) Results from subdividing the total overhead POR.

_____ 5. (CO1) Allocation of service department costs to other service and production departments.

_____ 6. (CO1) Not engaged directly in production activities but provide assistance and support to production departments.

_____ 7. (CO2) A cell or workcenter, where work is performed directly on manufactured products.

_____ 8. (CO1) Plantwide blanket rate.

_____ 9. (CO3) Cost allocation method which allows for limited recognition of services rendered by service departments to other service departments.

Completion

Please write in the word or words which will complete the sentence.

1. (CO2) Because service department costs cannot be directly traced to products being manufactured, these costs must be _____ to the production departments' _____ _____.

2. (CO3) The _____ method allows for limited recognition of services rendered by one service department to other service departments.

3. (CO3) The first step in making reciprocal allocations is to determine the _____ of each service department's costs that is to be _____ to the other service departments and to the production departments.

4. (CO3) When using the step method of service department cost allocation, the sequence begins with the _____ that renders the _____ services to _____ _____ departments.

5. (CO3) The _____ method allocates each service department's total costs to the _____ _____ overhead accounts.

6. (CO3) If a company has two service departments and two production departments and uses the step method of cost allocation, the larger service department will receive none of the smaller service department's costs because costs are not allocated _____ when the step method is used.

7. (CO3) The _____ method recognizes that services rendered by certain service departments are used, in part, by other service departments.

8. (CO3) The _____ method recognizes all _____ among service and production departments.

9. (CO3) When the reciprocal method of cost allocation is used, relationships among departments are expressed in the form of a system of _____ _____.

10. (CO4) A high-quality CAS will create separate _____ and _____; it will also recognize that these are caused by different _____, even within the same department.

True-False Statements

Please circle "T" if the sentence is true and "F" if it is false.

T F 1. (CO3) The direct method is the simplest, but least accurate, of the secondary (stage two) cost allocation methods.

T F 2. (CO3) The step method is considered to provide the most accurate allocations of the three methods commonly used for cost allocation.

T F 3. (CO1) Normally, the best way to begin designing the overhead accounting system is to set up separate PORs for production departments.

T F 4. (CO1) Generally, one total overhead POR provides management with more useful information than separate VOH and FOH PORs.

T F 5. (CO2) Service department costs are not part of the cost of manufacturing products.

T F 6. (CO2) Some costs can be directly traced to each service department. These include wages, indirect materials requisitioned by the service department, depreciation of service department equipment, and employment taxes.

T F 7. (CO3) The direct method is widely used for allocating service department costs.

T F 8. (CO3) The major weakness of the direct method is that it ignores any service rendered by one service department to other service departments.

T F 9. (CO3) The step method of allocating service department costs performs two-way allocation of services.

T F 10. (CO3) If a service department's total costs are $500,000; Production Department A has a budgeted payroll of $700,000; Production Department B has a budgeted payroll of $300,000; and the direct method of cost allocation is used; then Production Department A's share of the service department's total costs is $150,000.

Multiple Choice

Please circle the correct answer.

1. (CO3) Three common methods for allocating service department costs to production department overhead accounts, in order of increasing sophistication, are:
   a. step, direct, and reciprocal.
   b. step, reciprocal, and direct.
   c. reciprocal, direct, and step.
   d. direct, step, and reciprocal.

2. (CO3) When using the direct method of allocating service department costs, which of the following statements is true?
   a. The direct method is more complex than the step method because a sequence of allocations must be chosen.
   b. The direct method allocates services back and forth among all departments.
   c. With the direct method, the primary costs of operating each service department are allocated directly to the production departments.
   d. With the direct method, percentages are used to derive simultaneous equations for calculating the costs of the services rendered.

3. (CO3) When using the step method of allocating service department costs, which of the following statements is true?
   a. The step method is less complex than the direct method.
   b. Where inter-service department relationships exist, first allocating the service department providing the most service to the other service departments will generally result in the best step allocation.
   c. The strength in the step method is that it recognizes one-way inter-service department use.
   d. All of the above statements are true.

4. (CO3) When using the reciprocal method of allocating service department costs, which of the following statements is true?
   a. A spreadsheet program can be used to calculate the share of each service department's costs to be allocated to other service departments and to the production departments.
   b. When there are few departments and interrelationships, simultaneous equations can be solved by hand.
   c. If a large number of variables is present, then the simultaneous equations will be too complex to solve without the aid of a computer.
   d. All of the above statements are true.

5. (CO2) What is the proper sequence of steps in the three-stage overhead allocation process?
   a. Overhead cost assignments, service department overhead cost allocation, overhead cost application.
   b. Service department overhead cost allocation, overhead cost assignments, overhead cost application.
   c. Overhead cost application, service department overhead cost allocation, overhead cost assignments.
   d. Service department overhead cost allocation, overhead cost application, overhead cost assignments.

6. (CO2) Secondary cost allocation involves:
   a. overhead cost application.
   b. overhead cost assignments.
   c. service department overhead cost allocation.
   d. overhead cost application and overhead cost assignments.

7. (CO2) Primary cost assignment involves:
   a. overhead cost application.
   b. overhead cost assignments.
   c. service department overhead cost allocation.
   d. overhead cost application and overhead cost assignments.

8. (CO3) A company uses the step method of cost allocation and has two service departments and two production departments. Service Department 1 provides more services to Service Department 2 than Service Department 2 provides to Service Department 1. Which of the following statements is true?
   a. Service Department 1's costs are allocated to the two production departments; then, Service Department 2's costs are allocated to the two production departments.
   b. Service Department 1's costs are allocated to Service Department 2 and to the two production departments; then Service Department 2's costs are allocated to the two production departments.
   c. Service Department 1's costs are allocated to Service Department 2; then Service Department 2's costs are allocated to Service Department 1; then both departments' costs are allocated to the two production departments.
   d. Service Department 2's costs are allocated to Service Department 1 and to the two production departments; then Service Department 1's costs are allocated to the two production departments.

9. (CO3) Service Department 1 has $200,000 of total costs, while Service Department 2 has $100,000 of total costs. There are two production departments, Assembly and Finishing. Assembly occupies 400,000 square feet, while Finishing occupies 100,000 square feet. The company uses the direct method of cost allocation. What share of Service Department 2's costs does the Assembly Department receive?
   a. $160,000.
   b. $ 80,000.
   c. $ 40,000.
   d. $ 20,000.

