

to FG Inventory (entry 11). Total April sales were \$1,460,000 and these were all on account (entry 12); goods that were sold had a total cost of \$1,054,000 (entry 13). An abbreviated presentation of the cost flows is shown in selected T-accounts in **Exhibit 2.12**.

Exhibit 2.12 ■ Selected T-Accounts for Langley Corporation's April Production and Sales

Raw Material Inventory		Variable Overhead Control	
Beg. bal.	73,000	(2)	284,000
(1)	280,000	(3)	94,000
End. bal.	69,000	(5)	16,000
		(6)	5,200
Work in Process Inventory		Fixed Overhead Control	
Beg. bal.	145,000	(4)	20,000
(2) DM	284,000	(5)	12,000
(3) DL	436,000	(7)	7,000
(10) OH	214,080	(8)	56,880
End. bal.	20,880	(9)	3,000
Finished Goods Inventory		Cost of Goods Sold	
Beg. bal.	87,400	(13) CGS	1,054,000
(11) CGM	1,058,200		
End. bal.	91,600		

REVIEW 2-6

LO2-6

Determining Product Costs and Recording Cost Flow



Lazer Corp. makes one product line. During the month of January, the company transferred costs of \$302,000 to finished goods. January 1 and January 31 Work in Process balances were \$44,000 and \$91,000, respectively. The company credited materials inventory for \$98,000 in January. Actual direct labor costs were \$1.60 per unit. Lazer produced 75,000 units of product in the month of January.

- What amount of overhead was allocated to production costs for the month of January?
- What was the per-unit cost of goods manufactured in January? Round answer to two decimal places.
- If finished goods inventory decreased by \$28,000 from January 1 to January 31, what was the cost of goods sold for the month of January?
- Record the journal entries to (1) transfer cost of raw material to production, (2) accrue factory wages for direct labor, (3) assign actual overhead costs to WIP inventory, (4) record the transfer of work completed during the period, (5) to record cost of goods sold for the period.

More practice: E2-30
Solution on p. 2-40.

COST OF GOODS MANUFACTURED AND SOLD

LO7 How is cost of goods manufactured calculated and used in preparing an income statement?

The T-accounts in **Exhibit 2.12** provide detailed information about the cost of material used, goods transferred from work in process, and goods sold. This information is needed to prepare financial statements. A schedule of cost of goods manufactured is prepared as a preliminary step to the determination of cost of goods sold. **Cost of goods manufactured (CGM)** is the total production cost of the goods that were completed and transferred to FG Inventory during the period. This amount is similar to the cost of net purchases in the cost of goods sold schedule for a retailer. A service business prepares a schedule of cost of services rendered.

Formal schedules of cost of goods manufactured and cost of goods sold are presented in **Exhibit 2.13** using the amounts from **Exhibits 2.11** and **2.12**. The schedule of cost of goods manufactured starts with the beginning balance of WIP Inventory and details all product cost components. The cost of material used in production during the period is equal to the beginning balance

accounting records; any differences can be attributed to losses that could have arisen from theft, breakage, evaporation, or accounting errors. Ending FG Inventory is subtracted from the cost of goods available for sale to determine the CGS.

REVIEW 2-7**LO2-7 Preparing Cost of Goods Manufactured Statement and Schedule of Cost of Goods Sold**

Crafters Inc. produces custom cabinetry. The company's Raw Material Inventory account includes the costs of both direct and indirect materials. Account balances for the company at the beginning and end of September follow:

	September 1	September 30
Raw Material Inventory	\$102,000	\$ 88,000
Work in Process Inventory	220,000	296,000
Finished Goods Inventory	388,000	425,000

During the month, the company purchased \$814,000 of raw material and direct material used during the period amounted to \$568,000. Factory payroll costs for September were \$765,000, of which 65 percent was related to direct labor. Overhead charges for depreciation, insurance, utilities, and maintenance totaled \$900,000 for September.

- Prepare a schedule of cost of goods manufactured.
- Prepare a schedule of cost of goods sold.

More practice: E2-32,
E2-33, E2-34
Solution on p. 2-41.

Comprehensive Review Module

Key Terms

actual cost system, p. 2-15	distribution cost, p. 2-8	predictor, p. 2-6
appraisal costs, p. 2-14	expired cost, p. 2-2	prevention costs, p. 2-14
conversion cost, p. 2-8	failure costs, p. 2-14	prime cost, p. 2-8
cost, p. 2-2	finished goods, p. 2-10	product costs, p. 2-7
cost allocation, p. 2-15	fixed cost, p. 2-4	raw material, p. 2-10
cost driver, p. 2-6	indirect costs, p. 2-3	relevant range, p. 2-4
cost management system, p. 2-2	inventoriable costs, p. 2-7	service company, p. 2-9
cost object, p. 2-2	manufacturer, p. 2-9	step cost, p. 2-6
cost of goods manufactured (CGM), p. 2-18	mixed cost, p. 2-5	total cost to account for, p. 2-19
direct costs, p. 2-3	normal cost system, p. 2-16	unexpired cost, p. 2-2
direct labor, p. 2-7	overhead, p. 2-7	variable cost, p. 2-4
direct material, p. 2-7	period costs, p. 2-7	work in process, p. 2-10
	predetermined overhead rate, p. 2-16	

Chapter Summary

LO1 Cost Association (Page 2-2)

- Costs associated with a cost object are classified according to their relation to the cost object.
- Direct costs are traceable to the cost object.
- Indirect costs are allocated to the cost object.

LO2 Assumptions Used to Estimate Product Cost within Relevant Range of Activity (Page 2-3)

- Variable, fixed, or mixed depending on the cost's reaction to a change in a related activity level.

Required:

- a. Journalize the transactions for August.
- b. Post transactions to T-accounts for Raw Material Inventory, Work in Process Inventory, Finished Goods Inventory, and Cost of Goods Sold.
- c. Prepare a schedule of cost of goods manufactured for August using actual costing.
- d. Prepare an income statement, including a detailed schedule of cost of goods sold.

Solution to Demonstration Problem

a. (1)	Raw Material Inventory	164,000	
	Accounts Payable		164,000
	<i>To record raw material purchased on account</i>		
(2)	Work in Process Inventory	134,000	
	Variable Overhead Control	46,000	
	Raw Material Inventory		180,000
	<i>To transfer direct and indirect materials to production</i>		
(3)	Work in Process Inventory	62,000	
	Fixed Overhead Control	26,000	
	Salaries and Wages Payable		88,000
	<i>To accrue factory wages and salaries</i>		
(4)	Variable Overhead Control	5,400	
	Fixed Overhead Control	1,600	
	Utilities Payable		7,000
	<i>To accrue factory utility expenses</i>		
(5)	Fixed Overhead Control	2,000	
	Property Taxes Payable		2,000
	<i>To accrue property tax</i>		
(6)	Fixed Overhead Control	1,600	
	Prepaid Insurance		1,600
	<i>To record expired insurance on factory equipment</i>		
(7)	Fixed Overhead Control	40,000	
	Accumulated Depreciation—Factory Equipment		40,000
	<i>To record depreciation on factory equipment</i>		
(8)	Work in Process Inventory	122,600	
	Variable Overhead Control		51,400
	Fixed Overhead Control		71,200
	<i>To assign actual overhead to WIP Inventory</i>		
(9)	Finished Goods Inventory	320,000	
	Work in Process Inventory		320,000
	<i>To record cost of goods manufactured</i>		
(10)	Accounts Receivable	550,000	
	Cash	150,000	
	Sales		700,000
	<i>To record sales on account and for cash</i>		
(11)	Cost of Goods Sold	330,000	
	Finished Goods Inventory		330,000
	<i>To record cost of goods sold for the period</i>		
(12)	Selling & Administrative Expenses	280,000	
	Various accounts		280,000
	<i>To record selling and administrative expenses</i>		

machinery. The notebooks are produced in the same building using the same equipment that produces desktop computers and servers. Classify each raw material as direct or indirect when the cost object is the

- notebook.
- computer production plant.

L01**E2-12.**

Association with cost object Morris & Assoc., owned by Cindy Morris, provides accounting services to clients. The firm has two accountants (Jo Perkins, who performs basic accounting services, and Steve Tompkin, who performs tax services) and one office assistant. The assistant is paid on an hourly basis for the actual hours worked. One client the firm served during April was Vic Kennedy. During April the following labor time was incurred. Classify the labor time as direct, indirect, or unrelated based on whether the cost object is (1) Kennedy's services, (2) tax services provided, or (3) the accounting firm.

