Solutions Manual

to accompany

Managerial Accounting

Twelfth Edition

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Solutions Manual to accompany
MANAGERIAL ACCOUNTING
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Suggested Course Outlines

Course Outline #1: For lower division undergraduates who have completed one or two terms of financial accounting.

Course Outline #2: For accounting majors or graduate students seeking a comprehensive course in managerial accounting.

Course Outline #3: For management development programs and/or upper division survey courses in managerial accounting.

All outlines assume 45 periods during a term with each period being 50 minutes in length.

COURSE OUTLINE #1				**COURSE OUTLINE #2**		**COURSE OUTLINE #3**	
Outline #1A		**Outline #1B**					
Chapter	**Periods**	**Chapter**	**Periods**	**Chapter**	**Periods**	**Chapter**	**Periods**
1	1.0	1	1.0	1	1.0	1	2.0
2	3.0	16	3.0	2	3.0	2	2.5
3	3.0	17	2.5	3	3.0	3	3.0
4	3.0	2	2.0	4	3.0	5	2.0
5	3.0	3	3.0	5	2.0	6	3.0
6	3.0	4	2.5	6	3.0	7	2.5
7	2.0	5	2.5	7	2.0	8	3.0
8	3.5	6	2.5	8	3.0	9	3.0
9	3.0	7	2.0	9	3.0	10	3.0
10	3.5	8	3.0	10	3.0	11	3.0
11	3.0	9	3.0	11	3.0	12	4.5
12	3.0	10	3.0	12	5.0	13	5.5
13	4.0	11	2.5	13	5.0	14	5.0
14	4.0	12	3.5	14	4.0	Tests	3.0
Tests	3.0	13	3.0	Tests	3.0		45.0
	45.0	14	3.0		45.0		
		Tests	3.0				
			45.0				

Problem and Case Material Scaled as to Difficulty

Each exercise, problem, and case in the text has been rated below as Basic, Medium, or Difficult.

Basic: Straightforward application of concepts, with few extraneous or complicating factors.

Medium: More rigorous application of concepts than in basic problems. Extraneous material may be present and the student may have to use concepts in ways not specifically illustrated in the text. It is not necessary to go beyond this level to give students challenging and thought-provoking homework.

Difficult: Unusually rigorous application of concepts that often includes extraneous data.

	Basic	**Medium**	**Difficult**
Chapter 1	1, 2, 3, 4, 5	6, 7, 8	9
Chapter 2	1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 14, 16, 17	19, 20, 21, 23, 24, 25, 26, 27	28, 29, 30, 31, 32
Appendix 2A	8, 13, 15,		
Appendix 2B	9, 18	22	
Chapter 3	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21	22, 23, 24, 25, 27, 28, 29	30, 31, 33, 34, 35
Appendix 3A	14	26	32
Chapter 4	1, 2, 3, 4, 10, 11, 14, 18, 19, 21	24, 25	26, 27, 28, 29, 32
Appendix 4A	5, 6, 7, 12, 13, 15, 20, 22		30
Appendix 4B	8, 9, 16, 17	23	31
Chapter 5	1, 2, 3, 4, 6, 7, 9, 10, 11, 12, 15, 16	17, 18, 24	21, 22, 23, 27
Appendix 5A	5, 8, 13, 14	19, 20	25, 26, 28
Chapter 6	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21	22, 23, 24, 25, 26, 27, 28, 29, 30	31, 32, 33, 34
Chapter 7	1, 2, 3, 5, 6, 7, 8, 9, 10, 11	4, 12, 13, 14	15, 16, 17, 18, 19
Chapter 8	1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 14, 15, 17, 18, 19, 21	22, 25, 26	32
Appendix 8A	6, 13, 16	23, 27	30
Appendix 8B	7, 20	24, 28, 29	31
Chapter 9	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	16, 17, 18, 19, 20	21, 22, 23, 24
Chapter 10	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 16, 17, 19, 20	21, 22, 23, 24, 25	26, 27, 29, 30, 31, 32, 33
Appendix 10A	7, 15, 18		28
Chapter 11	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21	22, 23, 24, 25, 26, 27, 28	29, 30, 31
Chapter 12	1, 2, 3, 6, 7, 8, 11, 12, 13, 14, 15, 18, 20, 22, 23	19, 21, 26, 27, 29, 30, 33	34, 36
Appendix 12A	4, 9, 16	24, 28, 31	35
Appendix 12B	5, 10, 17, 32	25	
Chapter 13	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	18, 19, 20, 21, 22, 23, 27	24, 25, 26, 28, 29, 30
Chapter 14	1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 16, 17, 18, 19, 21, 22, 23, 25, 26	27, 28, 29, 30, 31, 32, 34, 36, 38	33, 39, 40
Appendix 14A	7, 14		
Appendix 14C	8, 15, 20, 24	35, 37	
Chapter 15	1, 2, 4, 6, 7, 9, 10, 12	14	16, 18, 19
Appendix 15A	3, 5, 8, 11, 13	15	17
Chapter 16	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	15, 16, 17	18, 19, 20
Pricing App.	1, 2, 3	4, 5	6, 7, 8
Profitability App.	1, 2, 3	4, 6, 7	5, 8

Suggested Problem and Case Assignments

Each problem and case in the text is categorized below as either essential or supplementary.

1. In choosing problems, keep an eye on the difficulty of problems as listed on the preceding page, to be sure that the problem material you choose is consistent with the capabilities of the class.
2. It is not expected that all of the essential problems will necessarily be used; indeed, you may prefer to concentrate entirely on the supplementary problems in some chapters. The categorization below is simply one view of essential versus supplementary.
3. Where problems are listed as, for example, 12 or 16, it means that the problems are similar and either can be assigned.

	Essential	Supplementary
Chapter 1		4, 5, 6, 7, 8, 9
Chapter 2	14 or 17, 16 or 21, 19 or 27	20, 23, 24, 25, 26, 28, 29, 30, 31, 32
Appendix 2A	15	
Appendix 2B	18	22
Chapter 3	18 or 19, 20 or 21, 22, 23 or 25	24, 27, 28, 29, 30 or 32, 31, 33, 34, 35
Appendix 3A	26	32
Chapter 4	1, 2, 3, 4, 10, 11, 14, 18, 19, 21	24, 25, 26, 27, 28, 29, 31
Appendix 4A	5, 6, 7, 12, 13, 15, 20, 22	30
Appendix 4B	8, 9, 16, 17	23, 32
Chapter 5	16, 18, 21 or 23	15, 17, 19, 22, 24, 27
Appendix 5A	14	19, 20, 25, 26
Chapter 6	18 or 19, 20, 21 or 23, 27	22, 24, 25, 26, 28, 29, 30, 31, 32, 33, 34
Chapter 7	10, 11 or 12, 14	13, 15, 16, 17, 18, 19
Chapter 8	22, 25, 26	32
Appendix 8A	23, 27	30
Appendix 8B	24 or 29	28, 31
Chapter 9	9, 11, 13, 15, 17 or 21	8, 10, 12, 14, 16, 18 or 19, 20, 22, 23, 24
Chapter 10	16, 17 or 19, 20 or 24, 23 or 10-25	21, 22 or 26, 27, 29, 30, 31, 32, 33
Appendix 10A	18 or 28	
Chapter 11	17 or 26, 18 or 21, 19 or 22	20, 23, 24, 25, 27, 28, 29 or 30, 31
Chapter 12	21 or 29, 22, 23	26, 27, 30, 33, 34
Appendix 12A	24	28, 31, 35
Appendix 12B	32	25
Chapter 13	16, 17, 18, 19 or 23, 20, 24	21, 22, 25, 26, 27, 28, 29, 30
Chapter 14	21, 22, 23, 25, 30, 32	26, 27, 28, 29, 31, 33, 34, 36, 38, 39, 40
Appendix 14C	24	35, 37
Chapter 15	9, 10 or 12	14, 16, 18, 19
Appendix 15A	11 or 13	15, 17
Chapter 16	11 and 12, 13, 14 and 15, 16	17, 18, 19, 16-20
Pricing App.	4, 5, 8	6, 7
Profitability App.	4, 6	5, 7, 8

Appendix A
Pricing Products and Services

Solutions to Questions

A-1 In cost-plus pricing, prices are set by applying a markup percentage to a product's cost.

A-2 The price elasticity of demand measures the degree to which a change in price affects unit sales. The unit sales of a product with inelastic demand are relatively insensitive to the price charged for the product. In contrast, the unit sales of a product with elastic demand *are* sensitive to the price charged for the product.

A-3 The profit-maximizing price should depend only on the variable (marginal) cost per unit and on the price elasticity of demand. Fixed costs do not enter into the pricing decision at all. Fixed costs are relevant in a decision of whether to offer a product or service, but are not relevant in deciding what to charge for the product or service. Because price affects unit sales, total variable costs are affected by the pricing decision and therefore are relevant.

A-4 The markup over variable cost depends on the price elasticity of demand. A product whose demand is elastic should have a lower markup over cost than a product whose demand is inelastic. If demand for a product is inelastic, the price can be increased without cutting as drastically into unit sales.

A-5 The markup in the absorption costing approach to pricing is supposed to cover selling and administrative expenses as well as providing for an adequate return on the assets tied up in the product. Full cost is an alternative approach not discussed in the chapter that is used almost as frequently as the absorption approach. Under the full cost approach, all costs—including selling and administrative expenses—are included in the cost base. If full cost is used, the markup is only supposed to provide for an adequate return on the assets.

A-6 The absorption costing approach assumes that consumers do not react to prices at all—consumers will purchase the forecasted unit sales regardless of the price that is charged. This is clearly an unrealistic assumption except under very special circumstances.

A-7 The protection offered by full cost pricing is an illusion. All costs will be covered only if actual sales equal or exceed the forecasted sales on which the absorption costing price is based. There is no assurance that a sufficient number of units will be sold.

A-8 Target costing is used to price new products. The target cost is the expected selling price of the new product less the desired profit per unit. The product development team is charged with the responsibility of ensuring that actual costs do not exceed this target cost.

This is the reverse of the way most companies have traditionally approached the pricing decision. Most companies start with their full cost and then add their markup to arrive at the selling price. In contrast to target costing, this traditional approach ignores how much customers are willing to pay for the product.

Exercise A-1 (30 minutes)

1. Kimio makes more money selling the ice cream cones at the lower price, as shown below:

	\$1.79 Price	*\$1.39 Price*
Unit sales	860	1,340
Sales	\$1,539.40	\$1,862.60
Cost of goods sold @ \$0.41	352.60	549.40
Contribution margin	1,186.80	1,313.20
Fixed expenses	425.00	425.00
Net operating income	\$ 761.80	\$ 888.20

2. The price elasticity of demand, as defined in the text, is computed as follows:

$$\varepsilon_d = \frac{\ln(1 + \text{\% change in quantity sold})}{\ln(1 + \text{\% change in price})}$$

$$= \frac{\ln\left(1 + \left(\frac{1{,}340 - 860}{860}\right)\right)}{\ln\left(1 + \left(\frac{1.39 - 1.79}{1.79}\right)\right)}$$

$$= \frac{\ln(1 + 0.55814)}{\ln(1 - 0.22346)}$$

$$= \frac{\ln(1.55814)}{\ln(0.77654)}$$

$$= \frac{0.44349}{-0.25291} = -1.75$$

Exercise A-1 (continued)

3. The profit-maximizing price can be estimated using the following formulas from the text:

$$\text{Profit-maximizing markup on variable cost} = \frac{-1}{1 + \varepsilon_d}$$

$$= \frac{-1}{1 + (-1.75)} = 1.333$$

$$\text{Profit-maximizing price} = \left(1 + \text{Profit-maximizing markup on variable cost}\right) \times \text{Variable cost per unit}$$

$$= (1 + 1.3333) \times \$0.41 = \$0.96$$

This price is much lower than the prices Maria has been charging in the past. Rather than immediately dropping the price to $0.96, it would be prudent to drop the price a bit and see what happens to unit sales and to profits. The formula assumes that the price elasticity is constant, which may not be the case.

Exercise A-2 (15 minutes)

1.

$$\text{Markup percentage on absorption cost} = \frac{\left(\begin{array}{l}\text{Required ROI}\\ \times \text{ Investment}\end{array}\right) + \begin{array}{c}\text{Selling and administrative}\\ \text{expenses}\end{array}}{\text{Unit product cost} \times \text{Unit sales}}$$

$$= \frac{(18\% \times \$500{,}000) + \$60{,}000}{\$30 \text{ per unit} \times 12{,}500 \text{ units}}$$

$$= \frac{\$150{,}000}{\$375{,}000}$$

$$= 40\%$$

2.

Unit product cost	$30
Markup: 40% × $30	12
Target selling price per unit	$42

Exercise A-3 (10 minutes)

Sales (50,000 batteries × $65 per battery)	$3,250,000
Less desired profit (20% × $2,500,000)	500,000
Target cost for 50,000 batteries	$2,750,000

Target cost per battery = ($2,750,000 ÷ 50,000 batteries)
= $55 per battery

Problem A-4 (30 minutes)

1. a. Number of jackets manufactured each year:

21,000 labor-hours ÷ 1.4 labor-hours per jacket = 15,000 jackets.

Selling and administrative expenses:

Variable (15,000 jackets × $4 per jacket)	$ 60,000
Fixed	474,000
Total	$534,000

$$\text{Markup percentage on absorption cost} = \frac{\begin{pmatrix}\text{Required ROI} \\ \times\ \text{Investment}\end{pmatrix} + \begin{matrix}\text{Selling and administrative} \\ \text{expenses}\end{matrix}}{\text{Unit product cost} \times \text{Unit sales}}$$

$$= \frac{(24\% \times \$900{,}000) + \$534{,}000}{\$40 \text{ per jacket} \times 15{,}000 \text{ jackets}}$$

$$= \frac{\$750{,}000}{\$600{,}000}$$

$$= 125\%$$

b.

Direct materials	$ 9.20
Direct labor	14.00
Manufacturing overhead	16.80
Unit product cost	40.00
Add markup: 125% of unit product cost	50.00
Target selling price	$90.00

Problem A-4 (continued)

c. The income statement is:

Sales (15,000 jackets × \$90 per jacket) ..		\$1,350,000
Cost of goods sold		
(15,000 jackets × \$40 per jacket)		600,000
Gross margin		750,000
Selling and administrative expenses:		
Shipping	\$ 60,000	
Salaries...	90,000	
Advertising and other	384,000	
Total selling and administrative expense ..		534,000
Net operating income		\$ 216,000

The company's ROI computation for the jackets is:

$$\text{ROI} = \frac{\text{Net operating income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Average operating assets}}$$

$$= \frac{\$216{,}000}{\$1{,}350{,}000} \times \frac{\$1{,}350{,}000}{\$900{,}000} = 16\% \times 1.5 = 24\%$$

2. Variable cost per unit:

Direct materials...	\$ 9.20
Direct labor...	14.00
Variable manufacturing overhead (1/6 × \$16.80)......	2.80
Shipping expense..	4.00
Total variable cost per unit.....................................	\$30.00

If the company has idle capacity and sales to the retail outlet would not affect the company's regular sales, any price above the variable cost of \$30 per jacket would add to profits. The company should aggressively bargain for more than this price; \$30 is simply the rock bottom below which the company should not go in its pricing.

Problem A-5 (30 minutes)

1. The postal service makes more money selling the souvenir sheets at the lower price, as shown below:

	\$5 Price	*\$6 Price*
Unit sales	50,000	40,000
Sales	\$250,000	\$240,000
Cost of goods sold @ \$0.60 per unit....	30,000	24,000
Contribution margin	\$220,000	\$216,000

2. The price elasticity of demand, as defined in the text, is computed as follows:

$$\varepsilon_d = \frac{\ln(1 + \text{\% change in quantity sold})}{\ln(1 + \text{\% change in price})}$$

$$= \frac{\ln\left(1 + \left(\frac{40{,}000 - 50{,}000}{50{,}000}\right)\right)}{\ln\left(1 + \left(\frac{6.00 - 5.00}{5.00}\right)\right)}$$

$$= \frac{\ln(1 - 0.2000)}{\ln(1 + 0.2000)}$$

$$= \frac{\ln(0.8000)}{\ln(1.2000)}$$

$$= \frac{-0.2231}{0.1823}$$

$$= -1.2239$$

Problem A-5 (continued)

3. The profit-maximizing price can be estimated using the following formulas from the text:

$$\text{Profit-maximizing markup on variable cost} = \frac{-1}{1 + \varepsilon_d}$$

$$= \frac{-1}{1 + (-1.2239)} = 4.4663$$

$$\text{Profit-maximizing price} = \left(1 + \text{Profit-maximizing markup on variable cost}\right) \times \text{Variable cost per unit}$$

$$= (1 + 4.4663) \times \$0.60 = \$3.28$$

This price is much lower than the price the postal service has been charging in the past. Rather than immediately dropping the price to $3.28, it would be prudent for the postal service to drop the price a bit and observe what happens to unit sales and to profits. The formula assumes that the price elasticity of demand is constant, which may not be true.

Problem A-5 (continued)

The critical assumption in the calculation of the profit-maximizing price is that the percentage increase (decrease) in quantity sold is always the same for a given percentage decrease (increase) in price. If this is true, we can estimate the demand schedule for souvenir sheets as follows:

*Price**	*Quantity Sold*§
$6.00	40,000
$5.00	50,000
$4.17	62,500
$3.48	78,125
$2.90	97,656
$2.42	122,070
$2.02	152,588
$1.68	190,735
$1.40	238,419
$1.17	298,024

*The price in each cell in the table is computed by taking 5/6 of the price just above it in the table. For example, $5.00 is 5/6 of $6.00 and $4.17 is 5/6 of $5.00.

§The quantity sold in each cell of the table is computed by multiplying the quantity sold just above it in the table by 50,000/40,000. For example, 62,500 is computed by multiplying 50,000 by the fraction 50,000/40,000.

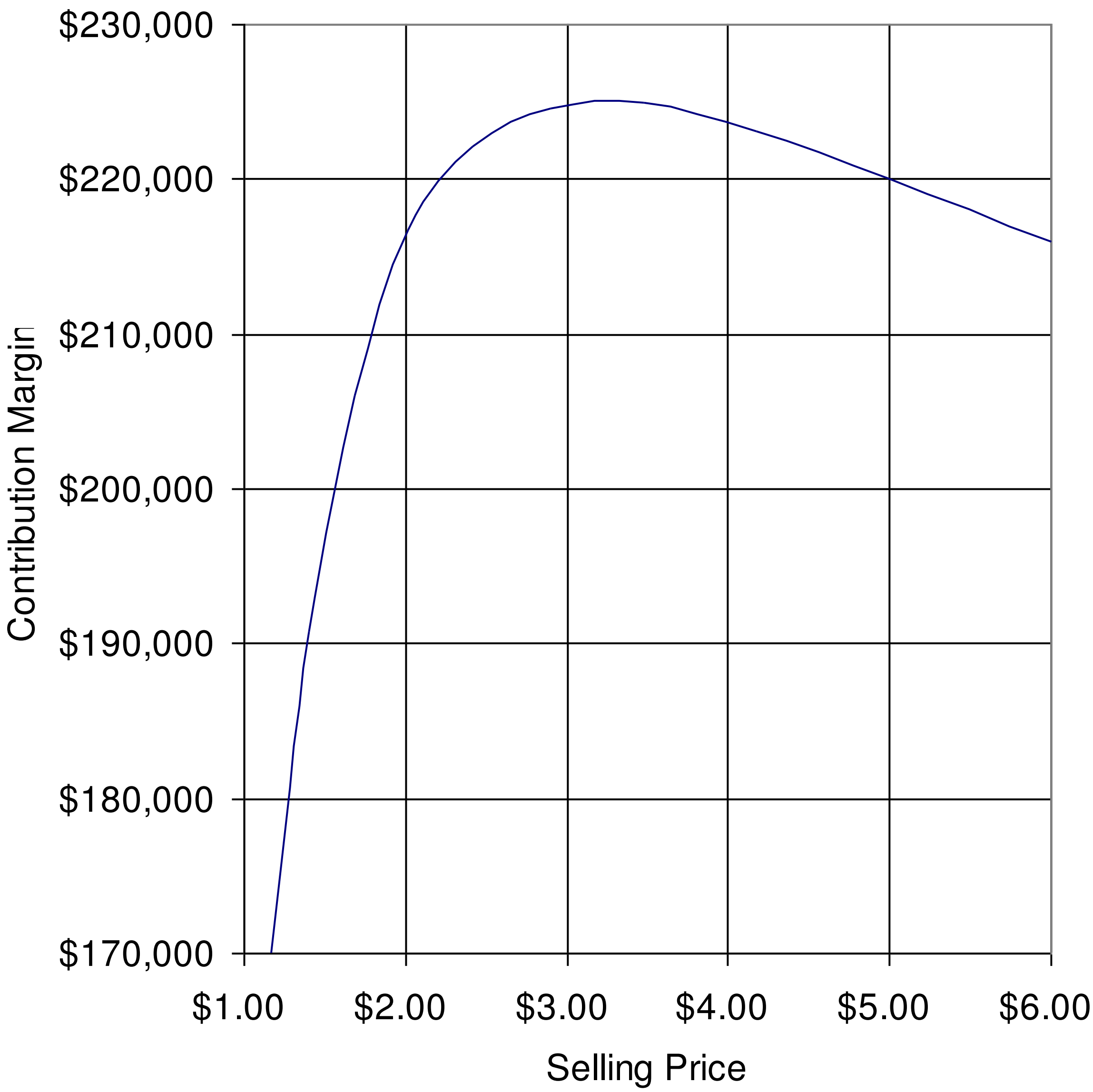
Problem A-5 (continued)

The profit at each price in the above demand schedule can be computed as follows:

Price (a)	*Quantity Sold (b)*	*Sales (a) × (b)*	*Cost of Sales \$0.60 × (b)*	*Contribution Margin*
\$6.00	40,000	\$240,000	\$24,000	\$216,000
\$5.00	50,000	\$250,000	\$30,000	\$220,000
\$4.17	62,500	\$260,625	\$37,500	\$223,125
\$3.48	78,125	\$271,875	\$46,875	\$225,000
\$2.90	97,656	\$283,202	\$58,594	\$224,608
\$2.42	122,070	\$295,409	\$73,242	\$222,167
\$2.02	152,588	\$308,228	\$91,553	\$216,675
\$1.68	190,735	\$320,435	\$114,441	\$205,994
\$1.40	238,419	\$333,787	\$143,051	\$190,736
\$1.17	298,024	\$348,688	\$178,814	\$169,874

Problem A-5 (continued)

The contribution margin is plotted below as a function of the selling price:



The plot confirms that the profit-maximizing price is about $3.28.