10. (CO3) Service Department 1 has $200,000 of total costs, while Service Department 2 has $100,000 of total costs. There are two production departments, Assembly and Finishing. Assembly occupies 400,000 square feet, while Finishing occupies 100,000 square feet. The company uses the direct method of cost allocation. What share of Service Department 1's costs does the Finishing Department receive?
   a. $160,000.
   b. $ 80,000.
   c. $ 40,000.
   d. $ 20,000.

Demonstration Problem

Consider the following data pertaining to the Gripper Manufacturing Company:

Service Department	Allocation Base
Personnel:	Budgeted Payroll:
Blank	$100,000
Finishing	150,000
	$250,000
Training:	Training Hours:
Blank	1,000
Finishing	1,500
	2,500
Maintenance:	Work Orders:
Blank	150
Finishing	250
	400

Budgeted costs for each of the service and production departments are as follows:

Maintenance	$300,000
Personnel	275,000
Training	100,000
Blank	500,000
Finishing	400,000

REQUIRED: Use the direct method to allocate the service departments' budgeted costs to the company's production departments.

SOLUTIONS TO SELF-TEST

Note: The notation (Pg. 1) means that information about the question and its answer can be found on page 1 of your textbook.

Matching

1. (Pg. 405) c
2. (Pg. 407) a
3. (Pg. 411) e
4. (Pg. 401) b
5. (Pg. 405) f
6. (Pg. 400) g
7. (Pg. 405) d
8. (Pg. 401) h
9. (Pg. 408) i

Completion

1. (Pg. 405) allocated, overhead account
2. (Pg. 408) step
3. (Pg. 411) share, allocated
4. (Pg. 408) department, most, service
5. (Pg. 407) direct, production departments'
6. (Pg. 408) backward
7. (Pg. 411) reciprocal
8. (Pg. 411) reciprocal, interrelationships
9. (Pg. 412) linear equations
10. (Pg. 416) VOH, FOH, activities

True-False Statements

1. (Pg. 407) T
2. (Pg. 411) F The reciprocal method is considered the most accurate.
3. (Pg. 402) T
4. (Pg. 404) F The opposite is true.
5. (Pg. 405) F These costs are part of production costs.
6. (Pg. 405) T
7. (Pg. 407) T
8. (Pg. 407) T
9. (Pg. 411) F The reciprocal method does this.
10. (Pg. 407) F Production Department A receives $350,000 [$500,000 x ($700,000 ÷ $1,000,000)].

Multiple Choice

1. (Pg. 406) d
2. (Pg. 407) c
3. (Pg. 408) b
4. (Pg. 411) d
5. (Pg. 405) a
6. (Pg. 405) c
7. (Pg. 405) b
8. (Pg. 408) b
9. (Pg. 407) b 100,000 + 400,000 = 500,000 square feet
   (400,000 ÷ 500,000) x $100,000
10. (Pg. 407) c 100,000 + 400,000 = 500,000 square feet
    (100,000 ÷ 500,000) x $200,000

Demonstration Problem

Service Department	Allocation Base	Percentage	Serv. Dept. Allocations
Maintenance:	Work Orders:		
Blank	150	37.5%	$112,500
Finishing	250	62.5%	187,500
	400	100.0%	$300,000
Personnel:	Bud. Payroll		
Blank	$100,000	40.0%	$110,000
Finishing	150,000	60.0%	165,000
	$250,000	100.0%	$275,000
Training:	Training Hrs.		
Blank	1,000	40.0%	$ 40,000
Finishing	1,500	60.0%	60,000
	2,500	100.0%	$100,000

	Service Departments			Production Departments	
	Maint.	Personnel	Training	Blank	Finishing
Stage One	$300,000	$275,000	$100,000	$500,000	$400,000
Stage Two:					
Maint.	(300,000)			112,500	187,500
Pers.		(275,000)		110,000	165,000
Train.			(100,000)	40,000	60,000
TOH Allocated	$ 0	$ 0	$ 0	$762,500	$812,500

CHAPTER 10

THE ACTIVITY-BASED COSTING SYSTEM

CHAPTER OVERVIEW

Chapter 10 introduces you to the activity-based costing system. The differences between traditional volume-based costing systems and the ABC system will be discussed, and you will learn how to develop an ABC system. Finally, you will learn how ABC systems are used in service organizations.

Review of Specific Chapter Objectives

1. Define activity-based costing systems (pgs. 445 - 453).

   - **Activity-based costing (ABC)** is the collection of financial and nonfinancial data about an enterprise's activities for two primary purposes: costing the enterprise's cost objects, and providing information for effective cost management through activity-based management.

   - **Activity analysis** is the process of defining and describing activities and their corresponding cost drivers and is the key to building an ABC system. **Activity-based management (ABM)** uses ABC information to support cost management via continuous improvement or to serve as a guide in completely reengineering activities of the enterprise.

   - The idea behind ABC is that cost objects, which can be products, services, jobs, units, batches, customers, or anything the management accountant is trying to cost, consume activities. Activities then consume resources. Activity drivers measure the activities consumed, and resource drivers measure the resources consumed.

   - An **ABC system has six components:** resource categories, first-stage resource drivers, activities and activity cost pools, second-stage activity drivers, cost objects, and direct cost inputs.

   - **RESOURCE CATEGORIES** represent the sources of costs that support activities. Examples include utilities; salaries and benefits; accounting; engineering; and insurance, licenses, and taxes.

   - **FIRST-STAGE RESOURCE DRIVERS** are used to assign resource costs to activities, thereby forming activity cost pools that contain their proper share of resource costs. The resource driver establishes a relationship between resource costs and activity cost pools based on some measure of usage (headcount, square feet, hours).

   - An **ACTIVITY** is what an organization does to convert inputs to outputs. It is an aggregation of highly related tasks that perform work in an organization. An

ACTIVITY COST POOL is the result of assigning resource costs to an activity.

▲ **SECOND-STAGE ACTIVITY DRIVERS** are measures of the consumption of the activity cost pools by cost objects. They are used to assign costs in activity cost pools to the cost objects.