- Four hours of Perkins's time in preparing Kennedy's financial statements
- Six hours of the assistant's time in copying Kennedy's tax materials
- Three hours of Morris's time playing golf with Kennedy
- Eight hours of continuing education paid for by the firm for Tompkin to attend a tax update seminar
- One hour of the assistant's time spent at lunch on the day that Kennedy's tax return was prepared
- Two hours of Perkins's time spent with Kennedy and his banker discussing Kennedy's financial statements
- One-half hour of Tompkin's time spent talking to an IRS agent about a deduction taken on Kennedy's tax return
- Forty hours of janitorial wages
- Seven hours of Tompkin's time preparing Kennedy's tax return

**L02****E2-13.**

Cost behavior Spirit Company produces baseball caps. The company incurred the following costs to produce 12,000 caps last month:



Cardboard for the brims	\$ 4,800
Cloth	12,000
Plastic for headbands	6,000
Straight-line depreciation	7,200
Supervisors' salaries	19,200
Utilities	3,600
Total	<u>\$52,800</u>

- What did each cap component cost on a per-unit basis?
- What is the probable type of behavior that each of the costs exhibits?
- The company expects to produce 10,000 caps this month. Would you expect each type of **per-unit cost** to increase or decrease? Why? Can the total cost of 10,000 caps be determined? Explain.

L02**E2-14.**

Cost behavior Merry Olde Games produces croquet sets. The company makes fixed monthly payments to the local utility based on the previous year's electrical usage. Any difference between actual and expected usage is paid in January of the year following usage. In February, Merry Olde Games made 2,000 croquet sets and incurred the following costs:



Cardboard boxes (1 per set)	\$ 1,000
Mallets (2 per set)	12,000
Croquet balls (6 per set)	9,000
Wire hoops (12 per set, including extras)	3,600
Total hourly wages for production workers	8,400
Supervisor's salary	2,600
Building and equipment rental	2,800
Utilities	1,300
Total	<u>\$40,700</u>

- L05 E2-27. Product cost classifications** In June, Carolyn Gardens incurred the following costs. One of several projects in process during the month was a landscaped terrace for Pam Beattie. Relative to the Beattie landscaping job, classify each of the costs as direct material, direct labor, or overhead. The terrace required two days to design and one five-day work week to complete. Some costs may not fit entirely into a single classification; in such cases, and if possible, provide a systematic and rational method to allocate such costs.

Mulch purchased for Beattie's landscaping	\$ 320
June salary of Z. Trumble, the landscape designer, who worked 20 days in June.	3,000
Construction permit for Beattie's landscaping	95
Gardeners' wages; all worked on Beattie's landscaping; gardeners work eight hours per day, five days per week; there were 20 working days in June	3,840
June depreciation on the company loader, driven by a gardener and used on Beattie's landscaping one day	200
Landscaping rock purchased for Beattie's landscaping	1,580
June rent on Carolyn Gardens offices, where Z. Trumble has an office that occupies 150 square feet of 3,000 total square feet	2,400
June utility bills for Carolyn Gardens	1,800
Plants and pots purchased for Beattie's landscaping	1,950

- L05 E2-28. Labor cost classification** Woodlands Restaurant Supply operates in two shifts, paying a late-shift premium of 10 percent and an overtime premium of 75 percent. The May payroll follows:



Total wages for 6,000 hours	\$54,000
Normal hourly employee wage	\$ 9
Total regular hours worked, split evenly between the shifts	5,000

All overtime was worked by the early shift during May. Shift and overtime premiums are considered part of overhead rather than direct labor.

- How many overtime hours were worked in May?
- How much of the total labor cost should be charged to direct labor? To overhead?
- What amount of overhead was for second-shift premiums? For overtime premiums?

- L05 E2-29. Labor cost classification** Tidy House produces a variety of household products. The firm operates 24 hours per day with three daily work shifts. The first-shift workers receive "regular pay." The second shift receives an 8 percent pay premium, and the third shift receives a 12 percent pay premium. In addition, when production is scheduled on weekends, the firm pays an overtime premium of 50 percent (based on the pay rate for first-shift employees). Labor premiums are included in overhead. The October factory payroll is as follows:



Total wages for October for 32,000 hours	\$435,600
Normal hourly wage for first-shift employees	\$ 12
Total regular hours worked, split evenly among the three shifts.	27,000

- How many overtime hours were worked in October?
- How much of the total labor cost should be charged to direct labor? To overhead?
- What amount of overhead was for second- and third-shift premiums? For overtime premiums?

- L06 E2-30. Analyzing product costs** Tamra Corp. makes one product line. In February, Tamra paid \$530,000 in factory overhead costs. Of that amount, \$124,000 was for January's factory utilities and \$48,000 was for property taxes on the factory for the year. February's factory utility bill arrived on March 12, and was only \$81,000 because the weather was significantly milder than in January. Tamra Corp. produced 50,000 units of product in both January and February.



- What were Tamra's actual factory overhead costs for February?
- Actual per-unit direct material and direct labor costs for February were \$24.30 and \$10.95. What was actual total product cost per unit for February?

- a. Determine the total amount of product cost (cost of goods manufactured) and period cost incurred during August.
- b. Compute the cost of goods sold for August.

P2-54. Missing data Grand Rapids Industrial suffered major losses in a fire on June 18. In addition to destroying several buildings, the blaze destroyed the company's Work in Process Inventory for an entire product line. Fortunately, the company was insured; however, it needs to substantiate the amount of the claim. To this end, the company has gathered the following information that pertains to production and sales of the affected product line:

LO5, 6, 7

1. The company's sales for the first 18 days of June amounted to \$230,000. Normally, this product line generates a gross profit equal to 40 percent of sales.
2. Finished Goods Inventory was \$29,000 on June 1 and \$42,500 on June 18.
3. On June 1, Work in Process Inventory was \$48,000.
4. During the first 18 days of June, the company incurred the following costs:

Direct material used	\$76,000
Direct labor	44,000
Manufacturing overhead	42,000

- a. Determine the value of Work in Process Inventory that was destroyed by the fire, assuming Grand Rapids Industrial uses an actual cost system.
- b. What other information might the insurance company require? How would management determine or estimate this information?

Review Solutions

Review 2-1

Raw Material	Cost Object	
	Baseball	Production Facility
Cork	Direct	Direct
Glue	Indirect	Direct
Rubber	Direct	Direct
Layering yarn	Direct	Direct
Thread	Indirect	Direct
Leather	Direct	Direct
Maintenance supplies	Indirect	Direct
Ink for logo	Indirect	Direct

Review 2-2

- a. 1. Total cost: \$45,000 (\$5,000 + (100 × \$400)); Cost per project: \$450 (\$45,000 ÷ 100)
2. Total cost: \$125,000 (\$5,000 + (300 × \$400)); Cost per project: \$417 (\$125,000 ÷ 300)
3. Total cost: \$205,000 (\$5,000 + (500 × \$400)); Cost per project: \$410 (\$205,000 ÷ 500)
- b. Total cost plus margin of \$160,000 (\$125,000 + \$35,000) ÷ 300 projects = \$533 fee per project
- c. Total costs: \$145,000 (\$5,000 + (350 × \$400))
Total margin: (\$533 × 350) – \$145,000 = \$41,550

Review 2-3

- a. Expired costs \$28,000, equal to depreciation of \$13,125 (((\$800,000 – \$50,000)/10 × 25% × 560/800) plus property taxes of \$14,875 (\$85,000/4 × 560/800).
- b. Cost of goods sold on the income statement of \$28,000 and finished goods inventory on the balance sheet of \$12,000 ((((\$800,000 – \$50,000)/10 × 25%) + \$85,000/4) – \$28,000).
Prepaid taxes of \$63,750 and Accumulated depreciation of \$18,750 on the balance sheet.

Review 2-4

	High, Low, or Moderate Degree of Conversion	Inventory Account(s) Likely Used
Ford Motor Company	High	Raw Materials, Work in Process, Finished Goods
U.S. Bancorp	High	n/a
Target Corporation	Low	Merchandise Inventory

Review 2-5

Direct Material, Direct Labor, or Overhead		
Material Costs:		
Leather	\$1,000,000	Direct Material
Thread	50,000	Overhead
Nylon	300,000	Direct Material
Ink for logo	1,000	Overhead
Foam	200,000	Direct Material
Rubber	400,000	Direct Material
Glue	5,000	Overhead
Labor Costs:		
Sewing machine operators	375,000	Direct Labor
Quality control supervisor	55,000	Overhead
Factory maintenance worker	10,000	Overhead
Assembly workers	80,000	Direct Labor

Review 2-6

- a. \$131,000 [$\$91,000 + \$302,000 - \$44,000 - \$98,000 - (\$1.60 \times 75,000)$]
 b. $\$302,000/75,000 = \4.03
 c. \$330,000 ($\$302,000 + \$28,000$)
 d.