Problem A-5 (continued)

4. If the postal service wants to maximize the contribution margin and profit from sales of souvenir sheets, the new price should be:

   Profit-maximizing price = 5.4663 × $0.70 = $3.83

   Note that a $0.10 increase in cost has led to a $0.55 ($3.83 – $3.28) increase in the profit-maximizing price. This is because the profit-maximizing price is computed by multiplying the variable cost by 5.4663. Since the variable cost has increased by $0.10, the profit-maximizing price has increased by $0.10 × 5.4663, or $0.55.

   Some people may object to such a large increase in price as "unfair" and some may even suggest that only the $0.10 increase in cost should be passed on to the consumer. The enduring popularity of full-cost pricing may be explained to some degree by the notion that prices should be "fair" rather than calculated to maximize profits.

Problem A-6 (60 minutes)

1. The complete, filled-in table appears below:

Selling Price	*Estimated Unit Sales*	*Sales*	*Variable Cost*	*Fixed Expenses*	*Net Operating Income*
$18.95	20,000	$379,000	$118,000	$264,000	$(3,000)
$17.06	24,000	$409,440	$141,600	$264,000	$3,840
$15.35	28,800	$442,080	$169,920	$264,000	$8,160
$13.82	34,560	$477,619	$203,904	$264,000	$9,715
$12.44	41,472	$515,912	$244,685	$264,000	$7,227
$11.20	49,766	$557,379	$293,619	$264,000	$(240)
$10.08	59,719	$601,968	$352,342	$264,000	$(14,374)
$9.07	71,663	$649,983	$422,812	$264,000	$(36,829)
$8.16	85,996	$701,727	$507,376	$264,000	$(69,649)
$7.34	103,195	$757,451	$608,851	$264,000	$(115,400)

Problem A-6 (continued)

2. The following graph is based on the table in part (1) above:

Based on this graph, a selling price of about $14 would maximize net operating income.

Problem A-6 (continued)

3. The price elasticity of demand, as defined in the text, is computed as follows:

$$\varepsilon_d = \frac{\ln(1 + \text{\% change in quantity sold})}{\ln(1 + \text{\% change in price})}$$

$$= \frac{\ln(1 + 0.20)}{\ln(1 - 0.10)}$$

$$= \frac{\ln(1.20)}{\ln(0.90)}$$

$$= \frac{0.18232}{-0.10536}$$

$$= -1.73$$

The profit-maximizing price can be estimated using the following formulas from the text:

$$\text{Profit-maximizing markup on variable cost} = \frac{-1}{1+ \varepsilon_d}$$

$$= \frac{-1}{1 + (-1.73)} = 1.37$$

$$\text{Profit-maximizing price} = \left(1 + \text{Profit-maximizing markup on variable cost}\right) \times \text{Variable cost per unit}$$

$$= (1 + 1.37) \times \$5.90 = \$13.98$$

Note that this answer is consistent with the plot of the data in part (2) above. The formula for the profit-maximizing price works in this case because the demand is characterized by constant price elasticity. Every 10% decrease in price results in a 20% increase in unit sales.

Problem A-6 (continued)

4. To apply the absorption costing approach, we must first compute the markup percentage, which is a function of the required ROI of 2% per month, the investment of $120,000, the unit product cost of $5.90, and the SG&A expenses of $264,000.

$$\text{Markup percentage on absorption cost} = \frac{\begin{pmatrix}\text{Required ROI}\\ \times \text{ Investment}\end{pmatrix} + \text{SG\&A expenses}}{\text{Unit product cost} \times \text{Unit sales}}$$

$$= \frac{(2\% \times \$120{,}000) + \$264{,}000}{\$5.90 \text{ per unit} \times 20{,}000 \text{ units}}$$

$$= 2.26 \text{ (rounded) or } 226\%$$

Unit product cost	$ 5.90
Markup ($5.90 × 2.26).....	13.33
Target selling price..........	$19.23

Charging $19.23 for the software would be a big mistake if the marketing manager is correct about the effect of price changes on unit sales. The graph prepared in part (2) above strongly suggests that the company would lose lots of money selling the software at this price.

Note: It can be shown that the unit sales at the $19.23 price would be about 19,444 units if the marketing manager is correct about demand. If so, the company would lose about $4,812 per month:

Sales (19,444 units × $19.23 per unit)	$373,908
Variable expenses (19,444 units × $5.90 per unit) .	114,720
Contribution margin	259,188
Fixed expenses	264,000
Net operating income (loss)................................	$ (4,812)

5. If the marketing manager is correct about demand, increasing the price above $13.98 per unit will result in a decrease in net operating income and hence in the return on investment. To increase the net operating income, the owners should look elsewhere. They should attempt to decrease costs or increase the perceived value of the product to more customers so that more units can be sold at any given price or the price can be increased without sacrificing unit sales.

Problem A-7 (60 minutes)

1. Supporting computations:

   Number of pads produced per year:
   100,000 labor-hours ÷ 2 labor-hours per pad = 50,000 pads

   Standard cost per pad:
   $4,000,000 cost of goods sold ÷ 50,000 pads = $80 cost per pad

   Fixed manufacturing overhead cost per pad:
   $1,750,000 ÷ 50,000 pads = $35 per pad

   Manufacturing overhead cost per pad:
   $7 variable cost per pad + $35 fixed cost per pad = $42 per pad

   Direct labor cost per pad:
   $80 – ($30 + $42) = $8

   Given the computations above, the completed standard cost card follows:

	Standard Quantity or Hours	*Standard Price or Rate*	*Standard Cost*
Direct materials	5 yards	$6 per yard	$30
Direct labor	2 hours	$4 per hour *	8
Manufacturing overhead	2 hours	$21 per hour **	42
Total standard cost per pad			$80

* 8 ÷ 2 hours = $4 per hour.
** $42 ÷ 2 hours = $21 per hour.

Problem A-7 (continued)

2. a.

$$\text{Markup percentage on absorption cost} = \frac{\begin{pmatrix}\text{Required ROI} \\ \times\ \text{Investment}\end{pmatrix} + \begin{matrix}\text{Selling and administrative} \\ \text{expenses}\end{matrix}}{\text{Unit product cost} \times \text{Unit sales}}$$

$$= \frac{(24\% \times \$3{,}500{,}000) + \$2{,}160{,}000}{\$80 \text{ per pad} \times 50{,}000 \text{ pads}}$$

$$= \frac{\$3{,}000{,}000}{\$4{,}000{,}000}$$

$$= 75\%$$

b.

Direct materials	$ 30
Direct labor	8
Manufacturing overhead	42
Unit product cost	80
Add 75% markup	60
Target selling price	$140

c.

Sales (50,000 pads × $140 per pad)	$7,000,000
Cost of goods sold (50,000 pads × $80 per pad)	4,000,000
Gross margin	3,000,000
Selling and administrative expense	2,160,000
Net operating income	$ 840,000

$$\text{ROI} = \frac{\text{Net operating income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Average operating assets}}$$

$$= \frac{\$840{,}000}{\$7{,}000{,}000} \times \frac{\$7{,}000{,}000}{\$3{,}500{,}000} = 12\% \times 2 = 24\%$$

Problem A-7 (continued)

3. Total fixed cost:

Manufacturing overhead	$1,750,000
Selling and administrative [$2,160,000 – (50,000 pads × $5 variable per pad)]	1,910,000
Total fixed cost	$3,660,000

Variable cost per pad:

Direct materials	$30
Direct labor	8
Variable manufacturing overhead	7
Variable selling	5
Total variable cost	$50

To achieve the 24% ROI, the company would have to sell at least the 50,000 units assumed in part (2) above. The break-even volume can be computed as follows:

$$\text{Break-even point in units sold} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \frac{\$3,660,000}{\$140 \text{ per pad} - \$50 \text{ per pad}}$$

$$= 40,667 \text{ pads}$$

Problem A-8 (45 minutes)

1\.

Projected sales (80 machines × $3,795 per machine)	$303,600
Less desired profit (20% × $50,000)	10,000
Target cost for 80 machines	$293,600
Target cost per machine ($293,600 ÷ 80 machines)	$3,670
Less Choice Culinary Supply's variable selling cost per machine	350
Maximum allowable purchase price per machine	$3,320

2\. The relation between the purchase price of the machine and ROI can be developed as follows:

$$\text{ROI} = \frac{\text{Total projected sales - Total cost}}{\text{Investment}}$$

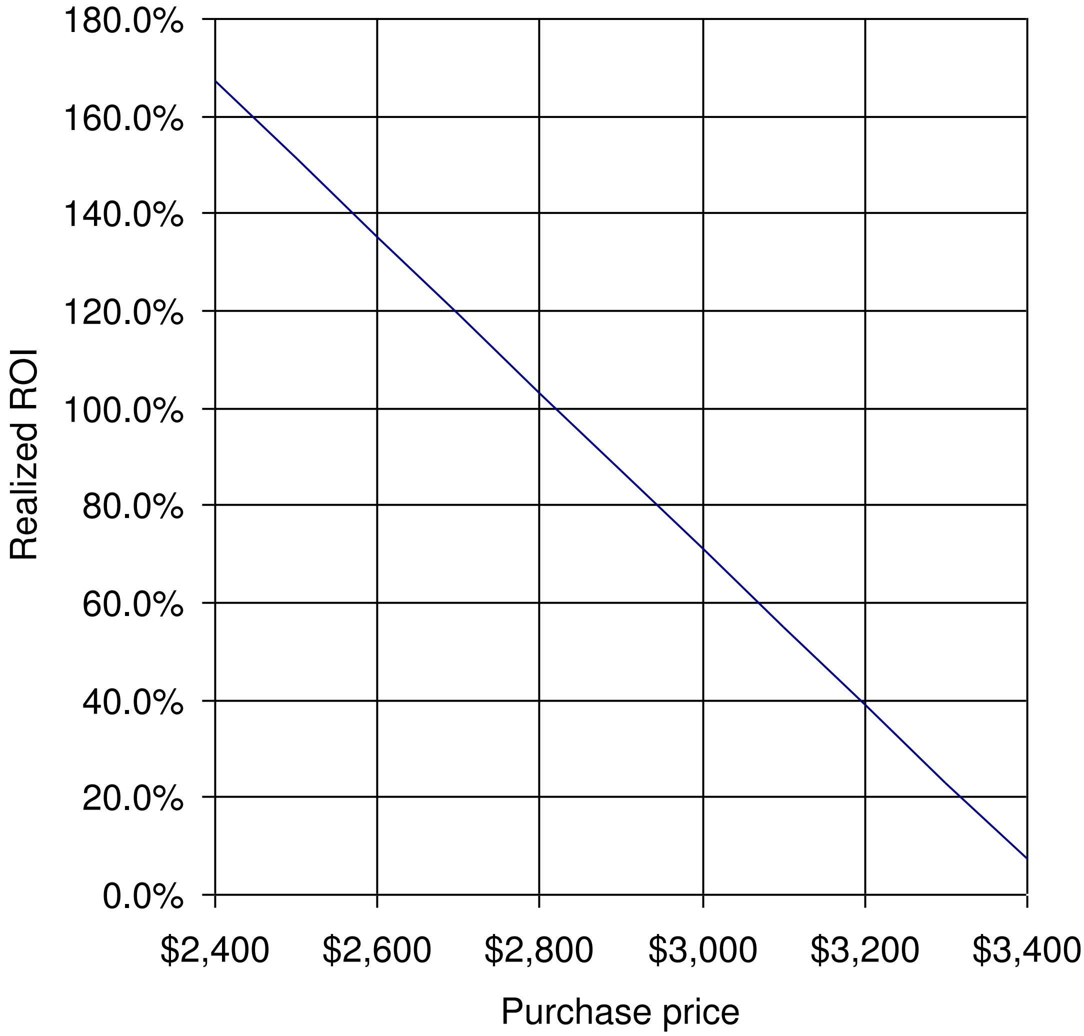
$$= \frac{\$303{,}600 - (\$350 + \text{Purchase price of machines}) \times 80}{\$50{,}000}$$

The above formula can be used to compute the ROI for purchase prices between $2,400 and $3,400 (in increments of $100):

Purchase price	*ROI*
$2,400	167.2%
$2,500	151.2%
$2,600	135.2%
$2,700	119.2%
$2,800	103.2%
$2,900	87.2%
$3,000	71.2%
$3,100	55.2%
$3,200	39.2%
$3,300	23.2%
$3,400	7.2%

Problem A-8 (continued)

Using the above data, the relation between purchase price and ROI can be plotted as follows:



Problem A-8 (continued)

3. A number of options are available in addition to simply giving up on adding the new gelato machines to the company's product lines. These options include:

- Check the projected unit sales. Perhaps more units could be sold at the $3,795 price. However, management should be careful not to indulge in wishful thinking just to make the numbers come out right.
- Modify the selling price. This does not necessarily mean increasing the projected selling price. Decreasing the selling price may generate enough additional unit sales to make carrying the gelato machines more profitable.
- Improve the selling process to decrease the variable selling costs.
- Rethink the investment that would be required to carry this new product. Can the size of the inventory be reduced? Are the new warehouse fixtures really necessary?
- Does the company really need a 20% ROI? Does it cost the company this much to acquire more funds?

Appendix B
Profitability Analysis

Solutions to Questions

B-1 Absolute profitability measures the impact on an organization's overall profits of adding or dropping a particular segment, such as a product or customer, without making any other changes.

B-2 Relative profitability involves ranking segments, each of which may be absolutely profitable, for purposes of making trade-offs among the segments. Such trade-offs are necessary when a constraint exists. Otherwise, they are not necessary.

B-3 Every business that seeks to maximize profits has a constraint. No business ever has had or ever will have infinite profits. Whatever prevents a business from attaining more profits is its constraint. The constraint might be a production constraint, it might be managerial time or talent, or it might be some internal policy that prevents the firm from progressing, but every profit-seeking organization faces at least one constraint. The same is true for almost all nonprofit organizations, which generally seek more of something—be it more health care, more land preserved from development, or more art.

B-4 The absolute profitability of a segment is measured by the difference between the incremental revenues from the segment and the incremental (avoidable) costs of the segment. So to measure absolute profitability, one would need the incremental revenues and costs of the segment.

B-5 The relative profitability of a segment is measured by the profitability index, which is computed by dividing the incremental profit from the segment by the amount of the constrained resource required by the segment. So to measure relative profitability, one would need the incremental profit from the segment and the amount of the constrained resource required by the segment.

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B-6 A volume trade-off decision involves trading off units of one product for another. In such decisions fixed costs are usually irrelevant and the products can be ranked by dividing their unit contribution margins by the amount of the constrained resource required by one unit of the product.

B-7 The selling price of a new product should at least cover its variable costs and opportunity costs. The opportunity costs can be determined by multiplying the opportunity cost per unit of the constrained resource by the amount of the constrained resource required by a unit of the new product. In addition, the selling price should cover any avoidable fixed costs of the product. Exactly how much of the avoidable fixed costs should be covered by each unit is difficult to determine *a priori* because the future unit sales volume of a product is not known with certainty.

Exercise B-1 (30 minutes)

1. This exercise can be solved by first computing the profitability index of each new ride and then ranking the rides based on that profitability index:

	Net Present Value (A)	*Safety Engineer Time Required (B)*	*Profitability Index (A) ÷ (B)*
Ride 1	$741,400	220	$3,370
Ride 2	$382,500	150	$2,550
Ride 3	$850,500	350	$2,430
Ride 4	$450,500	170	$2,650
Ride 5	$620,400	220	$2,820
Ride 6	$1,004,400	310	$3,240
Ride 7	$953,800	380	$2,510
Ride 8	$332,500	190	$1,750
Ride 9	$385,500	150	$2,570
Ride 10	$680,400	270	$2,520

	Profitability Index	*Safety Engineer Time Required*	*Cumulative Amount of Safety Engineer Time Required*
Ride 1	$3,370	220	220
Ride 6	$3,240	310	530
Ride 5	$2,820	220	750

Ride 4	$2,650	170	920
Ride 9	$2,570	150	1,070
Ride 2	$2,550	150	1,220
Ride 10	$2,520	270	1,490
Ride 7	$2,510	380	1,870
Ride 3	$2,430	350	2,220
Ride 8	$1,750	190	2,410

Given the 1,220 hours of safety engineer time available, the six rides above the line in the above table should be built.

Exercise B-1 (continued)

2. The total net present value for the six new rides to be built is computed as follows:

Ride 1	$ 741,400
Ride 6	1,004,400
Ride 5	620,400
Ride 4	450,500
Ride 9	385,500
Ride 2	382,500
Total	$3,584,700

Notes:

(a) Both the safety engineer's time and the individual projects would have to be *very* carefully scheduled to make sure that all projects are completed on time. We have assumed that the 1,220 hours of available safety engineer time does not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.

(b) If the cumulative amount of safety engineer time required did not exactly consume the total amount of time available, some adjustment might be required in which projects are accepted to ensure that the best plan is selected.

Exercise B-2 (30 minutes)

1. There is not enough capacity in the bottleneck operation to satisfy demand for all four products. The total amount of time available in the bottleneck operation is 1,800 hours, but 2,240 hours would be required to satisfy demand as shown below:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Annual demand in units (a)	80	80	70	120	
Hours required in the bottleneck operation per unit (b)	6	8	4	7	
Total hours required in the bottleneck operation (a) × (b)..	480	640	280	840	2,240

2. The profitability index should be used to rank the products.

	Trader	*Trapper*	*Quebec*	*Runner*
Unit contribution margin (a)....	$444	$464	$312	$462
Hours required in the bottleneck operation per unit (b)	6	8	4	7
Profitability index (a) ÷ (b)	$74	$58	$78	$66

The most profitable use of the bottleneck operation (the constraint) is the Quebec model, followed by the Trader model and then the Runner and Trapper models. Because no fixed costs would be affected by this decision, the optimal plan would be:

Exercise B-2 (continued)

Amount of constrained resource available	1,800 hours
Less: Constrained resource required for production of 70 units of the Quebec model	280 hours
Remaining constrained resource available	1,520 hours
Less: Constrained resource required for production of 80 units of the Trader model	480 hours
Remaining constrained resource available	1,040 hours
Less: Constrained resource required for production of 120 units of the Runner model	840 hours
Remaining constrained resource available	200 hours
Less: Constrained resource required for production of 25 units of the Trapper model	200 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $124,400:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Unit contribution margin (a)	$444	$464	$312	$462	
Optimal production plan (b)	80	25	70	120	
Total contribution margin (a) × (b) .	$35,520	$11,600	$21,840	$55,440	$124,400

Exercise B-3 (10 minutes)

The selling price of the new amaretto cappuccino product should at least cover its variable cost and its opportunity cost. The variable cost of the new product is $0.46 and its opportunity cost can be computed by multiplying the opportunity cost of $3.40 per minute of order filling time by the amount of time required to fill an order for the new product:

$$\begin{matrix}\text{Selling price of}\\ \text{the new product}\end{matrix} \geq \begin{matrix}\text{Variable cost of}\\ \text{the new product}\end{matrix} + \left(\begin{matrix}\text{Opportunity cost}\\ \text{per unit of the}\\ \text{constrained resource}\end{matrix} \times \begin{matrix}\text{Amount of the constrained}\\ \text{resource required by a unit}\\ \text{of the new product}\end{matrix}\right)$$

$$\begin{matrix}\text{Selling price of}\\ \text{the new product}\end{matrix} \geq \$0.46 + \left(\$3.40 \text{ per minute} \times \frac{45 \text{ seconds}}{60 \text{ seconds per minute}}\right)$$

$$\begin{matrix}\text{Selling price of}\\ \text{the new product}\end{matrix} \geq \$0.46 + (\$3.40 \text{ per minute} \times 0.75 \text{ minute})$$

$$\begin{matrix}\text{Selling price of}\\ \text{the new product}\end{matrix} \geq \$0.46 + \$2.55 = \$3.01$$

Hence, the selling price of the new product should at least cover both its variable cost of $0.46 and its opportunity cost of $2.55, for a total of $3.01.

Problem B-4 (60 minutes)

1. This problem can be solved by first computing the profitability index of each customer and then ranking the customers based on that profitability index:

Customer	*Incremental Profit (A)*	*Megan's Time Required (B)*	*Profitability Index (A) ÷ (B)*
Audet	$140	4	$35
Boyer	$124	4	$31
Comfort	$160	5	$32
Donaghe...	$96	3	$32
Due	$190	5	$38
Dupuy	$288	8	$36
Ebberts	$93	3	$31
Imm	$136	4	$34
Mulgrew	$234	6	$39
Paulding	$204	6	$34

Customer	*Profitability Index*	*Megan's Time Required*	*Cumulative Amount of Megan's Time Required*

Mulgrew	$39	6	6
Due	$38	5	11
Dupuy	$36	8	19
Audet	$35	4	23
Paulding	$34	6	29
Imm	$34	4	27
Comfort	$32	5	38
Donaghe...	$32	3	41
Boyer	$31	4	45
Ebberts	$31	3	48

Given that Megan should not be asked to work more than 33 hours, the four customers below the line in the above table should be told that their reservations have to be cancelled.

Problem B-4 (continued)

2. The total profit on wedding cakes for the weekend after canceling the four reservations would be:

Mulgrew	$ 234
Due	190
Dupuy	288
Audet	140
Paulding	204
Imm	136
Total	$1,192

Notes:

- Both Megan's time and the cakes would have to be *very* carefully scheduled to make sure that all cakes are completed on time. We have assumed that the 33 hours of Megan's time that are available for cake decorating do not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.
- If the cumulative amount of Megan's time required did not exactly consume the total amount of time available, some adjustment might be required in which reservations are cancelled to ensure that the most profitable plan is selected.

