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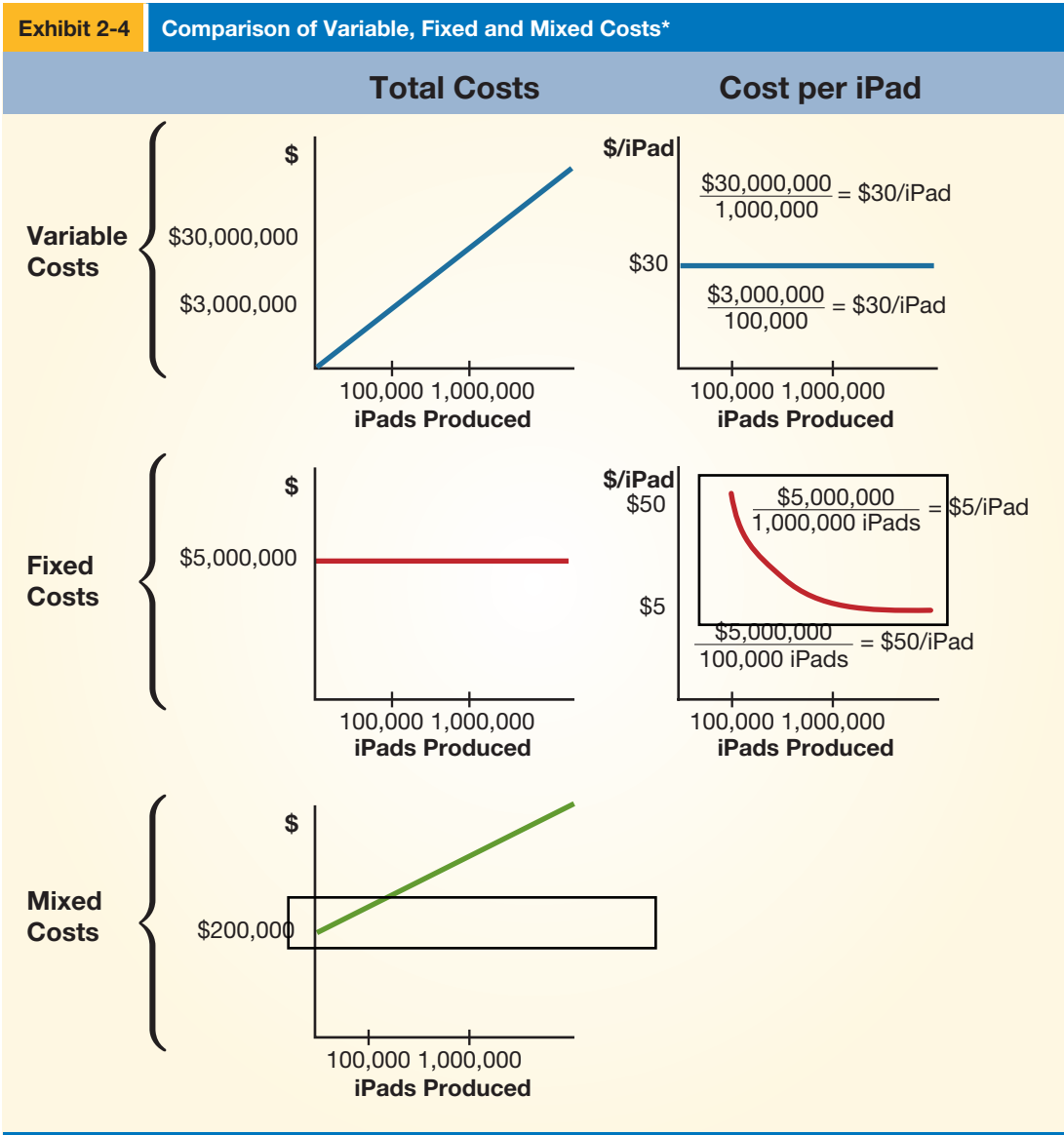
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Hint: The classification of costs into these three distinct groups can often be more difficult than it may appear at first glance.

how to determine the variable and fixed portions of a mixed cost in Chapter 6. **Exhibit 2-4** presents a graphic illustration of these three different types of costs.



*Assumes all costs are linear

TAKEAWAY 2.1

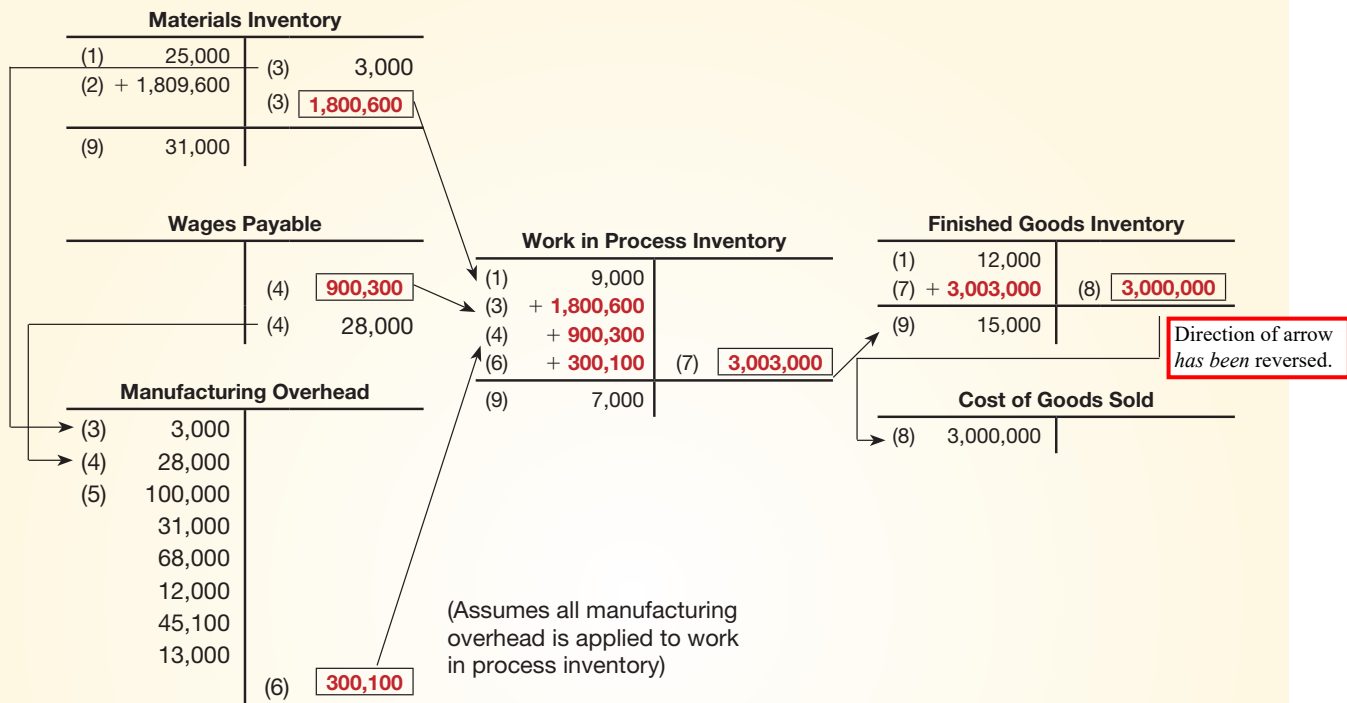
Product costs may be variable (direct material and direct labor), fixed (some overhead costs such as depreciation on assets employed in producing the good or service), or mixed (some overhead costs such as utilities).

Direct and Indirect Costs

Finally, costs can also be classified as *direct* or *indirect* costs (see **Exhibit 2-5**). A **direct cost** is a cost that can be easily and cost-effectively traced to a specific cost object, such as a unit of product. In a manufacturing company, two obvious direct costs are the main materials and labor used to produce a unit of product. However, other costs may be directly traced as well. For example, in determining the cost of an iPad, Apple would attempt to trace as many costs as possible directly to each iPad unit.

Exhibit 2-11

The Flow of Fezzari's Costs Through the Inventory Accounts



- (1) Beginning inventory balances.
- (2) \$1,809,600 of materials inventory is purchased and received.
- (3) Materials inventory is used in the production process. \$1,800,600 of direct materials is used and transferred to work in process inventory. \$3,000 of indirect materials is used and transferred to and accumulated in the manufacturing overhead account.
- (4) Factory wages are incurred in the production process. \$900,300 of direct labor is incurred and recorded in both the work in process inventory and wages payable accounts. \$28,000 of indirect labor is incurred and recorded in both the manufacturing overhead and wages payable accounts.
- (5) Additional indirect manufacturing costs are incurred during the production process and accumulated in the

- manufacturing overhead account. These costs include the lease on the factory of \$100,000, factory utilities of \$31,000, factory insurance of \$68,000, property taxes on the factory of \$12,000, depreciation on factory machinery of \$45,100 and other factory overhead of \$13,000.
- (6) At the end of the period, the \$300,100 of costs accumulated in manufacturing overhead are applied to work in process inventory.
- (7) As bikes are completed, their total manufacturing costs of \$3,003,000 are transferred from the work in process inventory to the finished goods inventory.
- (8) When bikes are sold, their total manufacturing costs of \$3,000,000 are transferred out of finished goods inventory and recognized as a cost of goods sold expense. This entry is recorded along with the related sales entry.
- (9) Ending inventory balances.

The second section of the schedule of cost of goods manufactured determines the cost of goods manufactured—the cost of goods completed during the year and transferred to finished goods. In this section, total manufacturing costs for the year are added to the amount representing the work in process at the beginning of the year to determine the total cost of work in process during the year. The cost of incomplete units (ending work in process inventory) is then subtracted to determine the cost associated with the completed units (cost of goods manufactured). These are all of the numbers that appear in the work in process inventory account.

Exhibit 2-13

Summary of Goods Sold

FEZZARI PERFORMANCE BICYCLES Summary of Cost of Goods Sold For the Year Ended December 31, 2016	
Cost of goods manufactured	\$3,003,000
Add: Beginning finished goods inventory	12,000
Cost of goods available for sale	\$3,015,000
Less: Ending finished goods inventory	(15,000)
Cost of goods sold	<u>\$3,000,000</u>

The schedule of cost of goods manufactured and the calculation of cost of goods sold provide useful information about product costs in support of the income statement. They are not, however, required financial statements.

Income Statement for a Manufacturing Firm

Exhibit 2-14 presents the income statement for 2016 for Fezzari. The format is virtually the same as the income statement for a merchandising firm that uses the perpetual inventory system. Because Fezzari uses the perpetual inventory system for its finished goods inventory, the cost of goods sold amount is available in a general ledger account. The schedule of cost of goods manufactured (see **Exhibit 2-12**) and the cost of goods sold calculation (see **Exhibit 2-13**) lead to the cost of goods sold amount in the income statement and provide additional information about the flow of product costs.

Exhibit 2-14

Income Statement

FEZZARI PERFORMANCE BICYCLES Income Statement For the Year Ended December 31, 2016	
Sales	\$4,500,000
Cost of goods sold	<u>3,000,000</u>
Gross profit on sales	\$1,500,000
Operating expenses:	
Selling expenses	\$400,000
Non-factory administrative expenses	<u>340,000</u>
	740,000
Income from operations	\$ 760,000
Other income and expense:	
Interest expense	<u>5,000</u>
	5,000
Income before income tax	\$ 755,000
Income tax expense	<u>264,250</u>
Net income	<u>\$ 490,750</u>

ILLUSTRATION OF PRODUCT COST JOURNAL ENTRIES

The following illustration for **Apple Inc.** presents hypothetical summary transactions and adjustment entries for 2014 related to the accounts used to accumulate product costs. Assume that Apple Inc. uses the perpetual inventory system and had the following manufacturing inventory account balances **(in millions)** at September 28, 2013 (the beginning of its 2014 fiscal year):



LO4 Illustrate the journal entries to record product cost flows using a perpetual inventory system.