▲ **COST OBJECTS** are the point to which activity costs are assigned. Typical cost objects include: products, services, units, batches, contracts, cases, jobs, projects, customers, customer groups, distribution channels, and sales territories. In some ABC systems, costs are assigned to different types of cost objects at different levels. For product-driven activity costs, there are typically three levels: unit-level, batch-level, and product-level.

▲ **DIRECT COST INPUTS** are cost elements that are easily traced to cost objects.

▲ **Costs can be assigned to cost objects in four ways:**

1. All costs are assigned to activity cost pools, and the activity costs are assigned to cost objects via appropriate activity drivers. This approach is applicable to some service organizations.
   Cost object = Costs assigned from activity cost pools
2. All costs except direct materials costs are assigned to activity cost pools, and the activity costs are assigned to cost objects via appropriate activity drivers. This approach is applicable to manufacturing enterprises in which "direct" labor has become "indirect."
   Cost object = Direct materials + Costs assigned from activity cost pools
3. All costs except direct materials and direct labor costs are assigned to activity cost pools, and the activity costs are assigned to cost objects via appropriate activity drivers. This approach is applicable in any organization in which direct materials and direct labor costs are easily traced to cost objects.
   Cost object = Direct materials + Direct labor + Costs assigned from activity cost pools
4. All costs except direct materials, direct labor, and direct technology (equipment) are assigned to activity cost pools, and the activity costs are assigned to cost objects via appropriate activity drivers. This approach is applicable to any organization in which those three elements are easily traced to cost objects.
   Cost object = Direct materials + Direct labor + Direct technology + Costs assigned from activity cost pools

▲ **A rule of thumb in developing an ABC system** is to first identify all costs that can be traced directly to cost

objects; then, all other costs are assigned to activity pools.

- An **activity center** represents an aggregation of related, function-specific activities. The sum of costs in activity cost pools aggregated in the activity center equals the total costs associated with the activity center.

- A **rule of thumb for selecting cost drivers** is that the appropriate cost driver is the one that represents the primary output of the activity. Cost drivers can be transaction-based, time-based, dollar-based, or percentage-based. In many instances, a cost driver that captures the number of activity transactions rather than the duration or dollar amount of activity transactions is a better cost driver. Selection of a cost driver can also have an effect on people's behavior.

2. Contrast traditional volume-based costing systems with activity-based costing systems (pgs. 453 - 458).

- **Traditionally, overhead costs have been applied according to four volume-related bases:** direct labor hours, direct labor dollars, machine hours, and materials dollars. The assumption is that all applied costs have the same behavior, but there are many costs that are driven by diversity and complexity, not by volume.

- **Nonvolume-related cost drivers are required.** These include items such as number of purchase orders, number of receipts, number of inspections, and number of payments. If a volume-related cost driver is used, then one product may cross-subsidize another product. In general, in a traditional volume-based costing system, low-volume products are undercosted and high-volume products are overcosted.

- **ABC is especially appropriate in companies in which the following are true:**
  1. Competition is high.
  2. Product mix is diverse in batch sizes, physical sizes, degree of complexity, and raw material characteristics.
  3. Product life cycles are short, such as three years or less.
  4. Collection and manipulation of data are performed by an ICBIS.

- The **three strategic goals of ABC systems are:**
  1. Appropriate pricing decisions based on good cost information.
  2. Appropriate product mix decisions based on good profitability information.
  3. Good cost management accomplished by focusing on activities and cost drivers.

3. Explain how to develop activity-based costing systems (pgs. 459 - 474).

▲ The **ABC systems development life cycle** is a structured series of phases followed by the systems project team in developing an ABC system. It is a methodology for developing an ABC system. It consists of five phases.

▲ **PHASE ONE: Plan the system.** There must be an understanding of how an ABC system works and of an ABC system's primary purposes, discussed in objective one. This phase establishes a broad strategic framework and clear vision of the enterprise and an understanding of how the ABC system will serve the enterprise. Active involvement by participants is critical to success, not only so that people can feel that it is their system, but also so that management accountants can understand what activities are performed and what it takes to get the job done.

▲ **PHASE TWO: Analyze and define resource categories.** The systems project team may choose to combine certain ledger accounts and budgetary items or to split these accounts and items because they are consumed differently by different activities.

▲ **PHASE THREE: Analyze and define activities.** In this phase, both service and production activities of an enterprise are identified. Activity analysis describes what an enterprise does. An activity flow diagram describes the activities that are performed in an organization and shows the interdependencies of these activities. This diagram uses the following symbols:
Rectangle: represents a source or destination (persons, companies, departments, or other systems) of the initial or final inputs or outputs of the system under analysis. Labels should be descriptive.
Circle: represents an activity that converts inputs to outputs. The description consists of a verb and an object or an object clause, such as Check Credit.
Line and an arrow: represents the input and output among sources, destinations, and activities. All of these flows either initiate an activity or result from an activity. Each line should have a noun or a noun clause (such as Purchase Order) next to it. Inputs and outputs can be paper documents, electronic data, materials, and various measurements (such as machine hours).

Activities are composed of tasks, which are pieces of work assigned to people or machines. A task may be computational, procedural, or physical. A fishbone diagram (or cause-and-effect diagram) can be used as a tool for defining activities. Aggregation is the process of combining tasks into a homogeneous group to form a function-specific activity. Decomposition is the process of breaking down groups of dissimilar tasks into several function-specific activities.

- **PHASE FOUR: Determine first-stage resource drivers, and establish activity cost pools.** The first-stage resource drivers assign resource costs to various activities forming activity cost pools.

- **PHASE FIVE: Determine second-stage activity drivers, and assign costs to cost objects.** These activity drivers are usually the outputs designated on the activity flow diagram. Generally, the best measure, and therefore, the best activity driver, is the primary output of the activity.

- Costs consumed are assigned to a cost object through a **bill of activities**, which lists activities and associated costs required by the cost object.

- In a **product-driven ABC system**, costs are assigned to cost objects such as units, batches of units, and product lines. In a **market-driven ABC system**, costs are assigned to cost objects such as customers, customer groups, distribution channels, and sales territories. Customers are usually aggregated into groups, such as distributors and retailers.