3. To avoid disappointing customers, reservations should probably not be accepted for any particular weekend after 33 hours of Megan's time have been committed for that weekend's cakes. To ensure that only the most profitable cake reservations are accepted, a reservation for any cake with a profitability index of less than $34 should probably not be accepted. This was the cutoff point for the cakes in the first weekend in June. This cutoff may need to be adjusted upward or downward over time—the cakes that were reserved for the first weekend in June may not be representative of the cakes that would be reserved for other weekends. If too many reservations are turned down and Megan's time is not fully utilized, then the cutoff should be adjusted downward. If too few reservations are turned down and Megan's time is once again overbooked or profitable cake orders are turned away, then the cutoff should be adjusted upward.

Problem B-4 (continued)

4. Ms. Chavez should consider changing the way prices are set so that they include a charge for Megan's time. On average, the prices may be the same, but they should be based not only on the size of the cakes, but also on the amount of cake decorating that the customer desires. The charge for Megan's time should be her hourly rate of pay (including any fringe benefits) plus the opportunity cost of at least $34 per hour. Because Megan will not be working more than 33 hours per week, if another cake reservation is accepted, some other cake reservation will have to be cancelled. Ms. Chavez would have to give up at least $34 profit per hour to accept another cake reservation.

5. Making Megan happy involves not asking her to work more than 33 hours per week decorating cakes. Making customers happy involves not canceling their reservations, not raising prices, and providing top quality wedding cakes. Ms. Chavez can accomplish both of these objectives *and* increase her profits by clever management of the constraint—Megan's time. The possibilities include:
   - Ms. Chavez should make sure that none of Megan's time is wasted on unnecessary tasks. For example, Megan should not be asked to cream butter by hand for frostings if a machine could do the job as well with less labor time.
   - Ms. Chavez should make sure that none of Megan's time is wasted on tasks that can be done by other persons. For example, an assistant can be assigned to prepare frosting and to clean up, relieving Megan of those tasks. As long as the cost of the assistant's time is less than $34 per hour, the result will be higher profits and more pleased customers.
   - Ms. Chavez should consider assigning an apprentice to Megan. The apprentice could relieve Megan of some of her workload while learning the skills to eventually expand the company's cake decorating capacity.
   - Ms. Chavez might consider subcontracting some of the less demanding cake decorating to another baker. This would be profitable as long as the charge is less than $34 per hour.

Problem B-5 (45 minutes)

1. The relative profitability of segments should be measured by the profitability index as follows:

$$\text{Profitability index} = \frac{\text{Incremental profit from the segment}}{\text{Amount of the constrained resource used by the segment}}$$

However, the hospital measures profitability using the following ratio:

$$\text{Profitability} = \frac{\text{Segment margin}}{\text{Segment revenue}}$$

The segment margin (i.e., revenue less fully allocated costs) should not be used in the numerator when measuring profitability because it does not represent the incremental profit from the segment. The incremental profit from a segment is its revenue less its *avoidable* costs. Fully allocated costs include avoidable costs *plus* other costs that are not avoidable, but are nevertheless allocated to the segment. These nonavoidable costs are completely irrelevant when considering the profitability of a segment because they would be unaffected even if the segment were eliminated.

Including nonavoidable costs in the numerator of the profitability measure distorts the measure and may result in incorrect rankings of the segments.

2. It is appropriate to use the segment revenue in the denominator of the profitability measure *only if total revenue is the organization's constraint*. In that case, the revenue of the segment would be the amount of the constrained resource used by the segment. Otherwise, segment revenue should not be used as the denominator when measuring the relative profitability of segments.

When would total revenue be the organization's constraint? In truth, it is difficult to imagine situations in which total revenue would be the constraint. One possibility is that the organization's customers have a fixed total budget for spending on the organization's products and services and the organization has excess productive capacity. In that case, total revenue would indeed be the organization's constraint. However, this situation would rarely arise.

Problem B-5 (continued)

Other situations might arise in which total revenue is the organization's constraint, but ordinarily the constraint would not be revenue. Instead, the constraint would be something like a particular production process or a critical input. Consequently, it is almost certainly the case that relative profitability should not be measured using segment revenues in the denominator.

Problem B-6 (60 minutes)

1. There is not enough kiln capacity to satisfy demand for all four products. The total amount of time available is 2,000 hours, but 2,300 hours would be required to satisfy demand as shown below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*	*Total*
Annual demand in pallets (a)...........	120	80	180	70	
Hours required in the drying kiln per pallet (b).......	5	7	4	6	
Total hours required in the drying kiln (a) × (b)............	600	560	720	420	2,300

2. The profitability index should be used to rank the products.

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*

Contribution margin per pallet (a)	$370	$497	$328	$390
Hours required in drying kiln per pallet (b)	5	7	4	6
Profitability index (a) ÷ (b).....................	$74	$71	$82	$65

The most profitable use of the bottleneck operation (the constraint) is the Cinder Block product, followed by the Traditional Brick product and then the Textured Facing and Roman Brick products. Since no fixed costs would be affected by this decision, the optimal plan would be:

Problem B-6 (continued)

Amount of constrained resource available	2,000 hours
Less: Constrained resource required for production of 180 pallets of Cinder Block..................................	720 hours
Remaining constrained resource available	1,280 hours
Less: Constrained resource required for production of 120 pallets of Traditional Brick	600 hours
Remaining constrained resource available	680 hours
Less: Constrained resource required for production of 80 pallets of Textured Facing................................	560 hours
Remaining constrained resource available	120 hours
Less: Constrained resource required for production of 20 pallets of Roman Brick	120 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $151,000:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*an Brick*	*Total*
Contribution margin per pallet (a)	$370	$497	$328	$390	
Optimal production plan (b)	120	80	180	20	
Total contribution margin (a) × (b)	$44,400	$39,760	$59,040	$7,800	$151,000

4. The company should be willing to pay up to $65 per hour to operate the kiln until demand is satisfied for Roman Bricks.

Problem B-6 (continued)

5. The selling price for the new product should at least cover its variable cost and opportunity cost:

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \begin{array}{c}\text{Variable cost of}\\\text{the new product}\end{array} + \left(\begin{array}{c}\text{Opportunity cost}\\\text{per unit of the}\\\text{constrained resource}\end{array} \times \begin{array}{c}\text{Amount of the constrained}\\\text{resource required by a unit}\\\text{of the new product}\end{array}\right)$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$530 + (\$65 \text{ per hour} \times 11 \text{ hours})$$

$$= \$530 + \$715 = \$1{,}245$$

6. Salespersons who are paid a commission of 5% of gross revenues will naturally prefer to sell a customer a pallet of any thing other than cinder blocks since they have the lowest gross revenues. However, given the company's constraint, they are in fact the company's most profitable product. The rankings of the products in terms of their gross sales and profitability indexes are given below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*
Gross revenues per pallet	\$789	\$1,264	\$569	\$836
Ranking based on gross revenues....................	3	1	4	2
Profitability index............	\$74	\$71	\$82	\$65

Ranking based on profitability index	2	3	1	4

To align the salespersons' incentives with the interests of the company, the salespersons should be compensated based on the profitability index of the products sold or on the total contribution margin generated by the sales.

Problem B-7 (30 minutes)

1. The constraint is customer representatives' time and the incremental profit is revenues less cost of drugs sold and customer service costs.

	Willows Pharmacy	*Swedish Hospital Pharmacy*	*Georgetown Clinic Pharmacy*	*Kristen Pharmacy*
Total revenues	$344,880	$1,995,200	$1,414,170	$154,800
Cost of drugs sold	263,340	1,446,520	1,047,660	120,960
Customer service costs	12,240	62,640	39,900	4,500
Incremental profit (a)	$ 69,300	$ 486,040	$ 326,610	$ 29,340
Customer representative time (b)	180 hours	1,160 hours	570 hours	90 hours
Profitability index (a) ÷ (b)	$385 per hour	$419 per hour	$573 per hour	$326 per hour

The Georgetown Clinic Pharmacy is the most profitable of the customers, followed by the Swedish Hospital Pharmacy, the Willows Pharmacy, and lastly Kristen Pharmacy.

2. The company could certainly afford to pay its customer representatives more in order to attract and retain them. The company makes at least $326 in incremental profit per hour of customer representative time after taking into account their current wages and commissions. Another way of putting this is that losing a customer representative who works 40 hours per week for 50 weeks a year costs the company between $652,000 ($326 per hour × 2,000 hours per year) and $1,146,000 ($573 per hour × 2,000 hours per year) per year in lost profits.

Case B-8 (45 minutes)

Prevala's management is not contemplating adding or dropping products; it simply wants to redirect salespersons' efforts toward the more profitable products. Therefore, this is a volume trade-off decision and the appropriate way to measure profitability is with the profitability index defined as follows:

$$\begin{array}{c}\text{Profitability index for}\\ \text{a volume trade-off decision}\end{array} = \frac{\text{Unit contribution margin}}{\begin{array}{c}\text{Amount of the constrained}\\ \text{resource used by one unit}\end{array}}$$

The unit contribution margin is the selling price of a product less sales commissions and the cost of sales, which is a variable cost in this company. The operating expenses are all fixed.

$$\begin{array}{c}\text{Profitability index for}\\ \text{a volume trade-off decision}\end{array} = \frac{\begin{array}{c}\text{Selling price}\\ \text{- Sales commission}\\ \text{- Cost of sales}\end{array}}{\begin{array}{c}\text{Amount of the constrained}\\ \text{resource used by one unit}\end{array}}$$

The case states that management wants "to redirect the effort of salespersons towards the more profitable products." Therefore, the constraint must be the effort of salespersons. Unfortunately, there is no direct measure of the amount of salespersons' effort required to sell a unit of each product. However, all other things equal, if one product has twice the sales commission per unit as another, then we can expect salespersons to exert twice as much effort selling the first product. Effort is likely to be proportional to commissions. Therefore, given the limited amount of available information, the best measure of relative profitability for purposes of redirecting salespersons' efforts would be:

$$\begin{array}{c}\text{Profitability index for}\\ \text{a volume trade-off decision}\end{array} = \frac{\begin{array}{c}\text{Selling price}\\ \text{- Sales commission}\\ \text{- Cost of sales}\end{array}}{\text{Sales commission}}$$

Case B-8 (continued)

Note that this profitability index takes into account the salespersons' natural inclinations to focus their efforts on the products with the highest sales commissions. Of course, it would be an even better idea to change the salespersons' compensation scheme, but this alternative was ruled out in the case. Appendix B

Profitability Analysis

Solutions to Questions

B-1 Absolute profitability measures the impact on an organization's overall profits of adding or dropping a particular segment, such as a product or customer, without making any other changes.

B-2 Relative profitability involves ranking segments, each of which may be absolutely profitable, for purposes of making trade-offs among the segments. Such trade-offs are necessary when a constraint exists. Otherwise, they are not necessary.

B-3 Every business that seeks to maximize profits has a constraint. No business ever has had or ever will have infinite profits. Whatever prevents a business from attaining more profits is its constraint. The constraint might be a production constraint, it might be managerial time or talent, or it might be some internal policy that prevents the firm from progressing, but every profit-seeking organization faces at least one constraint. The same is true for almost all nonprofit organizations, which generally seek more of something—be it more health care, more land preserved from development, or more art.

B-4 The absolute profitability of a segment is measured by the difference between the incremental revenues from the segment and the incremental (avoidable) costs of the segment. So to measure absolute profitability, one would need the incremental revenues and costs of the segment.

B-5 The relative profitability of a segment is measured by the profitability index, which is computed by dividing the incremental profit from the segment by the amount of the constrained resource required by the segment. So to measure relative profitability, one would need the incremental profit from the segment and the amount of the constrained resource required by the segment.

B-6 A volume trade-off decision involves trading off units of one product for another. In such decisions fixed costs are usually irrelevant and the products can be ranked by dividing their unit contribution margins by the amount of the constrained resource required by one unit of the product.

B-7 The selling price of a new product should at least cover its variable costs and opportunity costs. The opportunity costs can be determined by multiplying the opportunity cost per unit of the constrained resource by the amount of the constrained resource required by a unit of the new product. In addition, the selling price should cover any avoidable fixed costs of the product. Exactly how much of the avoidable fixed costs should be covered by each unit is difficult to determine *a priori* because the future unit sales volume of a product is not known with certainty.

Exercise B-1 (30 minutes)

1. This exercise can be solved by first computing the profitability index of each new ride and then ranking the rides based on that profitability index:

	Net Present Value (A)	*Safety Engineer Time Required (B)*	*Profitability Index (A) ÷ (B)*
Ride 1	$741,400	220	$3,370
Ride 2	$382,500	150	$2,550
Ride 3	$850,500	350	$2,430
Ride 4	$450,500	170	$2,650
Ride 5	$620,400	220	$2,820
Ride 6	$1,004,400	310	$3,240
Ride 7	$953,800	380	$2,510
Ride 8	$332,500	190	$1,750
Ride 9	$385,500	150	$2,570
Ride 10	$680,400	270	$2,520

	Profitability Index	*Safety Engineer Time Required*	*Cumulative Amount of Safety Engineer Time Required*
Ride 1	$3,370	220	220
Ride 6	$3,240	310	530
Ride 5	$2,820	220	750

Ride 4	$2,650	170	920
Ride 9	$2,570	150	1,070
Ride 2	$2,550	150	1,220
Ride 10	$2,520	270	1,490
Ride 7	$2,510	380	1,870
Ride 3	$2,430	350	2,220
Ride 8	$1,750	190	2,410

Given the 1,220 hours of safety engineer time available, the six rides above the line in the above table should be built.

Exercise B-1 (continued)

2. The total net present value for the six new rides to be built is computed as follows:

Ride 1	$ 741,400
Ride 6	1,004,400
Ride 5	620,400
Ride 4	450,500
Ride 9	385,500
Ride 2	382,500
Total	$3,584,700

Notes:

(c) Both the safety engineer's time and the individual projects would have to be *very* carefully scheduled to make sure that all projects are completed on time. We have assumed that the 1,220 hours of available safety engineer time does not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.

(d) If the cumulative amount of safety engineer time required did not exactly consume the total amount of time available, some adjustment might be required in which projects are accepted to ensure that the best plan is selected.

Exercise B-2 (30 minutes)

1. There is not enough capacity in the bottleneck operation to satisfy demand for all four products. The total amount of time available in the bottleneck operation is 1,800 hours, but 2,240 hours would be required to satisfy demand as shown below:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Annual demand in units (a)	80	80	70	120	
Hours required in the bottleneck operation per unit (b)	6	8	4	7	
Total hours required in the bottleneck operation (a) × (b)..	480	640	280	840	2,240

2. The profitability index should be used to rank the products.

	Trader	*Trapper*	*Quebec*	*Runner*
Unit contribution margin (a)....	$444	$464	$312	$462
Hours required in the bottleneck operation per unit (b)	6	8	4	7
Profitability index (a) ÷ (b)	$74	$58	$78	$66

The most profitable use of the bottleneck operation (the constraint) is the Quebec model, followed by the Trader model and then the Runner and Trapper models. Because no fixed costs would be affected by this decision, the optimal plan would be:

Exercise B-2 (continued)

Amount of constrained resource available	1,800 hours
Less: Constrained resource required for production of 70 units of the Quebec model	280 hours
Remaining constrained resource available	1,520 hours
Less: Constrained resource required for production of 80 units of the Trader model	480 hours
Remaining constrained resource available	1,040 hours
Less: Constrained resource required for production of 120 units of the Runner model	840 hours
Remaining constrained resource available	200 hours
Less: Constrained resource required for production of 25 units of the Trapper model	200 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $124,400:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Unit contribution margin (a)	$444	$464	$312	$462	
Optimal production plan (b)	80	25	70	120	
Total contribution margin (a) × (b) .	$35,520	$11,600	$21,840	$55,440	$124,400

Exercise B-3 (10 minutes)

The selling price of the new amaretto cappuccino product should at least cover its variable cost and its opportunity cost. The variable cost of the new product is $0.46 and its opportunity cost can be computed by multiplying the opportunity cost of $3.40 per minute of order filling time by the amount of time required to fill an order for the new product:

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \begin{array}{c}\text{Variable cost of}\\ \text{the new product}\end{array} + \left(\begin{array}{c}\text{Opportunity cost}\\ \text{per unit of the}\\ \text{constrained resource}\end{array} \times \begin{array}{c}\text{Amount of the constrained}\\ \text{resource required by a unit}\\ \text{of the new product}\end{array}\right)$$

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \$0.46 + \left(\$3.40\text{ per minute} \times \frac{45\text{ seconds}}{60\text{ seconds per minute}}\right)$$

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \$0.46 + (\$3.40\text{ per minute} \times 0.75\text{ minute})$$

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \$0.46 + \$2.55 = \$3.01$$

Hence, the selling price of the new product should at least cover both its variable cost of $0.46 and its opportunity cost of $2.55, for a total of $3.01.

Problem B-4 (60 minutes)

1. This problem can be solved by first computing the profitability index of each customer and then ranking the customers based on that profitability index:

Customer	*Incremental Profit (A)*	*Megan's Time Required (B)*	*Profitability Index (A) ÷ (B)*
Audet	$140	4	$35
Boyer	$124	4	$31
Comfort	$160	5	$32
Donaghe...	$96	3	$32
Due	$190	5	$38
Dupuy	$288	8	$36
Ebberts	$93	3	$31
Imm	$136	4	$34
Mulgrew	$234	6	$39
Paulding	$204	6	$34

Customer	*Profitability Index*	*Megan's Time Required*	*Cumulative Amount of Megan's Time Required*

Mulgrew	$39	6	6
Due	$38	5	11
Dupuy	$36	8	19
Audet	$35	4	23
Paulding	$34	6	29
Imm	$34	4	27
Comfort	$32	5	38
Donaghe...	$32	3	41
Boyer	$31	4	45
Ebberts	$31	3	48

Given that Megan should not be asked to work more than 33 hours, the four customers below the line in the above table should be told that their reservations have to be cancelled.

Problem B-4 (continued)

2. The total profit on wedding cakes for the weekend after canceling the four reservations would be:

Mulgrew	$ 234
Due	190
Dupuy	288
Audet	140
Paulding	204
Imm	136
Total	$1,192

Notes:

- Both Megan's time and the cakes would have to be *very* carefully scheduled to make sure that all cakes are completed on time. We have assumed that the 33 hours of Megan's time that are available for cake decorating do not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.
- If the cumulative amount of Megan's time required did not exactly consume the total amount of time available, some adjustment might be required in which reservations are cancelled to ensure that the most profitable plan is selected.

3. To avoid disappointing customers, reservations should probably not be accepted for any particular weekend after 33 hours of Megan's time have been committed for that weekend's cakes. To ensure that only the most profitable cake reservations are accepted, a reservation for any cake with a profitability index of less than $34 should probably not be accepted. This was the cutoff point for the cakes in the first weekend in June. This cutoff may need to be adjusted upward or downward over time—the cakes that were reserved for the first weekend in June may not be representative of the cakes that would be reserved for other weekends. If too many reservations are turned down and Megan's time is not fully utilized, then the cutoff should be adjusted downward. If too few reservations are turned down and Megan's time is once again overbooked or profitable cake orders are turned away, then the cutoff should be adjusted upward.

Problem B-4 (continued)

4. Ms. Chavez should consider changing the way prices are set so that they include a charge for Megan's time. On average, the prices may be the same, but they should be based not only on the size of the cakes, but also on the amount of cake decorating that the customer desires. The charge for Megan's time should be her hourly rate of pay (including any fringe benefits) plus the opportunity cost of at least $34 per hour. Because Megan will not be working more than 33 hours per week, if another cake reservation is accepted, some other cake reservation will have to be cancelled. Ms. Chavez would have to give up at least $34 profit per hour to accept another cake reservation.

5. Making Megan happy involves not asking her to work more than 33 hours per week decorating cakes. Making customers happy involves not canceling their reservations, not raising prices, and providing top quality wedding cakes. Ms. Chavez can accomplish both of these objectives *and* increase her profits by clever management of the constraint—Megan's time. The possibilities include:
   - Ms. Chavez should make sure that none of Megan's time is wasted on unnecessary tasks. For example, Megan should not be asked to cream butter by hand for frostings if a machine could do the job as well with less labor time.
   - Ms. Chavez should make sure that none of Megan's time is wasted on tasks that can be done by other persons. For example, an assistant can be assigned to prepare frosting and to clean up, relieving Megan of those tasks. As long as the cost of the assistant's time is less than $34 per hour, the result will be higher profits and more pleased customers.
   - Ms. Chavez should consider assigning an apprentice to Megan. The apprentice could relieve Megan of some of her workload while learning the skills to eventually expand the company's cake decorating capacity.
   - Ms. Chavez might consider subcontracting some of the less demanding cake decorating to another baker. This would be profitable as long as the charge is less than $34 per hour.

Problem B-5 (45 minutes)

1. The relative profitability of segments should be measured by the profitability index as follows:

$$\text{Profitability index} = \frac{\text{Incremental profit from the segment}}{\text{Amount of the constrained resource used by the segment}}$$

However, the hospital measures profitability using the following ratio:

$$\text{Profitability} = \frac{\text{Segment margin}}{\text{Segment revenue}}$$

The segment margin (i.e., revenue less fully allocated costs) should not be used in the numerator when measuring profitability because it does not represent the incremental profit from the segment. The incremental profit from a segment is its revenue less its *avoidable* costs. Fully allocated costs include avoidable costs *plus* other costs that are not avoidable, but are nevertheless allocated to the segment. These nonavoidable costs are completely irrelevant when considering the profitability of a segment because they would be unaffected even if the segment were eliminated.

Including nonavoidable costs in the numerator of the profitability measure distorts the measure and may result in incorrect rankings of the segments.

2. It is appropriate to use the segment revenue in the denominator of the profitability measure *only if total revenue is the organization's constraint*. In that case, the revenue of the segment would be the amount of the constrained resource used by the segment. Otherwise, segment revenue should not be used as the denominator when measuring the relative profitability of segments.

When would total revenue be the organization's constraint? In truth, it is difficult to imagine situations in which total revenue would be the constraint. One possibility is that the organization's customers have a fixed total budget for spending on the organization's products and services and the organization has excess productive capacity. In that case, total revenue would indeed be the organization's constraint. However, this situation would rarely arise.