(1)	Work in Process Inventory	98,000	
	Raw Material Inventory		98,000
	<i>To transfer cost of raw material to production</i>		
(2)	Work in Process Inventory	120,000	
	Salaries and Wages Payable		120,000
	<i>To accrue factory wages for direct labor</i>		
(3)	Work in Process Inventory	131,000	
	Overhead Control		131,000
	<i>To assign actual overhead costs to WIP inventory</i>		
(4)	Finished Goods Inventory	302,000	
	Work in Process Inventory		302,000
	<i>To record the transfer of work completed during the period</i>		
(5)	Cost of Goods Sold	330,000	
	Finished Goods Inventory		330,000
	<i>To record cost of goods sold for the period</i>		

LO6, 7

- E3-27. Absorption vs. variable costing** Pete's Plant Stands manufactures wooden stands used by plant nurseries. In May, the company sold 16,560 stands. The cost per unit for the 18,000 stands produced in May was as follows:

Direct material	\$ 9.00
Direct labor	6.00
Variable overhead	3.00
Fixed overhead	4.00
Total	<u>\$22.00</u>

There were no beginning inventories for May and no work in process at the end of May.

- What is the value of ending finished goods inventory using absorption costing?
- What is the value of ending finished goods inventory using variable costing?
- Which accounting method, variable or absorption, would have produced the higher net income for May?

LO6, 7

- E3-28. Absorption vs. variable costing** Reese's Tot Toy Boxes uses variable costing to manage its internal operations. The following data relate to the company's first year of operation, when 25,000 units were produced and 21,000 units were sold.

Variable costs per unit	
Direct material	\$50
Direct labor	30
Variable overhead	14
Variable selling costs	12
Fixed costs	
Selling and administrative	\$750,000
Manufacturing	500,000

How much higher (or lower) would the company's first-year net income have been if absorption costing had been used rather than variable costing? Show computations.

LO6, 7

- E3-29. Production cost; absorption vs. variable costing** In its first year of business, Ollie's Olive Oil produced 104,000 quarts of olive oil. During its first year, the company sold 100,000 quarts of olive oil. Costs incurred during the year were as follows:

Ingredients used	\$228,800
Direct labor	104,000
Variable overhead	197,600
Fixed overhead	98,800
Variable selling expenses	50,000
Fixed selling and administrative expenses	20,000
Total actual costs	<u>\$699,200</u>

- What was the actual production cost per quart under variable costing? Under absorption costing?
- What was variable cost of goods sold for the year under variable costing?
- What was cost of goods sold for the year under absorption costing?
- What was the value of ending inventory under variable costing? Under absorption costing?
- How much fixed overhead was charged to expense for the year under variable costing? Under absorption costing?

LO6, 7

- E3-30. Net income; absorption vs. variable costing** Tennessee Tack manufactures horse blankets. During the year, fixed overhead was applied to products at the rate of \$8 per unit. Variable cost per unit remained constant throughout the year. In July, income under variable costing was \$188,000. July's beginning and ending inventories were 20,000 and 10,400 units, respectively.

- Calculate income under absorption costing assuming no variances.
- Assume instead that the company's July beginning and ending inventories were 9,000 and 12,000 units, respectively. Calculate income under absorption costing.

Finishing Department: Costs	Transferred In	DM	Conversion	Total
Beginning inventory	\$ 2,176	\$ 30	\$ 95	\$ 2,301
Current period.	188,570	15,471	21,600	225,641
Total costs.	<u>\$190,746</u>	<u>\$15,501</u>	<u>\$21,695</u>	<u>\$227,942</u>

Required:

- Prepare a cost of production report for the Assembly Department.
- Prepare a cost of production report for the Finishing Department.
- Prepare T-accounts to show the flow of costs through the Assembly and Finishing Departments.
- Prepare the journal entries for the Assembly and the Finishing Department for June.

Solution to Demonstration Problem

Assembly Department WA Method	Physical Units	Equivalent Units of Production		
		DM	DL	OH
Beginning WIP Inventory	250			
Units started	8,800			
Units to account for.	<u>9,050</u>			
Beginning WIP Inventory	250	250	250	250
Started and completed	8,400	8,400	8,400	8,400
Units completed	8,650			
Ending WIP Inventory.	400	400	280	360
Units accounted for.	<u>9,050</u>	<u>9,050</u>	<u>8,930</u>	<u>9,010</u>
Cost Data	Total	DM	DL	OH
Beginning WIP Inventory	\$ 4,695	\$ 3,755	\$ 690	\$ 250
Current period.	191,607	100,320	63,606	27,681
Total cost to account for.	<u>\$196,302</u>	<u>\$104,075</u>	<u>\$64,296</u>	<u>\$27,931</u>
Divided by EUP		÷ 9,050	÷ 8,930	÷ 9,010
Cost per EUP	<u>\$ 21.80</u>	<u>\$ 11.50</u>	<u>\$ 7.20</u>	<u>\$ 3.10</u>
Cost Assignment				
Transferred out (8,650 × \$21.80)		\$188,570		
Ending WIP Inventory				
DM (400 × \$11.50)	\$ 4,600			
DL (280 × \$7.20).	2,016			
OH (360 × \$3.10)	<u>1,116</u>	<u>7,732</u>		
Total cost accounted for		<u>\$196,302</u>		

- E6-47. Appendix 3; WA; normal vs. abnormal spoilage** Hebert Industries uses a weighted average process costing system. Management has specified that the normal loss from shrinkage cannot exceed 3 percent of the units started in a period. All raw material is added at the start of the production process. Spoilage is determined upon inspection at the end of the production process. March processing information follows.

LO2, 8

Beginning WIP Inventory (30% complete as to conversion) . . .	20,000 units
Started during March	120,000 units
Completed during March	116,400 units
Ending WIP Inventory (20% complete as to conversion)	16,000 units

- How many total units are there to account for?
- How many units were spoiled during processing? Of the spoiled units, how many should be treated as a normal loss? As an abnormal loss?
- What are the equivalent units of production for direct material? For conversion?
- How are costs associated with the company's normal spoilage handled?
- How are costs associated with the company's abnormal spoilage handled?

- E6-48. Appendix 3; FIFO; normal and abnormal loss** Omaha Foods manufactures corn meal in a continuous, mass production process. Corn is added at the beginning of the process. Normal losses are minimal and abnormal losses infrequently occur when foreign materials are found in the corn meal. Routine inspection occurs at the 95 percent completion point as to conversion.

LO3, 8

During May, a machine malfunctioned and dumped salt into 8,000 pounds of corn meal. This abnormal loss occurred when conversion was 70 percent complete on those pounds of product. The error was immediately noticed, and those pounds of corn meal were pulled from the production process. Two thousand additional pounds of meal were detected as unsuitable at the routine inspection point; this amount was considered within normal limits. Production data for the month follow.

Beginning WIP Inventory (85% complete)	40,000 pounds
Started during the month	425,000 pounds
Ending WIP Inventory (25% complete).	10,000 pounds

- Determine the number of EUP for direct material and for conversion, assuming a FIFO cost flow.
- If the costs per EUP are \$0.08 and \$0.15 for direct material and conversion, respectively, what is the cost of the ending WIP Inventory?
- What is the cost of abnormal loss? How is this cost treated in May?

Problems

- P6-49. WA EUP & cost assignment** GitAlong Inc. manufactures belt buckles in a single-step production process. The following information is available for June:

LO2

	Physical Units	Cost of Material	Cost of Labor
Beginning work in process	200,000	\$1,200,000	\$ 671,875
Units started during period	1,000,000	7,800,000	3,976,250
Units in ending inventory	300,000		

All material is added at the start of the production process. Beginning and ending inventory units were, respectively 80 percent and 70 percent complete as to conversion. Overhead cost is applied to production at the rate of 60 percent of direct labor cost.

- Prepare a schedule to compute equivalent units of production by cost component assuming the weighted average method.
 - Determine the unit production costs for material and conversion.
 - Calculate the costs assigned to completed units and ending inventory for August.
- P6-50. WA EUP; cost assignment** Spangenberg Products manufactures computer cases. All material is added at the start of production and overhead is assumed to be incurred at the same rate as labor.

LO2

3. Actual rate per direct labor hour
 4. Labor rate variance
 5. Labor efficiency variance
 6. Variable overhead spending and efficiency variances
 7. Budgeted annual and monthly fixed overhead
 8. Fixed overhead spending and volume variances
 9. Combined variable and fixed overhead rate
 10. Overhead variances using a three-variance approach
 11. Overhead variances using a two-variance approach
 12. Overhead variance using a one-variance approach
- b. Record the entries to recognize the variances.

Solution to Demonstration Problem

a. 1.