4. Discuss how activity-based costing systems are used in service organizations (pgs. 475 -476).

- Service organizations differ from manufacturing organizations in two primary areas: They have little or no inventory, and their output is often intangible and difficult to define.

- Despite these differences, however, service firms are developing costing systems that are very similar to ABC systems used by manufacturers. For example, in a hospital, the nursing care activity is driven by acuteness levels. The occupancy and feeding activity is considered a daily cost that is the same for all acuteness levels. For a railroad, the ABC system enables the railroad to derive the actual cost of each shipment by gathering data each day from many locations on movements of trains and shipments.

CHAPTER SELF-TEST

Note: The notation (CO1) means that the question was drawn from chapter objective number one.

Matching

Please write the letters of the following terms in the spaces to the left of the definitions.

a. ABC systems development life cycle
b. Activity
c. Activity analysis
d. Activity-based costing (ABC)
e. Activity-based management (ABM)
f. Aggregation
g. Activity cost pool
h. Activity drivers
i. Activity flow diagram
j. Bill of activities
k. Cost objects
l. Decomposition
m. Direct cost inputs
n. Fishbone diagram
o. Resource drivers
p. Tasks

_____ 1. (CO1) An activity that has been assigned its portion of resource costs.

_____ 2. (CO1) Cost elements that are easily traced to cost objects.

_____ 3. (CO1) The process of defining and describing activities and their corresponding cost drivers.

_____ 4. (CO3) Lists activities and associated costs required by the cost object.

_____ 5. (CO3) A tool used to define the tasks that comprise an activity.

_____ 6. (CO3) Pieces of work assigned to people or machines.

_____ 7. (CO3) Describes activities, their interdependencies, and inputs and outputs.

_____ 8. (CO3) The process of breaking down groups of dissimilar tasks into several function-specific activities.

_____ 9. (CO1) A process made up of highly related tasks that converts inputs to outputs.

_____ 10. (CO1) Use of ABC information to perform continuous improvement, reduce or eliminate nonvalue-added activities, and make strategic decisions.

_____ 11. (CO1) Anything to which activity costs are assigned.

_____ 12. (CO1) Used to assign resource costs to activities.

_____ 13. (CO1) Used to assign activity costs to cost objects.

_____ 14. (CO3) An engineered, structured methodology used by multidisciplinary systems project teams to develop ABC systems.

_____ 15. (CO1) A costing methodology that collects financial and operational data about an enterprise's activities for costing cost objects and providing a tool for cost management.

_____ 16. (CO3) The process of combining tasks into homogeneous groups to form a function-specific activity.

Completion

Please write in the word or words which will complete the sentence.

1. (CO1) An _____ _____ is a manageable set of activities or activity cost pools.

2. (CO3) _____ are composed of _____, which are pieces of work assigned to people or machines.

3. (CO1) First-stage _____ _____ establish a relationship between resource costs and activity cost pools.

4. (CO1) The costs in activity cost pools are assigned to the cost objects by means of _____ _____.

5. (CO1) Cost drivers can be _____-based, _____-based, _____-based, or _____-based.

6. (CO2) In traditional volume-based costing systems, overhead costs have been applied according to four volume-related bases, which are _____, _____, _____, and _____.

7. (CO3) An ABC system has two primary purposes: _____ and _____ _____.

8. (CO3) In an activity flow diagram, a _____ represents a source or destination of the initial or final inputs or outputs of the system under analysis; activities, which convert inputs to outputs, are represented by _____.

9. (CO3) In an activity flow diagram, input and output flow is indicated by a _____ and an _____.

10. (CO3) When determining activity drivers, an activity with more than one output should be analyzed to see if it should be _____ into more than one activity.

True-False Statements

Please circle "T" if the sentence is true and "F" if it is false.

T F 1. (CO3) Decomposition is the process of combining tasks into homogeneous groups to form a function-specific activity.

T F 2. (CO3) Activity drivers are also called cause-and-effect diagrams.

T F 3. (CO1) Activities and cost drivers are the building blocks of all business processes and operations.

T F 4. (CO1) ABC systems assume that the costs of activities are variable.

T F 5. (CO1) Second-stage activity drivers are measures of consumption of the activity cost pools by cost objects.

T F 6. (CO2) ABC is especially appropriate in companies where product life cycles are long, such as ten years or more.

T F 7. (CO3) In an activity flow diagram, all activities must have both inputs and outputs; an activity that shows inputs but no outputs is called a "black hole."

T F 8. (CO4) Despite the differences between service and manufacturing firms, service firms are developing costing systems that are very similar to the ABC systems used by manufacturers.

T F 9. (CO3) When performing aggregation and decomposition, if an activity contains unrelated tasks, then it needs to be aggregated.

T F 10. (CO3) A rule of thumb for determining activity drivers states that if two or more activities have the same primary output measure, then they should be aggregated into one activity.

Multiple Choice

Please circle the correct answer.

1. (CO1) Ultimately, activities are performed in order to:
   a. manufacture products.
   b. render services.
   c. support customers.
   d. do all of the above.

2. (CO1) Which of the following is used to trace direct materials costs to a specific cost object (a unit of product)?
   a. Bill of materials.
   b. Number of setups.
   c. Purchase order.
   d. Receiving report.

3. (CO1) In ABC systems, which of the following is the costing formula for an organization in which direct materials, direct labor, and direct technology costs are easily traced to cost objects?
   a. Cost object = Costs assigned from activity cost pools
   b. Cost object = Direct materials + Costs assigned from activity cost pools
   c. Cost object = Direct materials + Direct labor + Costs assigned from activity cost pools
   d. Cost object = Direct materials + Direct labor + Direct technology + Costs assigned from activity cost pools

4. (CO1) In ABC systems, which of the following would be the first-stage resource driver for the purchasing resource category?
   a. Number of purchase orders.
   b. Number of invoices.
   c. Square footage.
   d. Number of shipments.

5. (CO1) In ABC systems, which of the following would be a second-stage activity driver for the engineering activity cost pool?
   a. Number of engineers.
   b. Number of engineering changes.
   c. Rental costs of the engineering facilities.
   d. Square footage of the engineering offices.

6. (CO2) ABC is not appropriate in companies where:
   a. competition is low.
   b. product mix is diverse.
   c. product life cycles are short.
   d. collection and manipulation of data are performed by an ICBIS.

