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ACKNOWLEDGMENTS

This text benefited greatly from the valuable feedback of focus group attendees, reviewers, students, and colleagues. We are extremely grateful to them for their help in making this project a success.

We are particularly grateful for the help of Niels Bybee, our graduate assistant and friend, whose timely and accurate work was so crucial.

Thanks, too, to our families (Ted's wife, Donna, and children, Tyler and Hannah Christensen, Scott and Hannah Christensen, Dallin, Matthew, Joshua, and Stephanie; Scott's wife, Kay Lani, and children, Ryan and Megan Hobson, Kellie and Callen Bagley, Todd and Chelsea Hobson, Jessica and Kyle Kubal, Daniel, and Kaitlyn; and Jim's wife, Debra Lester) for their love, encouragement, and support.

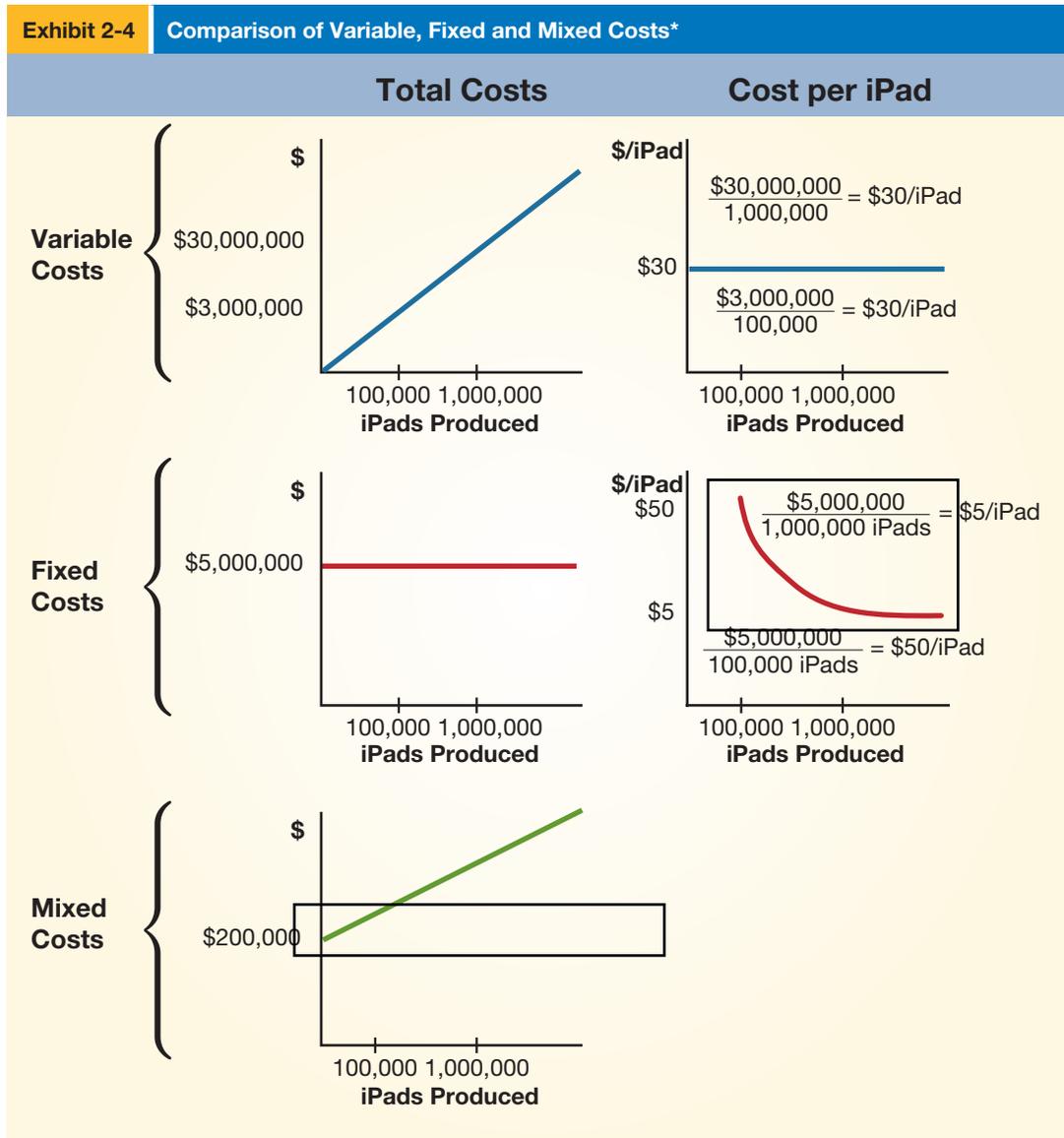
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Hint: The classification of costs into these three distinct groups can often be more difficult than it may appear at first glance.

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.