$AP \times AQ_p$ $\$5.92 \times 45,000$ $\$266,400$	$SP \times AQ_p$ $\$6.00 \times 45,000$ $\$270,000$
<div style="border-top: 1px solid black; width: 100%; margin-bottom: 5px;"></div> $\$3,600 \text{ F}$	

2. $SQ = 525 \times 80 \text{ pounds} = 42,000 \text{ pounds}$

$SP \times AQ_u$ $\$6 \times 43,020$ $\$258,120$	$SP \times SQ$ $\$6 \times 42,000$ $\$252,000$
<div style="border-top: 1px solid black; width: 100%; margin-bottom: 5px;"></div> $\$6,120 \text{ U}$	

3. $AR = \$24,955 \div 1,550 \text{ hours} = \16.10 per DLH

4. & 5. $SQ = 525 \times 3 \text{ hours} = 1,575 \text{ DLHs}$

$AP \times AQ$ $\$16.10 \times 1,550$ $\$24,955$	$SP \times AQ$ $\$16 \times 1,550$ $\$24,800$	$SP \times SQ$ $\$16 \times 1,575$ $\$25,200$
<div style="border-top: 1px solid black; width: 100%; margin-bottom: 5px;"></div> $\$155 \text{ U}$		<div style="border-top: 1px solid black; width: 100%; margin-bottom: 5px;"></div> $\$400 \text{ F}$

LRV LEV

6. $SQ = 525 \times 1.5 = 787.5 \text{ MHs}$

Actual VOH $\$43,750$	$SP \times AQ$ $\$50 \times 800$ $\$40,000$	$SP \times SQ$ $\$50 \times 787.5$ $\$39,375$
<div style="border-top: 1px solid black; width: 100%; margin-bottom: 5px;"></div> $\$3,750 \text{ U}$		<div style="border-top: 1px solid black; width: 100%; margin-bottom: 5px;"></div> $\$625 \text{ U}$

VOH Spending Variance VOH Efficiency Variance

7. Annual BFOH = $6,000 \times 1.5 \text{ hours} \times \$30 = \$270,000$

Monthly BFOH = $\$270,000 \div 12 \text{ months} = \$22,500$

8. $SQ = 787.5 \text{ machine hours [from (5)]}$

Actual FOH $\$22,800$	Budgeted FOH $\$22,500$	$SP \times SQ$ $\$30 \times 787.50$ $\$23,625$
<div style="border-top: 1px solid black; width: 100%; margin-bottom: 5px;"></div> $\$300 \text{ U}$		<div style="border-top: 1px solid black; width: 100%; margin-bottom: 5px;"></div> $\$1,125 \text{ F}$

FOH Spending Variance Volume Variance

9. Combined OH = $\$50 + \$30 = \$80 \text{ per MH}$

~~10. $SQ = 787.5 \text{ MHs [from (5)]}$.~~

10.	Actual VOH + Actual FOH \$ 43,750 + 22,800 \$ 66,550	(VOH Rate × AQ) + Budgeted FOH \$50 × 800 = \$ 40,000 + 22,500 \$ 62,500	(VOH Rate × SQ) + Budgeted FOH \$50 × 787.5 = \$ 39,375 + 22,500 \$ 61,875	Applied OH (SP × SQ) \$50 × 787.5 = \$ 39,375 + \$30 × 787.5 = 23,625 \$80 × 787.5 = \$ 63,000
		\$4,050 U	\$625 U	\$1,125 F
		Spending Variance	Efficiency Variance	Volume Variance

11.	Actual OH \$66,550	(VOH Rate × SQ) + Budgeted FOH \$50 × 787.5 = \$ 39,375 + 22,500 \$ 61,875	Applied OH (SP × SQ) \$ 80 × 787.5 = \$63,000
		\$4,675 U	\$1,125 F
		Budget Variance	Volume Variance

12.	Actual OH \$66,550	Applied OH SP × SQ \$80 × 787.5 = \$63,000
		\$3,550 U
		Total Overhead Variance (Total Underapplied Overhead)

b. All amounts are taken from the computations shown in (a).

Raw Material Inventory	270,000	
Material Purchase Price Variance		3,600
Accounts Payable		266,400
<i>To record acquisition of material</i>		
Work in Process Inventory	252,000	
Material Quantity Variance	6,120	
Raw Material Inventory		258,120
<i>To record issuance of material to production</i>		
Work in Process Inventory	25,200	
Labor Rate Variance	155	
Wages Payable		24,955
Labor Efficiency Variance		400
<i>To record direct labor costs in all departments</i>		
Work in Process Inventory	39,375	
Variable Overhead Efficiency Variance	3,750	
Variable Overhead Spending Variance	625	
Variable Manufacturing Overhead Control		43,750
<i>To close variable OH</i>		
Work in Process Inventory	23,625	
Fixed Overhead Spending Variance	300	
Fixed Manufacturing Overhead Control		22,800
Volume Variance		1,125
<i>To close fixed OH</i>		

Potential Ethical Issues

1. Setting labor time standards extremely high so that variances on which performance is evaluated are consistently favorable
2. Evaluating each manager on the variances generated in his or her production area without regard for potential implications on other production areas

Company management determines ending inventory policy. Desired ending FG Inventory balance is generally a function of the quantity and timing of demand in the upcoming period as related to the firm's capacity and speed to produce particular units. Frequently, management wants ending FG Inventory to equal a given percentage of the next period's projected sales. Other alternatives include

- a constant amount of inventory,
- a buildup of inventory for future high-demand periods, or
- near-zero inventory under a just-in-time system (discussed in depth in Chapter 18).

The decision about ending inventory levels often relates to whether a firm wants to have constant production with varying inventory levels or variable production with constant inventory levels.

Managers should consider the high costs of stockpiling inventory before making a decision about how much inventory to keep on hand. Demand for Dresdill's products is relatively constant year-round. Because most sales are to recurring customers, Dresdill's policy is that ending FG Inventory should be 5 percent of the next month's unit sales. Considering this policy and using the sales information from **Exhibit 8.8**, the production budget shown in **Exhibit 8.9** is prepared.

Exhibit 8.9 ■ Production Budget for the Three Months and Quarter Ending March 31, Year 4

	January	February	March	Total
Sales in units (from Exhibit 8.8)	30,000	28,000	33,000	91,000
+ Desired ending inventory	1,400	1,650	1,600	1,600
= Total needed	31,400	29,650	34,600	92,600
– Beginning inventory	(1,500)	(1,400)	(1,650)	(1,500)
= Units to be produced	29,900	28,250	32,950	91,100

January's beginning FG Inventory is the 1,500 units on hand at December 31, Year 3, or 5 percent of January's estimated sales of 30,000 units. Desired March ending inventory is 5 percent of the April sales of 32,000 units (given in **Exhibit 8.8**). Dresdill does not have any Work in Process Inventory because all units placed into production are assumed to be fully completed during each period.³

Purchases Budget

Direct material must be purchased each period in quantities sufficient to meet production needs and to conform to the company's desired ending inventory policies. Companies may have different policies for the raw material associated with different products or for different seasons of the year. For example, a company may maintain only a minimal ending inventory of a raw material that is consistently available in the quantity and quality desired. Alternatively, if a material is difficult to obtain at certain times of the year, a company may stockpile that material for use in future periods.

Dresdill Corp.'s management aligns its policy for ending Raw Material Inventory with its production needs for the following month. Because of occasional difficulty in obtaining the high quality of stainless steel needed, Dresdill's ending inventory for raw material is set at 10 percent

of the quantity needed for the following month's production except for the month of February where the percent is estimated at 9.724%.

The purchases budget is first stated in whole units of finished products and then converted to direct material component requirements and dollar amounts. Production of a Dresdill lock requires only one direct material: stainless steel. The cost of the appropriate grade of stainless steel has been estimated by the purchasing agent at \$2.30 per pound, and it takes 1.1 pounds of steel to produce one lock. **Exhibit 8.10** shows Dresdill's purchases cost for each month of the first quarter

³ Most manufacturing entities do not produce only whole units during the period. Normally, partially completed beginning and ending Work in Process inventories will exist. These inventories create the need to use equivalent units of production (discussed in Chapter 6) when computing the production budget.

of Year 4. Note that beginning and ending inventory quantities are expressed first in terms of locks and then are converted to the appropriate material quantity measure (pounds of steel). Total budgeted cost of direct material purchases for the first quarter of Year 4 is \$231,646.80.