5. Recognition of certain manufacturing overhead costs with year-end adjustments

Manufacturing overhead	4,000	
Manufacturing supplies		1,000
Accumulated depreciation—factory machinery		3,000
<i>To record cost of supplies used for and depreciation on factory machinery.</i>		

6. Application of manufacturing overhead

Work in process inventory	61,107	
Manufacturing overhead		61,107
<i>To record the application of manufacturing overhead to the work in process inventory. (The procedures for determining this application will be described in a subsequent chapter.)</i>		

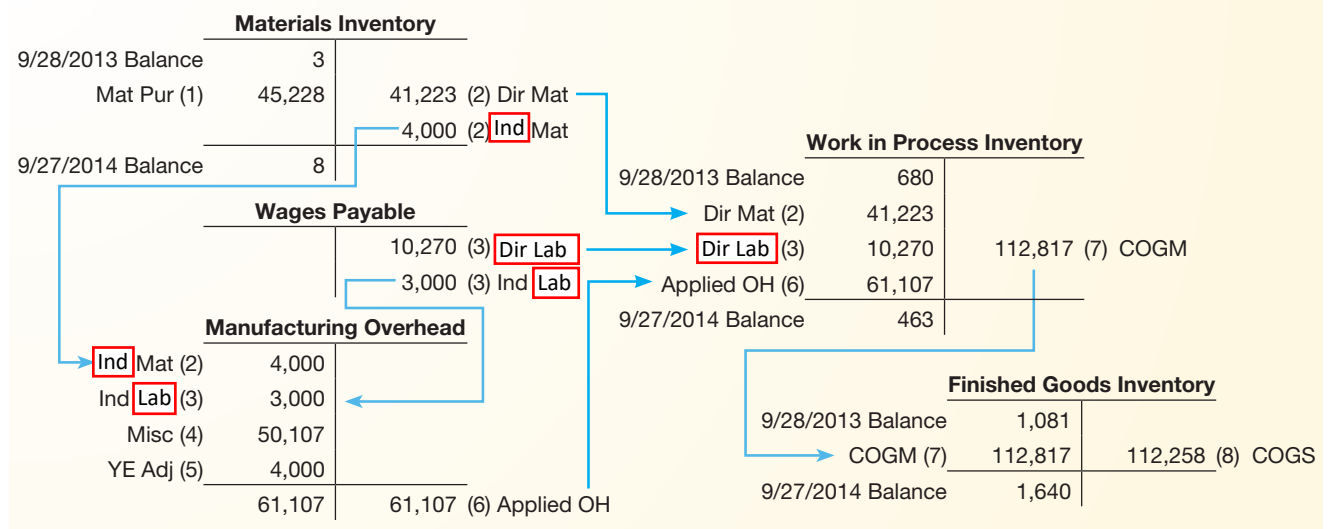
Cost Flows

Exhibit 2-15 presents T-accounts to which these summary entries have been posted. The arrows in **Exhibit 2-15** indicate the flows of product cost. Direct material flows from Materials Inventory to Work in Process Inventory, whereas indirect material flows from Materials Inventory to Manufacturing Overhead. Direct labor flows from Wages Expense to Work in Process Inventory, whereas indirect labor flows from Wages Payable to Manufacturing Overhead. Actual manufacturing overhead comes from several sources, and manufacturing overhead applied flows to Work in Process Inventory.

Hint: In practice, applied manufacturing overhead rarely equals the actual manufacturing overhead incurred during a period, as illustrated in this example. Chapter 3 explains how to deal with over- or underapplied overhead.

Exhibit 2-15

Apple Inc. Flow of Manufacturing Costs



Cost of goods manufactured (the product cost of goods completed during the accounting period) flows from Work in Process Inventory to Finished Goods Inventory. The cost of goods sold flows from Finished Goods Inventory to the Cost of Goods Sold account. These cost flows are represented by the following journal entries:

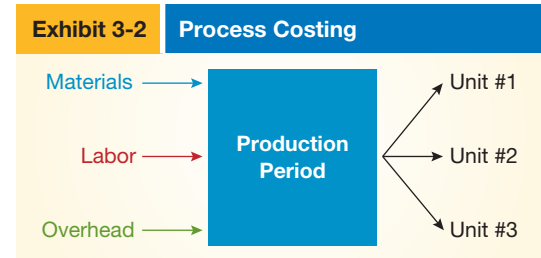
7. Recognition of cost of goods manufactured

Finished goods inventory	112,817	
Work in process inventory		112,817
<i>To record the transfer of the cost associated with goods completed from the work in process inventory to the finished goods inventory.</i>		

(to track the cost of each printing job), manufacturers of consumer products (to determine the cost per unit of each product manufactured), and hospitals (to determine the cost per patient). For example, CH2M Hill keeps track of the costs associated with its Singapore project separately from those associated with its Panama project.

A **process costing system** (Exhibit 3-2) lends itself to the production of a *large volume of homogenous products* manufactured in a continual flow operation, such as the distillation of fuels or manufacture of paint or wire. In these manufacturing contexts, the materials and operations are involved repetitively during each manufacturing period. Direct material, direct labor, and manufacturing overhead are accumulated by a production department or process for a period and then divided by the units produced during that period to calculate a per-unit cost. Assembly-line operations of entities such as breweries or flour mills and mass-production operations such as power plants and chemical companies would use process costing.

Job order costing and process costing are two extremes along the spectrum of costing systems. A company will design its own accounting system to fit its particular needs. Many companies blend ideas from both job order costing and process costing systems.



Choosing a Cost Accounting System

ACCOUNTING IN PRACTICE

Both job order and process costing systems allocate materials, labor, and overhead costs to determine unit costs. In a job order system, costs are identified with specific jobs or products, but a process costing system identifies costs with production processes and averages them over all jobs completed or products made during the period. The type of cost accounting system used by a particular company depends on the nature of the company's operations. One company may, in fact, use job order costing to account for one part of its operation and use process costing to account for another part of its operation. For example, Fezzari Performance Bicycles (introduced in Chapter 1) uses job costing for each unique bike order received. Yet, the manufacture of bicycle frames is accounted for using process costing because each frame of a particular size and model is identical.

Which costing system (job order or process) would most likely be used by the following industries?

Chemicals
Printing
Aircraft
Oil refining

Paints
Glass
Furniture
Machinery

YOUR TURN! 3.1

The solution is on page 109.

Timely Product Costing

Manufacturing Firms

A cost accounting system—either job order costing or process costing—must provide for the timely determination of product costs. Companies need to calculate product costs to determine work in process and finished goods inventory balances, which they report in periodic financial statements. In order to accurately calculate income, companies must develop a way to identify product costs for products sold and for products that remain on hand, either finished or unfinished.

Managers use engineering studies and cost analyses to establish budgets. They then compare actual product costs to budgets so that problems can be identified and remedial action can be taken when necessary. Managers also use product costs as one of the considerations in setting product prices.

10. Briefly explain the sequential flow of product costs through a cost accounting system. **L03**
11. What type of records would be used or maintained for the following manufacturing activities? **L03**
 - a. Determining the amount of a specific material on hand
 - b. Issuing direct material for production
 - c. Assigning the direct labor costs for a particular worker
 - d. Accumulating the cost of a particular product or batch of products
12. Explain the general format and give examples of the data that would appear on (a) a sales order, (b) a bill of materials, and (c) a job order cost sheet. **L03**
13. Why can we say that the sale of a manufactured product is recorded at two different amounts? **L04**
14. Slaton Company records both actual overhead and applied overhead in one account, Manufacturing Overhead. On January 31, the account has a credit balance. Has overhead been under- or overapplied during January? **L04**
15. Lyle Manufacturing Company applies manufacturing overhead at the rate of 150% of direct labor cost. During October 2016, Lyle incurred \$82,000 of direct labor costs and \$120,000 of manufacturing overhead costs. What is the amount of over- or underapplied manufacturing overhead for October 2016? **L04**
16. Contrast service departments with production departments. Give three examples of a service department. **L05**
17. Why might service departments be treated as cost centers? **L05**
18. Explain what each of the following statements means: **L05**
 - a. Service departments do not work directly on products.
 - b. Service department costs are manufacturing overhead costs.
 - c. Overhead rates are not used for service departments.
 - d. In spite of part (c), service department costs become part of product costs.
19. How do we choose a basis for allocating a cost to several departments? **L05**
20. How is an allocation rate calculated? How is the specific amount allocated to a department calculated? **L05**
21. Briefly describe the general format, data, and calculations that would appear on an overhead distribution worksheet for a company with a number of production and service departments. **L05**

EXERCISES—SET A

- E3-1A. Calculate and Use Overhead Rate** Selected data for the consulting department of Austin Consulting, Inc., follow: **L03, 5**

Estimated consulting overhead cost for the year	\$270,000
Estimated direct labor cost for the year (@ \$9/hr.)	180,000
Actual manufacturing overhead cost for January	16,000
Actual direct labor cost for January (1,200 hours)	11,000

Assuming that direct labor cost is the basis for applying consulting overhead,

- a. Calculate the predetermined overhead rate.
 - b. Prepare a journal entry that applies consulting overhead for January.
 - c. By what amount is consulting overhead over- or underapplied in January?
- E3-2A. Calculate and Use Overhead Rate** Using the data in Exercise 3-1A, but assuming that the basis for applying consulting overhead is direct labor hours, complete requirements (a) through (c). **L03, 5**
- E3-3A. Calculate and Use Overhead Rate** During the coming accounting year, Baker Manufacturing, Inc., anticipates the following costs, expenses, and operating data, ~~related to Job 63:~~ **L03**

Direct material (16,000 lb.)	\$ 80,000
Direct labor (@ \$10/hr.)	140,000
Indirect material	12,000
Indirect labor	22,000
Sales commissions	34,000
Factory administration	16,000
Non factory administrative expenses	20,000
Other manufacturing overhead*	48,000

*Provides for operating 35,000 machine hours.



SERVICE AND
MERCHANDISING



- Calculate the predetermined manufacturing overhead rate for the coming year for each of the following application bases: (1) direct labor hours, (2) direct labor costs, and (3) machine hours.
- For each item in requirement *a*, determine the proper application of manufacturing overhead to Job 63, to which 16 direct labor hours, \$150 of direct labor cost, and 40 machine hours have been charged.

LO4 E3-4A. Applied vs. Actual Manufacturing Overhead Davis Manufacturing Corporation applies manufacturing overhead on the basis of 150% of direct labor cost. An analysis of the related accounts and job order cost sheet indicates that during the year total manufacturing overhead incurred was \$315,000 and that at year-end Work in Process Inventory, Finished Goods Inventory, and Cost of Goods Sold included \$40,000, \$20,000, and \$140,000, respectively, of direct labor incurred during the current year.

- Determine the underapplied manufacturing overhead at year-end (assume it is significant).
- Prepare a journal entry to record the disposition of the underapplied manufacturing overhead.

LO3 E3-5A. Flow of Product Costs through Accounts Assuming a routine manufacturing activity, present journal entries (account titles only) for each of the following transactions:

- Purchased material on account.
- Recorded wages payable earned but not paid.
- Requisitioned both direct material and indirect material.
- Assigned direct and indirect labor costs.
- Recorded factory depreciation and accrued factory property tax.
- Applied manufacturing overhead to production.
- Completed work on products.
- Sold finished goods on account.

LO3 E3-6A. Job Order Cost Sheets For each of the manufacturing transactions or activities indicated in Exercise E3-5A, briefly identify the detailed forms, records, or documents (if any) that would probably underlie each journal entry.

LO4 E3-7A. Perpetual Inventories The following summary data are from the job order cost sheets of Hampton Company:

Job	Dates			Total Costs Assigned at April 30	Total Production Costs Added in May
	Started	Finished	Shipped		
1	4/10	4/20	5/9	\$7,300	
2	4/18	4/30	5/20	5,400	
3	4/24	5/10	5/25	2,900	\$5,700
4	4/28	5/20	6/3	3,600	4,800
5	5/15	6/10	6/20		2,600
6	5/22	6/18	6/28		3,800

Using the above data, compute (a) the finished goods inventory at May 1 and May 31, (b) the work in process inventory at May 1 and May 31, and (c) the cost of goods sold for May. Hampton began operations with Job 1.

LO4 E3-8A. Finished Goods and Cost of Goods Sold Before the completed production for June is recorded, the work in process inventory account for James Company appears as follows:

Work in Process Inventory	
Balance June 1	16,000
Direct material	45,000
Direct labor	32,000
Manufacturing overhead applied	34,000

Assume that completed production for June includes Jobs 107, 108, and 109 with total costs of \$28,000, \$59,000, and \$25,000, respectively.

- Determine the cost of unfinished jobs at June 30 and prepare a journal entry to record completed production.
- Using general journal entries, record the sale of Job 107 for \$40,000 on account.



- LO3 E3-3B. Calculate and Use Manufacturing Overhead Rate** During the coming accounting year, Ester Manufacturing, Inc., anticipates the following costs, expenses, and operating data, ~~related to Job 128:~~

Direct material (15,000 lb.)	\$45,000
Direct labor (@ \$12/hr.)	96,000
Indirect material	7,000
Indirect labor	12,000
Sales commissions	18,000
Factory administration	13,000
Nonfactory administrative expenses . . .	14,000
Other manufacturing overhead*	28,000

*Machine hours are 30,000 hours.

- Calculate the predetermined manufacturing overhead rate for the coming year for each of the following application bases: (1) direct labor hours, (2) direct labor costs, and (3) machine hours.
- For each item in requirement (a), determine the proper application of manufacturing overhead to Job 128, to which 9 direct labor hours, \$100 of direct labor cost, and 32 machine hours have been charged.



- LO4 E3-4B. Applied vs. Actual Manufacturing Overhead** Sloan Manufacturing Corporation applies manufacturing overhead on the basis of 120% of direct labor cost. An analysis of the related accounts and job order cost sheets indicates that during the year total manufacturing overhead incurred was \$210,000 and that at year-end Work in Process Inventory, Finished Goods Inventory, and Cost of Goods Sold included \$30,000, \$20,000, and \$150,000, respectively, of direct labor incurred during the current year.