Problem B-5 (continued)

Other situations might arise in which total revenue is the organization's constraint, but ordinarily the constraint would not be revenue. Instead, the constraint would be something like a particular production process or a critical input. Consequently, it is almost certainly the case that relative profitability should not be measured using segment revenues in the denominator.

Problem B-6 (60 minutes)

1. There is not enough kiln capacity to satisfy demand for all four products. The total amount of time available is 2,000 hours, but 2,300 hours would be required to satisfy demand as shown below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*	*Total*
Annual demand in pallets (a)...........	120	80	180	70	
Hours required in the drying kiln per pallet (b).......	5	7	4	6	
Total hours required in the drying kiln (a) × (b)............	600	560	720	420	2,300

2. The profitability index should be used to rank the products.

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*

Contribution margin per pallet (a)	$370	$497	$328	$390
Hours required in drying kiln per pallet (b)	5	7	4	6
Profitability index (a) ÷ (b).....................	$74	$71	$82	$65

The most profitable use of the bottleneck operation (the constraint) is the Cinder Block product, followed by the Traditional Brick product and then the Textured Facing and Roman Brick products. Since no fixed costs would be affected by this decision, the optimal plan would be:

Problem B-6 (continued)

Amount of constrained resource available	2,000 hours
Less: Constrained resource required for production of 180 pallets of Cinder Block....................................	720 hours
Remaining constrained resource available	1,280 hours
Less: Constrained resource required for production of 120 pallets of Traditional Brick	600 hours
Remaining constrained resource available	680 hours
Less: Constrained resource required for production of 80 pallets of Textured Facing................................	560 hours
Remaining constrained resource available	120 hours
Less: Constrained resource required for production of 20 pallets of Roman Brick	120 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $151,000:

	Traditional Brick	*Textured Facing*	*Cinder Bl oc k*	*an Brick*	*Total*
Contribution margin per pallet (a)	$370	$497	$328	$390	
Optimal production plan (b)	120	80	180	20	
Total contribution margin (a) × (b)	$44,400	$39,760	$59,040	$7,800	$151,000

4. The company should be willing to pay up to $65 per hour to operate the kiln until demand is satisfied for Roman Bricks.

Problem B-6 (continued)

5. The selling price for the new product should at least cover its variable cost and opportunity cost:

$$\begin{matrix}\text{Selling price of}\\ \text{the new product}\end{matrix} \geq \begin{matrix}\text{Variable cost of}\\ \text{the new product}\end{matrix} + \left(\begin{matrix}\text{Opportunity cost}\\ \text{per unit of the}\\ \text{constrained resource}\end{matrix} \times \begin{matrix}\text{Amount of the constrained}\\ \text{resource required by a unit}\\ \text{of the new product}\end{matrix}\right)$$

$$\begin{matrix}\text{Selling price of}\\ \text{the new product}\end{matrix} \geq \$530 + (\$65 \text{ per hour} \times 11 \text{ hours})$$

$$= \$530 + \$715 = \$1{,}245$$

6. Salespersons who are paid a commission of 5% of gross revenues will naturally prefer to sell a customer a pallet of any thing other than cinder blocks since they have the lowest gross revenues. However, given the company's constraint, they are in fact the company's most profitable product. The rankings of the products in terms of their gross sales and profitability indexes are given below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*
Gross revenues per pallet	$789	$1,264	$569	$836
Ranking based on gross revenues....................	3	1	4	2
Profitability index............	$74	$71	$82	$65

Ranking based on profitability index	2	3	1	4

To align the salespersons' incentives with the interests of the company, the salespersons should be compensated based on the profitability index of the products sold or on the total contribution margin generated by the sales.

Problem B-7 (30 minutes)

1. The constraint is customer representatives' time and the incremental profit is revenues less cost of drugs sold and customer service costs.

	Willows Pharmacy	*Swedish Hospital Pharmacy*	*Georgetown Clinic Pharmacy*	*Kristen Pharmacy*
Total revenues	$344,880	$1,995,200	$1,414,170	$154,800
Cost of drugs sold	263,340	1,446,520	1,047,660	120,960
Customer service costs	12,240	62,640	39,900	4,500
Incremental profit (a)	$ 69,300	$ 486,040	$ 326,610	$ 29,340
Customer representative time (b)	180 hours	1,160 hours	570 hours	90 hours
Profitability index (a) ÷ (b)	$385 per hour	$419 per hour	$573 per hour	$326 per hour

The Georgetown Clinic Pharmacy is the most profitable of the customers, followed by the Swedish Hospital Pharmacy, the Willows Pharmacy, and lastly Kristen Pharmacy.

2. The company could certainly afford to pay its customer representatives more in order to attract and retain them. The company makes at least $326 in incremental profit per hour of customer representative time after taking into account their current wages and commissions. Another way of putting this is that losing a customer representative who works 40 hours per week for 50 weeks a year costs the company between $652,000 ($326 per hour × 2,000 hours per year) and $1,146,000 ($573 per hour × 2,000 hours per year) per year in lost profits.

Case B-8 (45 minutes)

Prevala's management is not contemplating adding or dropping products; it simply wants to redirect salespersons' efforts toward the more profitable products. Therefore, this is a volume trade-off decision and the appropriate way to measure profitability is with the profitability index defined as follows:

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Unit contribution margin}}{\text{Amount of the constrained resource used by one unit}}$$

The unit contribution margin is the selling price of a product less sales commissions and the cost of sales, which is a variable cost in this company. The operating expenses are all fixed.

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Selling price} - \text{Sales commission} - \text{Cost of sales}}{\text{Amount of the constrained resource used by one unit}}$$

The case states that management wants "to redirect the effort of salespersons towards the more profitable products." Therefore, the constraint must be the effort of salespersons. Unfortunately, there is no direct measure of the amount of salespersons' effort required to sell a unit of each product. However, all other things equal, if one product has twice the sales commission per unit as another, then we can expect salespersons to exert twice as much effort selling the first product. Effort is likely to be proportional to commissions. Therefore, given the limited amount of available information, the best measure of relative profitability for purposes of redirecting salespersons' efforts would be:

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Selling price} - \text{Sales commission} - \text{Cost of sales}}{\text{Sales commission}}$$

Case B-8 (continued)

Note that this profitability index takes into account the salespersons' natural inclinations to focus their efforts on the products with the highest sales commissions. Of course, it would be an even better idea to change the salespersons' compensation scheme, but this alternative was ruled out in the case.

Appendix B
Profitability Analysis

Solutions to Questions

B-1 Absolute profitability measures the impact on an organization's overall profits of adding or dropping a particular segment, such as a product or customer, without making any other changes.

B-2 Relative profitability involves ranking segments, each of which may be absolutely profitable, for purposes of making trade-offs among the segments. Such trade-offs are necessary when a constraint exists. Otherwise, they are not necessary.

B-3 Every business that seeks to maximize profits has a constraint. No business ever has had or ever will have infinite profits. Whatever prevents a business from attaining more profits is its constraint. The constraint might be a production constraint, it might be managerial time or talent, or it might be some internal policy that prevents the firm from progressing, but every profit-seeking organization faces at least one constraint. The same is true for almost all nonprofit organizations, which generally seek more of something—be it more health care, more land preserved from development, or more art.

B-4 The absolute profitability of a segment is measured by the difference between the incremental revenues from the segment and the incremental (avoidable) costs of the segment. So to measure absolute profitability, one would need the incremental revenues and costs of the segment.

B-5 The relative profitability of a segment is measured by the profitability index, which is computed by dividing the incremental profit from the segment by the amount of the constrained resource required by the segment. So to measure relative profitability, one would need the incremental profit from the segment and the amount of the constrained resource required by the segment.

B-6 A volume trade-off decision involves trading off units of one product for another. In such decisions fixed costs are usually irrelevant and the products can be ranked by dividing their unit contribution margins by the amount of the constrained resource required by one unit of the product.

B-7 The selling price of a new product should at least cover its variable costs and opportunity costs. The opportunity costs can be determined by multiplying the opportunity cost per unit of the constrained resource by the amount of the constrained resource required by a unit of the new product. In addition, the selling price should cover any avoidable fixed costs of the product. Exactly how much of the avoidable fixed costs should be covered by each unit is difficult to determine *a priori* because the future unit sales volume of a product is not known with certainty.

Exercise B-1 (30 minutes)

1. This exercise can be solved by first computing the profitability index of each new ride and then ranking the rides based on that profitability index:

	Net Present Value (A)	*Safety Engineer Time Required (B)*	*Profitability Index (A) ÷ (B)*
Ride 1	$741,400	220	$3,370
Ride 2	$382,500	150	$2,550
Ride 3	$850,500	350	$2,430
Ride 4	$450,500	170	$2,650
Ride 5	$620,400	220	$2,820
Ride 6	$1,004,400	310	$3,240
Ride 7	$953,800	380	$2,510
Ride 8	$332,500	190	$1,750
Ride 9	$385,500	150	$2,570
Ride 10	$680,400	270	$2,520

	Profitability Index	*Safety Engineer Time Required*	*Cumulative Amount of Safety Engineer Time Required*
Ride 1	$3,370	220	220
Ride 6	$3,240	310	530
Ride 5	$2,820	220	750

Ride 4	$2,650	170	920
Ride 9	$2,570	150	1,070
Ride 2	$2,550	150	1,220
Ride 10	$2,520	270	1,490
Ride 7	$2,510	380	1,870
Ride 3	$2,430	350	2,220
Ride 8	$1,750	190	2,410

Given the 1,220 hours of safety engineer time available, the six rides above the line in the above table should be built.

Exercise B-1 (continued)

2. The total net present value for the six new rides to be built is computed as follows:

Ride 1	$ 741,400
Ride 6	1,004,400
Ride 5	620,400
Ride 4	450,500
Ride 9	385,500
Ride 2	382,500
Total	$3,584,700

Notes:

(e) Both the safety engineer's time and the individual projects would have to be *very* carefully scheduled to make sure that all projects are completed on time. We have assumed that the 1,220 hours of available safety engineer time does not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.

(f) If the cumulative amount of safety engineer time required did not exactly consume the total amount of time available, some adjustment might be required in which projects are accepted to ensure that the best plan is selected.

Exercise B-2 (30 minutes)

1. There is not enough capacity in the bottleneck operation to satisfy demand for all four products. The total amount of time available in the bottleneck operation is 1,800 hours, but 2,240 hours would be required to satisfy demand as shown below:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Annual demand in units (a)	80	80	70	120	
Hours required in the bottleneck operation per unit (b)	6	8	4	7	
Total hours required in the bottleneck operation (a) × (b)..	480	640	280	840	2,240

2. The profitability index should be used to rank the products.

	Trader	*Trapper*	*Quebec*	*Runner*
Unit contribution margin (a)....	$444	$464	$312	$462
Hours required in the bottleneck operation per unit (b)	6	8	4	7
Profitability index (a) ÷ (b)	$74	$58	$78	$66

The most profitable use of the bottleneck operation (the constraint) is the Quebec model, followed by the Trader model and then the Runner and Trapper models. Because no fixed costs would be affected by this decision, the optimal plan would be:

Exercise B-2 (continued)

Amount of constrained resource available	1,800 hours
Less: Constrained resource required for production of 70 units of the Quebec model	280 hours
Remaining constrained resource available	1,520 hours
Less: Constrained resource required for production of 80 units of the Trader model	480 hours
Remaining constrained resource available	1,040 hours
Less: Constrained resource required for production of 120 units of the Runner model	840 hours
Remaining constrained resource available	200 hours
Less: Constrained resource required for production of 25 units of the Trapper model	200 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $124,400:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Unit contribution margin (a)	$444	$464	$312	$462	
Optimal production plan (b)	80	25	70	120	
Total contribution margin (a) × (b) .	$35,520	$11,600	$21,840	$55,440	$124,400

Exercise B-3 (10 minutes)

The selling price of the new amaretto cappuccino product should at least cover its variable cost and its opportunity cost. The variable cost of the new product is $0.46 and its opportunity cost can be computed by multiplying the opportunity cost of $3.40 per minute of order filling time by the amount of time required to fill an order for the new product:

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \begin{array}{c}\text{Variable cost of}\\\text{the new product}\end{array} + \left(\begin{array}{c}\text{Opportunity cost}\\\text{per unit of the}\\\text{constrained resource}\end{array} \times \begin{array}{c}\text{Amount of the constrained}\\\text{resource required by a unit}\\\text{of the new product}\end{array}\right)$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$0.46 + \left(\$3.40\text{ per minute} \times \frac{45\text{ seconds}}{60\text{ seconds per minute}}\right)$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$0.46 + (\$3.40\text{ per minute} \times 0.75\text{ minute})$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$0.46 + \$2.55 = \$3.01$$

Hence, the selling price of the new product should at least cover both its variable cost of $0.46 and its opportunity cost of $2.55, for a total of $3.01.

Problem B-4 (60 minutes)

1. This problem can be solved by first computing the profitability index of each customer and then ranking the customers based on that profitability index:

Customer	Incremental Profit (A)	Megan's Time Required (B)	Profitability Index (A) ÷ (B)
Audet	$140	4	$35
Boyer	$124	4	$31
Comfort	$160	5	$32
Donaghe...	$96	3	$32
Due	$190	5	$38
Dupuy	$288	8	$36
Ebberts	$93	3	$31
Imm	$136	4	$34
Mulgrew	$234	6	$39
Paulding	$204	6	$34

Customer	Profitability Index	Megan's Time Required	Cumulative Amount of Megan's Time Required

Mulgrew	$39	6	6
Due	$38	5	11
Dupuy	$36	8	19
Audet	$35	4	23
Paulding	$34	6	29
Imm	$34	4	27
Comfort	$32	5	38
Donaghe...	$32	3	41
Boyer	$31	4	45
Ebberts	$31	3	48

Given that Megan should not be asked to work more than 33 hours, the four customers below the line in the above table should be told that their reservations have to be cancelled.

Problem B-4 (continued)

2. The total profit on wedding cakes for the weekend after canceling the four reservations would be:

Mulgrew	$ 234
Due	190
Dupuy	288
Audet	140
Paulding	204
Imm	136
Total	$1,192

Notes:

- Both Megan's time and the cakes would have to be *very* carefully scheduled to make sure that all cakes are completed on time. We have assumed that the 33 hours of Megan's time that are available for cake decorating do not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.
- If the cumulative amount of Megan's time required did not exactly consume the total amount of time available, some adjustment might be required in which reservations are cancelled to ensure that the most profitable plan is selected.

3. To avoid disappointing customers, reservations should probably not be accepted for any particular weekend after 33 hours of Megan's time have been committed for that weekend's cakes. To ensure that only the most profitable cake reservations are accepted, a reservation for any cake with a profitability index of less than $34 should probably not be accepted. This was the cutoff point for the cakes in the first weekend in June. This cutoff may need to be adjusted upward or downward over time—the cakes that were reserved for the first weekend in June may not be representative of the cakes that would be reserved for other weekends. If too many reservations are turned down and Megan's time is not fully utilized, then the cutoff should be adjusted downward. If too few reservations are turned down and Megan's time is once again overbooked or profitable cake orders are turned away, then the cutoff should be adjusted upward.

Problem B-4 (continued)

4. Ms. Chavez should consider changing the way prices are set so that they include a charge for Megan's time. On average, the prices may be the same, but they should be based not only on the size of the cakes, but also on the amount of cake decorating that the customer desires. The charge for Megan's time should be her hourly rate of pay (including any fringe benefits) plus the opportunity cost of at least $34 per hour. Because Megan will not be working more than 33 hours per week, if another cake reservation is accepted, some other cake reservation will have to be cancelled. Ms. Chavez would have to give up at least $34 profit per hour to accept another cake reservation.

5. Making Megan happy involves not asking her to work more than 33 hours per week decorating cakes. Making customers happy involves not canceling their reservations, not raising prices, and providing top quality wedding cakes. Ms. Chavez can accomplish both of these objectives *and* increase her profits by clever management of the constraint—Megan's time. The possibilities include:
   - Ms. Chavez should make sure that none of Megan's time is wasted on unnecessary tasks. For example, Megan should not be asked to cream butter by hand for frostings if a machine could do the job as well with less labor time.
   - Ms. Chavez should make sure that none of Megan's time is wasted on tasks that can be done by other persons. For example, an assistant can be assigned to prepare frosting and to clean up, relieving Megan of those tasks. As long as the cost of the assistant's time is less than $34 per hour, the result will be higher profits and more pleased customers.
   - Ms. Chavez should consider assigning an apprentice to Megan. The apprentice could relieve Megan of some of her workload while learning the skills to eventually expand the company's cake decorating capacity.
   - Ms. Chavez might consider subcontracting some of the less demanding cake decorating to another baker. This would be profitable as long as the charge is less than $34 per hour.

Problem B-5 (45 minutes)

1. The relative profitability of segments should be measured by the profitability index as follows:

$$\text{Profitability index} = \frac{\text{Incremental profit from the segment}}{\text{Amount of the constrained resource used by the segment}}$$

However, the hospital measures profitability using the following ratio:

$$\text{Profitability} = \frac{\text{Segment margin}}{\text{Segment revenue}}$$

The segment margin (i.e., revenue less fully allocated costs) should not be used in the numerator when measuring profitability because it does not represent the incremental profit from the segment. The incremental profit from a segment is its revenue less its *avoidable* costs. Fully allocated costs include avoidable costs *plus* other costs that are not avoidable, but are nevertheless allocated to the segment. These nonavoidable costs are completely irrelevant when considering the profitability of a segment because they would be unaffected even if the segment were eliminated.

Including nonavoidable costs in the numerator of the profitability measure distorts the measure and may result in incorrect rankings of the segments.

2. It is appropriate to use the segment revenue in the denominator of the profitability measure *only if total revenue is the organization's constraint*. In that case, the revenue of the segment would be the amount of the constrained resource used by the segment. Otherwise, segment revenue should not be used as the denominator when measuring the relative profitability of segments.

When would total revenue be the organization's constraint? In truth, it is difficult to imagine situations in which total revenue would be the constraint. One possibility is that the organization's customers have a fixed total budget for spending on the organization's products and services and the organization has excess productive capacity. In that case, total revenue would indeed be the organization's constraint. However, this situation would rarely arise.

Problem B-5 (continued)

Other situations might arise in which total revenue is the organization's constraint, but ordinarily the constraint would not be revenue. Instead, the constraint would be something like a particular production process or a critical input. Consequently, it is almost certainly the case that relative profitability should not be measured using segment revenues in the denominator.

Problem B-6 (60 minutes)

1. There is not enough kiln capacity to satisfy demand for all four products. The total amount of time available is 2,000 hours, but 2,300 hours would be required to satisfy demand as shown below:

	Traditional Brick	Textured Facing	Cinder Block	Roman Brick	Total
Annual demand in pallets (a)	120	80	180	70	
Hours required in the drying kiln per pallet (b)	5	7	4	6	
Total hours required in the drying kiln (a) × (b)	600	560	720	420	2,300

2. The profitability index should be used to rank the products.

	Traditional Brick	Textured Facing	Cinder Block	Roman Brick

Contribution margin per pallet (a)	$370	$497	$328	$390
Hours required in drying kiln per pallet (b)	5	7	4	6
Profitability index (a) ÷ (b).....................	$74	$71	$82	$65

The most profitable use of the bottleneck operation (the constraint) is the Cinder Block product, followed by the Traditional Brick product and then the Textured Facing and Roman Brick products. Since no fixed costs would be affected by this decision, the optimal plan would be:

Problem B-6 (continued)

Amount of constrained resource available	2,000 hours
Less: Constrained resource required for production of 180 pallets of Cinder Block................................	720 hours
Remaining constrained resource available	1,280 hours
Less: Constrained resource required for production of 120 pallets of Traditional Brick	600 hours
Remaining constrained resource available	680 hours
Less: Constrained resource required for production of 80 pallets of Textured Facing...............................	560 hours
Remaining constrained resource available	120 hours
Less: Constrained resource required for production of 20 pallets of Roman Brick	120 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $151,000:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*an Brick*	*Total*
Contribution margin per pallet (a)	$370	$497	$328	$390	
Optimal production plan (b)	120	80	180	20	
Total contribution margin (a) × (b)	$44,400	$39,760	$59,040	$7,800	$151,000

4. The company should be willing to pay up to $65 per hour to operate the kiln until demand is satisfied for Roman Bricks.

Problem B-6 (continued)

5. The selling price for the new product should at least cover its variable cost and opportunity cost:

$$\text{Selling price of the new product} \geq \text{Variable cost of the new product} + \left(\text{Opportunity cost per unit of the constrained resource} \times \text{Amount of the constrained resource required by a unit of the new product}\right)$$

$$\text{Selling price of the new product} \geq \$530 + (\$65 \text{ per hour} \times 11 \text{ hours})$$

$$= \$530 + \$715 = \$1,245$$

6. Salespersons who are paid a commission of 5% of gross revenues will naturally prefer to sell a customer a pallet of any thing other than cinder blocks since they have the lowest gross revenues. However, given the company's constraint, they are in fact the company's most profitable product. The rankings of the products in terms of their gross sales and profitability indexes are given below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*
Gross revenues per pallet	$789	$1,264	$569	$836
Ranking based on gross revenues....................	3	1	4	2
Profitability index............	$74	$71	$82	$65

Ranking based on profitability index	2	3	1	4

To align the salespersons' incentives with the interests of the company, the salespersons should be compensated based on the profitability index of the products sold or on the total contribution margin generated by the sales.

Problem B-7 (30 minutes)

1. The constraint is customer representatives' time and the incremental profit is revenues less cost of drugs sold and customer service costs.

	Willows Pharmacy	*Swedish Hospital Pharmacy*	*Georgetown Clinic Pharmacy*	*Kristen Pharmacy*
Total revenues	$344,880	$1,995,200	$1,414,170	$154,800
Cost of drugs sold	263,340	1,446,520	1,047,660	120,960
Customer service costs	12,240	62,640	39,900	4,500
Incremental profit (a)	$ 69,300	$ 486,040	$ 326,610	$ 29,340
Customer representative time (b)	180 hours	1,160 hours	570 hours	90 hours
Profitability index (a) ÷ (b)	$385 per hour	$419 per hour	$573 per hour	$326 per hour

The Georgetown Clinic Pharmacy is the most profitable of the customers, followed by the Swedish Hospital Pharmacy, the Willows Pharmacy, and lastly Kristen Pharmacy.