Exhibit 8.10 ■ Purchases Budget for the Three Months and Quarter Ending March 31, Year 4

	January	February	March	Quarter
Units to be produced (from Exhibit 8.9) . . .	29,900	28,250	32,950	91,100
× Pounds needed per unit	× 1.1	× 1.1	× 1.1	× 1.1
= Total pounds needed	32,890.0	31,075.0	36,245.0	100,210.0
+ Desired EI (percentage of next month's needs)	3,107.5	3,524.5	3,795.0 ^a	3,795.0
– Beginning inventory	(3,289.0) ^b	(3,107.5)	(3,524.5)	(3,289.0)
= Total pounds of steel to purchase	32,708.5	31,492.0	36,515.5	100,716.0
× Price per pound	× \$2.30	× \$2.30	× \$2.30	× \$2.30
= Total cost of steel purchases	\$75,229.55	\$72,431.60	\$83,985.65	\$231,646.80

^a April production is assumed to be 34,500 units, which would require 37,950 pounds.

^b From **Exhibit 8.7**.

Personnel Budget

Given expected production, the Engineering and Human Resources Departments can work together to determine the necessary labor requirements for the factory, sales force, and office staff. A variety of issues must be considered in preparing the personnel budget.

Labor Requirement Considerations	Labor Cost Considerations
<ul style="list-style-type: none"> • Total number of people • Specific number of worker “types” (skilled vs. unskilled labor; setup helpers; salespeople; clerical personnel; etc.) • Production hours needed • Vacation time provided 	<ul style="list-style-type: none"> • Union labor contracts • Minimum-wage laws • Fringe benefit costs • Payroll taxes • Bonus arrangements • Commission arrangements

The various personnel amounts are shown, as appropriate, in the direct labor budget, manufacturing overhead budget, or selling and administrative budget.

Direct Labor Budget

Dresdill’s management has reviewed the staffing requirements and has developed the direct labor cost estimates shown in **Exhibit 8.11** for the first quarter of Year 4. Factory direct labor costs are based on standard hours of labor needed to produce the units in the production budget. The average wage rate includes the direct labor payroll rate, payroll taxes, and fringe benefits; these items usually add between 25 and 30 percent to the base labor cost.

Exhibit 8.11 ■ Direct Labor Budget for the Three Months and Quarter Ending March 31, Year 4

	January	February	March	Total
Units to be produced	29,900	28,250	32,950	91,100
× Standard hours allowed	× 0.025	× 0.025	× 0.025	× 0.025
= Total hours allowed	747.50	706.25	823.75	2,277.50
× Average wage rate (including fringe benefits)	× \$14.00	× \$14.00	× \$14.00	× \$14.00
= Direct labor cost	\$ 10,465	\$ 9,888	\$ 11,532	\$ 31,885

operating cash flows and uses the information from the budgeted income statement in **Exhibit 8.20** and the balance sheets in **Exhibits 8.7** and **8.21**.

Dresdill's cash flow from operating activities (\$83,511) is low compared to net sales revenue of \$452,088, as is its net income per net sales dollar (11.2 percent). Dresdill may want to review the sales price for its locks and its production costs, especially given the very large increase (from \$9 to \$14 per hour) in the direct labor wage rate. Another issue that might be discussed is whether such a high proportion of retained earnings should be paid out as dividends.

Exhibit 8.22 ■ Budgeted Statement of Cash Flows

Dresdill Corp. Budgeted Statement of Cash Flows For Quarter Ending March 31, Year 4			
Operating activities			
Cash collections from sales			\$436,440
Interest earned			118
Total			\$436,558
Cash payments			
For inventory:			
Raw material	\$221,906		
Direct labor	31,885		
Overhead	43,206	(296,997)	
For S&A costs		(56,050)	
Net cash inflow from operating activities			\$ 83,511
Investing activities			
Purchase of plant asset		\$ (28,000)	
Short-term investment		(10,000)	
Net cash outflow from investing activities			(38,000)
Financing activities			
Dividends paid		\$ (45,000)	
Net cash outflow from financing activities			(45,000)
Net increase in cash			\$ 511
Beginning balance of cash (1/1/Year 4)			10,000
Ending balance of cash (3/31/Year 4)			\$ 10,511
Alternative (indirect) basis for operating activities			
Net income		\$ 50,479	
+ Depreciation (Exhibit 8.12 and Exhibit 8.13)	\$ 6,600		
– Increase in net Accounts Receivable (\$68,592 – \$82,056)	(13,464)		
– Increase in total inventory (\$12,365 – \$14,009)	(1,644)		
+ Increase in Taxes Payable (\$0 – \$33,653)	33,653		
+ Increase in Accounts Payable (\$42,504 – \$50,391)	7,887	33,032	
= Net cash inflow from operating activities		\$ 83,511	

REVIEW 8-5

LO8-5

Operating Income Budget



The operating results in summarized form for a commercial printer and related supplies store for the prior year are:

Revenue	
Commercial printers	\$ 6,240,000
Printer supplies	2,600,000
Maintenance contracts	1,560,000
Total revenue	\$10,400,000

continued

Iced tea mix	24,600 cans of finished product
Tea	750 pounds
Sugar substitute	200 pounds

So Sweet! generally carries a finished goods inventory equal to 5 percent of the following month's needs; raw material ending inventories should equal the production needs for 10 percent of ending Finished Goods Inventory. Assuming that the ending inventory policy is met, answer the following questions.

- How many cans of iced tea mix will be produced in June?
- How many pounds of tea will be purchased in June?
- How many pounds of sugar substitute will be purchased in June?
- Tea and sugar substitute cost \$3.50 and \$0.40 per pound, respectively. What dollar amount of raw material purchases is budgeted for June?
- If the company normally pays for 40 percent of its budgeted purchases during the month of purchase and takes a 2 percent discount, what are budgeted cash disbursements in June for June purchases? How much will So Sweet! owe for June purchases in July?

P8-49. Production; purchases; direct labor & OH budgets Atkinson's Reliable Tools makes two products that use similar raw materials: #587Q and #253X. Estimated production needs for a unit of each product follow.

LO3

	#587Q	#253X
Steel (in pounds)	3	5
Wood (in board feet)	0.5	0.2
Direct labor (in hours)	2	3
Machine hours	0.5	0.7

Estimated sales in units by product for the year are 80,000 of #587Q and 30,000 of #253X. Additionally, estimated beginning and desired ending inventory quantities are as follows.

	Beginning	Ending
#587Q (units)	800	640
#253X (units)	1,200	900
Steel (in pounds)	2,000	1,400
Wood (in board feet)	800	600

Overhead is applied to production at the rate of \$15 per machine hour and the direct labor wage rate is \$10.50 per hour. Prepare the production, purchases, direct labor, and overhead budgets for the year.

P8-50. Production; purchases; cash budgets Corner Brook Furniture Co. makes bookstands and expects sales and collections for the first three months of 2021 to be as follows:

LO3, 4

	January	February	March	Total
Sales quantity (units)	6,400	5,200	7,400	19,000
Revenue	\$128,000	\$104,000	\$148,000	\$380,000
Collections	\$116,200	\$ 81,300	\$101,500	\$299,000

The December 31, 2020, balance sheet revealed the following selected account balances: Cash, \$18,320; Direct Material Inventory, \$8,230; Finished Goods Inventory, \$23,200; and Accounts Payable, \$5,800. The Direct Material Inventory balance represents 1,580 pounds of scrap iron and 1,200 bookstand bases. The Finished Goods Inventory consists of 1,220 bookstands.

Each bookstand requires two pounds of scrap iron, which costs \$3 per pound. Bookstand bases are purchased from a local lumber mill at a cost of \$2.50 per unit. Company management decided that, beginning in 2021, the ending balance of Direct Material Inventory should be 25 percent of the following month's production requirements and that the ending balance of Finished Goods Inventory should be 20 percent of the next month's sales. Sales for April and May are expected to be 8,000 bookstands per month.

REVIEW 9-1

LO9-1

Variable Costing Income Statement



Leopold manufactures plastic component parts for refrigeration units. The following information is available for the company's first year of business when it produced 100,000 units. Revenue of \$160,000 was generated by the sale of 80,000 units.

	Variable Cost	Fixed Cost
Production		
Direct material.	\$0.40 per unit	
Direct labor	\$0.20 per unit	
Overhead	\$0.60 per unit	\$30,000
Selling and administrative.	\$0.20 per unit	10,000

More practice: E9-8,
E9-9
Solution on p. 9-39.

- What is the variable production cost per unit?
- What is the total contribution margin per unit?
- Prepare a variable costing income statement.

IDENTIFYING THE BREAK-EVEN POINT

LO2 How is the BEP determined, and what methods are used to identify BEP?

Break-even calculations can be demonstrated using the formula, graph, and income statement approaches. Data needed to compute the break-even point and perform CVP analysis are given in the income statement shown in **Exhibit 9.1** for Calispell Company.