7. (CO3) Which of the following is the first phase of an ABC systems development life cycle?
   a. Analyze and define resource categories.
   b. Analyze and define activities.
   c. Determine first-stage resource drivers.
   d. Plan the system.

8. (CO3) Which of the following symbols is <u>not</u> found on an activity flow diagram?
   a. Arrow.
   b. Circle.
   c. Rectangle.
   d. Triangle.

9. (CO3) Which of the following is <u>not</u> a rule of thumb when performing aggregation and decomposition?
   a. Activities that are responsibilities of different people should be aggregated.
   b. An activity should contain no more than 5 to 15 well-defined, highly related tasks.
   c. If there is only one input and one output, then the activity has been decomposed enough.
   d. If there are multiple inputs and outputs, then the activity may be a candidate for decomposition.

10. (CO3) Which of the following statements is true of market-driven activity-based costing systems?
    a. A market-driven ABC system can be developed along with a product-driven ABC system.
    b. Two different enterprises that produce the same products can incur different market-driven costs.
    c. If an activity contains only one task, then it has probably been subjected to excessive decomposition.
    d. Both a and b are true.

SOLUTIONS TO SELF-TEST

Note: The notation (Pg. 1) means that information about the question and its answer can be found on page 1 of your <u>textbook</u>.

<u>Matching</u>

1. (Pg. 448) g
2. (Pg. 449) m
3. (Pg. 446) c
4. (Pg. 468) j
5. (Pg. 464) n
6. (Pg. 464) p
7. (Pg. 462) i
8. (Pg. 464) l
9. (Pg. 448) b
10. (Pg. 446) e
11. (Pg. 448) k
12. (Pg. 448) o
13. (Pg. 448) h
14. (Pg. 459) a
15. (Pg. 445) d
16. (Pg. 464) f

<u>Completion</u>

1. (Pg. 452) activity center
2. (Pg. 464) Activities, tasks
3. (Pg. 448) resource drivers

4. (Pg. 448) activity drivers
5. (Pg. 452) transaction, time, dollar, percentage
6. (Pg. 453) direct labor hours, direct labor dollars, machine hours, materials dollars
7. (Pg. 460) costing of cost objects, providing information (for daily operational management, continuous improvement, and, in some instances, business reengineering)
8. (Pg. 462) rectangle, circles
9. (Pg. 462) line, arrow
10. (Pg. 466) decomposed

True-False Statements

1. (Pg. 464) F This is the definition of aggregation.
2. (Pg. 464) F A fishbone diagram is also called a cause-and-effect diagram.
3. (Pg. 446) T
4. (Pg. 448) T
5. (Pg. 448) T
6. (Pg. 458) F It is appropriate where product life cycles are short (three years or less).
7. (Pg. 462) T
8. (Pg. 475) T
9. (Pg. 465) F The activity needs to be decomposed.
10. (Pg. 467) T

Multiple Choice

1. (Pg. 449) d
2. (Pg. 449) a
3. (Pg. 450) d
4. (Pg. 448) c
5. (Pg. 449) b
6. (Pg. 458) a
7. (Pg. 459) d
8. (Pg. 462) d
9. (Pg. 465) a
10. (Pg. 472) d

CHAPTER 11

COST MANAGEMENT THROUGH ACTIVITY-BASED MANAGEMENT

CHAPTER OVERVIEW

Chapter 11 expands on the activity-based costing ideas presented in Chapter 10. Activity-based management and its four phases will be discussed. Various performance measurements will be introduced, along with methods of presenting these measurements in a way that users can readily visualize, comprehend, and apply.

Review of Specific Chapter Objectives

1. Define activity-based management (ABM) (pg. 495).

   ▲ **Activity-based management (ABM)** is the process of understanding, reengineering, measuring, and making decisions about activities to put the enterprise on the road to continuous improvement and excellence. **Continuous improvement** calls for systematic and small incremental actions. **Reengineering** requires large quantum changes in how the enterprise is currently operating.

   ▲ If an organization is going to change, the change must ultimately be made at the activity level.

   ▲ **ABM is an ongoing process involving four phases:**
   1. Identify value-added and nonvalue-added activities.
   2. Reengineer the enterprise.
   3. Benchmark value-added activities.
   4. Develop a performance measurement system for continuous improvement.

2. Describe each phase of the four-phase ABM process (pgs. 496 - 504).

   ▲ **PHASE 1: IDENTIFYING VALUE-ADDED AND NONVALUE-ADDED ACTIVITIES**

   Value-added activities contribute something that is worthwhile to the enterprise and its customers. There are two types: those which add value to the customer, and those which are essential for the proper functioning of the enterprise.

   Nonvalue-added activities are those activities which can be reduced or eliminated without decreasing the enterprise's ability to compete and meet customer demands. These activities should not be made more efficient but should be eliminated.

   ▲ **PHASE 2: REENGINEERING THE ENTERPRISE**

   Reengineering is the redesign of how work is done through activities. It involves changing the enterprise into

what it should be. It involves correcting the source of a cost rather than treating the symptoms of a cost.

Simplicity is the watchword of reengineering, while **complexity** is what drives costs. Two examples of complexities are excessive number of vendors and excessive number of purchase orders.

▲ **PHASE 3: BENCHMARKING VALUE-ADDED ACTIVITIES**

Benchmarking involves comparing activities to world-class best practices. An attempt is made by the enterprise doing the benchmarking to set targets that equal or surpass the best-practices benchmark. Benchmarking should be directed to both world-class competitors and to organizations outside the industry. It is the key tool for performing continuous improvement or additional reengineering.

3. Summarize vendor, time-based, productivity, and customer satisfaction performance measurements (pgs. 505 - 527).

▲ The **primary purpose of management accountants' performance measurements** is to bring about improvement and make the enterprise successful. A well-designed performance measurement system can be used to encourage day-to-day actions that improve vendor performance, reduce lead times, increase productivity, satisfy customers, and improve quality.

▲ **Performance measurements** ascertain the work done and the results achieved in an activity. Developing and using a performance measurement system is the key to continuous improvement and cost management.

▲ A **target** is a numerical value set by management or customers. Setting short-term, intermediate-term, and long-term targets helps people not to become discouraged in trying to meet or exceed targets in the short run.