2. The company could certainly afford to pay its customer representatives more in order to attract and retain them. The company makes at least $326 in incremental profit per hour of customer representative time after taking into account their current wages and commissions. Another way of putting this is that losing a customer representative who works 40 hours per week for 50 weeks a year costs the company between $652,000 ($326 per hour × 2,000 hours per year) and $1,146,000 ($573 per hour × 2,000 hours per year) per year in lost profits.

Case B-8 (45 minutes)

Prevala's management is not contemplating adding or dropping products; it simply wants to redirect salespersons' efforts toward the more profitable products. Therefore, this is a volume trade-off decision and the appropriate way to measure profitability is with the profitability index defined as follows:

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Unit contribution margin}}{\text{Amount of the constrained resource used by one unit}}$$

The unit contribution margin is the selling price of a product less sales commissions and the cost of sales, which is a variable cost in this company. The operating expenses are all fixed.

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Selling price} - \text{Sales commission} - \text{Cost of sales}}{\text{Amount of the constrained resource used by one unit}}$$

The case states that management wants "to redirect the effort of salespersons towards the more profitable products." Therefore, the constraint must be the effort of salespersons. Unfortunately, there is no direct measure of the amount of salespersons' effort required to sell a unit of each product. However, all other things equal, if one product has twice the sales commission per unit as another, then we can expect salespersons to exert twice as much effort selling the first product. Effort is likely to be proportional to commissions. Therefore, given the limited amount of available information, the best measure of relative profitability for purposes of redirecting salespersons' efforts would be:

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Selling price} - \text{Sales commission} - \text{Cost of sales}}{\text{Sales commission}}$$

Case B-8 (continued)

Note that this profitability index takes into account the salespersons' natural inclinations to focus their efforts on the products with the highest sales commissions. Of course, it would be an even better idea to change the salespersons' compensation scheme, but this alternative was ruled out in the case.

Appendix B
Profitability Analysis

Solutions to Questions

B-1 Absolute profitability measures the impact on an organization's overall profits of adding or dropping a particular segment, such as a product or customer, without making any other changes.

B-2 Relative profitability involves ranking segments, each of which may be absolutely profitable, for purposes of making trade-offs among the segments. Such trade-offs are necessary when a constraint exists. Otherwise, they are not necessary.

B-3 Every business that seeks to maximize profits has a constraint. No business ever has had or ever will have infinite profits. Whatever prevents a business from attaining more profits is its constraint. The constraint might be a production constraint, it might be managerial time or talent, or it might be some internal policy that prevents the firm from progressing, but every profit-seeking organization faces at least one constraint. The same is true for almost all nonprofit organizations, which generally seek more of something—be it more health care, more land preserved from development, or more art.

B-4 The absolute profitability of a segment is measured by the difference between the incremental revenues from the segment and the incremental (avoidable) costs of the segment. So to measure absolute profitability, one would need the incremental revenues and costs of the segment.

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B-5 The relative profitability of a segment is measured by the profitability index, which is computed by dividing the incremental profit from the segment by the amount of the constrained resource required by the segment. So to measure relative profitability, one would need the incremental profit from the segment and the amount of the constrained resource required by the segment.

B-6 A volume trade-off decision involves trading off units of one product for another. In such decisions fixed costs are usually irrelevant and the products can be ranked by dividing their unit contribution margins by the amount of the constrained resource required by one unit of the product.

B-7 The selling price of a new product should at least cover its variable costs and opportunity costs. The opportunity costs can be determined by multiplying the opportunity cost per unit of the constrained resource by the amount of the constrained resource required by a unit of the new product. In addition, the selling price should cover any avoidable fixed costs of the product. Exactly how much of the avoidable fixed costs should be covered by each unit is difficult to determine *a priori* because the future unit sales volume of a product is not known with certainty.

Exercise B-1 (30 minutes)

1. This exercise can be solved by first computing the profitability index of each new ride and then ranking the rides based on that profitability index:

	Net Present Value (A)	*Safety Engineer Time Required (B)*	*Profitability Index (A) ÷ (B)*
Ride 1	$741,400	220	$3,370
Ride 2	$382,500	150	$2,550
Ride 3	$850,500	350	$2,430
Ride 4	$450,500	170	$2,650
Ride 5	$620,400	220	$2,820
Ride 6	$1,004,400	310	$3,240
Ride 7	$953,800	380	$2,510
Ride 8	$332,500	190	$1,750
Ride 9	$385,500	150	$2,570
Ride 10	$680,400	270	$2,520

	Profitability Index	*Safety Engineer Time Required*	*Cumulative Amount of Safety Engineer Time Required*
Ride 1	$3,370	220	220
Ride 6	$3,240	310	530
Ride 5	$2,820	220	750

Ride 4	$2,650	170	920
Ride 9	$2,570	150	1,070
Ride 2	$2,550	150	1,220
Ride 10	$2,520	270	1,490
Ride 7	$2,510	380	1,870
Ride 3	$2,430	350	2,220
Ride 8	$1,750	190	2,410

Given the 1,220 hours of safety engineer time available, the six rides above the line in the above table should be built.

Exercise B-1 (continued)

2. The total net present value for the six new rides to be built is computed as follows:

Ride 1	$ 741,400
Ride 6	1,004,400
Ride 5	620,400
Ride 4	450,500
Ride 9	385,500
Ride 2	382,500
Total	$3,584,700

Notes:

(g) Both the safety engineer's time and the individual projects would have to be *very* carefully scheduled to make sure that all projects are completed on time. We have assumed that the 1,220 hours of available safety engineer time does not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.

(h) If the cumulative amount of safety engineer time required did not exactly consume the total amount of time available, some adjustment might be required in which projects are accepted to ensure that the best plan is selected.

Exercise B-2 (30 minutes)

1. There is not enough capacity in the bottleneck operation to satisfy demand for all four products. The total amount of time available in the bottleneck operation is 1,800 hours, but 2,240 hours would be required to satisfy demand as shown below:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Annual demand in units (a)	80	80	70	120	
Hours required in the bottleneck operation per unit (b)	6	8	4	7	
Total hours required in the bottleneck operation (a) × (b)..	480	640	280	840	2,240

2. The profitability index should be used to rank the products.

	Trader	*Trapper*	*Quebec*	*Runner*
Unit contribution margin (a)....	$444	$464	$312	$462
Hours required in the bottleneck operation per unit (b)	6	8	4	7
Profitability index (a) ÷ (b)	$74	$58	$78	$66

The most profitable use of the bottleneck operation (the constraint) is the Quebec model, followed by the Trader model and then the Runner and Trapper models. Because no fixed costs would be affected by this decision, the optimal plan would be:

Exercise B-2 (continued)

Amount of constrained resource available	1,800 hours
Less: Constrained resource required for production of 70 units of the Quebec model	280 hours
Remaining constrained resource available	1,520 hours
Less: Constrained resource required for production of 80 units of the Trader model	480 hours
Remaining constrained resource available	1,040 hours
Less: Constrained resource required for production of 120 units of the Runner model	840 hours
Remaining constrained resource available	200 hours
Less: Constrained resource required for production of 25 units of the Trapper model	200 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $124,400:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Unit contribution margin (a)	$444	$464	$312	$462	
Optimal production plan (b)	80	25	70	120	
Total contribution margin (a) × (b) .	$35,520	$11,600	$21,840	$55,440	$124,400

Exercise B-3 (10 minutes)

The selling price of the new amaretto cappuccino product should at least cover its variable cost and its opportunity cost. The variable cost of the new product is $0.46 and its opportunity cost can be computed by multiplying the opportunity cost of $3.40 per minute of order filling time by the amount of time required to fill an order for the new product:

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \begin{array}{c}\text{Variable cost of}\\ \text{the new product}\end{array} + \left(\begin{array}{c}\text{Opportunity cost}\\ \text{per unit of the}\\ \text{constrained resource}\end{array} \times \begin{array}{c}\text{Amount of the constrained}\\ \text{resource required by a unit}\\ \text{of the new product}\end{array}\right)$$

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \$0.46 + \left(\$3.40 \text{ per minute} \times \frac{45 \text{ seconds}}{60 \text{ seconds per minute}}\right)$$

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \$0.46 + (\$3.40 \text{ per minute} \times 0.75 \text{ minute})$$

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \$0.46 + \$2.55 = \$3.01$$

Hence, the selling price of the new product should at least cover both its variable cost of $0.46 and its opportunity cost of $2.55, for a total of $3.01.

Problem B-4 (60 minutes)

1. This problem can be solved by first computing the profitability index of each customer and then ranking the customers based on that profitability index:

Customer	*Incremental Profit (A)*	*Megan's Time Required (B)*	*Profitability Index (A) ÷ (B)*
Audet	$140	4	$35
Boyer	$124	4	$31
Comfort	$160	5	$32
Donaghe...	$96	3	$32
Due	$190	5	$38
Dupuy	$288	8	$36
Ebberts	$93	3	$31
Imm	$136	4	$34
Mulgrew	$234	6	$39
Paulding	$204	6	$34

Customer	*Profitability Index*	*Megan's Time Required*	*Cumulative Amount of Megan's Time Required*

Mulgrew	$39	6	6
Due	$38	5	11
Dupuy	$36	8	19
Audet	$35	4	23
Paulding	$34	6	29
Imm	$34	4	27
Comfort	$32	5	38
Donaghe...	$32	3	41
Boyer	$31	4	45
Ebberts	$31	3	48

Given that Megan should not be asked to work more than 33 hours, the four customers below the line in the above table should be told that their reservations have to be cancelled.

Problem B-4 (continued)

2. The total profit on wedding cakes for the weekend after canceling the four reservations would be:

Mulgrew	$ 234
Due	190
Dupuy	288
Audet	140
Paulding	204
Imm	136
Total	$1,192

Notes:

- Both Megan's time and the cakes would have to be *very* carefully scheduled to make sure that all cakes are completed on time. We have assumed that the 33 hours of Megan's time that are available for cake decorating do not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.
- If the cumulative amount of Megan's time required did not exactly consume the total amount of time available, some adjustment might be required in which reservations are cancelled to ensure that the most profitable plan is selected.

3. To avoid disappointing customers, reservations should probably not be accepted for any particular weekend after 33 hours of Megan's time have been committed for that weekend's cakes. To ensure that only the most profitable cake reservations are accepted, a reservation for any cake with a profitability index of less than $34 should probably not be accepted. This was the cutoff point for the cakes in the first weekend in June. This cutoff may need to be adjusted upward or downward over time—the cakes that were reserved for the first weekend in June may not be representative of the cakes that would be reserved for other weekends. If too many reservations are turned down and Megan's time is not fully utilized, then the cutoff should be adjusted downward. If too few reservations are turned down and Megan's time is once again overbooked or profitable cake orders are turned away, then the cutoff should be adjusted upward.

Problem B-4 (continued)

4. Ms. Chavez should consider changing the way prices are set so that they include a charge for Megan's time. On average, the prices may be the same, but they should be based not only on the size of the cakes, but also on the amount of cake decorating that the customer desires. The charge for Megan's time should be her hourly rate of pay (including any fringe benefits) plus the opportunity cost of at least $34 per hour. Because Megan will not be working more than 33 hours per week, if another cake reservation is accepted, some other cake reservation will have to be cancelled. Ms. Chavez would have to give up at least $34 profit per hour to accept another cake reservation.

5. Making Megan happy involves not asking her to work more than 33 hours per week decorating cakes. Making customers happy involves not canceling their reservations, not raising prices, and providing top quality wedding cakes. Ms. Chavez can accomplish both of these objectives *and* increase her profits by clever management of the constraint—Megan's time. The possibilities include:
   - Ms. Chavez should make sure that none of Megan's time is wasted on unnecessary tasks. For example, Megan should not be asked to cream butter by hand for frostings if a machine could do the job as well with less labor time.
   - Ms. Chavez should make sure that none of Megan's time is wasted on tasks that can be done by other persons. For example, an assistant can be assigned to prepare frosting and to clean up, relieving Megan of those tasks. As long as the cost of the assistant's time is less than $34 per hour, the result will be higher profits and more pleased customers.
   - Ms. Chavez should consider assigning an apprentice to Megan. The apprentice could relieve Megan of some of her workload while learning the skills to eventually expand the company's cake decorating capacity.
   - Ms. Chavez might consider subcontracting some of the less demanding cake decorating to another baker. This would be profitable as long as the charge is less than $34 per hour.

Problem B-5 (45 minutes)

1. The relative profitability of segments should be measured by the profitability index as follows:

$$\text{Profitability index}=\frac{\text{Incremental profit from the segment}}{\text{Amount of the constrained resource used by the segment}}$$

However, the hospital measures profitability using the following ratio:

$$\text{Profitability}=\frac{\text{Segment margin}}{\text{Segment revenue}}$$

The segment margin (i.e., revenue less fully allocated costs) should not be used in the numerator when measuring profitability because it does not represent the incremental profit from the segment. The incremental profit from a segment is its revenue less its *avoidable* costs. Fully allocated costs include avoidable costs *plus* other costs that are not avoidable, but are nevertheless allocated to the segment. These nonavoidable costs are completely irrelevant when considering the profitability of a segment because they would be unaffected even if the segment were eliminated.

Including nonavoidable costs in the numerator of the profitability measure distorts the measure and may result in incorrect rankings of the segments.

2. It is appropriate to use the segment revenue in the denominator of the profitability measure *only if total revenue is the organization's constraint*. In that case, the revenue of the segment would be the amount of the constrained resource used by the segment. Otherwise, segment revenue should not be used as the denominator when measuring the relative profitability of segments.

When would total revenue be the organization's constraint? In truth, it is difficult to imagine situations in which total revenue would be the constraint. One possibility is that the organization's customers have a fixed total budget for spending on the organization's products and services and the organization has excess productive capacity. In that case, total revenue would indeed be the organization's constraint. However, this situation would rarely arise.

Problem B-5 (continued)

Other situations might arise in which total revenue is the organization's constraint, but ordinarily the constraint would not be revenue. Instead, the constraint would be something like a particular production process or a critical input. Consequently, it is almost certainly the case that relative profitability should not be measured using segment revenues in the denominator.

Problem B-6 (60 minutes)

1. There is not enough kiln capacity to satisfy demand for all four products. The total amount of time available is 2,000 hours, but 2,300 hours would be required to satisfy demand as shown below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*	*Total*
Annual demand in pallets (a)...........	120	80	180	70	
Hours required in the drying kiln per pallet (b).......	5	7	4	6	
Total hours required in the drying kiln (a) × (b)............	600	560	720	420	2,300

2. The profitability index should be used to rank the products.

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*

Contribution margin per pallet (a)	$370	$497	$328	$390
Hours required in drying kiln per pallet (b)	5	7	4	6
Profitability index (a) ÷ (b).....................	$74	$71	$82	$65

The most profitable use of the bottleneck operation (the constraint) is the Cinder Block product, followed by the Traditional Brick product and then the Textured Facing and Roman Brick products. Since no fixed costs would be affected by this decision, the optimal plan would be:

Problem B-6 (continued)

Amount of constrained resource available	2,000 hours
Less: Constrained resource required for production of 180 pallets of Cinder Block	720 hours
Remaining constrained resource available	1,280 hours
Less: Constrained resource required for production of 120 pallets of Traditional Brick	600 hours
Remaining constrained resource available	680 hours
Less: Constrained resource required for production of 80 pallets of Textured Facing	560 hours
Remaining constrained resource available	120 hours
Less: Constrained resource required for production of 20 pallets of Roman Brick	120 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $151,000:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*an Brick*	*Total*
Contribution margin per pallet (a)	$370	$497	$328	$390	
Optimal production plan (b)	120	80	180	20	
Total contribution margin (a) × (b)	$44,400	$39,760	$59,040	$7,800	$151,000

4. The company should be willing to pay up to $65 per hour to operate the kiln until demand is satisfied for Roman Bricks.

Problem B-6 (continued)

5. The selling price for the new product should at least cover its variable cost and opportunity cost:

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \begin{array}{c}\text{Variable cost of}\\ \text{the new product}\end{array} + \left(\begin{array}{c}\text{Opportunity cost}\\ \text{per unit of the}\\ \text{constrained resource}\end{array} \times \begin{array}{c}\text{Amount of the constrained}\\ \text{resource required by a unit}\\ \text{of the new product}\end{array}\right)$$

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \$530 + (\$65 \text{ per hour} \times 11 \text{ hours})$$

$$= \$530 + \$715 = \$1{,}245$$

6. Salespersons who are paid a commission of 5% of gross revenues will naturally prefer to sell a customer a pallet of any thing other than cinder blocks since they have the lowest gross revenues. However, given the company's constraint, they are in fact the company's most profitable product. The rankings of the products in terms of their gross sales and profitability indexes are given below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*
Gross revenues per pallet	$789	$1,264	$569	$836
Ranking based on gross revenues....................	3	1	4	2
Profitability index............	$74	$71	$82	$65

Ranking based on profitability index	2	3	1	4

To align the salespersons' incentives with the interests of the company, the salespersons should be compensated based on the profitability index of the products sold or on the total contribution margin generated by the sales.

Problem B-7 (30 minutes)

1. The constraint is customer representatives' time and the incremental profit is revenues less cost of drugs sold and customer service costs.

	Willows Pharmacy	*Swedish Hospital Pharmacy*	*Georgetown Clinic Pharmacy*	*Kristen Pharmacy*
Total revenues	$344,880	$1,995,200	$1,414,170	$154,800
Cost of drugs sold	263,340	1,446,520	1,047,660	120,960
Customer service costs	12,240	62,640	39,900	4,500
Incremental profit (a)	$ 69,300	$ 486,040	$ 326,610	$ 29,340
Customer representative time (b)	180 hours	1,160 hours	570 hours	90 hours
Profitability index (a) ÷ (b)	$385 per hour	$419 per hour	$573 per hour	$326 per hour

The Georgetown Clinic Pharmacy is the most profitable of the customers, followed by the Swedish Hospital Pharmacy, the Willows Pharmacy, and lastly Kristen Pharmacy.

2. The company could certainly afford to pay its customer representatives more in order to attract and retain them. The company makes at least $326 in incremental profit per hour of customer representative time after taking into account their current wages and commissions. Another way of putting this is that losing a customer representative who works 40 hours per week for 50 weeks a year costs the company between $652,000 ($326 per hour × 2,000 hours per year) and $1,146,000 ($573 per hour × 2,000 hours per year) per year in lost profits.

Case B-8 (45 minutes)

Prevala's management is not contemplating adding or dropping products; it simply wants to redirect salespersons' efforts toward the more profitable products. Therefore, this is a volume trade-off decision and the appropriate way to measure profitability is with the profitability index defined as follows:

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Unit contribution margin}}{\text{Amount of the constrained resource used by one unit}}$$

The unit contribution margin is the selling price of a product less sales commissions and the cost of sales, which is a variable cost in this company. The operating expenses are all fixed.

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Selling price} - \text{Sales commission} - \text{Cost of sales}}{\text{Amount of the constrained resource used by one unit}}$$

The case states that management wants "to redirect the effort of salespersons towards the more profitable products." Therefore, the constraint must be the effort of salespersons. Unfortunately, there is no direct measure of the amount of salespersons' effort required to sell a unit of each product. However, all other things equal, if one product has twice the sales commission per unit as another, then we can expect salespersons to exert twice as much effort selling the first product. Effort is likely to be proportional to commissions. Therefore, given the limited amount of available information, the best measure of relative profitability for purposes of redirecting salespersons' efforts would be:

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Selling price} - \text{Sales commission} - \text{Cost of sales}}{\text{Sales commission}}$$

Case B-8 (continued)

Note that this profitability index takes into account the salespersons' natural inclinations to focus their efforts on the products with the highest sales commissions. Of course, it would be an even better idea to change the salespersons' compensation scheme, but this alternative was ruled out in the case.

Appendix B
Profitability Analysis

Solutions to Questions

B-1 Absolute profitability measures the impact on an organization's overall profits of adding or dropping a particular segment, such as a product or customer, without making any other changes.

B-2 Relative profitability involves ranking segments, each of which may be absolutely profitable, for purposes of making trade-offs among the segments. Such trade-offs are necessary when a constraint exists. Otherwise, they are not necessary.

B-3 Every business that seeks to maximize profits has a constraint. No business ever has had or ever will have infinite profits. Whatever prevents a business from attaining more profits is its constraint. The constraint might be a production constraint, it might be managerial time or talent, or it might be some internal policy that prevents the firm from progressing, but every profit-seeking organization faces at least one constraint. The same is true for almost all nonprofit organizations, which generally seek more of something—be it more health care, more land preserved from development, or more art.

B-4 The absolute profitability of a segment is measured by the difference between the incremental revenues from the segment and the incremental (avoidable) costs of the segment. So to measure absolute profitability, one would need the incremental revenues and costs of the segment.

B-5 The relative profitability of a segment is measured by the profitability index, which is computed by dividing the incremental profit from the segment by the amount of the constrained resource required by the segment. So to measure relative profitability, one would need the incremental profit from the segment and the amount of the constrained resource required by the segment.

B-6 A volume trade-off decision involves trading off units of one product for another. In such decisions fixed costs are usually irrelevant and the products can be ranked by dividing their unit contribution margins by the amount of the constrained resource required by one unit of the product.

B-7 The selling price of a new product should at least cover its variable costs and opportunity costs. The opportunity costs can be determined by multiplying the opportunity cost per unit of the constrained resource by the amount of the constrained resource required by a unit of the new product. In addition, the selling price should cover any avoidable fixed costs of the product. Exactly how much of the avoidable fixed costs should be covered by each unit is difficult to determine *a priori* because the future unit sales volume of a product is not known with certainty.