Formula Approach to Breakeven

The formula approach to break-even analysis uses an algebraic equation to calculate the BEP. In this analysis, sales volume, rather than production activity, is the focus of the relevant range. The equation represents the variable costing income statement and shows the relationships among revenue, fixed cost, variable cost, volume, and profit as follows:

$$R(X) - VC(X) - FC = P$$

where R = revenue (selling price) per unit
 X = volume (number of units)
 $R(X)$ = total revenue
 VC = variable cost per unit
 $VC(X)$ = total variable cost
 FC = total fixed cost
 CM = contribution margin per unit
 P = total profit

Solving for Break-Even in Sales Units

Because the equation above simply represents an income statement, P can be set equal to zero to solve for the break-even point. At the point where $P = \$0$, total revenue equals total cost, and break-even point (BEP) in units can be found by solving the equation for X .

Break-even in sales units:

$$\frac{FC}{CM \text{ per unit}}$$

$$\begin{aligned} R(X) - VC(X) - FC &= \$0 \\ R(X) - VC(X) &= FC \\ (R - VC)(X) &= FC \\ X &= FC \div (R - VC) \\ X &= FC \div CM \end{aligned}$$

Expected annual sales volume: 400,000 pounds of cod

The company's estimated tax rate is 40 percent.

- What is the expected net income for the coming year? Prepare a contribution income statement.
- Compute the contribution margin per unit and the contribution margin ratio. (Round to the nearest tenth of a percent.)
- What is the break-even point in pounds sold and revenues? (Round to the nearest whole unit and dollar.)
- Compute the degree of operating leverage and margin of safety expected for the coming year. (Round to the nearest tenth of a percent.)
- Refer to the original data. Using the degree of operating leverage you computed in (d), compute the expected profit if sales are 20% above the expected level.
- Refer to the original data. How many pounds of cod must be sold to earn an after-tax net income of \$900,000? (Round to the nearest dollar.)

Review Solutions

Review 9-1

- $\$1.20 = \$0.40 + \$0.20 + \0.60
- $\$0.60 = (\$160,000 \div 80,000) - (\$1.20 + \$0.20)$

c. **Variable Costing Income Statement**

Sales revenue		\$160,000
Variable cost		
Cost of goods sold	\$96,000	
Selling and administrative	16,000	(112,000)
Contribution margin		48,000
Fixed cost		
Manufacturing overhead	\$30,000	
Selling and administrative	10,000	(40,000)
Income before income tax		\$ 8,000

Review 9-2

- 11,300 units = (Fixed cost of \$113,000 \div CM per unit of \$10)
- \$226,000 = (Fixed cost of \$113,000 \div CM percentage of 50%)
- 12,556 units = (Fixed cost of \$113,000 \div CM per unit of \$9)
- 11,100 units = (Fixed cost of \$111,000 \div CM per unit of \$10)

Review 9-3

- $\$37 = \$70 - \$15 - \$10 - \$8$
- 53% (rounded) = $\$37 \div \70
- 676 units = $(\$15,000 + \$10,000) \div \$37$
- $\$47,297 = (\$15,000 + \$10,000) \div 52.857\%$
- 1,244 units (1,243.2 rounded up) = $(\$15,000 + \$10,000 + \$21,000) \div \37
- 871 units (870.3 rounded up) = $(\$15,000 + \$10,000 + [\$5,400 / (1 - 0.25)]) \div \37
- 766 units (765.3 rounded up) = $(\$15,000 + \$10,000) \div (\$37 - [\$3.25 / (1 - 0.25)])$

Review 9-4

- Sales mix = 118 bags = $\$424,800 \div [(5 \times (\$600 - \$300)) + (3 \times (\$750 - \$350)) + (2 \times (\$1,000 - \$550))]$
 Basic: 590 units = 118×5 Basic: $\$354,000 = 590 \times \600
 Intermediate: 354 units = 118×3 Intermediate: $\$265,500 = 354 \times \750
 Advanced: 236 units = 118×2 Advanced: $\$236,000 = 236 \times \$1,000$

- b. Sales mix = $192 \text{ bags} = (\$424,800 + [\$200,000 / (1 - 0.25)]) \div [(5 \times (\$600 - \$300)) + (3 \times (\$750 - \$350)) + (2 \times (\$1,000 - \$550))]$
- Basic: 960 units = 192×5 Basic: $\$576,000 = 960 \times \600
 Intermediate: 576 units = 192×3 Intermediate: $\$432,000 = 576 \times \750
 Advanced: 384 units = 192×2 Advanced: $\$384,000 = 384 \times \$1,000$
- c. Sales mix = $107.54 \text{ bags} = \$424,800 \div [(2 \times (\$600 - \$300)) + (5 \times (\$750 - \$350)) + (3 \times (\$1,000 - \$550))]$
- Basic: 215 units (rounded) = 107.54×2 Basic: $\$129,000 = 215 \times \600
 Intermediate: 538 units (rounded) = 107.54×5 Intermediate: $\$403,500 = 538 \times \750
 Advanced: 323 units (rounded) = 107.54×3 Advanced: $\$323,000 = 323 \times \$1,000$
- Note: Due to the rounding of the number of sales units (company is unable to sell partial units), at the break-even point in this scenario, a slight profit would be recognized of \$250.

Review 9-5

- a. 166,667 packages (rounded) = $\$1,000,000 \div (\$20 - \$14)$
 b. Margin of safety in dollars: $\$466,660 = (\$20 \times 190,000) - (\$20 \times 166,667)$
 Margin of safety in units: $\$466,660 \div \$20 = 23,333$ units

c.	Sales ($\$20 \times 190,000$)	\$3,800,000
	Variable cost ($\$14 \times 190,000$)	2,660,000
	Contribution margin	1,140,000
	Fixed cost	1,000,000
	Income before income tax	\$ 140,000

Degree of operating leverage = $8.143 = \$1,140,000 \div \$140,000$

- d. $244\% = 8.143 \times 30\%$

e.	Sales ($\$20 \times 190,000 \times 1.3$)	\$4,940,000
	Variable cost ($\$14 \times 190,000 \times 1.3$)	3,458,000
	Contribution margin	1,482,000
	Fixed cost	1,000,000
	Income before income tax	\$ 482,000

Percentage increase = $244\% = (\$482,000 - \$140,000) \div \$140,000$

- e. (1) $\$3,733,333 = (\$1,000,000 + \$120,000) / [(\$20 - \$14) / \$20]$

(2)	Sales ($\$20 \times 1.10 \times 190,000$)	\$4,180,000
	VC ($\$14 \times 1.10 \times 190,000$)	2,926,000
	CM	1,254,000
	FC ($\$1,000,000 + \$120,000$)	1,120,000
	Pretax operating income	\$ 134,000

Degree of operating leverage = $9.36 = \$1,254,000 \div \$134,000$

Review 9-6

- | | | | | |
|------|------|------|------|-------|
| 1. c | 3. a | 5. a | 7. a | 9. a |
| 2. a | 4. a | 6. a | 8. b | 10. a |

In classifying product line costs, managers should be aware that some costs can appear to be avoidable but are actually not. For example, the salary of a supervisor working directly with a product line appears to be an avoidable fixed cost if the product line is eliminated. However, if such supervisors are transferred to other areas upon disposition of a product line, their salaries will continue and must be treated as unavoidable. These types of determinations must be made before costs can be appropriately classified in product line elimination decisions.

Depreciation on factory equipment used to manufacture a specific product is an irrelevant cost in product line decisions. But if the equipment can be sold, the selling price is relevant to the decision because the sale increases the benefit of discontinuing the product line. Even if the equipment will be kept in service and used to make other products, the depreciation expense is unavoidable and irrelevant to the decision.

Before deciding to discontinue a product line, management should carefully consider what resources would be required to make the product line profitable as well as the long-term ramifications of product line elimination. For example, product line elimination shrinks market assortment, which could cause some customers to seek other suppliers that maintain a broader market assortment. And, as in other relevant costing situations, decisions have qualitative as well as quantitative factors that must be analyzed. Individual customers also should be assessed (in the same manner as product lines) for profitability. When necessary, ways to improve the cost-benefit relationship should be determined.

Management's task is to effectively and efficiently allocate its finite stock of resources to accomplish its objectives. A cost accountant must learn what uses management will make of requested information to ensure that it is relevant and provided in the appropriate form. Managers must have a reliable quantitative basis on which to analyze problems, compare viable solutions, and choose the best course of action. Because management is a social rather than a natural science, it has no fundamental "truths," and few related problems are susceptible to black-or-white solutions. Relevant costing is a process of making human approximations of the costs of alternative decision results.

REVIEW 10-6**LO10-6****Product Line**

Celestial Inc. is organized into 3 distinct divisions. The company is currently contemplating the elimination of either Division 1 or Division 2 because they are showing a pre-tax loss. An annual income statement follows.