- Determine the manufacturing overapplied overhead at year-end (assume it is significant).
- Prepare a journal entry to record the disposition of the overapplied overhead.



- LO3 E3-5B. Flow of Product Costs Through Accounts** The following T accounts present a cost flow in which all or part of typical manufacturing transactions are indicated by parenthetical letters on the debit or credit side of each account.

Material Inventory		Wages Payable		Manufacturing Overhead	
(a)	(c) (e)	(i)	(b) (d)	(c) (d) (e)	(f)
Work in Process Inventory		Finished Goods Inventory		Cost of Goods Sold	
(c) (d) (f)	(g)	(g)	(h)	(h)	

For each parenthetical letter, present a general journal entry with explanation indicating the apparent transaction or procedure that has occurred (disregard amounts).

- LO3 E3-6B. Job Order Cost Sheets** For each of the manufacturing transactions or activities indicated by the parenthetical letters in Exercise E3-5B, briefly identify the detailed forms or documents (if any) that would probably underlie each journal entry.



- LO4 E3-7B. Perpetual Inventories** The following summary data are from the job order cost sheets of Castle Company:

Job	Dates			Total Assigned Costs at September 30	Total Production Costs Added in October
	Started	Finished	Shipped		
1	9/10	9/20	10/11	\$9,000	
2	9/17	9/29	10/22	6,600	
3	9/25	10/11	10/27	3,500	\$7,100
4	9/27	10/19	11/4	4,400	5,700
5	10/14	11/10	11/18		3,200
6	10/23	11/17	11/29		4,900

Using the data provided, compute (a) the finished goods inventory at October 1 and October 31, (b) the work in process inventory at October 1 and October 31, and (c) the cost of goods sold for October. Castle began operations with Job 1.

- E3-8B. Finished Goods and Cost of Goods Sold** Before the completed production for August is recorded, the work in process inventory account for Bayfield Company appears as follows: **LO4**

Work in Process Inventory	
Balance, August 1	15,000
Direct material	33,000
Direct labor	20,000
Manufacturing overhead applied	20,000

Assume that completed production for August includes Jobs 317, 318, and 319 with total costs of \$31,000, \$18,000, and \$22,000, respectively.

- Determine the cost of unfinished jobs at August 31 and prepare a journal entry to record completed production.
- Using general journal entries, record the sale of Job 317 for \$45,000 on account.

- E3-9B. Job Order Cost Sheet** Everglade Accounting Company has the following account in its cost records: **LO4**

Work in Process—Davis Audit			
Direct labor	48,000	Services completed	95,000
Project overhead	57,600		

Everglade applies overhead to projects at a predetermined rate based on direct labor costs. Assume that Everglade uses a job order costing system and that Davis Audit is the only job in process at the end of the period. Complete the following cost sheet for services still in process for Davis Audit.

Job Order Cost Sheet—Davis Audit (Services in Process)	
Direct labor	_____
Project overhead	_____
Total cost	_____

- E3-10B. Service Department Cost Allocation** Presented below are certain operating data for the four departments of Modern Manufacturing Company. **LO5**

	Service		Production	
	1	2	1	2
Total overhead cost either identifiable with or to each department	\$45,000	\$60,000	\$55,000	\$116,000
Square feet of factory floor space			90,000	45,000
Number of factory workers			20	60
Planned direct labor hours for the year			25,000	32,000

Allocate, to the two production departments, the costs of service departments 1 and 2, using factory floor space and number of workers, respectively, as bases.

What is the apparent manufacturing overhead rate for each production department if planned direct labor hours are the overhead application base?

Required

- Set up the following general ledger T accounts: Materials Inventory, Wages Payable, Manufacturing Overhead, Work in Process Inventory, Finished Goods Inventory, Cost of Goods Sold, and Sales.
- Set up T accounts for each of Jobs 1–6 as job order cost sheets.
- Noting the accounting procedures described in the first paragraph of the problem, do the following:
 - Record general journal entries for all transactions. Note that general journal entries are not required in transactions 3 and 7. Post only those portions of these entries affecting the general ledger accounts set up in requirement (a).
 - Enter the applicable amounts directly on the appropriate job order cost sheets for transactions 3, 4, 7, 8, and 13. Note parenthetically the nature of each amount entered.
- Present a brief analysis showing that the general ledger accounts for Work in Process Inventory and for Finished Goods Inventory agree with the related job order cost sheets.
- Explain in one sentence each what the balance of each general ledger account established in requirement (a) represents.

LO5 P3-8A. Manufacturing Overhead Distribution Worksheet The following are selected operating data for the production and service departments of Bluestone Company for 2016.

	Departments			
	Service		Production	
	1	2	1	2
Overhead costs (identified by department)				
Indirect material	\$48,400	\$ 82,200	\$ 25,440	\$ 516,000
Indirect labor	\$97,200	\$144,000	\$ 32,584	\$1,439,000
Square feet of building floor space used	4,800	7,200	12,000	24,000
Assessed value of equipment used	\$21,000	\$ 63,000	\$126,000	\$ 210,000
Cubic yards of factory space used			88,000	132,000
Machine hours			51,200	204,800
Direct labor			\$ 20,000	\$ 400,000

Building depreciation of \$96,000 is allocated on the basis of square feet of floor space. Personal property taxes of \$36,000 are allocated on the basis of assessed values of equipment used. Costs for service departments 1 and 2 are allocated to production departments on the basis of cubic yards of factory space and machine hours, respectively.

Required

- Prepare a 2016 overhead distribution worksheet for Bluestone Company similar to the one prepared for **Exhibit 3-16**.
- Compute the manufacturing overhead rates for production departments 1 and 2 using machine hours and direct labor costs, respectively, for allocation bases.

PROBLEMS—SET B

LO3, 5 P3-1B. Determine and Use Consulting Rate Oxford Consulting, Inc., expects the following costs and expenses during the coming year:

Direct labor (@ \$8/hr.)	\$336,000
Sales commissions.	72,000
Overhead	378,000

Required

- Compute a predetermined overhead rate applied on the basis of direct labor hours.



- e. Explain in one sentence each what the balance of each general ledger account established in requirement (a) represents.

P3-8B. Manufacturing Overhead Distribution Worksheet The following are selected operating data for the production and service departments of Danville Company for 2016.

LO5

	Departments			
	Service		Production	
	1	2	1	2
Manufacturing overhead costs (identified by department)				
Factory supplies used	\$12,800	\$21,440	\$ 67,840	\$137,600
Indirect labor	\$25,920	\$38,400	\$ 86,400	\$384,000
Square feet of building floor space used	7,200	10,800	18,000	36,000
Assessed value of equipment used	\$28,000	\$84,000	\$168,000	\$280,000
Cubic yards of factory space used			132,000	198,000
Machine hours			51,200	204,800
Direct labor (\$10 per hour)			\$250,000	\$500,000

Building depreciation of \$51,200 is allocated on the basis of square feet of floor space. Personal property taxes of \$19,200 are allocated on the basis of assessed values of equipment used. Costs for service departments 1 and 2 are allocated to production departments on the basis of cubic yards of factory space and machine hours, respectively.

Required

- Prepare a 2016 manufacturing overhead distribution worksheet for Danville Company similar to the one prepared for **Exhibit 3-16**.
- Compute the manufacturing overhead rates for production departments 1 and 2 using machine hours and direct labor hours, respectively, for allocation bases.

CERTIFIED MANAGEMENT ACCOUNTANT (CMA®) EXAM SAMPLE QUESTIONS

CMA3-1. Henry Manufacturing, which uses direct labor hours to apply overhead to its product line, undertook an extensive renovation and modernization program two years ago. Manufacturing processes were reengineered, considerable automated equipment was acquired, and 60% of the company's non-union factory workers were terminated.

Which of the following statements would apply to the situation at Henry?

- The company's factory overhead rate has likely increased.
 - The use of direct labor hours seems to be appropriate.
 - Henry will lack the ability to properly determine labor variances.
 - Henry has likely reduced its ability to quickly cut costs in order to respond to economic downturns.
- I, II, III, and IV.
 - I and IV only.
 - II and IV only.
 - I and III only.

CMA3-2. Using the following budget data for Valley Corporation, which produces only one product, calculate the company's predetermined manufacturing overhead application rate for variable overhead. *Hint:* The factory supervisor's salary is direct labor, since it is incurred regardless of production. SG&A expenses relate to the entire operations of Valley Corporation and not just related to manufacturing.



Exhibit 4-15 Product Cost Report: Where Do the Costs Come From?			
Product Cost Report General Mills Big G Division January Production			
Where do the costs come from?	Total	Direct Materials	Conversion Costs
Beginning inventory	\$ 280,800	\$ 166,400	\$ 114,400
Current	32,000,000	19,250,000	12,750,000
Total costs to account for	\$32,280,800	\$19,416,400	\$12,864,400

We then calculate the average cost per unit by dividing total costs in each category by total equivalent units in each category from Step 2. In other words, we divide total materials costs by total equivalent units of materials (\$19,416,400/61,100 equivalent units) to get an average cost per unit of \$317.78. Similarly, we divide total conversion costs by total equivalent units of conversion costs (\$12,864,400/59,000 equivalent units) to get an average cost per unit of \$218.04. **Exhibit 4-16** summarizes this calculation.

Exhibit 4-16 Step 3: Product Cost Report: Determine Per-Unit Costs			
Product Cost Report General Mills Big G Division January Production			
Where do the costs come from?	Total	Direct Materials	Conversion Costs
Beginning inventory	\$ 280,800	\$ 166,400	\$ 114,400
Current	32,000,000	19,250,000	12,750,000
Total costs to account for	\$32,280,800	\$19,416,400	\$12,864,400
÷ Total equivalent units		61,100	59,000
Average cost/unit		\$ 317.7807	\$ 218.0407

Note that the weighted average method includes *all* costs incurred on units worked on during the month, whereas the FIFO method only includes costs incurred during the *current* period. Hence, both the numerator (costs incurred) and the denominator (equivalent units) will differ between the weighted average and FIFO methods.

Step 4: Calculate the Cost of Goods Manufactured

At the end of each month and for each department, we calculate the cost of goods manufactured (illustrated in **Exhibit 4-17**), which is comprised of the cost of the goods that are completed and transferred to the finished goods inventory. Under the weighted average cost flow assumption, the Big G division's cost of goods manufactured during January consists of 57,600 equivalent units of materials and conversion costs (shown in **red** in **Exhibit 4-14**) multiplied by their respective per-unit costs computed in Step 2 (shown in **green** in **Exhibit 4-16**).

Exhibit 4-17 Step 4: Cost of Goods Manufactured Calculation

Materials	[57,600 EU × \$317.7807]	18,304,168
Conversion costs	[57,600 EU × \$218.0407]	12,559,143*
Total cost of goods manufactured		\$30,863,311

*Difference due to rounding

Step 5: Calculate the Ending Work in Process Inventory

Exhibit 4-18 illustrates the final step, which is to calculate the **cost of goods remaining** in ending work in process. Assuming all materials are added at the beginning and conversion costs are added evenly throughout the process, we multiply the equivalent units of materials and conversion costs in ending inventory (denoted in **red** in **Exhibit 4-14**) by their respective unit costs (shown in **green** in **Exhibit 4-16**) computed in Step 2, as shown in **Exhibit 4-18**.

Exhibit 4-18 Step 5: Calculate Cost of Ending Inventory

Materials	[3,500 EU × \$317.7807]	1,112,232
Conversion costs	[1,400 EU × \$218.0407]	305,257
Total cost of ending inventory		\$1,417,489

General Mills Tries to Make a Difference**CORPORATE SOCIAL RESPONSIBILITY**

If you read the current popular media reports, you are likely to get the idea that the only stakeholders a corporation cares about are its shareholders. General Mills thinks differently. The goal of General Mills is to stand among the world's most socially responsible food companies. The company believes that being a good corporate citizen means considering all its stakeholders. To do this, General Mills seeks to create long-term economic, social, and environmental value.

General Mills recognizes that its customers depend on the company to provide healthy food choices. One example of what General Mills is doing in this area is an improvement in the health profile of 76% of its retail U.S. sales volume since 2005. To help the environment, General Mills has reduced its waste generation by 41% since 2005. General Mills' is also committed to sustainable sourcing, with a goal of 50% of its annual raw material purchases to be from sustainable sources by 2020. General Mills strives to create a culture of ethics with 95% of employees stating that General Mills leaders demonstrate a commitment to ethical business. Finally, General Mills commitment to community included over \$151 million of donations to charitable causes in 2014 and over \$1.5 billion since the General Mills Foundation was established in 1954.