Exercise B-1 (30 minutes)

1. This exercise can be solved by first computing the profitability index of each new ride and then ranking the rides based on that profitability index:

	Net Present Value (A)	*Safety Engineer Time Required (B)*	*Profitability Index (A) ÷ (B)*
Ride 1	$741,400	220	$3,370
Ride 2	$382,500	150	$2,550
Ride 3	$850,500	350	$2,430
Ride 4	$450,500	170	$2,650
Ride 5	$620,400	220	$2,820
Ride 6	$1,004,400	310	$3,240
Ride 7	$953,800	380	$2,510
Ride 8	$332,500	190	$1,750
Ride 9	$385,500	150	$2,570
Ride 10	$680,400	270	$2,520

	Profitability Index	*Safety Engineer Time Required*	*Cumulative Amount of Safety Engineer Time Required*
Ride 1	$3,370	220	220
Ride 6	$3,240	310	530
Ride 5	$2,820	220	750

Ride 4	$2,650	170	920
Ride 9	$2,570	150	1,070
Ride 2	$2,550	150	1,220
Ride 10	$2,520	270	1,490
Ride 7	$2,510	380	1,870
Ride 3	$2,430	350	2,220
Ride 8	$1,750	190	2,410

Given the 1,220 hours of safety engineer time available, the six rides above the line in the above table should be built.

Exercise B-1 (continued)

2. The total net present value for the six new rides to be built is computed as follows:

Ride 1	$ 741,400
Ride 6	1,004,400
Ride 5	620,400
Ride 4	450,500
Ride 9	385,500
Ride 2	382,500
Total	$3,584,700

Notes:

(i) Both the safety engineer's time and the individual projects would have to be *very* carefully scheduled to make sure that all projects are completed on time. We have assumed that the 1,220 hours of available safety engineer time does not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.

(j) If the cumulative amount of safety engineer time required did not exactly consume the total amount of time available, some adjustment might be required in which projects are accepted to ensure that the best plan is selected.

Exercise B-2 (30 minutes)

1. There is not enough capacity in the bottleneck operation to satisfy demand for all four products. The total amount of time available in the bottleneck operation is 1,800 hours, but 2,240 hours would be required to satisfy demand as shown below:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Annual demand in units (a)	80	80	70	120	
Hours required in the bottleneck operation per unit (b)	6	8	4	7	
Total hours required in the bottleneck operation (a) × (b)..	480	640	280	840	2,240

2. The profitability index should be used to rank the products.

	Trader	*Trapper*	*Quebec*	*Runner*
Unit contribution margin (a)....	$444	$464	$312	$462
Hours required in the bottleneck operation per unit (b)	6	8	4	7
Profitability index (a) ÷ (b)	$74	$58	$78	$66

The most profitable use of the bottleneck operation (the constraint) is the Quebec model, followed by the Trader model and then the Runner and Trapper models. Because no fixed costs would be affected by this decision, the optimal plan would be:

Exercise B-2 (continued)

Amount of constrained resource available	1,800 hours
Less: Constrained resource required for production of 70 units of the Quebec model	280 hours
Remaining constrained resource available	1,520 hours
Less: Constrained resource required for production of 80 units of the Trader model	480 hours
Remaining constrained resource available	1,040 hours
Less: Constrained resource required for production of 120 units of the Runner model	840 hours
Remaining constrained resource available	200 hours
Less: Constrained resource required for production of 25 units of the Trapper model	200 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $124,400:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Unit contribution margin (a)	$444	$464	$312	$462	
Optimal production plan (b)	80	25	70	120	
Total contribution margin (a) × (b) .	$35,520	$11,600	$21,840	$55,440	$124,400

Exercise B-3 (10 minutes)

The selling price of the new amaretto cappuccino product should at least cover its variable cost and its opportunity cost. The variable cost of the new product is $0.46 and its opportunity cost can be computed by multiplying the opportunity cost of $3.40 per minute of order filling time by the amount of time required to fill an order for the new product:

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \begin{array}{c}\text{Variable cost of}\\\text{the new product}\end{array} + \left(\begin{array}{c}\text{Opportunity cost}\\\text{per unit of the}\\\text{constrained resource}\end{array} \times \begin{array}{c}\text{Amount of the constrained}\\\text{resource required by a unit}\\\text{of the new product}\end{array}\right)$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$0.46 + \left(\$3.40\text{ per minute} \times \frac{45\text{ seconds}}{60\text{ seconds per minute}}\right)$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$0.46 + (\$3.40\text{ per minute} \times 0.75\text{ minute})$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$0.46 + \$2.55 = \$3.01$$

Hence, the selling price of the new product should at least cover both its variable cost of $0.46 and its opportunity cost of $2.55, for a total of $3.01.

Problem B-4 (60 minutes)

1. This problem can be solved by first computing the profitability index of each customer and then ranking the customers based on that profitability index:

Customer	*Incremental Profit (A)*	*Megan's Time Required (B)*	*Profitability Index (A) ÷ (B)*
Audet	$140	4	$35
Boyer	$124	4	$31
Comfort	$160	5	$32
Donaghe...	$96	3	$32
Due	$190	5	$38
Dupuy	$288	8	$36
Ebberts	$93	3	$31
Imm	$136	4	$34
Mulgrew	$234	6	$39
Paulding	$204	6	$34

Customer	*Profitability Index*	*Megan's Time Required*	*Cumulative Amount of Megan's Time Required*

Mulgrew	$39	6	6
Due	$38	5	11
Dupuy	$36	8	19
Audet	$35	4	23
Paulding	$34	6	29
Imm	$34	4	27
Comfort	$32	5	38
Donaghe...	$32	3	41
Boyer	$31	4	45
Ebberts	$31	3	48

Given that Megan should not be asked to work more than 33 hours, the four customers below the line in the above table should be told that their reservations have to be cancelled.

Problem B-4 (continued)

2. The total profit on wedding cakes for the weekend after canceling the four reservations would be:

Mulgrew	$ 234
Due	190
Dupuy	288
Audet	140
Paulding	204
Imm	136
Total	$1,192

Notes:

- Both Megan's time and the cakes would have to be *very* carefully scheduled to make sure that all cakes are completed on time. We have assumed that the 33 hours of Megan's time that are available for cake decorating do not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.
- If the cumulative amount of Megan's time required did not exactly consume the total amount of time available, some adjustment might be required in which reservations are cancelled to ensure that the most profitable plan is selected.

3. To avoid disappointing customers, reservations should probably not be accepted for any particular weekend after 33 hours of Megan's time have been committed for that weekend's cakes. To ensure that only the most profitable cake reservations are accepted, a reservation for any cake with a profitability index of less than $34 should probably not be accepted. This was the cutoff point for the cakes in the first weekend in June. This cutoff may need to be adjusted upward or downward over time—the cakes that were reserved for the first weekend in June may not be representative of the cakes that would be reserved for other weekends. If too many reservations are turned down and Megan's time is not fully utilized, then the cutoff should be adjusted downward. If too few reservations are turned down and Megan's time is once again overbooked or profitable cake orders are turned away, then the cutoff should be adjusted upward.

Problem B-4 (continued)

4. Ms. Chavez should consider changing the way prices are set so that they include a charge for Megan's time. On average, the prices may be the same, but they should be based not only on the size of the cakes, but also on the amount of cake decorating that the customer desires. The charge for Megan's time should be her hourly rate of pay (including any fringe benefits) plus the opportunity cost of at least $34 per hour. Because Megan will not be working more than 33 hours per week, if another cake reservation is accepted, some other cake reservation will have to be cancelled. Ms. Chavez would have to give up at least $34 profit per hour to accept another cake reservation.

5. Making Megan happy involves not asking her to work more than 33 hours per week decorating cakes. Making customers happy involves not canceling their reservations, not raising prices, and providing top quality wedding cakes. Ms. Chavez can accomplish both of these objectives *and* increase her profits by clever management of the constraint—Megan's time. The possibilities include:
   - Ms. Chavez should make sure that none of Megan's time is wasted on unnecessary tasks. For example, Megan should not be asked to cream butter by hand for frostings if a machine could do the job as well with less labor time.
   - Ms. Chavez should make sure that none of Megan's time is wasted on tasks that can be done by other persons. For example, an assistant can be assigned to prepare frosting and to clean up, relieving Megan of those tasks. As long as the cost of the assistant's time is less than $34 per hour, the result will be higher profits and more pleased customers.
   - Ms. Chavez should consider assigning an apprentice to Megan. The apprentice could relieve Megan of some of her workload while learning the skills to eventually expand the company's cake decorating capacity.
   - Ms. Chavez might consider subcontracting some of the less demanding cake decorating to another baker. This would be profitable as long as the charge is less than $34 per hour.

Problem B-5 (45 minutes)

1. The relative profitability of segments should be measured by the profitability index as follows:

$$\text{Profitability index} = \frac{\text{Incremental profit from the segment}}{\text{Amount of the constrained resource used by the segment}}$$

However, the hospital measures profitability using the following ratio:

$$\text{Profitability} = \frac{\text{Segment margin}}{\text{Segment revenue}}$$

The segment margin (i.e., revenue less fully allocated costs) should not be used in the numerator when measuring profitability because it does not represent the incremental profit from the segment. The incremental profit from a segment is its revenue less its *avoidable* costs. Fully allocated costs include avoidable costs *plus* other costs that are not avoidable, but are nevertheless allocated to the segment. These nonavoidable costs are completely irrelevant when considering the profitability of a segment because they would be unaffected even if the segment were eliminated.

Including nonavoidable costs in the numerator of the profitability measure distorts the measure and may result in incorrect rankings of the segments.

2. It is appropriate to use the segment revenue in the denominator of the profitability measure *only if total revenue is the organization's constraint*. In that case, the revenue of the segment would be the amount of the constrained resource used by the segment. Otherwise, segment revenue should not be used as the denominator when measuring the relative profitability of segments.

When would total revenue be the organization's constraint? In truth, it is difficult to imagine situations in which total revenue would be the constraint. One possibility is that the organization's customers have a fixed total budget for spending on the organization's products and services and the organization has excess productive capacity. In that case, total revenue would indeed be the organization's constraint. However, this situation would rarely arise.

Problem B-5 (continued)

Other situations might arise in which total revenue is the organization's constraint, but ordinarily the constraint would not be revenue. Instead, the constraint would be something like a particular production process or a critical input. Consequently, it is almost certainly the case that relative profitability should not be measured using segment revenues in the denominator.

Problem B-6 (60 minutes)

1. There is not enough kiln capacity to satisfy demand for all four products. The total amount of time available is 2,000 hours, but 2,300 hours would be required to satisfy demand as shown below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*	*Total*
Annual demand in pallets (a)	120	80	180	70	
Hours required in the drying kiln per pallet (b)	5	7	4	6	
Total hours required in the drying kiln (a) × (b)	600	560	720	420	2,300

2. The profitability index should be used to rank the products.

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*

Contribution margin per pallet (a)	$370	$497	$328	$390
Hours required in drying kiln per pallet (b)	5	7	4	6
Profitability index (a) ÷ (b).....................	$74	$71	$82	$65

The most profitable use of the bottleneck operation (the constraint) is the Cinder Block product, followed by the Traditional Brick product and then the Textured Facing and Roman Brick products. Since no fixed costs would be affected by this decision, the optimal plan would be:

Problem B-6 (continued)

Amount of constrained resource available	2,000 hours
Less: Constrained resource required for production of 180 pallets of Cinder Block..................................	720 hours
Remaining constrained resource available	1,280 hours
Less: Constrained resource required for production of 120 pallets of Traditional Brick	600 hours
Remaining constrained resource available	680 hours
Less: Constrained resource required for production of 80 pallets of Textured Facing...............................	560 hours
Remaining constrained resource available	120 hours
Less: Constrained resource required for production of 20 pallets of Roman Brick	120 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $151,000:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*an Brick*	*Total*
Contribution margin per pallet (a)	$370	$497	$328	$390	
Optimal production plan (b)	120	80	180	20	
Total contribution margin (a) × (b)	$44,400	$39,760	$59,040	$7,800	$151,000

4. The company should be willing to pay up to $65 per hour to operate the kiln until demand is satisfied for Roman Bricks.

Problem B-6 (continued)

5. The selling price for the new product should at least cover its variable cost and opportunity cost:

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \begin{array}{c}\text{Variable cost of}\\ \text{the new product}\end{array} + \left(\begin{array}{c}\text{Opportunity cost}\\ \text{per unit of the}\\ \text{constrained resource}\end{array} \times \begin{array}{c}\text{Amount of the constrained}\\ \text{resource required by a unit}\\ \text{of the new product}\end{array}\right)$$

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \$530 + (\$65 \text{ per hour} \times 11 \text{ hours})$$

$$= \$530 + \$715 = \$1,245$$

6. Salespersons who are paid a commission of 5% of gross revenues will naturally prefer to sell a customer a pallet of any thing other than cinder blocks since they have the lowest gross revenues. However, given the company's constraint, they are in fact the company's most profitable product. The rankings of the products in terms of their gross sales and profitability indexes are given below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*
Gross revenues per pallet	$789	$1,264	$569	$836
Ranking based on gross revenues....................	3	1	4	2
Profitability index............	$74	$71	$82	$65

Ranking based on profitability index	2	3	1	4

To align the salespersons' incentives with the interests of the company, the salespersons should be compensated based on the profitability index of the products sold or on the total contribution margin generated by the sales.

Problem B-7 (30 minutes)

1. The constraint is customer representatives' time and the incremental profit is revenues less cost of drugs sold and customer service costs.

	Willows Pharmacy	*Swedish Hospital Pharmacy*	*Georgetown Clinic Pharmacy*	*Kristen Pharmacy*
Total revenues	$344,880	$1,995,200	$1,414,170	$154,800
Cost of drugs sold.......................	263,340	1,446,520	1,047,660	120,960
Customer service costs	12,240	62,640	39,900	4,500
Incremental profit (a)	$ 69,300	$ 486,040	$ 326,610	$ 29,340
Customer representative time (b)	180 hours	1,160 hours	570 hours	90 hours
Profitability index (a) ÷ (b)	$385 per hour	$419 per hour	$573 per hour	$326 per hour

The Georgetown Clinic Pharmacy is the most profitable of the customers, followed by the Swedish Hospital Pharmacy, the Willows Pharmacy, and lastly Kristen Pharmacy.

2. The company could certainly afford to pay its customer representatives more in order to attract and retain them. The company makes at least $326 in incremental profit per hour of customer representative time after taking into account their current wages and commissions. Another way of putting this is that losing a customer representative who works 40 hours per week for 50 weeks a year costs the company between $652,000 ($326 per hour × 2,000 hours per year) and $1,146,000 ($573 per hour × 2,000 hours per year) per year in lost profits.

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Prevala's management is not contemplating adding or dropping products; it simply wants to redirect salespersons' efforts toward the more profitable products. Therefore, this is a volume trade-off decision and the appropriate way to measure profitability is with the profitability index defined as follows:

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Unit contribution margin}}{\text{Amount of the constrained resource used by one unit}}$$

The unit contribution margin is the selling price of a product less sales commissions and the cost of sales, which is a variable cost in this company. The operating expenses are all fixed.

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Selling price} - \text{Sales commission} - \text{Cost of sales}}{\text{Amount of the constrained resource used by one unit}}$$

The case states that management wants "to redirect the effort of salespersons towards the more profitable products." Therefore, the constraint must be the effort of salespersons. Unfortunately, there is no direct measure of the amount of salespersons' effort required to sell a unit of each product. However, all other things equal, if one product has twice the sales commission per unit as another, then we can expect salespersons to exert twice as much effort selling the first product. Effort is likely to be proportional to commissions. Therefore, given the limited amount of available information, the best measure of relative profitability for purposes of redirecting salespersons' efforts would be:

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Selling price} - \text{Sales commission} - \text{Cost of sales}}{\text{Sales commission}}$$

Case B-8 (continued)

Note that this profitability index takes into account the salespersons' natural inclinations to focus their efforts on the products with the highest sales commissions. Of course, it would be an even better idea to change the salespersons' compensation scheme, but this alternative was ruled out in the case.

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B-5 The relative profitability of a segment is measured by the profitability index, which is computed by dividing the incremental profit from the segment by the amount of the constrained resource required by the segment. So to measure relative profitability, one would need the incremental profit from the segment and the amount of the constrained resource required by the segment.

B-6 A volume trade-off decision involves trading off units of one product for another. In such decisions fixed costs are usually irrelevant and the products can be ranked by dividing their unit contribution margins by the amount of the constrained resource required by one unit of the product.

B-7 The selling price of a new product should at least cover its variable costs and opportunity costs. The opportunity costs can be determined by multiplying the opportunity cost per unit of the constrained resource by the amount of the constrained resource required by a unit of the new product. In addition, the selling price should cover any avoidable fixed costs of the product. Exactly how much of the avoidable fixed costs should be covered by each unit is difficult to determine *a priori* because the future unit sales volume of a product is not known with certainty.

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Ride 3	$850,500	350	$2,430
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Ride 8	$332,500	190	$1,750
Ride 9	$385,500	150	$2,570
Ride 10	$680,400	270	$2,520

	Profitability Index	*Safety Engineer Time Required*	*Cumulative Amount of Safety Engineer Time Required*
Ride 1	$3,370	220	220
Ride 6	$3,240	310	530
Ride 5	$2,820	220	750

Ride 4	$2,650	170	920
Ride 9	$2,570	150	1,070
Ride 2	$2,550	150	1,220
Ride 10	$2,520	270	1,490
Ride 7	$2,510	380	1,870
Ride 3	$2,430	350	2,220
Ride 8	$1,750	190	2,410

Given the 1,220 hours of safety engineer time available, the six rides above the line in the above table should be built.

Exercise B-1 (continued)

2. The total net present value for the six new rides to be built is computed as follows:

Ride 1	$ 741,400
Ride 6	1,004,400
Ride 5	620,400
Ride 4	450,500
Ride 9	385,500
Ride 2	382,500
Total	$3,584,700

Notes:

(k) Both the safety engineer's time and the individual projects would have to be *very* carefully scheduled to make sure that all projects are completed on time. We have assumed that the 1,220 hours of available safety engineer time does not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.

(l) If the cumulative amount of safety engineer time required did not exactly consume the total amount of time available, some adjustment might be required in which projects are accepted to ensure that the best plan is selected.

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1. There is not enough capacity in the bottleneck operation to satisfy demand for all four products. The total amount of time available in the bottleneck operation is 1,800 hours, but 2,240 hours would be required to satisfy demand as shown below:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Annual demand in units (a)	80	80	70	120	
Hours required in the bottleneck operation per unit (b)	6	8	4	7	
Total hours required in the bottleneck operation (a) × (b)..	480	640	280	840	2,240

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The most profitable use of the bottleneck operation (the constraint) is the Quebec model, followed by the Trader model and then the Runner and Trapper models. Because no fixed costs would be affected by this decision, the optimal plan would be:

Exercise B-2 (continued)

Amount of constrained resource available	1,800 hours
Less: Constrained resource required for production of 70 units of the Quebec model	280 hours
Remaining constrained resource available	1,520 hours
Less: Constrained resource required for production of 80 units of the Trader model	480 hours
Remaining constrained resource available	1,040 hours
Less: Constrained resource required for production of 120 units of the Runner model	840 hours
Remaining constrained resource available	200 hours
Less: Constrained resource required for production of 25 units of the Trapper model	200 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $124,400:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Unit contribution margin (a)	$444	$464	$312	$462	
Optimal production plan (b)	80	25	70	120	
Total contribution margin (a) × (b) .	$35,520	$11,600	$21,840	$55,440	$124,400

Exercise B-3 (10 minutes)

The selling price of the new amaretto cappuccino product should at least cover its variable cost and its opportunity cost. The variable cost of the new product is $0.46 and its opportunity cost can be computed by multiplying the opportunity cost of $3.40 per minute of order filling time by the amount of time required to fill an order for the new product:

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \begin{array}{c}\text{Variable cost of}\\\text{the new product}\end{array} + \left(\begin{array}{c}\text{Opportunity cost}\\\text{per unit of the}\\\text{constrained resource}\end{array} \times \begin{array}{c}\text{Amount of the constrained}\\\text{resource required by a unit}\\\text{of the new product}\end{array}\right)$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$0.46 + \left(\$3.40 \text{ per minute} \times \frac{45 \text{ seconds}}{60 \text{ seconds per minute}}\right)$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$0.46 + (\$3.40 \text{ per minute} \times 0.75 \text{ minute})$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$0.46 + \$2.55 = \$3.01$$

Hence, the selling price of the new product should at least cover both its variable cost of $0.46 and its opportunity cost of $2.55, for a total of $3.01.

Problem B-4 (60 minutes)

1. This problem can be solved by first computing the profitability index of each customer and then ranking the customers based on that profitability index:

Customer	*Incremental Profit (A)*	*Megan's Time Required (B)*	*Profitability Index (A) ÷ (B)*
Audet	$140	4	$35
Boyer	$124	4	$31
Comfort	$160	5	$32
Donaghe...	$96	3	$32
Due	$190	5	$38
Dupuy	$288	8	$36
Ebberts	$93	3	$31
Imm	$136	4	$34
Mulgrew	$234	6	$39
Paulding	$204	6	$34

Customer	*Profitability Index*	*Megan's Time Required*	*Cumulative Amount of Megan's Time Required*

Mulgrew	$39	6	6
Due	$38	5	11
Dupuy	$36	8	19
Audet	$35	4	23
Paulding	$34	6	29
Imm	$34	4	27
Comfort	$32	5	38
Donaghe...	$32	3	41
Boyer	$31	4	45
Ebberts	$31	3	48

Given that Megan should not be asked to work more than 33 hours, the four customers below the line in the above table should be told that their reservations have to be cancelled.

Problem B-4 (continued)

2. The total profit on wedding cakes for the weekend after canceling the four reservations would be:

Mulgrew	$ 234
Due	190
Dupuy	288
Audet	140
Paulding	204
Imm	136
Total	$1,192

Notes:

- Both Megan's time and the cakes would have to be *very* carefully scheduled to make sure that all cakes are completed on time. We have assumed that the 33 hours of Megan's time that are available for cake decorating do not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.
- If the cumulative amount of Megan's time required did not exactly consume the total amount of time available, some adjustment might be required in which reservations are cancelled to ensure that the most profitable plan is selected.

3. To avoid disappointing customers, reservations should probably not be accepted for any particular weekend after 33 hours of Megan's time have been committed for that weekend's cakes. To ensure that only the most profitable cake reservations are accepted, a reservation for any cake with a profitability index of less than $34 should probably not be accepted. This was the cutoff point for the cakes in the first weekend in June. This cutoff may need to be adjusted upward or downward over time—the cakes that were reserved for the first weekend in June may not be representative of the cakes that would be reserved for other weekends. If too many reservations are turned down and Megan's time is not fully utilized, then the cutoff should be adjusted downward. If too few reservations are turned down and Megan's time is once again overbooked or profitable cake orders are turned away, then the cutoff should be adjusted upward.