(in \$000s)	Division 1	Division 2	Division 3	Total
Sales.	\$5,300	\$8,200	\$30,240	\$43,740
Cost of sales.	3,920	7,000	18,144	29,064
Gross margin	\$1,380	\$1,200	\$12,096	\$14,676
Avoidable fixed costs*	1,484	600	5,836	7,920
Avoidable variable costs*	280	300	2,900	3,480
Allocated fixed costs.	252	940	1,764	2,956
Operating profit.	\$ (636)	\$ (640)	\$ 1,596	\$ 320

*Selling and administrative costs; there are no **unavoidable** fixed costs included in cost of sales.

More practice: E10-27,
E10-28

Solution on p. 10-45.

- How would the company's pre-tax profit be affected if it dropped Division 1?
- How would the company's pre-tax profit be affected if it dropped Division 2?

The historical data of Cellular Communications suggest that, for each of the seven cell phones sold, two ear bud sets and one battery charger are sold. The company is currently exploring two options to increase overall corporate income for the upcoming year. The alternatives that follow would maintain the historical sales mix ratios:

1. Increase corporate advertising by \$1,000,000. The company estimates doing so would increase total unit sales to 2,200,000.
2. Decrease the price of cell phones to \$70. The company estimates doing so would increase cell phone sales to 3,150,000 units and have no effect on the **unit selling price of the other products.**
 - a. Determine the effect of each proposal on budgeted profits for the coming year. Which alternative is preferred, and what is the relative financial benefit of that alternative?
 - b. How could the firm's management increase the ratio of ear buds and chargers to cell phone unit sales?

E10-25. Special order Wyoming Wire produces 12.5-gauge barbed wire that is retailed through farm supply companies. Presently, the company has the capacity to produce 100,000 tons of wire per year. It is operating at 80 percent of annual capacity, and at this level of operations, the cost per ton of wire is as follows:

Direct material	\$560
Direct labor	40
Variable overhead	50
Fixed overhead	190
Total	<u>\$840</u>

The average sales price for the output produced by the firm is \$900 per ton. The State of Texas has approached the firm to supply 200 tons of wire for the state's prisons for \$670 per ton. No production modifications would be necessary to fulfill the order from the State of Texas.

- a. What costs per ton are relevant to the decision to accept this special order?
- b. What would be the dollar effect on pre-tax income if this order were accepted?

E10-26. Special order For The Ages Inc. produces solid-oak umbrella stands. Each stand is handmade and hand finished using the finest materials available. The firm has been operating at capacity (2,000 stands per year) for the past three years. Based on this capacity of operations, the firm's costs per stand are as follows:

Direct material	\$ 50
Direct labor	40
Variable overhead	10
Fixed overhead	30
Total	<u>\$130</u>

All selling and administrative expenses incurred by the firm are fixed. The average selling price of stands is \$230. Recently, a large retailer approached Bill Wood, the president of For The Ages, about supplying three special stands to give as gifts to CEOs of key suppliers. Wood estimates that the following per-unit costs would be incurred to make the three stands:

Direct material	\$250
Direct labor	350
Variable overhead	90
Total direct costs	<u>\$690</u>

To accept the special order, the firm would have to sacrifice production of 20 regular units.

- a. Identify all relevant costs that Wood should consider in deciding whether to accept the special order.
- b. Assume the retailer offers to pay For The Ages a total of \$3,800 for the three stands. How would accepting this offer affect For The Ages' pre-tax income?

LO5



LO5



The choice of reducing WIP Inventory-Joint Products or Cost of Goods Sold creates alternative income statement presentations and balance sheet information. A reduction in WIP Inventory-Joint Products lowers the production cost per unit of the joint products. To illustrate, assume that Poultry Plus used a physical measure joint cost allocation. If by-product NRV were used to reduce WIP Inventory-Joint Products, the company's joint cost to allocate would have been \$5,000,000 rather than \$5,400,000: the difference is the 2,000,000 pounds of by-product multiplied by **\$0.20** NRV per pound. The reduction in WIP Inventory-Joint Products would create a corresponding reduction in cost of goods manufactured. Thus, the allocated joint cost per ton would have been approximately \$555 (or $\$5,000,000 \div 9,000$) per ton for any joint product rather than the \$600 joint cost per ton allocation shown in **Exhibit 11.6**. The reduced cost per ton would affect not only the amount of CGS upon joint product sale but also the amount shown in the inventory account. Alternatively, reducing CGS by the NRV would not affect the \$600 per ton allocated cost of the joint products. **Exhibit 11.12** shows the presentation of these two NRV approaches; a zero balance in beginning finished goods inventory is used to highlight the differences in the CGS computation. All other figures are assumed amounts. Note that the \$22,500 difference in income before taxes is equal to the 500 tons of finished goods inventory multiplied by the \$45 difference in cost per ton.

Exhibit 11.12 ■ Poultry Plus's Comparative Income Statements—NRV Approach to By-Products

(a) Net Realizable Value Approach: Reduce WIP—Joint Products

Sales		\$ 7,200,000
Cost of goods sold		
Beginning FG	\$ 0	
CGM (\$5,400,000 – \$400,000)	5,000,000	
CGA	<u>\$5,000,000</u>	
Ending FG (assumed to be 500 tons @ \$555 per ton)	(277,500)	(4,722,500)
Gross margin		\$ 2,477,500
Operating expenses		<u>(1,600,000)</u>
Income from principal operations		\$ 877,500
Other income		
Royalties	Difference: \$22,500	80,000
Income before income taxes		<u>\$ 957,500</u>

(b) Net Realizable Value Approach: Reduce Cost of Goods Sold

Sales		\$ 7,200,000
Cost of goods sold		
Beginning finished goods (FG)	\$ 0	
Cost of goods manufactured (CGM)	5,400,000	
Cost of goods available (CGA)	<u>\$5,400,000</u>	
Ending FG (assumed to be 500 tons @ \$600 per ton)	(300,000)	
Unadjusted CGS	<u>\$5,100,000</u>	
NRV of by-product	(400,000)	(4,700,000)
Gross margin		\$ 2,500,000
Operating expenses		<u>(1,600,000)</u>
Income from principal operations		\$ 900,000
Other income		
Royalties		80,000
Income before income taxes		<u>\$ 980,000</u>

Difference:
\$22,500

Although commonly used to account for such goods, the NRV method is not necessarily best for internal decision making or by-product management. This method does not indicate the

produced an NPV of \$23,210, which is relatively close to \$0 relative to the initial investment cost of \$13,500,000.

The following formula can be used to determine NPV:

$$\begin{aligned}\text{NPV} &= -\text{Investment at } t_0 + \text{PV of future cash inflows} - \text{PV of future cash outflows} \\ &= -\text{Investment} + \text{Future cash inflows (PV factor)} - \text{Future cash outflows (PV factor)}\end{aligned}$$

Capital project information should include investment, cash inflow, and cash outflow amounts. Thus, the only missing data in the preceding formula are the PV factors. By inserting the known amounts into the formulas, the missing PV factors can be calculated and then located in the PV tables. The interest rate with which the factors are associated is the internal rate of return.

The IRR is most easily computed for projects having equal annual net cash inflows. When an annuity exists, the NPV formula can be restated as follows:

$$\begin{aligned}\text{NPV} &= -\text{Net investment} + \text{PV of annuity amount} \\ &= -\text{Net investment} + (\text{Cash flow annuity amount} \times \text{PV factor})\end{aligned}$$

The investment and annual cash flow amounts are known from the expected data, and the NPV is known to be zero at the IRR. The IRR and its present value factor are unknown. To determine the internal rate of return, substitute known amounts into the formula, rearrange terms, and solve for the unknown (the PV factor):

$$\begin{aligned}\text{NPV} &= -\text{Net investment} + (\text{Annuity} \times \text{PV factor}) \\ \$0 &= -\text{Net investment} + (\text{Annuity} \times \text{PV factor}) \\ \text{Net investment} &= (\text{Annuity} \times \text{PV factor}) \\ \text{Net investment} \div \text{Annuity} &= \text{PV factor}\end{aligned}$$

The solution yields a present value factor for the number of annuity periods corresponding to the project's life at an interest rate equal to the IRR. Finding this PV factor in an annuity table and reading the interest rate at the top of the column in which the factor is found provides the internal rate of return. Alternatively, IRR may be calculated through the RATE function in Excel when there are equal annual net cash flows related to the project. When solving for RATE, enter the cash outflow as a negative amount and the cash inflow as a positive amount. Entering both values as either negative or positive will result in an error in Excel.