Source: <https://www.generalmills.com/en/Responsibility/Overview>

THE PRODUCT COST REPORT

Using the Big G example, the product cost report illustrated in **Exhibit 4-19** summarizes all of the steps in the total cost allocation process from (1) visualizing the physical flow of the units, to (2) calculating equivalent units, to (3) calculating unit costs, to (4) calculating cost of goods manufactured, to (5) calculating ending inventory. Moreover, **Exhibit 4-19** also provides Big G's product cost report. Note that in this illustration, the equivalent units of production for materials and conversion costs (the numbers in **red**) are multiplied by the corresponding cost per unit figures for materials and conversion costs (the numbers in **green**) to calculate the cost allocation to cost of goods manufactured and ending inventory.



LO4 Explain the procedures used to prepare the product cost report using the weighted average method in a process costing system.

to finished goods (called Cost of Goods Manufactured), we multiply the equivalent units of materials and conversion costs transferred (shown in **red** in **Exhibit 4-8A**) by their respective per-unit costs computed in Step 2 (shown in **green** in **Exhibit 4-10A**) and add these costs to the cost value of the beginning work in process, as shown in **Exhibit 4-11A**.

Exhibit 4-11A		Step 4: Cost of Goods Manufactured Calculation	
			Carry from Step 3
Beginning inventory:			
Costs incurred in December		\$	280,800 ←
Conversion costs incurred in January	[2,080 EU × \$218.0233]		453,488
Started and finished:			
Materials	[55,000 EU × \$329.0598]		18,098,291*
Conversion costs	[55,000 EU × \$218.0233]		11,991,279*
Total cost of goods manufactured			\$30,823,858

* Difference due to rounding.

Step 5: Calculate the Ending Work in Process Inventory

Exhibit 4-12A illustrates the final step, which is to calculate the cost of goods remaining in ending work in process inventory. Assuming all materials are added at the beginning and conversion costs are added evenly through the process, we multiply the equivalent units of materials and conversion costs in ending inventory (denoted in **red** in **Exhibit 4-8A**) by their respective unit costs (shown in **green** in **Exhibit 4-10A**) computed in Step 2, as follows:

Exhibit 4-12A		Step 5: Calculate Cost of Ending Inventory	
Materials	[3,500 EU × \$329.0598]	\$	1,151,709
Conversion costs	[1,400 EU × \$218.0233]		305,233
Total cost of goods remaining in ending inventory			\$ 1,456,942

Cost of goods manufactured and transferred out (Exhibit 4-11A)	\$30,823,858
Cost of ending inventory (Exhibit 4-12A)	1,456,942
Total cost to account for (Exhibit 4-10A)	<u>\$32,280,800</u>



THE PRODUCT COST REPORT

LO7 Explain the procedures used to prepare the product cost report using the FIFO method in a process costing system.

The product cost report in **Exhibit 4-13A** summarizes the last three steps in the cost allocation process. The report calculates the cost of goods manufactured and transferred out of work in process and into finished goods. The report also calculates the cost of the remaining ending balance in work in process. Using the Big G example, **Exhibit 4-13A** also summarizes all of the steps in the total cost allocation process from (1) visualizing the physical flow of the units, to (2) calculating equivalent units, to (3) calculating per-unit costs, to (4) calculating cost of goods manufactured, to (5) calculating ending inventory. Finally, **Exhibit 4-13A** provides Big G's product cost report. Note that in this illustration, the equivalent units of production for materials and conversion costs (the numbers in **red**) are multiplied by the corresponding cost per unit figures for materials and conversion costs (the numbers in **green**) to calculate the cost allocation amounts used to assign costs to cost of goods manufactured and ending inventory.

Materials inventory	\$30,000
Work in process—Department 1 (3,000 units, 30% complete)	
Direct materials	4,560
Conversion costs	10,640
Work in process—Department 2 (4,000 units, 40% complete)	48,100
Finished goods inventory (2,000 units @ \$16)	32,000

During January, the following transactions occurred:

1. Purchased material on account, \$90,000.
2. Placed \$84,000 of material into process in Department 1. This \$84,000 represents 24,000 units of materials.
3. Distributed total payroll costs: \$108,000 of direct labor to Department 1, \$62,700 of direct labor to Department 2, and \$51,000 of indirect labor to Manufacturing Overhead.
4. Incurred other actual manufacturing overhead costs, \$81,000. (Credit Other Accounts.)
5. Applied overhead to the two processing departments: \$88,000 to Department 1 and \$43,900 to Department 2.
6. Transferred 25,000 completed units from Department 1 to Department 2. The 2,000 units remaining in Department 1 were 20% completed with respect to conversion costs.
7. Transferred 26,000 completed units from Department 2 to finished goods inventory. The 3,000 units remaining in Department 2 were 75% completed with respect to conversion costs.
8. Sold 20,000 units on account at \$27 per unit. Patterson uses FIFO inventory costing procedures for the finished goods inventory.

Required

- a. Record the **January** transactions in general journal form for Department 1 and Department 2.
- b. Prepare a product cost report (with its supporting calculations) for Department 1.
- c. Prepare a product cost report (with its supporting calculations) for Department 2.
- d. Determine the balances remaining in the Materials Inventory account, in each work in process account, and in the Finished Goods Inventory account.

P4-6A. Calculate Equivalent Units, Unit Costs, and Transferred Costs—FIFO Method Godfrey Manufacturing, Inc., operates a plant that produces its own regionally marketed Spicy Steak Sauce. The sauce is produced in two processes, blending and bottling. In the Blending Department, all materials are added at the start of the process, and labor and overhead are incurred evenly throughout the process. Godfrey uses the FIFO method. The following data from the Work in Process—Blending Department account for January 2016 is missing a few items:

LO6, 7



Work in Process—Blending Department	
January 1 inventory (5,000 gallons, 60% processed)	\$17,900
Transferred to Bottling Department (60,000 gallons)	_____
January charges:	
Direct material (61,000 gallons)	152,500
Direct labor	73,600
Manufacturing overhead	48,800
January 31 inventory (_____ gallons, 70% processed)	_____

Required

Assuming Godfrey uses the FIFO method in process costing, calculate the following amounts for the Blending Department:

- a. Number of units in the January 31 inventory.
- b. Equivalent units for materials and conversion costs.
- c. January cost per equivalent unit for materials and conversion costs.
- d. Cost of the units transferred to the Bottling Department.
- e. Cost of the incomplete units in the January 31 inventory

so forth. Each machine contains a small computer that automatically summarizes and reports transactions to the head cashier. The head cashier reconciles the activities of the two associate cashiers to the computerized reports. The supervisor, who does not handle cash, reviews the reconciliation. When an automatic teller's computer, a customer, or a cashier reports a problem, the two maintenance employees and one cashier are dispatched immediately. The cashier removes all cash and transaction records, and the maintenance employees repair the machine.

Maintenance employees spend all of their time on maintenance-related activities. The associate cashiers spend approximately 50 percent of their time on maintenance-related activities and 50 percent on daily trips. The head cashier's time is divided, with 75 percent directly related to daily trips to each machine and 25 percent related to supervising cashiers on maintenance calls. The supervisor devotes 20 percent of the time to daily trips to each machine and 80 percent to the equal supervision of each employee. Cost information for a recent month follows:

Salaries	
Supervisor.	\$4,000
Head cashier.	3,000
Other (\$1,800 each)	7,200
Lease and operating costs	
Cashiers' service vehicle	1,200
Maintenance service vehicle.	1,400
Office rent and utilities	2,300
Machine lease, space rent, and utilities (\$1,500 each).	15,000
Total	\$34,100

Related monthly activity information for this month follows:

Machine	Routine Trips	Maintenance Hours
1	30	5
2	90	17
3	60	15
4	60	30
5	120	15
6	30	10
7	90	25
8	120	5
9	60	20
10	60	18
Total	720	160

Additional information follows:

- The office is centrally located with about equal travel time to each machine.
- Maintenance hours include travel time.
- The cashiers' service vehicle is used exclusively for routine visits.
- The office space is divided equally between the supervisor and the head cashier.

Required

- Determine the monthly operating costs of machines 7 and 8 when cost assignments are based on the number of machines.
- Determine the activity cost of a routine trip and a maintenance hour for the month given. Round answers to the nearest cent.
- Determine the operating costs assigned and reassigned to machines 7 and 8 when activity-based costing is used.
- How can ABC cost information be used by Red River Banking Company to improve the overall management of monthly operating costs?

P5-9A. Product Costing: Company-wide Overhead Versus ABC LaMesa produces machine parts as a contract provider for a large manufacturing company. LaMesa produces two particular parts, shafts and gears. The competition is keen among contract producers, and LaMesa's top management realizes

LO3, 4



how vulnerable its market is to cost-cutting competitors. Hence, having a very accurate understanding of costs is important to LaMesa's survival.

LaMesa's president, Jose Rodriguez, has observed that the company's current cost to produce shafts is \$21.35, and the current cost to produce gears is \$12.36. He indicated to the controller that he suspects some problems with the cost system because LaMesa is suddenly experiencing extraordinary competition on shafts, but it seems to have a virtual corner on the gears market. He is even considering dropping the shaft line and converting the company to a one-product manufacturer of gears. He asked the controller, Felix Bernhardt, to conduct a thorough cost study and to consider whether changes in the cost system are necessary. The controller collected the following data about the company's costs and various manufacturing activities for the most recent month:

	Shafts	Gears
Production units	50,000	10,500
Selling price	\$31.86	\$24
Overhead per unit (based on direct labor hours)	\$12.82	\$6.10
Materials and direct labor cost per unit	\$8.53	\$6.26
Number of production runs	10	20
Number of purchasing and receiving orders processed	40	100
Number of machine hours	12,750	6,000
Number of direct labor hours	25,000	2,500
Number of engineering hours	5,000	5,000
Number of material moves	50	40

The controller was able to summarize the company's total manufacturing overhead into the following pools:

Setup costs	\$ 30,000
Machine cost	175,000
Purchasing and receiving costs	210,000
Engineering costs	200,000
Materials handling costs	90,000
Total	\$705,000

Required

- Calculate LaMesa's current company-wide overhead rate based on direct labor hours.
- Verify LaMesa's calculation of overhead cost per unit of \$12.82 for shafts and \$6.10 for gears.
- Calculate the manufacturing overhead cost per unit for shafts and gears using activity-based costing, assuming each of the five cost pools represents a separate activity pool. Use the most appropriate activity driver for assigning activity costs to the two products.
- Comment on LaMesa's current cost system and the reason the company is facing fierce competition for shafts but little competition for gears.

PROBLEMS—SET B

- LO2, 3 P5-1B. Activity-Based Costing and Conventional Costs Compared** Hickory Grill Company manufactures two types of cooking grills: the Gas Cooker and the Charcoal Smoker. The Cooker is a premium product sold in upscale outdoor shops; the Smoker is sold in major discount stores. Following is information pertaining to the manufacturing costs for the current month.

	Gas Cooker	Charcoal Smoker
Units	1,000	5,000
Number of batches	50	10
Number of batch moves	80	20
Direct materials	\$40,000	\$100,000
Direct labor	\$20,000	\$ 25,000

YOUR TURN! 6.3

The solution is on
page 239.



Your supervisor is concerned about your company's degree of operating leverage. She explains that other companies in your industry have operating leverage averaging over 3.0. Your sales for the current year are \$2,500,000, variable costs are \$1,400,000, and fixed costs are \$600,000. Should you be concerned?

**CORPORATE SOCIAL
RESPONSIBILITY**
True Innovation

Anyone who pays monthly water bills for a home, condo, business, or anything else knows that water is becoming increasingly scarce. Apple recognizes this, and has constructed manufacturing processes that reuse as much water as possible. When it comes to Apple's relationship with suppliers, the company does not simply criticize inefficient suppliers but rather works "with suppliers that don't meet our standards for water reuse" and "help them improve until they do."

Water use is not the only environmental impact Apple considers in its manufacturing processes; as highlighted on Apple's environmental responsibility web page, "We believe true innovation must consider everything." This all-inclusive approach to environmental consideration includes a partnership with the Conservation Fund to "protect and create the type of forests we use in our packaging," develop "a renewable micro-hydro project to power our data center in Prineville, Oregon," and construct "a solar farm in China to offset energy used by our offices and retail stores." While environmental impact is a necessary aspect of Apple's operations, the company has implemented processes that reduce the environmental impact and improve the company's relationship with its various stakeholders and with the general public.

Using Cost-Volume-Profit Relationships

Cost-volume-profit relationships can be used in a number of ways during planning and budgeting sessions to test possible courses of action. The following three independent situations, based on Fezzari's operating income presented in **Exhibit 6-11**, reveal ways that Fezzari might use cost-volume-profit relationships to make business decisions.