▲ There are **seven rules for developing performance measurements:**

1. Performance measurements should be supportive of company goals and strategies.
2. Performance measurements should be quantifiable.
3. Performance measurements should be simple.
4. Performance measurements should induce beneficial behavior.
5. Performance measurements should focus on the positive aspects as well as on the problems.
6. Performance measurements are intended to foster improvement rather than serve as monitors.
7. Too many performance measurements can confuse people and actually obscure rather than enlighten.

▲ At the activity level, nonfinancial performance measurements are normally more important than financial performance measurements. Since management's goals are

both financial and nonfinancial, performance measurements that reflect both of these goals need to be developed. A performance measurement system that communicates goals and strategies throughout the organization should be developed.

▲ A discussion of **VENDOR PERFORMANCE MEASUREMENTS** follows.

Vendors must meet standards of quality, price, and delivery time. A vendor certification program selects vendors that can meet these standards, and certified vendors become extensions of the enterprise.

A vendor financial performance measurement discloses unnecessary costs caused by a vendor's nonconformance with specifications for quality and delivery schedules. The vendor performance index (VPI) is calculated by dividing the sum of the cost of purchased raw materials and the cost of nonvalue-added activities by the cost of purchased raw materials. If the cost of purchased raw materials is $20,000 and the cost of nonvalue-added activities is $500, then the VPI is 1.03 ([$20,000 + $500] ÷ $20,000). A VPI of 1.02 to 1.04 may place a vendor on acceptable or probationary status. A VPI of 1.04 or higher may make a vendor unacceptable. If there are no nonvalue-added activities, then the VPI will equal 1. Anything above 1 indicates some form of vendor nonconformance. In time, the absolute best vendors will emerge as potential certified vendors.

A vendor nonfinancial performance measurement measures on the basis of points the following: quality, price, on-time delivery, and bonus. A vendor must provide zero- or near zero-defect material at a competitive price at the right time and be willing to improve continually. Vendors are audited weekly or monthly during the selection process, and it can take from 6 to 12 months to build a reliable vendor performance score that can be used to certify a vendor.

The vendor quality performance measurement focuses on the vendor's ability to deliver raw materials of consistently high quality. The formula is:

$$\text{Acceptance percentage} = \frac{\text{Number of parts accepted}}{\text{Number of parts delivered}}$$

The buying company must set a target acceptance percentage.

The vendor on-time delivery performance measurement discloses the vendor's ability to deliver raw materials just in time, not too early and not too late. The buying company tracks vendor delivery performance in order to determine which vendor might become a certified vendor.

The vendor simplicity performance measurement calculates two values: the number of vendors per product and the

number of purchase orders per product. The buying company usually has a goal of reducing these two values, since complexity drives costs. The following are the pertinent formulas:

$$\text{Number of vendors per product} = \frac{\text{Number of vendors}}{\text{Number of products}}$$

$$\text{Number of purchase orders per product} = \frac{\text{Number of purchase orders}}{\text{Number of products}}$$

▲ A discussion of **TIME-BASED PERFORMANCE MEASUREMENTS** follows.

Time is the equivalent of money, productivity, quality, and resources; it is manageable and a source of competitive advantage throughout every activity in the organization. Lead time is the time between the beginning of a process or activity and the appearance of its results. Production lead time is the interval between the acquisition of raw materials and first stage of production and the time that the finished products come off the production line.

$$\text{Production lead time efficiency (LTE) ratio} = \frac{\text{Value-added activities}}{\text{Value-added activities} + \text{Nonvalue-added activities}}$$

The higher the ratio, the less there is of nonvalue-added activity. Traditional manufacturers have an LTE ratio of 10 percent or less, while world-class manufacturers have an LTE ratio of 40 percent, with some as high as 70 to 80 percent.

The contribution margin velocity ratio performance measurement is based on the observation that profitability is a function of both the absolute profitability of a product and the production lead time. It is calculated as follows:

$$\text{Contribution margin velocity ratio} = \frac{\text{Product contribution margin}}{\text{Production lead time}}$$

The delivery production (D:P) ratio performance measurement compares delivery lead time to production lead time. Delivery lead time is the lead time required by customers to receive the product or service.

$$\text{D:P ratio} = \frac{\text{Production lead time (P)}}{\text{Delivery lead time (D)}}$$

Generally, world-class manufacturers' objective is to reduce the D:P ratio continuously until is less than one.

If a manufacturer wants to achieve a continuous flow and synchronized operation, then a D:P ratio of one is ideal. This indicates zero inventories and the elimination of all costs related to holding inventory.

The setup time performance measurement indicates how efficiently the production facilities are made ready to make another product or provide a service. Setup time is the amount of time needed to change production facilities for a different product or service. Decreasing the setup time is a key element of continuous improvement.

$$\text{Setup time} = \frac{\text{Total setup time during the week}}{\text{Number of setups}}$$

The machine uptime performance measurement determines the percentage of time the machine is ready for production when needed.

$$\text{Machine uptime} = 1 - \frac{\text{Number of hours machine ready for production}}{\text{Number of hours machine needed for production}}$$

World-class manufacturers expect 100 percent machine uptime, a stringent target leading them to install comprehensive preventive maintenance programs.

▲ A discussion of **PRODUCTIVITY PERFORMANCE MEASUREMENTS** follows.

Productivity performance measurements ascertain the amount of outputs produced by inputs.

The work force productivity performance measurement indicates the number of units produced per direct labor hour.

$$\text{Work force productivity} = \frac{\text{Units produced during the day}}{\text{DLHrs consumed during the day}}$$

The direct materials yield performance measurement indicates how efficiently raw materials are being converted into finished products.

$$\text{DM yield} = \frac{\text{Number of fin. units produced during the day}}{\text{Number of dir. materials input during the day}}$$

The activity productivity performance measurement indicates how efficiently an activity is being performed.

$$\text{Activity} = \frac{\text{Activity's output volume during a period}}{\text{Input required by the activity during a period}}$$

▲ A discussion of **CUSTOMER SATISFACTION PERFORMANCE MEASUREMENTS** follows.