To illustrate an IRR computation for a project with a simple annuity, assume that Family One Stop is considering the purchase of a warehouse distribution management system. The system would cost \$1,500,000, be installed immediately, and generate cost savings of \$300,000 per year over its seven-year life. The system has no expected salvage value.

The NPV equation is solved for the present value factor.

Excel Function	Solution
=RATE(NPER,PMT,PV,FV)	RATE
=RATE(7,300000,-1500000,0)	9.2%

$$\begin{aligned}\text{NPV} &= -\text{Net investment} + (\text{Annuity} \times \text{PV factor}) \\ \$0 &= -\$1,500,000 + (\$300,000 \times \text{PV factor}) \\ \$1,500,000 &= (\$300,000 \times \text{PV factor}) \\ \$1,500,000 \div \$300,000 &= \text{PV factor} \\ 5.0000 &= \text{PV factor}\end{aligned}$$

The PV of an ordinary annuity table (Appendix A, Table 2) is examined to find the IRR. In the table, find the row representing the project's life (in this case, seven periods) and find the PV factor resulting from the equation solution. In row 7, a factor of 5.0330 appears under the column headed 9 percent. Thus, the internal rate of return for this investment is very near 9 percent. By using Excel, the exact IRR can be found, indicating that the warehouse distribution management system's IRR is 9.2 percent.

Refer to **Exhibit 15.5** for a plot of the NPVs that result from discounting the warehouse distribution management system cash flows at various rates of return. For example, the NPV at 7 percent is \$109,146 and at 11 percent is \$(77,785). (These computations are not provided here but can be performed by discounting the \$300,000 annual cash flows and subtracting \$1,500,000 of investment cost.)

Review 15-2

- a. $\$580,000 \div \$130,000 = 4.46$ years
- b. Four years = $\$100,000 + \$130,000 + \$150,000 + \$160,000 = \$540,000$
 0.25 year = $(\$580,000 - \$540,000) \div 160,000$
 Total payback period = 4.25 years

Review 15-3

- a. Net cash flows = $\$219,000 = \$279,000 - \$60,000$
 PV of cash flows = $\$1,469,508 = PV(0.08, 10, -219000)$
 NPV = $\$179,508 = \$1,469,508 - (\$1,300,000 - \$10,000)$
 Or
 PV of cash flows = $\$1,469,512 = \$219,000 \times 6.7101$
 NPV = $\$179,512 = \$1,469,512 - (\$1,300,000 - \$10,000)$
- b. $1.14 = \$1,469,508 \div \$1,290,000$
 Or
 $1.14 = \$1,469,512 \div \$1,290,000$
- c. $11\% = RATE(10, 219000, -1290000)$
 Or
 FACTOR = $\$1,290,000 \div \$219,000 = 5.890$
 11% return at 10 periods with a factor of 5.890.
- d. Yes; NPV is positive and the IRR of 11% exceeds the company's 8% cost of capital.

Review 15-4

	1	2	3	4	5	6	Total
Cash flow—after tax* . . .	\$43,450	\$43,450	\$43,450	\$43,450	\$39,500	\$39,500	
Tax shield**	10,080	10,080	10,080	10,080	10,080	—	
Total cash flows	53,530	53,530	53,530	53,530	49,580	39,500	
Present value***	\$50,500	\$47,642	\$44,945	\$42,401	\$37,049	\$27,846	\$250,383
OR							
Total cash flows	\$53,530	\$53,530	\$53,530	\$53,530	\$49,580	\$39,500	
Factor	0.9434	0.8900	0.8396	0.7921	0.7473	0.7050	
Present value	\$50,500	\$47,642	\$44,944	\$42,401	\$37,051	\$27,848	\$250,386

*\$43,450 = $\$55,000 \times (1 - 0.21)$; \$39,500 = $\$50,000 \times (1 - 0.21)$

**\$10,080 = $(\$240,000 \div 5) \times 0.21$

***\$50,500 = $PV(0.06, 1, 0, -53530)$; \$47,642 = $PV(0.06, 2, 0, -53530)$; \$44,945 = $PV(0.06, 3, 0, -53530)$; 42,401 = $PV(0.06, 4, 0, -53530)$; \$37,049 = $PV(0.06, 5, 0, -49580)$; \$27,846 = $PV(0.06, 6, 0, -39500)$

NPV = \$10,383 (\$250,383 - \$240,000) OR \$10,386 (\$250,386 - \$240,000)

Review 15-5

- a. Internal rate of return
- b. Payback method
- c. Profitability index
- d. Net present value and profitability index
- e. Payback method
- f. Profitability index
- g. Net present value, profitability index, internal rate of return
- h. Payback

One type of quantity variance is not caused by errors but by engineering changes made to the product specifications. A JIT system typically has two comparison standards: an annual standard and a current standard. Design modifications would change the current standard but not the annual one. The annual standard provides a basis for preparing and executing the company's master budget, and the annual standards are ordinarily kept intact because the annual financial plans and arrangements are predicated on the standards and plans used to prepare the master budget.

Using two standards allows comparisons to be made that indicate the cost effects of ECOs implemented after a product has begun to be manufactured. **Exhibit 18.11** shows the calculation of a material quantity variance caused by an ECO. The portion of the total quantity variance caused by the ECO (\$2,700 U) is shown separately from that caused by efficiency (\$540 F). Labor, overhead, and/or conversion can also have ECO variances.

Exhibit 18.11 ■ Material Variances under a JIT System

Current standard	
Material M (7 feet × \$3.05)	\$21.35
Material N (6 feet × \$3.35)	20.10
	<u>\$41.45</u>
Annual standard	
Material M (8 feet × \$3.05)	\$24.40
Material N (5 feet × \$3.35)	16.75
	<u>\$41.15</u>
Production during month	<u>9,000 units</u>
Actual material cost	
Material M (64,800 feet × \$3.05)	\$ 197,640
Material N (52,200 feet × \$3.35)	174,870
Total cost of material used	<u>\$ 372,510</u>
Material cost at current standard	
Material M (9,000 × 7 × \$3.05)	\$ 192,150
Material N (9,000 × 6 × \$3.35)	180,900
Material cost at current standard	<u>\$ 373,050</u>
Material cost at annual standard	
Material M (9,000 × 8 × \$3.05)	\$ 219,600
Material N (9,000 × 5 × \$3.35)	150,750
Material cost at annual standard	<u>\$ 370,350</u>
Material quantity variance	
Actual material cost	\$ 372,510
Less: Material cost at current standard	(373,050)
Material quantity variance	<u>\$ (540) F</u>
Engineering change variance for material	
Material cost at current standard	\$ 373,050
Less: Material cost at annual standard	(370,350)
ECO variance	<u>\$ 2,700 U</u>

Actual material cost
 – Material cost at current standard
 JIT Material quantity variance*

*Material price variance considered immaterial

Material cost at current standard
 – Material cost at annual standard
 JIT ECO variance

Labor variances in an automated just-in-time system should be minimal if standard rates and times have been set appropriately. If the plant is not entirely automated, redesigning the physical layout and minimizing any NVA labor activities should decrease the direct labor time component.

An accounting alternative that could occur in a JIT system is the use of a conversion cost category, rather than separate labor and overhead categories, for purposes of cost control. This category becomes more helpful as factories reduce the direct labor cost component through continuous improvements and automation. A standard departmental or manufacturing cell conversion

Part 2:

- a. $[(\$5.80 \times 17,000) + (\$6.40 \times 24,000)] - [(\$5.80 \times 3 \times 9,000) + (\$6.40 \times 2 \times 9,000)] = \$19,600$ F
- b. $[(\$5.80 \times 3 \times 9,000) + (\$6.40 \times 2 \times 9,000)] - [(\$5.80 \times 2 \times 9,000) + (\$6.40 \times 3 \times 9,000)] = \$5,400$ F

Review 18-6

- a. Lean c. Flexible e. Lean and Flexible g. Lean and Flexible
- b. Flexible d. Lean f. Lean

Review 18-7

- a. Department 2 is the bottleneck in the system as this department cannot process as quickly as Department 1, causing unfinished inventory to be held in Department 2.
- b. 20 units are on hand in Department 2 after four hours (see table below).

	Number of Units				
	Maximum Hourly Production	First Hour	Second Hour	Third Hour	Fourth Hour
Dept. 1 production		48	60	55	49
Dept. 2 production	48	48	48	48	48
Dept. 2 unfinished units		0	12	19	20
Dept. 3 production	55	48	48	48	48

Review 18-8**Part 1:**

$$\text{EOQ} = 632 \text{ pounds} = \sqrt{\frac{(2 \times 5,000 \times \$30)}{\$0.75}}$$

Part 2:

$$\text{EPR} = 1,680 \text{ units} = \sqrt{\frac{(2 \times 10,080 \times \$840)}{\$6}}$$