Situation 1

Assume that Fezzari's managers are considering reducing the average price of the CR1 (on a per-unit basis) from \$1,500 to \$1,300. *How would this change affect the break-even point in units?*

$$\begin{aligned}
 \text{Break-even units} &= \frac{\text{Total fixed cost}}{\text{Unit contribution margin}} \\
 &= \frac{\$595,000}{(\$1,300 - \$1,138)} \\
 &= 3,673 \text{ units}
 \end{aligned}$$

The \$200 price decrease would cause the break-even point to increase from 1,644 units (previously calculated) to 3,673 units.

Situation 2

Assume that Fezzari's managers are considering an advertising campaign that would increase the CR1's fixed costs by \$50,000 to \$645,000 and allow a price increase from \$1,500 to \$1,600 per unit. *How would this change affect the break-even point in units for the CR1 product line?*

EXERCISES—SET A

LO1

SERVICE AND
MERCHANDISING

E6-1A. Cost-Volume Graphs Set up a cost-volume graph. Volume should range from zero to 24,000 units (in 4,000-unit increments), and cost should range from zero to \$24,000 (in \$4,000 increments). Plot each of the following groups of cost data using different marks for each group. After completing the graph, indicate the type of cost behavior exhibited by each group.

Volume (applicable to each group)	Group A Costs	Group B Costs	Group C Costs
2,000	\$ 6,600	\$ 2,400	\$8,000
6,000	9,800	7,000	8,000
10,000	13,000	12,000	8,000
20,000	21,000	24,000	8,000

LO3

SERVICE AND
MERCHANDISING

E6-2A. High-Low Method Apply the high-low method of cost analysis to the three cost data groups in E6-1A. What cost behavior patterns are apparent? Express each as a cost formula.

LO2, 3

E6-3A. Relevant Range and High-Low Method The following selected data relate to the major cost categories experienced by Shaw Company at varying levels of operating volumes. Assuming that all operating volumes are within the relevant range, calculate the appropriate costs in each column in which blanks appear.

	Total Cost (@ 3,000 units)	Total Cost (@ 4,000 units)	Variable Cost per Unit	Total Fixed Cost	Total Cost (@ 5,000 units)
Direct labor (variable)	\$60,000	\$80,000	_____	_____	_____
Factory supervision (semivariable) . . .	50,000	65,000	_____	_____	_____
Factory depreciation (fixed)	30,000	30,000	_____	_____	_____

LO3

SERVICE AND
MERCHANDISING

E6-4A. Total Cost Formula Davis Company has analyzed its overhead costs and derived a general formula for their behavior: \$60,000 + \$14 per direct labor hour employed. The company expects to use 50,000 direct labor hours during the next accounting period. What overhead rate per direct labor hour should be applied to jobs worked during the period?

LO4

E6-5A. Break-Even Chart Set up a break-even chart similar to the one in **Exhibit 6-12** with proportional scales from zero to \$72,000 (in \$12,000 increments) on the vertical axis and from zero to 12,000 units of production (in 2,000-unit increments) on the horizontal axis. Prepare the break-even chart for Morton Company, assuming total fixed costs of \$18,000 and unit selling price and unit variable cost for the company's one product of \$6 and \$4, respectively. Label the total revenue line and the total cost line. Indicate the break-even point in units and dollars.

LO6

E6-6A. Net Income Planning Nolden Company has charged a selling price of \$20 per unit, incurred variable costs of \$14 per unit, and total fixed costs of \$90,000. What unit sales volume is necessary to earn the following related amounts of net income before income tax? (a) \$18,000; (b) \$27,000; or (c) equal to 20% of sales revenue.

LO4, 5, 6

E6-7A. Cost-Volume Profit Analysis Hailstorm Company sells a single product for \$22 per unit. Variable costs are \$14 per unit and fixed costs are \$60,000 at an operating level of 7,000 to 12,000 units.

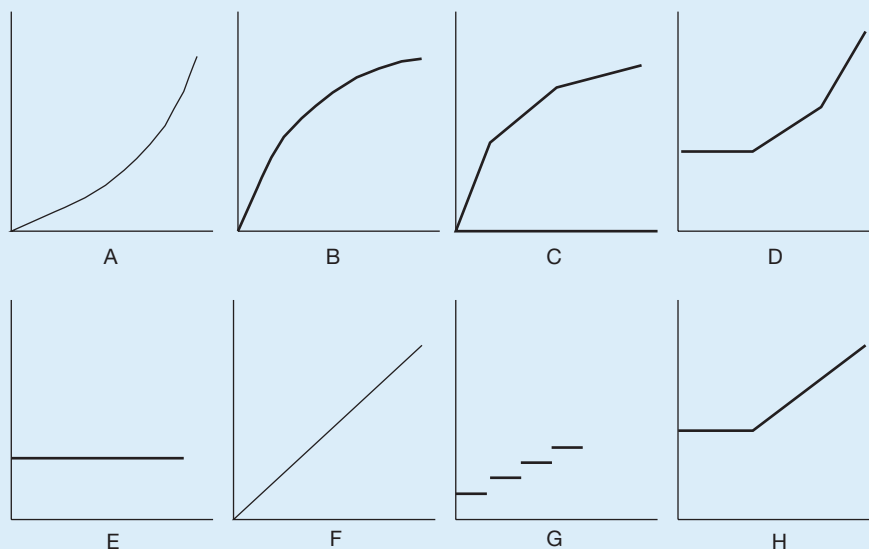
- What is Hailstorm Company's break-even point in units?
- How many units must be sold to earn \$12,000 before income tax?
- How many units must be sold to earn \$13,000 after income tax, assuming a 35% tax rate?

LO6

E6-8A. Break-Even with Multiple Products Warner Company has \$228,000 of total fixed costs and sells products A and B with a product mix of 40% A and 60% B. Selling prices and variable costs for A and B result in contribution margins per unit of \$10 and \$6, respectively. Compute the break-even point.

LO1

E6-9A. Cost Patterns The graphs below represent approximations of cost behavior patterns. The horizontal axis of each graph represents units and the vertical axis represents dollars of total cost.



Select the graph that best matches each of the situations described below. Each graph may be selected more than once.

- Straight-line depreciation of a factory building.
- Utility bill for electricity that includes a fixed charge per month plus a constant usage rate per hour for hours in excess of 100.
- Cost of microchip incorporated into a product.
- Labor cost of machine operators who become more productive as they gain experience.
- Water bill that includes a flat fee for the first 10,000 gallons used plus an increasing usage charge for each additional 10,000 gallons used.
- Cost of factory supplies when increasing quantities bring cost discounts as each price break level is attained.
- Salaries of quality inspectors when one additional inspector is hired for each 20,000 units produced.
- Cost of an advertising campaign.

EXERCISES—SET B

E6-1B. High-Low Method The highest and lowest levels of activity for the Denton Company were 54,000 direct labor hours and 36,000 direct labor hours, respectively. If maintenance costs were \$320,000 at the 54,000-hour level and \$230,000 at the 36,000-hour level, what cost might we expect at an operating level of 40,000 direct labor hours?

LO3

**SERVICE AND
MERCHANDISING**

E6-2B. High-Low Method During the past year, Cutler, Inc., operated within the relevant range of its fixed costs. Monthly production volume during the year ranged from 40,000 to 60,000 units of product and corresponding total manufacturing costs ranged from \$4.00 to \$3.80 per unit. Determine the total cost behavior pattern experienced by Cutler, Inc.

LO3

E6-3B. Relevant Range and High-Low Method The following selected data relate to the major cost categories experienced by Sterling Company at varying levels of operating volumes. Assuming that all operating volumes are within the relevant range, calculate the appropriate costs in each column in which blanks appear:

L02, 3

	Total Cost (@ 5,000 units)	Total Cost (@ 6,000 units)	Variable Cost per Unit	Total Fixed Cost	Total Cost (@ 7,000 units)
Direct labor (variable)	\$60,000	\$72,000	—	—	—
Factory supervision (semivariable) . . .	20,000	22,000	—	—	—
Factory depreciation (fixed)	18,000	18,000	—	—	—



- c. Assume that in addition to the cost avoidance in requirement (b), the capacity released by discontinuance of the engineering division can be used to provide 6,000 new services that would have a variable cost per service of \$36 and would require additional fixed costs totaling \$68,000. At what unit price must the new service be sold if Bingham is to increase its total net income by \$120,000?



LO5 P8-5A. Joint Cost The Sun-Kissed Company manufactures two skin-care lotions, Soft Skin and Silken Skin, out of a joint process. The joint (common) costs incurred are \$420,000 for a standard production run that generates 180,000 gallons of Soft Skin and 120,000 gallons of Silken Skin. Additional processing costs beyond the split-off point are \$1.40 per gallon for Soft Skin and \$0.90 per gallon for Silken Skin. Soft Skin sells for \$2.40 per gallon while Silken Skin sells for \$3.90 per gallon.

The Best Eastern Hotel chain has asked the Sun-Kissed Company to supply it with 240,000 gallons of Silken Skin at a price of \$3.65 per gallon. Best Eastern plans to have the Silken Skin bottled in 1.5-ounce personal-use containers that are supplied in each of its hotel rooms as part of the complimentary personal products for guest use.

If Sun-Kissed accepts the order, it will save \$0.05 per gallon in packaging of Silken Skin. There is sufficient excess capacity in Sun-Kissed's production system to handle just one more production run in order to have sufficient Silken Skin for this special order. However, the nature of the joint process always results in 180,000 gallons of Soft Skin and 120,000 gallons of Silken Skin. Also, the market for Soft Skin is saturated; hence, any additional sales of Soft Skin would take place at a price of \$1.60 per gallon.

Required

- What is the profit normally earned on one production run of Soft Skin and Silken Skin?
- What is the incremental effect on overall income if the Sun-Kissed Company accepts the special order for Silken Skin?

LO6 P8-6A. Product Emphasis Lowell Corporation manufactures both a deluxe and a standard model of a household food blender. Because of limited demand, for several years production has been at 80% of estimated capacity, which is thought to be limited by the number of machine hours available. At current operation levels, a profit analysis for each product line shows the following data:

	Per-Unit Data	
	Deluxe	Standard
Sales price	\$216	\$84
Production costs:		
Direct material	\$89	\$12
Direct labor	36	23
Variable manufacturing overhead	15	11
Fixed manufacturing overhead*	25	10
Variable operating expenses	18	10
Fixed operating expenses	8	5
Total cost	\$191	\$71
Operating income	\$ 25	\$13

* Assigned on the basis of machine hours at normal capacity.

Management wants to utilize the company's current excess capacity by increasing production.

Required

- What general decision guideline applies in this situation?
- Assuming that sufficient units of either product can be sold at current prices to use existing capacity fully and that total fixed cost will not be affected, prepare an analysis showing which product line should be emphasized if net income for the firm is the decision basis.

Required

- Present an analysis supporting a decision to accept or reject the special order.
- What is the lowest price Greenfield could receive and still make a profit of \$5,000 before income taxes on the special order?
- What general qualitative factors should Greenfield consider?

LO3 P8-3B. Make or Buy Walsh Corporation currently makes the nylon mooring cover for its main product, a fiberglass boat designed for tournament bass fishing. The costs of producing the 2,000 **covers** needed each year follow:



Nylon fabric	\$320,000
Wood battens	64,000
Brass fittings	32,000
Direct labor	128,000
Variable manufacturing overhead	96,000
Fixed manufacturing overhead	160,000

Calvin Company, a specialty fabricator of synthetic materials, can make the needed covers of comparable quality for \$320 each, F.O.B. shipping point. Walsh would furnish its own trademark insignia at a unit cost of \$20. Transportation in would be \$16 per unit, paid by Walsh Corporation.

Walsh's chief accountant has prepared a cost analysis that shows that only 30% of fixed overhead could be avoided if the covers are purchased. The covers have been made in a remote section of Walsh's factory building, using equipment for which no alternate use is apparent in the foreseeable future.

Required

- Prepare a differential analysis showing whether or not you would recommend that the mooring covers be purchased from Calvin Company.
- Assuming that the production capacity released by purchasing the covers could be devoted to a subcontracting job for another company that netted a contribution margin of \$64,000, what maximum purchase price could Walsh pay for the covers?
- Identify two important qualitative factors that Walsh Corporation should consider in deciding whether to purchase the needed covers.

LO4 P8-4B. Dropping Unprofitable Division Based on the following analysis of last year's operations of Groves, Inc., a financial vice president of the company believes that the firm's total net income could be increased by \$160,000 if its design division were discontinued. (Amounts are given in thousands of dollars.)



	Totals	All Other Divisions	Design Division
Sales	\$18,800	\$14,400	\$4,400
Cost of services:			
Variable	(7,600)	(5,600)	(2,000)
Fixed	(4,800)	(4,000)	(800)
Gross profit	\$ 6,400	\$ 4,800	\$1,600
Operating expenses:			
Variable	(3,360)	(2,000)	(1,360)
Fixed	(1,600)	(1,200)	(400)
Net income (loss)	\$ 1,440	\$ 1,600	\$ (160)

Required

Provide answers for each of the following independent situations:

- Assuming that total fixed costs and expenses would not be affected by discontinuing the design division, prepare an analysis showing why you agree or disagree with the vice president.
- Assume that discontinuance of the design division will enable the company to avoid 30% of the fixed portion of cost of services and 40% of the fixed operating expenses allocated to the design division. Calculate the resulting effect on net income.