4. Ms. Chavez should consider changing the way prices are set so that they include a charge for Megan's time. On average, the prices may be the same, but they should be based not only on the size of the cakes, but also on the amount of cake decorating that the customer desires. The charge for Megan's time should be her hourly rate of pay (including any fringe benefits) plus the opportunity cost of at least $34 per hour. Because Megan will not be working more than 33 hours per week, if another cake reservation is accepted, some other cake reservation will have to be cancelled. Ms. Chavez would have to give up at least $34 profit per hour to accept another cake reservation.

5. Making Megan happy involves not asking her to work more than 33 hours per week decorating cakes. Making customers happy involves not canceling their reservations, not raising prices, and providing top quality wedding cakes. Ms. Chavez can accomplish both of these objectives *and* increase her profits by clever management of the constraint—Megan's time. The possibilities include:
   - Ms. Chavez should make sure that none of Megan's time is wasted on unnecessary tasks. For example, Megan should not be asked to cream butter by hand for frostings if a machine could do the job as well with less labor time.
   - Ms. Chavez should make sure that none of Megan's time is wasted on tasks that can be done by other persons. For example, an assistant can be assigned to prepare frosting and to clean up, relieving Megan of those tasks. As long as the cost of the assistant's time is less than $34 per hour, the result will be higher profits and more pleased customers.
   - Ms. Chavez should consider assigning an apprentice to Megan. The apprentice could relieve Megan of some of her workload while learning the skills to eventually expand the company's cake decorating capacity.
   - Ms. Chavez might consider subcontracting some of the less demanding cake decorating to another baker. This would be profitable as long as the charge is less than $34 per hour.

Problem B-5 (45 minutes)

1. The relative profitability of segments should be measured by the profitability index as follows:

$$\text{Profitability index} = \frac{\text{Incremental profit from the segment}}{\text{Amount of the constrained resource used by the segment}}$$

However, the hospital measures profitability using the following ratio:

$$\text{Profitability} = \frac{\text{Segment margin}}{\text{Segment revenue}}$$

The segment margin (i.e., revenue less fully allocated costs) should not be used in the numerator when measuring profitability because it does not represent the incremental profit from the segment. The incremental profit from a segment is its revenue less its *avoidable* costs. Fully allocated costs include avoidable costs *plus* other costs that are not avoidable, but are nevertheless allocated to the segment. These nonavoidable costs are completely irrelevant when considering the profitability of a segment because they would be unaffected even if the segment were eliminated.

Including nonavoidable costs in the numerator of the profitability measure distorts the measure and may result in incorrect rankings of the segments.

2. It is appropriate to use the segment revenue in the denominator of the profitability measure *only if total revenue is the organization's constraint*. In that case, the revenue of the segment would be the amount of the constrained resource used by the segment. Otherwise, segment revenue should not be used as the denominator when measuring the relative profitability of segments.

When would total revenue be the organization's constraint? In truth, it is difficult to imagine situations in which total revenue would be the constraint. One possibility is that the organization's customers have a fixed total budget for spending on the organization's products and services and the organization has excess productive capacity. In that case, total revenue would indeed be the organization's constraint. However, this situation would rarely arise.

Problem B-5 (continued)

Other situations might arise in which total revenue is the organization's constraint, but ordinarily the constraint would not be revenue. Instead, the constraint would be something like a particular production process or a critical input. Consequently, it is almost certainly the case that relative profitability should not be measured using segment revenues in the denominator.

Problem B-6 (60 minutes)

1. There is not enough kiln capacity to satisfy demand for all four products. The total amount of time available is 2,000 hours, but 2,300 hours would be required to satisfy demand as shown below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*	*Total*
Annual demand in pallets (a)...........	120	80	180	70	
Hours required in the drying kiln per pallet (b).......	5	7	4	6	
Total hours required in the drying kiln (a) × (b)............	600	560	720	420	2,300

2. The profitability index should be used to rank the products.

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*

Contribution margin per pallet (a)	$370	$497	$328	$390
Hours required in drying kiln per pallet (b)	5	7	4	6
Profitability index (a) ÷ (b).....................	$74	$71	$82	$65

The most profitable use of the bottleneck operation (the constraint) is the Cinder Block product, followed by the Traditional Brick product and then the Textured Facing and Roman Brick products. Since no fixed costs would be affected by this decision, the optimal plan would be:

Problem B-6 (continued)

Amount of constrained resource available	2,000 hours
Less: Constrained resource required for production of 180 pallets of Cinder Block..................................	720 hours
Remaining constrained resource available	1,280 hours
Less: Constrained resource required for production of 120 pallets of Traditional Brick	600 hours
Remaining constrained resource available	680 hours
Less: Constrained resource required for production of 80 pallets of Textured Facing...............................	560 hours
Remaining constrained resource available	120 hours
Less: Constrained resource required for production of 20 pallets of Roman Brick	120 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $151,000:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*an Brick*	*Total*
Contribution margin per pallet (a)	$370	$497	$328	$390	
Optimal production plan (b)	120	80	180	20	
Total contribution margin (a) × (b)	$44,400	$39,760	$59,040	$7,800	$151,000

4. The company should be willing to pay up to $65 per hour to operate the kiln until demand is satisfied for Roman Bricks.

Problem B-6 (continued)

5. The selling price for the new product should at least cover its variable cost and opportunity cost:

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \begin{array}{c}\text{Variable cost of}\\ \text{the new product}\end{array} + \left(\begin{array}{c}\text{Opportunity cost}\\ \text{per unit of the}\\ \text{constrained resource}\end{array} \times \begin{array}{c}\text{Amount of the constrained}\\ \text{resource required by a unit}\\ \text{of the new product}\end{array}\right)$$

$$\begin{array}{c}\text{Selling price of}\\ \text{the new product}\end{array} \geq \$530 + (\$65 \text{ per hour} \times 11 \text{ hours})$$

$$= \$530 + \$715 = \$1,245$$

6. Salespersons who are paid a commission of 5% of gross revenues will naturally prefer to sell a customer a pallet of any thing other than cinder blocks since they have the lowest gross revenues. However, given the company's constraint, they are in fact the company's most profitable product. The rankings of the products in terms of their gross sales and profitability indexes are given below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*
Gross revenues per pallet	$789	$1,264	$569	$836
Ranking based on gross revenues....................	3	1	4	2
Profitability index............	$74	$71	$82	$65

Ranking based on profitability index	2	3	1	4

To align the salespersons' incentives with the interests of the company, the salespersons should be compensated based on the profitability index of the products sold or on the total contribution margin generated by the sales.

Problem B-7 (30 minutes)

1. The constraint is customer representatives' time and the incremental profit is revenues less cost of drugs sold and customer service costs.

	Willows Pharmacy	*Swedish Hospital Pharmacy*	*Georgetown Clinic Pharmacy*	*Kristen Pharmacy*
Total revenues	$344,880	$1,995,200	$1,414,170	$154,800
Cost of drugs sold	263,340	1,446,520	1,047,660	120,960
Customer service costs	12,240	62,640	39,900	4,500
Incremental profit (a)	$ 69,300	$ 486,040	$ 326,610	$ 29,340
Customer representative time (b)	180 hours	1,160 hours	570 hours	90 hours
Profitability index (a) ÷ (b)	$385 per hour	$419 per hour	$573 per hour	$326 per hour

The Georgetown Clinic Pharmacy is the most profitable of the customers, followed by the Swedish Hospital Pharmacy, the Willows Pharmacy, and lastly Kristen Pharmacy.

2. The company could certainly afford to pay its customer representatives more in order to attract and retain them. The company makes at least $326 in incremental profit per hour of customer representative time after taking into account their current wages and commissions. Another way of putting this is that losing a customer representative who works 40 hours per week for 50 weeks a year costs the company between $652,000 ($326 per hour × 2,000 hours per year) and $1,146,000 ($573 per hour × 2,000 hours per year) per year in lost profits.

Case B-8 (45 minutes)

Prevala's management is not contemplating adding or dropping products; it simply wants to redirect salespersons' efforts toward the more profitable products. Therefore, this is a volume trade-off decision and the appropriate way to measure profitability is with the profitability index defined as follows:

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Unit contribution margin}}{\text{Amount of the constrained resource used by one unit}}$$

The unit contribution margin is the selling price of a product less sales commissions and the cost of sales, which is a variable cost in this company. The operating expenses are all fixed.

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Selling price} - \text{Sales commission} - \text{Cost of sales}}{\text{Amount of the constrained resource used by one unit}}$$

The case states that management wants "to redirect the effort of salespersons towards the more profitable products." Therefore, the constraint must be the effort of salespersons. Unfortunately, there is no direct measure of the amount of salespersons' effort required to sell a unit of each product. However, all other things equal, if one product has twice the sales commission per unit as another, then we can expect salespersons to exert twice as much effort selling the first product. Effort is likely to be proportional to commissions. Therefore, given the limited amount of available information, the best measure of relative profitability for purposes of redirecting salespersons' efforts would be:

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Selling price} - \text{Sales commission} - \text{Cost of sales}}{\text{Sales commission}}$$

Case B-8 (continued)

Note that this profitability index takes into account the salespersons' natural inclinations to focus their efforts on the products with the highest sales commissions. Of course, it would be an even better idea to change the salespersons' compensation scheme, but this alternative was ruled out in the case.

Appendix B
Profitability Analysis

Solutions to Questions

B-1 Absolute profitability measures the impact on an organization's overall profits of adding or dropping a particular segment, such as a product or customer, without making any other changes.

B-2 Relative profitability involves ranking segments, each of which may be absolutely profitable, for purposes of making trade-offs among the segments. Such trade-offs are necessary when a constraint exists. Otherwise, they are not necessary.

B-3 Every business that seeks to maximize profits has a constraint. No business ever has had or ever will have infinite profits. Whatever prevents a business from attaining more profits is its constraint. The constraint might be a production constraint, it might be managerial time or talent, or it might be some internal policy that prevents the firm from progressing, but every profit-seeking organization faces at least one constraint. The same is true for almost all nonprofit organizations, which generally seek more of something—be it more health care, more land preserved from development, or more art.

B-4 The absolute profitability of a segment is measured by the difference between the incremental revenues from the segment and the incremental (avoidable) costs of the segment. So to measure absolute profitability, one would need the incremental revenues and costs of the segment.

B-5 The relative profitability of a segment is measured by the profitability index, which is computed by dividing the incremental profit from the segment by the amount of the constrained resource required by the segment. So to measure relative profitability, one would need the incremental profit from the segment and the amount of the constrained resource required by the segment.

B-6 A volume trade-off decision involves trading off units of one product for another. In such decisions fixed costs are usually irrelevant and the products can be ranked by dividing their unit contribution margins by the amount of the constrained resource required by one unit of the product.

B-7 The selling price of a new product should at least cover its variable costs and opportunity costs. The opportunity costs can be determined by multiplying the opportunity cost per unit of the constrained resource by the amount of the constrained resource required by a unit of the new product. In addition, the selling price should cover any avoidable fixed costs of the product. Exactly how much of the avoidable fixed costs should be covered by each unit is difficult to determine *a priori* because the future unit sales volume of a product is not known with certainty.

Exercise B-1 (30 minutes)

1. This exercise can be solved by first computing the profitability index of each new ride and then ranking the rides based on that profitability index:

	Net Present Value (A)	*Safety Engineer Time Required (B)*	*Profitability Index (A) ÷ (B)*
Ride 1	$741,400	220	$3,370
Ride 2	$382,500	150	$2,550
Ride 3	$850,500	350	$2,430
Ride 4	$450,500	170	$2,650
Ride 5	$620,400	220	$2,820
Ride 6	$1,004,400	310	$3,240
Ride 7	$953,800	380	$2,510
Ride 8	$332,500	190	$1,750
Ride 9	$385,500	150	$2,570
Ride 10	$680,400	270	$2,520

	Profitability Index	*Safety Engineer Time Required*	*Cumulative Amount of Safety Engineer Time Required*
Ride 1	$3,370	220	220
Ride 6	$3,240	310	530
Ride 5	$2,820	220	750

Ride 4	$2,650	170	920
Ride 9	$2,570	150	1,070
Ride 2	$2,550	150	1,220
Ride 10	$2,520	270	1,490
Ride 7	$2,510	380	1,870
Ride 3	$2,430	350	2,220
Ride 8	$1,750	190	2,410

Given the 1,220 hours of safety engineer time available, the six rides above the line in the above table should be built.

Exercise B-1 (continued)

2. The total net present value for the six new rides to be built is computed as follows:

Ride 1	$ 741,400
Ride 6	1,004,400
Ride 5	620,400
Ride 4	450,500
Ride 9	385,500
Ride 2	382,500
Total	$3,584,700

Notes:

(m) Both the safety engineer's time and the individual projects would have to be *very* carefully scheduled to make sure that all projects are completed on time. We have assumed that the 1,220 hours of available safety engineer time does not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.

(n) If the cumulative amount of safety engineer time required did not exactly consume the total amount of time available, some adjustment might be required in which projects are accepted to ensure that the best plan is selected.

Exercise B-2 (30 minutes)

1. There is not enough capacity in the bottleneck operation to satisfy demand for all four products. The total amount of time available in the bottleneck operation is 1,800 hours, but 2,240 hours would be required to satisfy demand as shown below:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Annual demand in units (a)	80	80	70	120	
Hours required in the bottleneck operation per unit (b)	6	8	4	7	
Total hours required in the bottleneck operation (a) × (b)..	480	640	280	840	2,240

2. The profitability index should be used to rank the products.

	Trader	*Trapper*	*Quebec*	*Runner*
Unit contribution margin (a)....	$444	$464	$312	$462
Hours required in the bottleneck operation per unit (b)	6	8	4	7
Profitability index (a) ÷ (b)	$74	$58	$78	$66

The most profitable use of the bottleneck operation (the constraint) is the Quebec model, followed by the Trader model and then the Runner and Trapper models. Because no fixed costs would be affected by this decision, the optimal plan would be:

Exercise B-2 (continued)

Amount of constrained resource available	1,800 hours
Less: Constrained resource required for production of 70 units of the Quebec model	280 hours
Remaining constrained resource available	1,520 hours
Less: Constrained resource required for production of 80 units of the Trader model	480 hours
Remaining constrained resource available	1,040 hours
Less: Constrained resource required for production of 120 units of the Runner model	840 hours
Remaining constrained resource available	200 hours
Less: Constrained resource required for production of 25 units of the Trapper model	200 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $124,400:

	Trader	*Trapper*	*Quebec*	*Runner*	*Total*
Unit contribution margin (a)	$444	$464	$312	$462	
Optimal production plan (b)	80	25	70	120	
Total contribution margin (a) × (b) .	$35,520	$11,600	$21,840	$55,440	$124,400

Exercise B-3 (10 minutes)

The selling price of the new amaretto cappuccino product should at least cover its variable cost and its opportunity cost. The variable cost of the new product is $0.46 and its opportunity cost can be computed by multiplying the opportunity cost of $3.40 per minute of order filling time by the amount of time required to fill an order for the new product:

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \begin{array}{c}\text{Variable cost of}\\\text{the new product}\end{array} + \left(\begin{array}{c}\text{Opportunity cost}\\\text{per unit of the}\\\text{constrained resource}\end{array} \times \begin{array}{c}\text{Amount of the constrained}\\\text{resource required by a unit}\\\text{of the new product}\end{array}\right)$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$0.46 + \left(\$3.40\text{ per minute} \times \frac{45\text{ seconds}}{60\text{ seconds per minute}}\right)$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$0.46 + (\$3.40\text{ per minute} \times 0.75\text{ minute})$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$0.46 + \$2.55 = \$3.01$$

Hence, the selling price of the new product should at least cover both its variable cost of $0.46 and its opportunity cost of $2.55, for a total of $3.01.

Problem B-4 (60 minutes)

1. This problem can be solved by first computing the profitability index of each customer and then ranking the customers based on that profitability index:

Customer	*Incremental Profit (A)*	*Megan's Time Required (B)*	*Profitability Index (A) ÷ (B)*
Audet	$140	4	$35
Boyer	$124	4	$31
Comfort	$160	5	$32
Donaghe...	$96	3	$32
Due	$190	5	$38
Dupuy	$288	8	$36
Ebberts	$93	3	$31
Imm	$136	4	$34
Mulgrew	$234	6	$39
Paulding	$204	6	$34

Customer	*Profitability Index*	*Megan's Time Required*	*Cumulative Amount of Megan's Time Required*

Mulgrew	$39	6	6
Due	$38	5	11
Dupuy	$36	8	19
Audet	$35	4	23
Paulding	$34	6	29
Imm	$34	4	27
Comfort	$32	5	38
Donaghe...	$32	3	41
Boyer	$31	4	45
Ebberts	$31	3	48

Given that Megan should not be asked to work more than 33 hours, the four customers below the line in the above table should be told that their reservations have to be cancelled.

Problem B-4 (continued)

2. The total profit on wedding cakes for the weekend after canceling the four reservations would be:

Mulgrew	$ 234
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Total	$1,192

Notes:

- Both Megan's time and the cakes would have to be *very* carefully scheduled to make sure that all cakes are completed on time. We have assumed that the 33 hours of Megan's time that are available for cake decorating do not include hours that have been set aside as a buffer to provide protection from inevitable disruptions in the schedule.
- If the cumulative amount of Megan's time required did not exactly consume the total amount of time available, some adjustment might be required in which reservations are cancelled to ensure that the most profitable plan is selected.

3. To avoid disappointing customers, reservations should probably not be accepted for any particular weekend after 33 hours of Megan's time have been committed for that weekend's cakes. To ensure that only the most profitable cake reservations are accepted, a reservation for any cake with a profitability index of less than $34 should probably not be accepted. This was the cutoff point for the cakes in the first weekend in June. This cutoff may need to be adjusted upward or downward over time—the cakes that were reserved for the first weekend in June may not be representative of the cakes that would be reserved for other weekends. If too many reservations are turned down and Megan's time is not fully utilized, then the cutoff should be adjusted downward. If too few reservations are turned down and Megan's time is once again overbooked or profitable cake orders are turned away, then the cutoff should be adjusted upward.

Problem B-4 (continued)

4. Ms. Chavez should consider changing the way prices are set so that they include a charge for Megan's time. On average, the prices may be the same, but they should be based not only on the size of the cakes, but also on the amount of cake decorating that the customer desires. The charge for Megan's time should be her hourly rate of pay (including any fringe benefits) plus the opportunity cost of at least $34 per hour. Because Megan will not be working more than 33 hours per week, if another cake reservation is accepted, some other cake reservation will have to be cancelled. Ms. Chavez would have to give up at least $34 profit per hour to accept another cake reservation.

5. Making Megan happy involves not asking her to work more than 33 hours per week decorating cakes. Making customers happy involves not canceling their reservations, not raising prices, and providing top quality wedding cakes. Ms. Chavez can accomplish both of these objectives *and* increase her profits by clever management of the constraint—Megan's time. The possibilities include:
   - Ms. Chavez should make sure that none of Megan's time is wasted on unnecessary tasks. For example, Megan should not be asked to cream butter by hand for frostings if a machine could do the job as well with less labor time.
   - Ms. Chavez should make sure that none of Megan's time is wasted on tasks that can be done by other persons. For example, an assistant can be assigned to prepare frosting and to clean up, relieving Megan of those tasks. As long as the cost of the assistant's time is less than $34 per hour, the result will be higher profits and more pleased customers.
   - Ms. Chavez should consider assigning an apprentice to Megan. The apprentice could relieve Megan of some of her workload while learning the skills to eventually expand the company's cake decorating capacity.
   - Ms. Chavez might consider subcontracting some of the less demanding cake decorating to another baker. This would be profitable as long as the charge is less than $34 per hour.

Problem B-5 (45 minutes)

1. The relative profitability of segments should be measured by the profitability index as follows:

$$\text{Profitability index} = \frac{\text{Incremental profit from the segment}}{\text{Amount of the constrained resource used by the segment}}$$

However, the hospital measures profitability using the following ratio:

$$\text{Profitability} = \frac{\text{Segment margin}}{\text{Segment revenue}}$$

The segment margin (i.e., revenue less fully allocated costs) should not be used in the numerator when measuring profitability because it does not represent the incremental profit from the segment. The incremental profit from a segment is its revenue less its *avoidable* costs. Fully allocated costs include avoidable costs *plus* other costs that are not avoidable, but are nevertheless allocated to the segment. These nonavoidable costs are completely irrelevant when considering the profitability of a segment because they would be unaffected even if the segment were eliminated.

Including nonavoidable costs in the numerator of the profitability measure distorts the measure and may result in incorrect rankings of the segments.

2. It is appropriate to use the segment revenue in the denominator of the profitability measure *only if total revenue is the organization's constraint*. In that case, the revenue of the segment would be the amount of the constrained resource used by the segment. Otherwise, segment revenue should not be used as the denominator when measuring the relative profitability of segments.

When would total revenue be the organization's constraint? In truth, it is difficult to imagine situations in which total revenue would be the constraint. One possibility is that the organization's customers have a fixed total budget for spending on the organization's products and services and the organization has excess productive capacity. In that case, total revenue would indeed be the organization's constraint. However, this situation would rarely arise.

Problem B-5 (continued)

Other situations might arise in which total revenue is the organization's constraint, but ordinarily the constraint would not be revenue. Instead, the constraint would be something like a particular production process or a critical input. Consequently, it is almost certainly the case that relative profitability should not be measured using segment revenues in the denominator.