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

The diagram shows the following T-accounts and flows:

- Materials Inventory:**
 - 9/28/2013 Balance: 3
 - Mat Pur (1): 45,228
 - 9/27/2014 Balance: 8
 - Outflows: 41,223 (2) Dir Mat to WIP; 4,000 (2) Ind Mat to MO.
- Wages Payable:**
 - 10,270 (3) Dir Lab to WIP
 - 3,000 (3) Ind Lab to MO
- Manufacturing Overhead:**
 - Inflows: 4,000 (2) Ind Mat; 3,000 (3) Ind Lab; 50,107 (4) Misc; 4,000 (5) YE Adj.
 - Outflows: 61,107 (6) Applied OH to WIP.
- Work in Process Inventory:**
 - 9/28/2013 Balance: 680
 - Inflows: 41,223 (2) Dir Mat; 10,270 (3) Dir Lab; 61,107 (6) Applied OH.
 - 9/27/2014 Balance: 463
 - Outflow: 112,817 (7) COGM to FG Inventory.
- Finished Goods Inventory:**
 - 9/28/2013 Balance: 1,081
 - Inflow: 112,817 (7) COGM from WIP.
 - 9/27/2014 Balance: 1,640
 - Outflow: 112,258 (8) COGS.

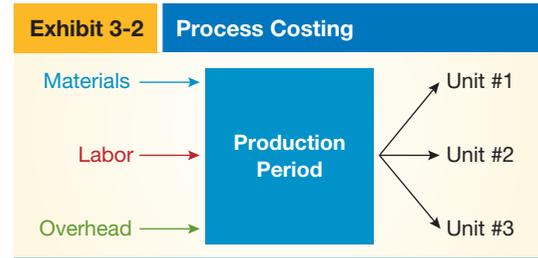
Cost of goods manufactured (the product cost of goods completed during the accounting period) flows from Work in Process Inventory to Finished Goods Inventory. The cost of goods sold flows from Finished Goods Inventory to the Cost of Goods Sold account. These cost flows are represented by the following 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	Paints
Printing	Glass
Aircraft	Furniture
Oil refining	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. LO3
- 11. What type of records would be used or maintained for the following manufacturing activities? LO3
 - 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. LO3
- 13. Why can we say that the sale of a manufactured product is recorded at two different amounts? LO4
- 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? LO4
- 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? LO4
- 16. Contrast service departments with production departments. Give three examples of a service department. LO5
- 17. Why might service departments be treated as cost centers? LO5
- 18. Explain what each of the following statements means: LO5
 - 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? LO5
- 20. How is an allocation rate calculated? How is the specific amount allocated to a department calculated? LO5
- 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. LO5

EXERCISES—SET A

E3-1A. Calculate and Use Overhead Rate Selected data for the consulting department of Austin Consulting, Inc., follow: LO3, 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). LO3, 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:~~ LO3

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



SERVICE AND MERCHANDISING

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) (f) (d) (e)
Work in Process Inventory	Finished Goods Inventory	Cost of Goods Sold
(c) (g) (d) (f)	(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



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	<u>32,000,000</u>	<u>19,250,000</u>	<u>12,750,000</u>
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	<u>32,000,000</u>	<u>19,250,000</u>	<u>12,750,000</u>
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**).

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?*

- 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

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

- a. Prepare a differential analysis showing whether or not you would recommend that the mooring covers be purchased from Calvin Company.
- b. 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?
- c. 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	<u>(4,800)</u>	<u>(4,000)</u>	<u>(800)</u>
Gross profit	\$ 6,400	\$ 4,800	\$1,600
Operating expenses:			
Variable	(3,360)	(2,000)	(1,360)
Fixed	<u>(1,600)</u>	<u>(1,200)</u>	<u>(400)</u>
Net income (loss)	<u>\$ 1,440</u>	<u>\$ 1,600</u>	<u>\$ (160)</u>

Required

Provide answers for each of the following independent situations:

- a. 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.
- b. 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	<u>1,525</u>
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	<u>1,525</u>	<u>1,560</u>	<u>(35)</u>	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.

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

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

SERVICE AND MERCHANDISING



	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

SERVICE AND 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>

- a. Calculate and record in column A the related after-tax cash flow effect(s). Place parentheses around outflows.
- b. 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:

1. 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.
2. 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

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

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

- a. Compute the excess present value index for each of the five proposals.
- b. Compute the average rate of return for each of the five proposals.
- c. 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	75,000	170,000
Pretax income		\$ 60,000
Income tax expense (35%)		21,000
Net income		<u>\$ 39,000</u>

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

Required

- a. What are the annual net cash flows (net inflows) from this proposal?
- b. Compute the cash payback period.
- c. Compute the average rate of return.
- d. Compute the net present value and indicate whether it is positive or negative.
- e. 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?