Use of Standard Costs in Setting Selling Prices

ACCOUNTING IN PRACTICE

Standard costs of products are an important consideration in setting selling prices, but are certainly not the only, or even the most important, consideration. Prices of competitors' products and prices of substitute products must also be considered when determining product selling prices.

COST VARIANCES

Standard costs are extremely helpful in budgeting prior to the start of a fiscal period. Moreover, they can also be very useful in evaluating performance at the end of a period. Even in well-managed companies with carefully established and currently maintained cost standards, actual costs will differ from standard costs. The differences, often called *variances*, should be analyzed for indications of their cause so that appropriate action may be taken to prevent them in future periods.

We first provide an overview of each type of variance and then illustrate the calculation of these variances based on the production data for an important Fezzari product. Suppose that during June 2016, Fezzari Bicycles produced 100 Fore CR2 road bikes for which it incurred the following actual costs (assume no beginning or ending work in process inventories):

Direct material:	
Frame	\$33,600
Build kit	31,500
Direct labor:	
Assembly	15,000
Quality control and packaging	5,000
Variable overhead	1,525
Total actual variable production costs	<u>\$86,625</u>

Exhibit 10-4 compares the actual costs with standard costs to produce 100 bikes, and calculates the differences, or variances, for each cost category. We multiply the standard costs by the actual quantity of 100 bikes produced in June. Note that both favorable and unfavorable variances exist and that the overall net variance of \$7,315 is unfavorable. To initiate remedial action, management must analyze the variance for each manufacturing cost element to determine the underlying causal factors related to prices paid, quantities used, and productive capacity used.

Exhibit 10-4

Comparison of Standard and Actual Costs

FEZZARI PERFORMANCE BICYCLES Variance Analysis June 30, 2016				
	Actual Costs	Standard Costs	Total Flexible Budget Variances	
Direct material	\$65,100	\$60,000	\$5,100	Unfavorable*
Direct labor	20,000	17,750	2,250	Unfavorable
Variable overhead	1,525	1,560	(35)	Favorable
	<u>\$86,625</u>	<u>\$79,310</u>	<u>\$7,315</u>	Unfavorable

*The total material variance calculated in the next section is not equal to the difference between the total standard costs and total actual costs because the amount purchased is different from the amount used in production. See the chapter discussion for a detailed explanation.

3. The formula $[(\text{Actual Price} - \text{Standard Price}) \times \text{Actual Quantity}]$ can be used to calculate which cost variance? LO3
 - a. Variable overhead volume
 - b. Labor efficiency
 - c. Materials efficiency
 - d. Materials price
 4. Which variance considers production capacity not used? LO5
 - a. Variable overhead efficiency
 - b. Labor efficiency
 - c. Variable overhead spending
 - d. Materials efficiency
 5. The gross profit on the interim income statement of a firm using standard costs is computed as: LO6
 - a. Sales less cost of goods sold at standard
 - b. Sales less cost of goods sold at standard plus net unfavorable variances
 - c. Sales less cost of goods sold at standard less net unfavorable variances
 - d. Sales less cost of goods sold at actual

QUESTIONS

1. What is the difference between budgeted costs and standard costs? **L01**
2. Define standard costs and describe how they are developed. **L02**
3. When should standard costs be established and how often should such standards be changed? **L01**
4. "Standard costs can be set too high or too low for motivational purposes." Comment. **L01**
5. What is standard cost accounting? **L02**
6. A finished product requires 2 pounds of a material costing \$6 per pound. What is the standard cost of direct material per unit of product? **L02**
7. A finished product requires 20 minutes of direct labor to complete each unit. Factory workers are paid \$12 per hour. What is the standard cost of direct labor per unit of product? **L02**
8. Assume that the variable overhead rate for the product described in Question 7 is \$9 per hour. What is the standard cost of variable overhead per unit of product? **L02**
9. Name and briefly describe the two direct material variances. **L03**
10. Garcia Company used 6,300 pounds of direct material costing \$7.80 per pound for a batch of products that should have consumed 6,000 pounds costing \$8 per pound. What are the material variances? **L03**
11. Name and briefly describe the two direct labor variances. **L04**
12. Wong Lee used 1,200 direct labor hours at an average wage rate of \$8.70 to manufacture products that should have used 1,300 direct labor hours at an average wage rate of \$8.50 per hour. What are the labor variances? **L04**
13. "Total actual cost exactly equals total standard cost, so everything must be okay." Comment. **L01**
14. The variable overhead rate is \$5 per direct labor hour; 31,000 direct labor hours were used to produce 7,500 units of product. The standard is 4 direct labor hours per unit. Actual, variable overhead cost was \$153,000. Determine the variable overhead variances. **L05**
15. Who in the firm might be responsible for each of the following variances? **L07**
 - a. Materials price and efficiency variances
 - b. Labor rate and efficiency variances
 - c. Variable overhead spending and efficiency variances
16. Briefly explain how standard cost variances are reported on financial statements. **L06**

EXERCISES—SET A

- E10-1A. Standard Product Costs** Deerfield Company manufactures product M in its factory. Production of M requires 2 pounds of material P, costing \$4 per pound and 0.5 hour of direct labor costing, \$10 per hour. The variable overhead rate is \$8 per direct labor hour, and the fixed overhead rate is \$12 per direct labor hour. What is the standard product cost for product M? **LO2**
- E10-2A. Material and Labor Variances** The following actual and standard cost data for direct material and direct labor relate to the production of 2,000 units of a product: **LO3, 4**

	Actual costs	Standard costs
Direct material	3,900 lb. @ \$5.30	4,000 lb. @ \$5.10
Direct labor	6,200 hrs. @ \$8.40	6,000 hrs. @ \$8.70

Determine the following variances:

- a. Materials price
- b. Materials efficiency
- c. Labor rate
- d. Labor efficiency

LO5 E10-3A. Variable Overhead Variances Morgan Tax Company considers 6,000 direct labor hours or 300 tax returns its normal monthly capacity. Its standard variable overhead rate is \$5 per direct labor hour. During the current month, \$25,400 of variable overhead cost was incurred in working 5,600 direct labor hours to prepare 270 tax returns. Determine the following variances, and indicate whether each is favorable or unfavorable:

- a. Variable overhead spending
- b. Variable overhead efficiency

LO3, 4, 5 E10-4A. Material, Labor, and Variable Overhead Variances The following summarized manufacturing data relate to Thomas Corporation's April operations, during which 2,000 finished units of product were produced. Normal monthly capacity is 1,100 direct labor hours.

	Standard Unit Costs	Total Actual Costs
Direct material:		
Standard (2 lb. @ \$9/lb.)	\$18	
Actual (4,200 lb. @ \$10.20/lb.)		\$42,840
Direct labor:		
Standard (0.5 hr. @ \$24/hr.)	12	
Actual (950 hrs. @ \$23.40/hr.)		22,230
Variable overhead:		
Standard (0.5 hr. @ \$6/hr.)	3	
Actual		6,450
Total	<u>\$33</u>	<u>\$71,520</u>

Determine the materials price and efficiency variances, labor rate and efficiency variances, and variable overhead spending and efficiency variances.

LO3, 4, 5 E10-5A. Working With Variances From the following data, determine the total actual costs incurred for direct material, direct labor, and variable overhead.

	Standard Costs	Variances
Direct material	\$120,000	
Price variance		\$3,000 U
Quantity variance		4,000 F
Direct labor	100,000	
Rate variance		1,400 U
Efficiency variance		1,800 U
Variable overhead	44,000	
Spending variance		1,000 F
Efficiency variance		600 U

EXERCISES—SET B

LO2 E10-1B. Standard Product Costs Harrison Company manufactures product Q in its factory. Production of Q requires 3 pounds of material T, costing \$7 per pound and 2 hours of direct labor, costing \$10 per hour. The variable overhead rate is \$6 per direct labor hour, and the fixed overhead rate is \$9 per direct labor hour. What is the standard product cost for product Q?

E10-2B. Material and Labor Variances The following actual and standard cost data for direct material and direct labor relate to the production of 2,000 units of a product:

LO3, 4

	Actual Costs	Standard Costs
Direct material	4,200 lb. @ \$4.90	4,000 lb. @ \$5.20
Direct labor	5,700 hrs. @ \$9.30	6,000 hrs. @ \$9.50

Determine the following variances:

- a. Materials price
- b. Materials efficiency
- c. Labor rate
- d. Labor efficiency

E10-3B. Variable Overhead Variances Marshfield Tax Company considers 8,000 direct labor hours or 400 tax returns its normal monthly capacity. Its standard variable overhead rate is \$4 per direct labor hour. During the current month, \$31,500 of variable overhead cost was incurred in working 7,500 direct labor hours to produce 360 units of product. Determine the following variances, and indicate whether each is favorable or unfavorable:

LO5

- a. Variable overhead spending
- b. Variable overhead efficiency

E10-4B. Material, Labor, and Variable Overhead Variances The following summarized manufacturing data relate to Brown Corporation's May operations, during which 2,000 finished units of product were produced. Normal monthly capacity is 1,100 direct labor hours.

LO3, 4, 5

	Standard Unit Costs	Total Actual Costs
Direct material:		
Standard (3 lb. @ \$2.00/lb.)	\$ 6	
Actual (6,400 lb. @ \$2.20/lb.)		\$14,080
Direct labor:		
Standard (0.5 hr. @ \$14/hr.)	7	
Actual (950 hrs. @ \$13.70/hr.)		13,015
Variable overhead:		
Standard (0.5 hr. @ \$4/hr.)	2	
Actual		4,300
Total	<u>\$15</u>	<u>\$31,395</u>

Determine the materials price and efficiency variances, labor rate and efficiency variances, and variable overhead spending and efficiency variances.

E10-5B. Working With Variances From the following data, determine the total actual costs incurred for direct material, direct labor, and variable overhead.

LO3, 4, 5

	Standard Costs	Variances
Direct material	\$55,000	
Price variance		\$1,200 U
Quantity variance		2,200 F
Direct labor	46,000	
Rate variance		500 U
Efficiency variance		800 U
Variable overhead	18,000	
Spending variance		400 F
Efficiency variance		700 U



PROBLEMS—SET A

LO3, 4, 5

P10-1A. Calculate Variances The following summary data relate to the operations of Dobson Company for April, during which 9,000 finished units were produced. Normal monthly capacity was 20,000 direct labor hours.

	Standard Unit Costs	Total Actual Costs
Direct material:		
Standard (4 lb. @ \$2.20/lb.)	\$ 8.80	
Actual (38,000 lb. @ \$2.00/lb.)		\$ 76,000
Direct labor:		
Standard (2 hrs. @ \$11.00/hr.)	22.00	
Actual (18,500 hrs. @ \$11.30/hr.)		209,050
Variable overhead:		
Standard (2 hrs. @ \$3.00/hr.)	6.00	
Actual		54,900
Total	<u>\$36.80</u>	<u>\$339,950</u>

Required

Determine the following variances and indicate whether each is favorable or unfavorable:

- Materials price and efficiency variances
- Labor rate and efficiency variances
- Variable overhead spending and efficiency variances

LO3, 4, 5, 6, 7

P10-2A. Variances, Entries, and Income Statement A summary of Glendale Company's manufacturing variance report for May 2016 follows:

	Total Standard Costs (9,200 units)	Total Actual Costs (9,200 units)	Variances
Direct material	\$ 38,640	\$ 42,630	\$3,990 U
Direct labor	193,200	193,120	80 F
Variable overhead	23,460	23,230	230 F
Fixed overhead	9,660	9,660	
	<u>\$264,960</u>	<u>\$268,640</u>	<u>\$3,680 U</u>

Standard material cost per unit of product is 0.5 pounds at \$8.40 per pound, and standard direct labor cost is 1.5 hours at \$14.00 per hour. The total actual materials cost represents 4,900 pounds purchased at \$8.70 per pound. Total actual labor cost represents 14,200 hours at \$13.60 per hour. According to standards, variable overhead rate is applied at \$1.70 per direct labor hour (based on a normal capacity of 15,000 direct labor hours or 10,000 units of product). Assume that all fixed overhead is applied to work in progress inventory.

Required

- Calculate variances for materials price and efficiency, labor rate and efficiency, and variable overhead spending and efficiency.
- Prepare general journal entries to record standard costs, actual costs, and related variances for material, labor, and overhead.
- Prepare journal entries to record the transfer of all completed units to Finished Goods Inventory and the subsequent sale of 8,400 units on account at \$54 each (assume no beginning finished goods inventory).
- Prepare a partial income statement (through gross profit on sales) showing gross profit based on standard costs, the incorporation of variances, and gross profit based on actual costs.