Customer satisfaction performance measurements determine how well the company is meeting the needs, wants, and expectations of customers. World-class enterprises view customer satisfaction as the primary reason for being in business. A snake chart is used to show what customers think is important and how they rate the company in those areas.

The on-time delivery performance measurement determines if the finished product or service is being delivered at the time specified by the customer.

$$\text{On-time delivery} = \frac{\text{No. of units delivered during the week}}{\text{No. of units committed during the week}}$$

The complete order filling performance measurement determines how many orders are completely filled over some time period.

$$\text{Complete order filling percentage} = 1 - \frac{\text{Number of backorders}}{\text{Number of orders}}$$

The sales growth performance measurement calculates the percentage rate of growth from the last period to the current period.

$$\text{Sales Growth} = \frac{(\text{Sales this period} - \text{Sales last period})}{\text{Sales last period}} \times 100\%$$

The budgeted sales variance performance measurement compares budgeted sales with actual sales and indicates a variance in percentage terms.

$$\text{Budgeted sales variance} = \frac{(\text{Actual sales} - \text{Budgeted sales})}{\text{Budgeted sales}} \times 100\%$$

4. Explain why care should be taken in developing performance measurements that users can readily visualize, comprehend, and apply (pgs. 527 - 536).

▲ **Graphs** are devices that present information in image form so it can be visualized and quickly comprehended. The goal of a graph is to convey a clear vision and understanding of the underlying data.

▲ Scattergraphs (also called scatterplots or scatter diagrams) clearly reveal behavior and trends of underlying data.

▲ Line graphs show fluctuations over time by means of a rising and falling line that indicates highs, lows, rapid

movement, or stability.

- A control chart is a picture of an activity and its variation. It includes upper and lower control limits drawn on either side of the activity average. Control charts help improve performance by displaying problems within activities.

- Bar graphs show how proportions or quantities are related to each other. There are horizontal bar graphs, which compare different items during the same time frame, and vertical bar graphs, which measure the same item at different periods of time.

- Sectographs show how total amounts are divided up. A pie chart is a circle that has been segmented into two or more pieces, like slices of a pie. A layer graph is created like a line graph, but the areas between the lines represent quantities and add up to a total amount.

- Picturegraphs are similar to bar charts except that columns of little signs or icons are used in place of bars. They are best used to convey a general impression of quantities rather than precise information.

CHAPTER SELF-TEST

Note: The notation (CO1) means that the question was drawn from chapter objective number one.

Matching

Please write the letters of the following terms in the spaces to the left of the definitions.

a. Activity-based management (ABM)
b. Benchmarking
c. Control chart
d. Horizontal bar graph
e. Layer graph
f. Lead time
g. Nonvalue-added activities
h. Performance measurements
i. Production lead time
j. Productivity performance measurements
k. Reengineering
l. Sectographs
m. Snake chart
n. Vendor nonfinancial performance measurements
o. Vendor performance index (VPI)
p. Vertical bar graph
q. Work force productivity performance measurement

_____ 1. (CO3) To ascertain work done and results achieved in an activity.

_____ 2. (CO3) The interval between the acquisition of raw materials and first stage of production and the time that the finished products come off the production line.

_____ 3. (CO3) Weights the vendor on quality, price, on-time delivery, and general performance.

_____ 4. (CO1) An ongoing process of understanding, reengineering, measuring, and making decisions about activities to put the enterprise on the road to continuous improvement and excellence.

_____ 5. (CO4) Compares different items during the same time frame.

_____ 6. (CO3) Indicates the cost per unit of product produced by the work force.

_____ 7. (CO1) Requires large quantum changes in how the enterprise is currently operating.

_____ 8. (CO4) A line graph in which the areas between the lines represent quantities which add up to a total amount.

_____ 9. (CO4) Measures the same item at different periods of time.

_____ 10. (CO2) Process of comparing activities to world-class best activities.

_____ 11. (CO3) The sum of the cost of purchased raw materials and the cost of nonvalue-added activities, divided by the cost of purchased raw materials.

_____ 12. (CO4) A picture of an activity and its variations over time.

_____ 13. (CO3) The time between the beginning of a process or activity and the appearance of its results.

_____ 14. (CO2) Represents waste.

_____ 15. (CO4) A type of graph which shows how total amounts are divided.

_____ 16. (CO3) Ascertains the amount of outputs produced by the inputs consumed.

_____ 17. (CO3) Shows what the customer thinks is important and how the customer rates the company in those areas.

Completion

Please write in the word or words which will complete the sentence.

1. (CO1) ABM is an ongoing process involving four phases: _____, _____, _____, and _____.

2. (CO2) Value-added activities contribute something that is worthwhile to the _____ and its _____.

3. (CO2) _____ is the watchword of reengineering.

4. (CO2) Benchmarking should be directed to both _____ _____ and to _____.

5. (CO2) Superior performance, or _____ in Japanese, means "striving to be the best of the best."

6. (CO3) A _____ is a numerical value set by management or customers, a goal or objective to meet or exceed that is often established during _____.

7. (CO4) A _____ _____ is used to compare fluctuations in several items over time.

8. (CO4) A _____ _____ is a circle that has been segmented into portions, each of which represents a certain percentage of the whole.

9. (CO4) _____ are similar to bar charts except that columns of little signs or _____ are used in place of bars.

10. (CO3) The use of time-based performance measurements means that time is recognized as the equivalent of _____, _____, _____, and _____.

True-False Statements

Please circle "T" if the sentence is true and "F" if it is false.

T F 1. (CO3) A VPI of one means that the vendor has eliminated all nonvalue-added activities.

T F 2. (CO2) Nonvalue-added activities can always be totally eliminated.

T F 3. (CO3) The amount of time needed to change production facilities for a different product or service is called lead time.

T F 4. (CO3) A vendor who delivers 8,000 parts and has 250 rejected has an acceptance percentage of 3 percent (rounded).

T F 5. (CO3) Reducing lead times and eliminating nonvalue-added activities improve virtually all aspects of an enterprise.

T F 6. (CO3) The vendor simplicity performance measurement calculates the number of vendors per product, the number of purchase orders per product, and the vendor on-time delivery performance.

T F 7. (CO3) JIT manufacturing does not necessarily use machines 100 percent of the time because the philosophy is that an idle machine is preferable to a machine making product that is not needed immediately.