P10-3A. Variances and Journal Entries Jacobs Company manufactures a single product and uses a standard costing system. The nature of its product dictates that it be sold in the period it is produced. Thus, no ending work in process or finished goods inventories remain at the end of the period. However, raw materials can be stored and are purchased in bulk when prices are favorable. Per-unit standard product costs are material, \$8 (4 pounds); labor, \$6 (0.5 hour); and variable overhead, \$4 (based on direct labor hours). Budgeted fixed overhead is \$54,000.

Jacobs accounts for all inventories and cost of goods sold at standard cost and records each variance in a separate account. The following data relate to May 2016 when 17,700 finished units were produced.

Required

- Assume Jacobs purchased 69,000 pounds of raw materials on account at \$2.20 per pound and used 67,000 pounds in May's production, prepare a journal entry to record the purchase of raw materials and a separate journal entry to record the use of raw materials in production. Record these entries using standard costs and include the appropriate materials variances.
- Assuming employees worked 8,900 direct labor hours at an average hourly rate of \$11.70, prepare a journal entry to record actual costs, standard costs, and any labor variances.
- Assuming Jacobs' actual and applied variable overhead was \$74,200 and that budgeted and actual fixed overhead incurred was \$54,000, prepare a journal entry to record actual and standard overhead costs and any overhead variances.

P10-4A. Variances, Total Overhead Variances, and Variance Reconciliation Milton Company planned to produce 21,000 units of its only product during the year. Milton established the following standard cost data for this product prior to the beginning of the year:

	Per Unit
Direct material (3 lbs. @ \$5.00 per lb.)	\$15.00
Direct labor (2 hrs. @ \$17.50 per hr.)	35.00
Variable overhead (2 hrs. @ \$6 per hr.)	12.00
Total standard cost per unit	<u>\$62.00</u>
Total budgeted fixed overhead is \$400,000.	

Assume that Milton (1) actually produced 22,000 units, (2) used 68,000 pounds of direct materials in production, (3) and incurred the following actual total costs:

	Total Cost
Direct materials purchased (70,000 lbs. @ 4.80)	\$ 336,000
Direct labor (43,000 hrs. @ \$18.00)	774,000
Variable overhead	262,320
Fixed overhead	<u>400,000</u>
Total actual costs	\$1,772,320

Required

- Calculate the variances for materials, labor, and variable overhead.
- Does the difference between total actual costs and total standard costs equal the sum of all of the variances? Explain.

LO3, 4, 5, 7



LO3, 4, 5

PROBLEMS—SET B

LO3, 4, 5

P10-1B. Calculate Variances The following summary data relate to the operations of Randolph Company for July, during which 4,500 finished units were produced:

	Standard Total Unit Costs	Total Actual Costs
Direct material:		
Standard (0.6 lb. @ \$9.00/lb.)	\$ 5.40	
Actual (3,000 lb. @ \$9.40/lb.)		\$ 28,200
Direct labor:		
Standard (0.8 hr. @ \$12.80/hr.)	10.24	
Actual (3,800 hrs. @ \$12.50/hr.)		47,500
Variable overhead:		
Standard (0.8 hr. @ \$7.50/hr.)	6.00	
Actual		30,100
Total	<u>\$21.64</u>	<u>\$105,800</u>

Required

Determine the following variances and indicate whether each is favorable or unfavorable:

- Materials price variance and efficiency variance
- Labor rate variance and efficiency variance
- Variable overhead spending variance and efficiency variance

LO3, 4, 5, 6, 7

P10-2B. Variances, Entries, and Income Statement A summary of Blake Company's manufacturing variance report for June 2016 follows.

	Total Standard Costs (7,600 units)	Total Actual Costs (7,600 units)	Variances
Direct material	\$ 66,880	\$ 65,100	\$1,780 F
Direct labor	77,520	82,800	5,280 U
Variable overhead	34,200	33,000	1,200 F
Fixed overhead	<u>102,600</u>	<u>102,600</u>	
	<u>\$281,200</u>	<u>\$283,500</u>	<u>\$2,300 U</u>

Standard material cost per unit of product is 4 pounds at \$2.20 per pound, and standard direct labor cost is 0.75 hours at \$13.60 per hour. Total actual material cost represents 31,000 pounds purchased at \$2.10 per pound. Total actual labor cost represents 6,000 hours at \$13.80 per hour. According to standards, variable overhead rate is applied at \$6 per direct labor hour (based on a normal capacity of 6,000 direct labor hours or 8,000 units of product). Assume that all fixed overhead is applied to work in progress inventory.

Required

- Calculate variances for materials price and efficiency, labor rate and efficiency, and variable overhead spending and efficiency.
- Prepare general journal entries to record standard costs, actual costs, and related variances for material, labor, and overhead.
- Prepare journal entries to record the transfer of all completed units to Finished Goods Inventory and the subsequent sale of 6,400 units on account at \$60 each (assume no beginning finished goods inventory).
- Prepare a partial income statement (through gross profit on sales) showing gross profit based on standard costs, the incorporation of variances, and gross profit based on actual costs.

LO3, 4, 5, 7

P10-3B. Variances and Journal Entries Kent Company manufactures a single product and uses a standard costing system. The nature of its product dictates that it be sold in the period it is produced. Thus, no ending work in process or finished goods inventories remain at the end of the period. However, raw materials can be stored and are purchased in bulk when prices are favorable. Per-unit, standard

QUESTIONS

1. What is capital budgeting? LO1
2. List three reasons why capital budgeting decisions are often important. LO1
3. What are the three stages typical of most investments in plant and equipment? LO1
4. Briefly describe the concept of weighted average cost of capital. LO2
5. In what sense does the cost of capital limit a firm's investment considerations? LO2
6. A company plans to accumulate 75% of its needed investment capital by issuing bonds having a capital cost percentage of 12%; the balance will be raised by issuing stock having a capital cost percentage of 16%. What would be the weighted average cost of capital for the total amount of capital? LO2
7. Briefly describe the concept of the time value of money. LO2
8. You have the right to receive \$30,000 at the end of each of the next four years, and money is worth 8%. Using the PV tables, your financial calculator, or Excel, compute the present value of this annuity. LO3, 7
9. A rich uncle allows you to stipulate which of two ways you receive your inheritance: LO3, 7
 - a. \$850,000 one year after his death or
 - b. \$250,000 on his death and \$200,000 each year at the end of the first, second, and third years following his death. If money is worth 10%, what is the relative advantage of the more attractive alternative?
10. You can settle a debt with either a single payment now of \$30,000 or with payments of \$8,000 at the end of each of the next five years. If money is worth 10%, what is the relative advantage of the most attractive alternative? If money is worth 12%, would your answer change? Why? LO3, 7
11. Explain how to convert before-tax cash operating expenses and depreciation deductions into after-tax amounts. LO4
12. What is meant by the term *depreciation tax shield*? LO4
13. What amounts are compared in net present value analysis? State the related decision rule. LO3, 5
14. What is an excess present value index? LO5
15. Define cash payback period, state the related decision rule, and specify an important limitation of this analysis. LO6
16. Define average rate of return, state the related decision rule, and specify an important limitation of this analysis. LO6

EXERCISES—SET A

- E12-1A. Weighted Average Cost of Capital** Gardner, Inc., plans to finance its expansion by raising the needed investment capital from the following sources in the indicated proportions and respective capital cost rates: LO2

Source	Capital Cost	
	Proportion	Rate
Bonds	40%	13%
Preferred stock	20	9
Common stock	30	12
Retained earnings	10	9
	100%	

Calculate the weighted average cost of capital.

- E12-2A. Present Value Computations** Assuming that money is worth 10%, compute the present value of LO3
1. \$7,000 received 15 years from today.
 2. The right to inherit \$1,000,000 14 years from now.
 3. The right to receive \$1,000 at the end of each of the next six years.
 4. The obligation to pay \$3,000 at the end of each of the next 10 years.
 5. The right to receive \$5,000 at the end of the 7th, 8th, 9th, and 10th years from today.



Source	Proportion	Capital Cost Rate
Bonds	45%	10%
Preferred stock	10	8
Common stock	25	14
Retained earnings	20	12
	100%	

Calculate the weighted average cost of capital.

E12-2B. Present Value Computations Assuming that money is worth 10%, compute the present value of

- \$6,000 received 15 years from today.
- The right to inherit \$2,000,000 14 years from now.
- The right to receive \$2,000 at the end of each of the next six years.
- The obligation to pay \$1,000 at the end of each of the next 10 years.
- The right to receive \$10,000 at the end of the 7th, 8th, 9th, and 10th years from today.

LO3



E12-3B. After-Tax Cash Flows For each of the following independent situations, compute the net after-tax cash flow amount by subtracting cash outlays for operating expenses and income taxes from cash revenue. The cash outlay for income taxes is determined by applying the income tax rate to the cash revenue received less the cash and noncash (depreciation) expenses.

LO4

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	A	B	C
Cash revenue received	\$80,000	\$400,000	\$200,000
Cash operating expenses paid	45,000	260,000	120,000
Depreciation on tax return	10,000	25,000	15,000
Income tax rate	30%	40%	20%

E12-4B. After-Tax Cash Flows Using the data in E12-3B, (a) calculate the individual after-tax cash flow effect of each relevant item in each independent situation, and (b) sum the individual after-tax cash flows in each situation to determine the overall net after-tax cash flow.

LO4

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MERCHANDISING

E12-5B. Depreciation Tax Shields Mendota Company has purchased equipment for \$100,000. After it is fully depreciated, the equipment will have no salvage value. Mendota may select either of the following depreciation schedules for tax purposes:

LO4



Year	Option 1 Depreciation	Option 2 Depreciation
1	\$20,000	\$10,000
2	32,000	20,000
3	19,200	20,000
4	11,520	20,000
5	11,520	20,000
6	5,760	10,000

Assuming a 40% tax rate and a 12% desired annual return, compute the total present value of the tax savings provided by these alternative depreciation tax shields. Which depreciation schedule would be more attractive to Mendota?

E12-6B. Net Present Value Analysis Hermson Company must evaluate two capital expenditure proposals. Hermson's hurdle rate is 12%. Data for the two proposals follow.

LO5



	Proposal X	Proposal Y
Required investment	\$140,000	\$140,000
Annual after-tax cash inflows	33,000	
After-tax cash inflows at the end of years 3, 6, 9, and 12		99,000
Life of project	12 years	12 years

Year 1	\$ 8,000
Year 2	16,000
Year 3	16,000
Year 4	16,000
Year 5	8,000

Although salvage value is ignored in the tax depreciation calculations, Champion estimates the equipment will be sold for \$8,000 after five years.

Required

Assuming a 35% income tax rate and a 10% hurdle rate, compute the net present value of this contract proposal. Using net present value analysis, should Champion accept the contract? (Round amounts to the nearest dollar.)

P12-3A. Net Present Value, Cash Payback, and Average Rate of Return Methods Western Company is evaluating a possible \$42,000 investment in special tools that would increase cash flows from operations for four years. The tools will have no salvage value. The income tax rate is 40%. Western uses a 12% hurdle rate when using present value analysis. Other information regarding the proposal is as follows:

LO5, 6

	Year 1	Year 2	Year 3	Year 4
Cash inflow from operations (pre-tax)	\$15,000	\$20,000	\$16,500	\$12,000
Depreciation on tax return	14,000	18,500	6,500	3,000
Depreciation in financial statements	10,500	10,500	10,500	10,500
Net income from investment	2,700	5,700	3,600	900

Required

- What are the annual net after-tax cash inflows from this proposal?
- Compute the net present value and indicate whether it is positive or negative (round amounts to nearest dollar).
- Compute the excess present value index.
- Compute the cash payback period.
- Compute the average rate of return.

P12-4A. Excess Present Value Index and Average Rate of Return Highpoint Company is evaluating five different capital expenditure proposals. The company's hurdle rate for net present value analyses is 12%. A 10% salvage value is expected from each of the investments. Information on the five proposals is as follows:

LO5, 6



Proposal	Required Investment	Present Value at 12% of After-tax Cash Flows	Average Annual Net Income from Investment
A	\$270,000	\$310,030	\$37,400
B	200,000	236,780	26,000
C	160,000	173,040	19,200
D	180,000	216,300	27,600
E	128,000	136,990	14,960

Required

- Compute the excess present value index for each of the five proposals.
- Compute the average rate of return for each of the five proposals.
- Assume that Highpoint will commit no more than \$500,000 to new capital expenditure proposals. Using the excess present value index, which proposals would be accepted? Using the average rate of return, which proposals would be accepted?

P12-5A. Cash Payback, Average Rate of Return, and Net Present Value Methods Landover Amusement Park is considering the construction of a new facility to house a curved, multistory movie screen. The facility will cost \$400,000 and be useful for 10 years, with no salvage value. The facility will be

LO5, 6

SERVICE AND MERCHANDISING

depreciated on a straight-line basis over 10 years on both the books and the tax return. The following annual results are expected if the facility is constructed:

Increase in annual cash revenue		\$200,000
Increase in expenses:		
Cash operating expenses	\$80,000	
Depreciation	40,000	120,000
Pretax income		\$ 80,000
Income tax expense (40%)		32,000
Net income		<u>\$ 48,000</u>

Landover uses a 12% **hurdle** rate when analyzing capital expenditure proposals using net present value.

Required

- What are the annual net cash flows (net inflows) from this project?
- Compute the cash payback period.
- Compute the average rate of return.
- Compute the net present value and indicate whether it is positive or negative.
- Assume that Landover decides to use a 10% **hurdle** rate when using net present value analysis. Compute the net present value using a 10% **hurdle** rate and indicate whether it is positive or negative.

LO2, 5 P12-6A. Weighted Average Cost of Capital and Net Present Value Analysis Tate Company is considering a proposal to acquire new equipment for its manufacturing division. The equipment will cost \$192,000, be useful for four years, and have a \$12,000 salvage value. Tate expects annual savings in cash operating expenses (before taxes) of \$68,000. For tax purposes, the annual depreciation deduction will be \$64,000, \$86,000, \$28,000, and \$14,000, respectively, for the four years (the salvage value is ignored on the tax return). The income tax rate is 40%.

Tate establishes a **hurdle** rate for a net present value analysis at the company's weighted average cost of capital plus 1 percentage point. Tate's capital is provided in the following proportions: debt, 60%; common stock, 20%; and retained earnings, 20%. The cost rates for these capital sources are debt, 10%; common stock, 12%; and retained earnings, 13%.

Required

- Compute Tate's (1) weighted average cost of capital and (2) **hurdle** rate.
- Using Tate's **hurdle** rate, compute the net present value of this capital expenditure proposal. Under net present value analysis, should Tate accept the proposal? (Round amounts to the nearest dollar.)

PROBLEMS—SET B

LO4 P12-1B. After-Tax Cash Flows Below is a list of aspects of various capital expenditure proposals that the capital budgeting team of Modern Systems, Inc., has incorporated into its net present value analyses during the past year. Unless otherwise noted, the items listed are unrelated to each other. All situations assume a 30% income tax rate and a 10% minimum desired rate of return.

- Pre-tax savings of \$5,000 in cash expenses will occur in each of the next three years.
- A machine is purchased now for \$82,000.
- Special tools costing \$45,000 will be depreciated \$9,000, \$18,000, and \$18,000, respectively, on the tax return over a three-year life.
- A patent purchased for \$330,000 will be amortized on a straight-line basis over 15 years on the tax return. No salvage value is expected.
- Pre-tax savings of \$8,000 in cash expenses will occur in each of the next seven years.
- Pre-tax savings of \$5,500 in cash expenses will occur in the first, fourth, and seventh years from now.
- The special tools described in aspect 3 will be sold after three years for \$10,000 cash.
- A truck with a tax book value of \$7,200 after two years will be sold at that time for \$4,600.

Required

Set up an answer form with the four column headings as shown below. Answer each investment aspect separately. Prepare your calculations on a separate paper and key them to each item. The answer to investment aspect 1 is presented as an example.

Investment Aspect 1	A After-tax Cash Flow Effect(s) Inflows (Outflows)	B Year(s) of Cash Flow
	\$3,500	1, 2, 3
Calculations:		
1. Pre-tax cash savings		\$5,000
Less income tax at 30%		<u>1,500</u>
After-tax cash inflow		<u>\$3,500</u>

- Calculate and record in column A the related after-tax cash flow effect(s). Place parentheses around outflows.
- Indicate in column B the timing of each cash flow shown in column A. Use 0 to indicate immediately and 1, 2, 3, 4, and so on for each year involved.

P12-2B. Net Present Value Analysis You have an opportunity to invest in a concession at a world exposition. To use the building and exhibits more fully, the venture is expected to cover a six-year period consisting of a preliminary year, the two years of formal exposition, and a three-year period of reduced operation as a regional exposition.

LO5

The terms of the concession agreement specify the following:

- At inception, a \$60,000 deposit is paid to Global Expo, Inc., the promoting organization. This amount is returned in full at the end of the six years if the operator maintains the concession in order and keeps it open during scheduled hours. The deposit is not tax deductible, nor is its return subject to income taxes.
- The operator must install certain fixtures that will cost \$240,000. The fixtures become the property of Global Expo, Inc., at the end of the six years.

After careful investigation and consultation with local experts, you conclude that the following schedule reflects the estimated pre-tax income of the concession (amounts in thousands of dollars):

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Sales (all cash)	\$150	\$435	\$488	\$300	\$240	\$180
Operating expenses:						
Cash	\$ 75	\$228	\$279	\$170	\$140	\$106
Tax depreciation	48	77	46	28	28	13
Total expenses	<u>\$123</u>	<u>\$305</u>	<u>\$325</u>	<u>\$198</u>	<u>\$168</u>	<u>\$119</u>
Pre-tax income	<u>\$ 27</u>	<u>\$130</u>	<u>\$163</u>	<u>\$102</u>	<u>\$ 72</u>	<u>\$ 61</u>

Required

Assuming an income tax rate of 40% and a desired annual return of 9%, what is the net present value of this investment opportunity? What is the maximum amount that could be invested and still earning a 9% annual return? (Round amounts to the nearest dollar.)

P12-3B. Cash Payback, Average Rate of Return, and Net Present Value Methods At a cash cost of \$330,000, Monona, Inc., can acquire equipment that will save \$100,000 in annual cash operating expenses. No salvage value is expected at the end of its five-year useful life. Assume the machine will be depreciated over five years on a straight-line basis on both the books and the tax return. The income tax rate is 30% and Monona has a 10% **hurdle** rate when using a net present value analysis.

LO5, 6

Required

- What are the annual after-tax cash savings in operating expenses?
- What are the annual tax savings from the depreciation tax shield?

- Compute the cash payback period.
- Compute the average rate of return.
- Compute the net present value and indicate whether it is positive or negative (round amounts to nearest dollar).
- Compute the excess present value index.

LO5, 6**SERVICE AND
MERCHANDISING**

P12-4B. Excess Present Value Index and Average Rate of Return Swanson Corporation is evaluating five different capital expenditure proposals. The company's **hurdle** rate for net present value analysis is 12%. A 15% salvage value is expected from each of the investments. Information on the five proposals is as follows:

Proposal	Required Investment	Net Present Value	Average Annual Net Income from Investment
A.....	\$ 50,000	\$ 8,996	\$ 9,100
B.....	80,000	5,812	12,000
C.....	110,000	27,034	18,300
D.....	150,000	7,544	21,500
E.....	72,000	15,822	13,960

Required

- Compute the excess present value index for each of the five proposals.
- Compute the average rate of return for each of the five proposals.
- Assume that Swanson will commit no more than \$200,000 to new capital expenditure proposals. Using the excess present value index, which proposals would be accepted? Using the average rate of return, which proposals would be accepted?

LO5, 6

P12-5B. Cash Payback, Average Rate of Return, and Net Present Value Methods Lyle Company is considering whether to enter into a franchise agreement that would give the company exclusive distribution rights in a three-state region to a quality line of leisure spas. The franchise agreement will extend eight years and cost \$600,000. There is no salvage value. The franchise cost will be amortized on a straight-line basis over eight years on both the books and the tax return. The following annual results are expected if the franchise is acquired:

Increase in annual cash revenue		\$230,000
Increase in expenses:		
Cash operating expenses	\$95,000	
Amortization	<u>75,000</u>	<u>170,000</u>
Pretax income		\$ 60,000
Income tax expense (35%)		<u>21,000</u>
Net income		<u><u>\$ 39,000</u></u>

Lyle uses a 12% **hurdle** rate when analyzing capital expenditure proposals using net present value.

Required

- What are the annual net cash flows (net inflows) from this proposal?
- Compute the cash payback period.
- Compute the average rate of return.
- Compute the net present value and indicate whether it is positive or negative.
- Assume that Lyle decides to use a 10% **hurdle** rate when using net present value analysis. Compute the net present value using a 10% **hurdle** rate and indicate whether it is positive or negative.

LO2, 5

P12-6B. Weighted Average Cost of Capital and Net Present Value Analysis Manchester Company is considering a proposal to purchase special equipment at a cost of \$640,000. The equipment will be useful for five years and has an expected \$60,000 salvage value. Manchester expects annual savings in cash operating expenses (before taxes) of \$230,000. For tax purposes, the annual depreciation deduction will be as follows (salvage value is ignored on the tax return):

Year 1	\$ 80,000
Year 2	160,000
Year 3	160,000
Year 4	160,000
Year 5	80,000

The income tax rate is 40%.

Manchester establishes a **hurdle** rate for a net present value analysis at the company's weighted average cost of capital plus 2 percentage points. Manchester's capital is provided in the following proportions: debt, 70%; common stock, 20%; and retained earnings, 10%. The cost rates for these capital sources are debt, 8%; common stock, 12%; and retained earnings, 10%.

Required

- Compute Manchester's (1) weighted average cost of capital and (2) **hurdle** rate.
- Using Manchester's **hurdle** rate, compute the net present value of this capital expenditure proposal. Under net present value analysis, should Manchester accept the proposal?

CERTIFIED MANAGEMENT ACCOUNTANT (CMA®) EXAM SAMPLE QUESTIONS

CMA12-1. An accountant for Stability Inc. must calculate the weighted average cost of capital of the corporation using the following information.

		Interest Rate
Accounts payable	\$35,000,000	0
Long-term debt	10,000,000	8%
Common stock	10,000,000	15%
Retained earnings	5,000,000	18%

What is the weighted average cost of capital of Stability?

- 6.88%
- 8.00%
- 10.25%
- 12.80%

CMA12-2. Kielly Machines Inc. is planning an expansion program estimated to cost \$100 million. Kielly is going to raise funds according to its target capital structure shown below.

Debt	0.30
Preferred stock	0.24
Equity	0.46

Kielly had net income available to common shareholders of \$184 million last year of which 75% was paid out in dividends. The company has a marginal tax rate of 40%.

Additional data:

- The before-tax cost of debt is estimated to be 11%.
- The market yield of preferred stock is estimated to be 12%.
- The after-tax cost of common stock is estimated to be 16%.



2. Projected cash revenue and operating expenses:

Year	Cash Revenue	Cash Expenses
1	\$ 620,000	\$240,000
2	560,000	200,000
3	400,000	170,000
4	250,000	80,000
5	200,000	50,000
	<u>\$2,030,000</u>	<u>\$740,000</u>

3. Source of capital: New Haven plans to raise 10% of the needed capital by issuing bonds, 30% by issuing stock, and the balance from retained earnings. For these sources, the capital cost rates are 8%, 9%, and 10%, respectively. New Haven has a policy of seeking a return equal to the weighted average cost of capital plus 2.5 percentage points as a “buffer margin” for the uncertainties involved.
4. Income taxes: New Haven has an overall income tax rate of 30%.
5. Treasurer’s analysis:

Average cost of capital (8% + 9% + 10%)/3 = 9%		
Total cash revenue		\$2,030,000
Total cash expenses	\$740,000	
Total amortization	<u>720,000</u>	
Total operating expenses		<u>1,460,000</u>
Projected net income over five years		\$ 570,000
Average annual income		\$ 114,000
Present value of future returns		\$ 443,420
Required investment		<u>720,000</u>
Negative net present value		<u>\$ (276,580)</u>

Recommendation: Reject investment because of insufficient net present value.

Required

- Review the treasurer’s analysis, identifying any questionable aspects and briefly comment on the apparent effect of each such item on the treasurer’s analysis.
- Prepare your own analysis of the investment, including a calculation of the proper cost of capital and hurdle rates, a net present value analysis of the project, and a brief recommendation to Decker regarding the investment (round amounts to nearest dollar).
- Because of his concern for the uncertainties of the CD recorder business, Decker also has asked you to provide analyses supporting whether or not your recommendation would change
 - If estimates of projected cash revenue were reduced by 10%.
 - If the “buffer margin” were tripled from 2.5% to 7.5%.

EYK12-2. Ethics Case Sandy Williams is the manager of General Company’s cutting department, which employs 70 people. The cutting department desperately needs new equipment to increase productivity and thus avoid the layoff of 25 people. This department is one of four departments being considered for new equipment. The budget committee has announced that only one department’s capital request will be approved this year.

Williams works up the cost savings from the new machinery and contacts suppliers to learn the equipment’s estimated cost. Williams knows that General Company uses the payback method to evaluate capital projects. The estimated costs for the equipment are extremely high, particularly with all the safety shields recommended by the manufacturer. If one of these recommended safety features, electronic safety sensors not on the current equipment, were left off, the cost would be \$200,000 less and the payback period would decrease by three years. If only minimum electronic safety sensors required by the union contract were included, the cost would be \$70,000 less and the payback period would decrease by one year.

Required

What are the ethical considerations Sandy Williams faces as she prepares the equipment proposal?