T F 8. (CO4) Graphs pack a small amount of information into a large area.

T F 9. (CO4) On a control chart, the more activity, the less waste.

T F 10. (CO4) By using control charts, an enterprise can identify activities that can be improved; this will enable it to stop defects before they occur.

Multiple Choice

Please circle the correct answer.

1. (CO4) Which of the following is a sectograph?
   a. Line graph.
   b. Pie chart.
   c. Snake chart.
   d. Vertical bar graph.

2. (CO1) One of the two main purposes of ABC is to:
   a. increase cash flow.
   b. improve customer service.
   c. reduce inventories.
   d. provide costing information on cost objects.

3. (CO3) Traditional financial performance measurements concentrate on several items, one of which is:
   a. return on investment (ROI).
   b. customer satisfaction.
   c. vendor performance.
   d. productivity performance.

4. (CO3) A vendor certification program selects vendors that meet:
   a. quality standards.
   b. price standards.
   c. delivery time standards.
   d. all of the above.

5. (CO3) Which of the following vendor performance indexes is the best?
   a. 1.10.
   b. 1.01.
   c. 1.02.
   d. 1.03.

6. (CO3) Based on the following data, which vendor provides the best overall value?

	Vendor			
	A	B	C	D
Bid price	$100	$98	$110	$90
VPI	1.0	1.1	1.2	1.3

   a. A.
   b. B.
   c. C.
   d. D.

7. (CO3) When the following data are considered, which of the products has the best contribution margin velocity ratio?

	Product			
	A	B	C	D
Contribution margin	$12	$11	$14	$10
Production lead time in days	4	5	3	6

   a. A.
   b. B.
   c. C.
   d. D.

8. (CO4) Which of the following graphs is used to convey a general impression of quantities rather than precise information?
   a. Layer graph.
   b. Picture graph.
   c. Pie graph.
   d. Scattergraph.

9. (CO4) Which of the following statements is incorrect concerning the construction of line graphs?
   a. Relatively thin lines should be used so that points of reference are not obscured.
   b. Using contrasting color for emphasis is more effective than bold lines.
   c. Too many lines make information difficult to read.
   d. Too many grid lines obstruct the view.

10. (CO3) If a machine is needed for 40 hours for production and it is not ready for production for 2 hours, then what is the machine uptime?
    a. 4 percent.
    b. 5 percent.
    c. 94 percent.
    d. 95 percent.

Demonstration Problems

1. The following data for one production day are presented below:
   75,000 units produced
   1,500 direct labor hours consumed
   25,000 direct material parts (inputs)
   2,500 machine hours consumed

   REQUIRED:
   a. Calculate the work force productivity performance measurement.

   b. Calculate the direct materials yield performance measurement.

   c. Calculate the activity productivity performance measurement.

2. If a company budgeted sales of $500,000 and had actual sales of $550,000, then what is the budgeted sales variance performance measurement?

3. If a company had $1,000,000 sales in 1993 and $1,025,000 sales in 1994, then what is the sales growth percentage?

SOLUTIONS TO SELF-TEST

Note: The notation (Pg. 1) means that information about the question and its answer can be found on page 1 of your textbook.

Matching

1. (Pg. 505) h
2. (Pg. 517) i
3. (Pg. 513) n
4. (Pg. 495) a
5. (Pg. 532) d
6. (Pg. 523) q
7. (Pg. 495) k
8. (Pg. 535) e
9. (Pg. 532) p
10. (Pg. 502) b
11. (Pg. 513) o
12. (Pg. 529) c
13. (Pg. 516) f
14. (Pg. 497) g
15. (Pg. 533) l
16. (Pg. 523) j
17. (Pg. 526) m

Completion

1. (Pg. 495) identify value-added and nonvalue-added activities, reengineer the enterprise, benchmark value-added activities, develop a performance measurement system for continuous improvement
2. (Pg. 496) enterprise, customers
3. (Pg. 501) Simplicity
4. (Pg. 502) world-class competitors, organizations outside the industry
5. (Pg. 504) dantotsu
6. (Pg. 506) target, benchmarking
7. (Pg. 528) line graph
8. (Pg. 533) pie chart
9. (Pg. 535) Picturegraphs, icons
10. (Pg. 516) money, productivity, quality, resources

True-False Statements

1. (Pg. 513) T
2. (Pg. 501) F In some instances an activity, such as moving materials, cannot be totally eliminated.
3. (Pg. 521) F This is the definition of setup time.
4. (Pg. 515) F 7750 ÷ 8000 = 97 percent (rounded)
5. (Pg. 518) T
6. (Pg. 515) F It does not measure on-time delivery performance.

7. (Pg. 522) T
8. (Pg. 527) F It packs a large amount of information into a small area.
9. (Pg. 529) F The less activity, the less waste.
10. (Pg. 531) T

Multiple Choice

1. (Pg. 533) b
2. (Pg. 495) d
3. (Pg. 509) a
4. (Pg. 512) d
5. (Pg. 513) b
6. (Pg. 513) a A = $100; B = $108; C = $132; D = $117
7. (Pg. 519) c A = $3.00; B = $2.20; C = $4.67; D = $1.67
8. (Pg. 535) b
9. (Pg. 528) c
10. (Pg. 522) d Uptime = 1 - (2 hours ÷ 40 hours)
= 1 - .05
= 95 percent

Demonstration Problems

1. a. Units produced during the day ÷ DLHr consumed during the day
75,000 units ÷ 1,500 DLHr = 50 units produced / DLHr

b. Units produced during the day ÷ Direct materials input during the day
75,000 units ÷ 25,000 DM parts = 300% DM yield

c. Units produced during the day ÷ Machine hours consumed during the day
75,000 units ÷ 2,500 M-hrs = 30 units produced / M-hr

2. $$\frac{\text{Actual sales - Budgeted sales}}{\text{Budgeted sales}} \times 100\%$$

$$\frac{\$550{,}000 - \$500{,}000}{\$500{,}000} \times 100\% = 10\%$$

3. $$\frac{\text{1994 sales - 1993 sales}}{\text{1993 sales}} \times 100\%$$

$$\frac{\$1{,}025{,}000 - \$1{,}000{,}000}{\$1{,}000{,}000} \times 100\% = 2.5\%$$