Problem B-6 (60 minutes)

1. There is not enough kiln capacity to satisfy demand for all four products. The total amount of time available is 2,000 hours, but 2,300 hours would be required to satisfy demand as shown below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*	*Total*
Annual demand in pallets (a)...........	120	80	180	70	
Hours required in the drying kiln per pallet (b).......	5	7	4	6	
Total hours required in the drying kiln (a) × (b)............	600	560	720	420	2,300

2. The profitability index should be used to rank the products.

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*

Contribution margin per pallet (a)	$370	$497	$328	$390
Hours required in drying kiln per pallet (b)	5	7	4	6
Profitability index (a) ÷ (b).....................	$74	$71	$82	$65

The most profitable use of the bottleneck operation (the constraint) is the Cinder Block product, followed by the Traditional Brick product and then the Textured Facing and Roman Brick products. Since no fixed costs would be affected by this decision, the optimal plan would be:

Problem B-6 (continued)

Amount of constrained resource available	2,000 hours
Less: Constrained resource required for production of 180 pallets of Cinder Block..................................	720 hours
Remaining constrained resource available	1,280 hours
Less: Constrained resource required for production of 120 pallets of Traditional Brick	600 hours
Remaining constrained resource available	680 hours
Less: Constrained resource required for production of 80 pallets of Textured Facing...............................	560 hours
Remaining constrained resource available	120 hours
Less: Constrained resource required for production of 20 pallets of Roman Brick	120 hours
Remaining constrained resource available	0 hours

3. The total contribution margin under the above plan would be $151,000:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*an Brick*	*Total*
Contribution margin per pallet (a)	$370	$497	$328	$390	
Optimal production plan (b)	120	80	180	20	
Total contribution margin (a) × (b)	$44,400	$39,760	$59,040	$7,800	$151,000

4. The company should be willing to pay up to $65 per hour to operate the kiln until demand is satisfied for Roman Bricks.

Problem B-6 (continued)

5. The selling price for the new product should at least cover its variable cost and opportunity cost:

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \begin{array}{c}\text{Variable cost of}\\\text{the new product}\end{array} + \left(\begin{array}{c}\text{Opportunity cost}\\\text{per unit of the}\\\text{constrained resource}\end{array} \times \begin{array}{c}\text{Amount of the constrained}\\\text{resource required by a unit}\\\text{of the new product}\end{array}\right)$$

$$\begin{array}{c}\text{Selling price of}\\\text{the new product}\end{array} \geq \$530 + (\$65 \text{ per hour} \times 11 \text{ hours})$$

$$= \$530 + \$715 = \$1{,}245$$

6. Salespersons who are paid a commission of 5% of gross revenues will naturally prefer to sell a customer a pallet of any thing other than cinder blocks since they have the lowest gross revenues. However, given the company's constraint, they are in fact the company's most profitable product. The rankings of the products in terms of their gross sales and profitability indexes are given below:

	Traditional Brick	*Textured Facing*	*Cinder Block*	*Roman Brick*
Gross revenues per pallet	$789	$1,264	$569	$836
Ranking based on gross revenues....................	3	1	4	2
Profitability index............	$74	$71	$82	$65

Ranking based on profitability index	2	3	1	4

To align the salespersons' incentives with the interests of the company, the salespersons should be compensated based on the profitability index of the products sold or on the total contribution margin generated by the sales.

Problem B-7 (30 minutes)

1. The constraint is customer representatives' time and the incremental profit is revenues less cost of drugs sold and customer service costs.

	Willows Pharmacy	*Swedish Hospital Pharmacy*	*Georgetown Clinic Pharmacy*	*Kristen Pharmacy*
Total revenues	$344,880	$1,995,200	$1,414,170	$154,800
Cost of drugs sold	263,340	1,446,520	1,047,660	120,960
Customer service costs	12,240	62,640	39,900	4,500
Incremental profit (a)	$ 69,300	$ 486,040	$ 326,610	$ 29,340
Customer representative time (b)	180 hours	1,160 hours	570 hours	90 hours
Profitability index (a) ÷ (b)	$385 per hour	$419 per hour	$573 per hour	$326 per hour

The Georgetown Clinic Pharmacy is the most profitable of the customers, followed by the Swedish Hospital Pharmacy, the Willows Pharmacy, and lastly Kristen Pharmacy.

2. The company could certainly afford to pay its customer representatives more in order to attract and retain them. The company makes at least $326 in incremental profit per hour of customer representative time after taking into account their current wages and commissions. Another way of putting this is that losing a customer representative who works 40 hours per week for 50 weeks a year costs the company between $652,000 ($326 per hour × 2,000 hours per year) and $1,146,000 ($573 per hour × 2,000 hours per year) per year in lost profits.

Case B-8 (45 minutes)

Prevala's management is not contemplating adding or dropping products; it simply wants to redirect salespersons' efforts toward the more profitable products. Therefore, this is a volume trade-off decision and the appropriate way to measure profitability is with the profitability index defined as follows:

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Unit contribution margin}}{\text{Amount of the constrained resource used by one unit}}$$

The unit contribution margin is the selling price of a product less sales commissions and the cost of sales, which is a variable cost in this company. The operating expenses are all fixed.

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Selling price} - \text{Sales commission} - \text{Cost of sales}}{\text{Amount of the constrained resource used by one unit}}$$

The case states that management wants "to redirect the effort of salespersons towards the more profitable products." Therefore, the constraint must be the effort of salespersons. Unfortunately, there is no direct measure of the amount of salespersons' effort required to sell a unit of each product. However, all other things equal, if one product has twice the sales commission per unit as another, then we can expect salespersons to exert twice as much effort selling the first product. Effort is likely to be proportional to commissions. Therefore, given the limited amount of available information, the best measure of relative profitability for purposes of redirecting salespersons' efforts would be:

$$\text{Profitability index for a volume trade-off decision} = \frac{\text{Selling price} - \text{Sales commission} - \text{Cost of sales}}{\text{Sales commission}}$$

Chapter 1

Managerial Accounting and the Business Environment

Solutions to Questions

1-1 Managerial accounting is concerned with providing information to managers for use within the organization. Financial accounting is concerned with providing information to stockholders, creditors, and others outside of the organization.

1-2 A strategy is a game plan that enables a company to attract customers by distinguishing itself from competitors. The focal point of a company's strategy should be its target customers.

1-3 Customer value propositions fall into three broad categories—customer intimacy, operational excellence, and product leadership. A company with a customer intimacy strategy attempts to better understand and respond to its customers' individual needs than its competitors. A company that adopts an operational excellence strategy attempts to deliver products faster, more conveniently, and at a lower price than its competitors. A company that has a product leadership strategy attempts to offer higher quality products than its competitors.

1-4 Managers carry out three major activities in an organization: planning, directing and motivating, and controlling. Planning involves establishing a basic strategy, selecting a course of action, and specifying how the action will be implemented. Directing and motivating involves mobilizing people to carry out plans and run routine operations. Controlling involves ensuring that the plan is actually carried out and is appropriately modified as circumstances change.

1-5 The Planning and Control Cycle involves formulating plans, implementing plans, measuring performance, and evaluating differences between planned and actual performance.

1-6 In contrast to financial accounting, managerial accounting: (1) focuses on the needs of managers rather than outsiders; (2) emphasizes decisions affecting the future rather than the financial consequences of past actions; (3) emphasizes relevance rather than objectivity and verifiability; (4) emphasizes timeliness rather than precision; (5) emphasizes the segments of an organization rather than summary data concerning the entire organization; (6) is not governed by GAAP; and (7) is not mandatory.

1-7 A person in a line position is directly involved in achieving the basic objectives of the organization. A person in a staff position provides services and assistance to other parts of the organization, but is not directly involved in achieving the basic objectives of the organization.

1-8 The Chief Financial Officer is responsible for providing timely and relevant data to support planning and control activities and for preparing financial statements for external users.

1-9 The three main categories of inventories in a manufacturing company are raw materials, work in process, and finished goods.

1-10 The five steps in the lean thinking model are: (1) identify value in specific products and services; (2) identify the business process that delivers value; (3) organize work arrangements around the flow of the business process; (4) create a pull system that responds to customer orders; and (5) continuously pursue perfection in the business process.

1-11 Successful implementation of the lean thinking model should result in lower inventories, fewer defects, less wasted effort, and quicker customer response times.

1-12 In a pull production system, production is not initiated until a customer order is received. Inventories are reduced to a minimum by purchasing raw materials and producing products only as needed to meet customer demand.

1-13 Some benefits from improvement efforts come from cost reductions, but the primary benefit is often an increase in capacity. At non-constraints, increases in capacity just add to the already-existing excess capacity. Therefore, improvement efforts should ordinarily focus on the constraint.

1-14 Six Sigma is a process improvement method that relies on customer feedback and fact-based data gathering and analysis techniques to drive process improvement. The goal is to reduce defect rates below 3.4 defects per million.

1-15 The five stages in the Six Sigma DMAIC Framework are (1) Define; (2) Measure; (3) Analyze; (4) Improve; and (5) Control. The goals for the define stage are to establish the scope and purpose of the project, to diagram the flow of the current process, and to establish the customer's requirements for the process. The goals for the measure stage are to gather baseline performance data related to the existing process and to narrow the scope of the project to the most important problems. The goal in the analyze stage is to identify the root causes of the problems identified in the measure stage. The goal in the improve stage is to develop, evaluate, and implement solutions to the problems. The goals in the control stage are to ensure the problems remain fixed and to seek to improve the new methods over time.

1-16 An enterprise system is supposed to overcome the problems that result from having separate, unintegrated software applications that support specific business functions. It does this by integrating data across an organization in a single software system that enables all employees to have simultaneous access to a common set of data.

1-17 If people generally did not act ethically in business, no one would trust anyone else and people would be reluctant to enter into business transactions. The result would be less funds raised in capital markets, fewer goods and services available for sale, lower quality, and higher prices.

1-18 Corporate governance is the system by which a company is directed and controlled. If properly implemented, the corporate governance system should provide incentives for the board of directors and top management to pursue objectives that are in the best interests of the company's owners and it should provide for effective monitoring of performance.

1-19 Enterprise risk management is a process used by a company to proactively identify the risks that it faces and to manage those risks.

Exercise 1-1 (10 minutes)

1. Managerial accounting, financial accounting
2. Planning
3. directing and motivating
4. feedback
5. decentralization
6. line
7. staff
8. controller
9. budgets
10. performance report
11. Chief Financial Officer
12. precision; nonmonetary data

Exercise 1-2 (20 minutes)

1. strategy
2. Six Sigma
3. business process
4. corporate governance
5. enterprise risk management
6. just-in-time
7. Internet
8. constraint
9. nonconstraint
10. value chain
11. enterprise system
12. supply chain management
13. lean thinking model; pulls
14. customer value proposition
15. budget
16. non-value-added activity
17. Theory of Constraints

Exercise 1-3 (15 minutes)

If cashiers routinely short-changed customers whenever the opportunity presented itself, most of us would be careful to count our change before leaving the counter. Imagine what effect this would have on the line at your favorite fast-food restaurant. How would you like to wait in line while each and every customer laboriously counts out his or her change? Additionally, if you can't trust the cashiers to give honest change, can you trust the cooks to take the time to follow health precautions such as washing their hands? If you can't trust anyone at the restaurant would you even want to eat out?

Generally, when we buy goods and services in the free market, we assume we are buying from people who have a certain level of ethical standards. If we could not trust people to maintain those standards, we would be reluctant to buy. The net result of widespread dishonesty would be a shrunken economy with a lower growth rate and fewer goods and services for sale at a lower overall level of quality.

Problem 1-4 (20 minutes)

1. No, Sarver did not act in an ethical manner. In complying with the president's instructions to omit liabilities from the company's financial statements he was in direct violation of the IMA's *Statement of Ethical Professional Practice.* He violated both the "Integrity" and "Credibility" guidelines on this code of ethical conduct. The fact that the president ordered the omission of the liabilities is irrelevant.
2. No, Sarver's actions can't be justified. In dealing with similar situations, the Securities and Exchange Commission (SEC) has consistently ruled that "…corporate officers…cannot escape culpability by asserting that they acted as 'good soldiers' and cannot rely upon the fact that the violative conduct may have been condoned or ordered by their corporate superiors." (Quoted from: Gerald H. Lander, Michael T. Cronin, and Alan Reinstein, "In Defense of the Management Accountant," *Management Accounting,* May, 1990, p. 55) Thus, Sarver not only acted unethically, but he could be held legally liable if insolvency occurs and litigation is brought against the company by creditors or others. It is important that students understand this point early in the course, since it is widely assumed that "good soldiers" are justified by the fact that they are just following orders. In the case at hand, Sarver should have resigned rather than become a party to the fraudulent misrepresentation of the company's financial statements.

Problem 1-5 (30 minutes)

1. See the organization chart on the following page.

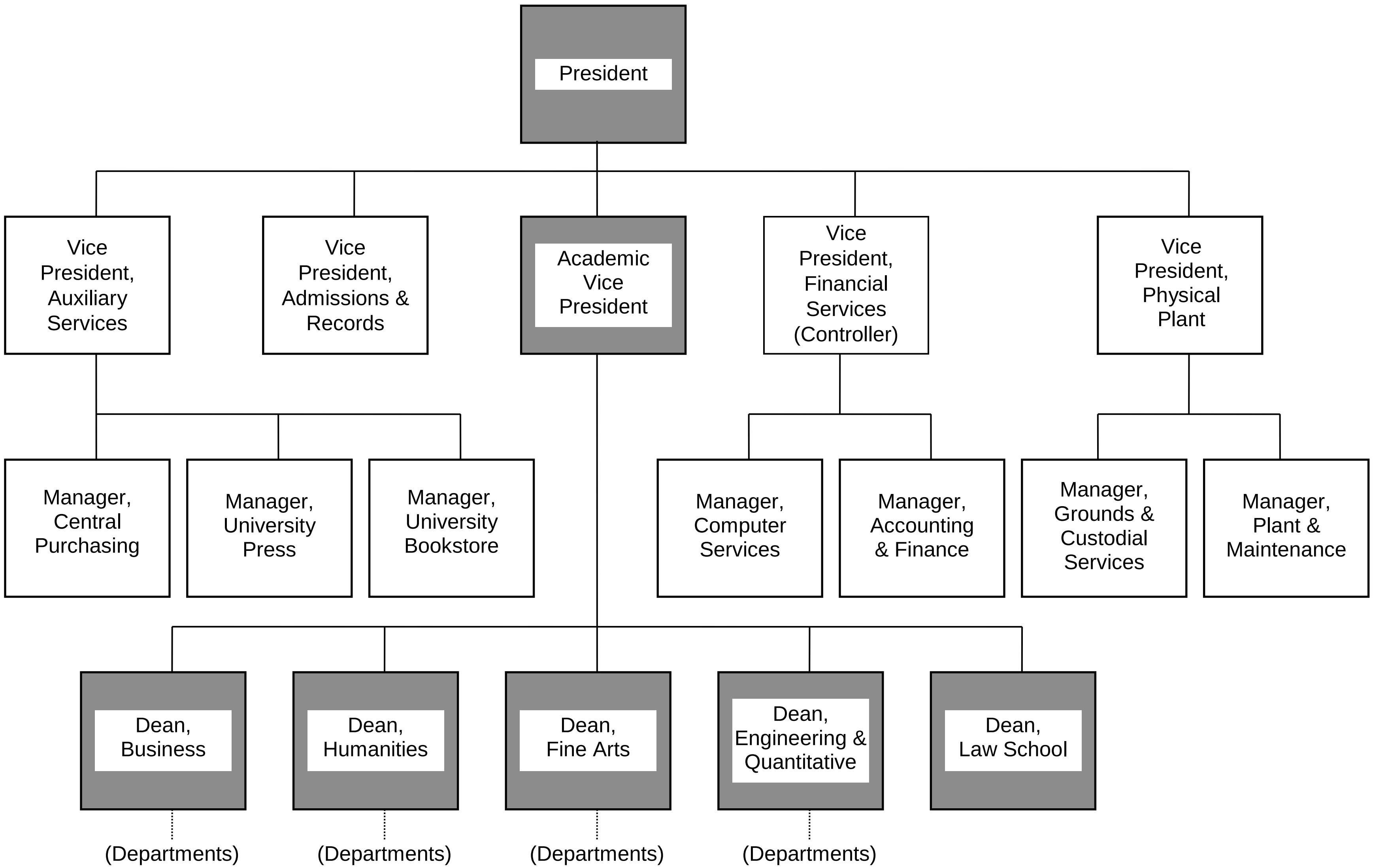
2. Line positions would include the university president, academic vice-president, the deans of the four colleges, and the dean of the law school. In addition, the department heads (as well as the faculty) would be in line positions. The reason is that their positions are directly related to the basic purpose of the university, which is education. (Line positions are shaded on the organization chart.)

   All other positions on the organization chart are staff positions. The reason is that these positions are indirectly related to the educational process, and exist only to provide service or support to the line positions.

3. All positions would have need for accounting information of some type. For example, the manager of central purchasing would need to know the level of current inventories and budgeted allowances in various areas before doing any purchasing; the vice president for admissions and records would need to know the status of scholarship funds as students are admitted to the university; the dean of the business college would need to know his/her budget allowances in various areas, as well as information on cost per student credit hour; and so forth.

Problem 1-5 (continued)

1. Organization chart:



Problem 1-6 (30 minutes)

1. Adam Williams has an ethical responsibility to take some action in the matter of GroChem Inc. and the dumping of toxic wastes. The specific standards in the IMA's *Statement of Ethical Professional Practice* that apply are as follows.

   - **Competence.** Management accountants have a responsibility to perform their professional duties in accordance with relevant laws, regulations, and technical standards.
   - **Objectivity.** Management accountants must disclose all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, comments, and recommendations.

   Given that the dumping of toxic wastes in a residential landfill is illegal, there is a clear responsibility to bring this issue to the attention of management.

2. The IMA's *Statement of Ethical Professional Practice* indicates that the first alternative being considered by Adam Williams, seeking the advice of his boss, is appropriate. To resolve an ethical conflict, the first step is to discuss the problem with the immediate superior, unless it appears that this individual is involved in the conflict. In this case, it does not appear that Williams' boss is involved.

   Communication of confidential information to anyone outside the company is inappropriate unless there is a legal obligation to do so, in which case Williams should contact the proper authorities.

   Contacting a member of the Board of Directors would be an inappropriate action at this time. Williams should report the conflict to successively higher levels within the organization and turn only to the Board of Directors if the problem is not resolved at lower levels.

3. Adam Williams should report the problem to successively higher levels of management until it is satisfactorily resolved. There is no requirement for Williams to inform his immediate superior of this action because the superior is involved in the conflict. If the conflict is not resolved after exhausting all courses of internal review, Williams probably should consult his own attorney regarding his legal obligations and rights.

(CMA Unofficial Solution, adapted)

Problem 1-7 (20 minutes)

1. If all automotive service shops routinely tried to sell parts and services to customers that they didn't really need, most customers would eventually figure this out. They would then be reluctant to accept the word of the service representative that a particular problem needs to be corrected—even when there is a legitimate problem. Either the work would not be done, or customers would learn to diagnose and repair problems themselves, or customers would hire an independent expert to verify that the work is really needed. All three of these alternatives impose costs and hassles on customers.

2. As argued above, if customers could not trust their service representatives, they would be reluctant to follow the service representative's advice. They would be inclined not to order the work done even when it is really necessary. And, more customers would learn to do automotive repairs and maintenance themselves. Moreover, customers would be unwilling to pay as much for work that is done since customers would have reason to believe that the work may be unnecessary. These two effects would reduce demand for automotive repair services. The reduced demand would reduce employment in the industry and would lead to lower overall profits.

Problem 1-8 (30 minutes)

1. Line positions are in the direct chain of command and are directly responsible for the achievement of the basic objectives of an organization. These positions involve a direct relationship to the organization's product or service.

   Staff positions are intended to provide expertise, advice, and support for line positions, being only indirectly related to the achievement of the basic objectives of the organization.

2. Reasons for conflict between line and staff positions include the following.
   - Line managers perceive staff managers as threats to their authority, especially when staff persons have functional authority.
   - Line managers may become uncomfortable when they grow dependent on staff expertise and knowledge.
   - Line managers may perceive staff managers as overstepping their authority, having a narrow perspective, or stealing credit. Staff managers, on the other hand, may perceive line managers as not utilizing their expertise, not giving staff enough authority, or resisting staff's ideas.

Problem 1-8 (continued)

3. a. and b. Listed below are the identification, explanation, and potential problems that could arise for each position described in the text.

   Jere Feldon–Staff Liaison to the Chairperson. Feldon has a staff position as he is not in the direct line of activities. Feldon has a potential conflict between his two superiors because he reports directly to the chairperson yet he also works for the president.

   Lana Dickson–Director of Self-Study Programs. Dickson's position is a line position as her job provides educational opportunities to members. Her potential problems include the marketing of the courses and acquisition of outside or accounting services because she needs to rely on the services of individuals from different departments where she has no line authority.

   Jess Paige–Editor of Special Publications. This is a line function because the publication of educational materials and the sale of monographs are part of the organization's objectives. Paige's potential problems include difficulties he may experience in working with the Research Department as he has no authority over this department but is dependent on its work.

   George Ackers–Manager of Personnel. Ackers has a staff position that provides services across the entire organization. Ackers' potential problems include being ignored due to his position being lower than the vice-president level in the organization, and attempting to take more authority than he is entitled.

(CMA Unofficial Solution, adapted)

Research and Application 1-9 (240 minutes)

1. Whole Foods Market succeeds first and foremost because of its product leadership customer value proposition. The first boldface heading in the company's Declaration of Interdependence says "We Sell the Highest Quality Natural and Organic Products Available." Page 4 of the 10-K/A indicates that the real source of the company's product leadership position centers on perishable products (e.g., produce, dairy, meat, seafood, bakery, and prepared foods). Perishable product sales account for about 67% of total retail sales. Customers choose Whole Foods Market primarily because they are able to buy better natural and organic foods and higher-quality perishable products than in conventional supermarkets.

   Customer service is also an important part of Whole Foods Market's success, but it is secondary in importance to product quality.

2. Whole Foods Market faces numerous business risks as described in pages 11-15 of the 10-K/A. Here are four of the more prominent risks with suggested control activities:

- Risk: Customers will defect to conventional supermarkets that are beginning to stock more natural and organic foods. Control activities: Whole Foods Market can expand its selection of product offerings, particularly perishables, and continue to invest heavily in employee training and retention so that it offers market-leading levels of informed customer service.
- Risk: Growth targets will not be realized due to failed new store openings. Control activities: Implement formal reviews of the sight selection, construction, and new employee hiring and training processes.
- Risk: Adverse economic conditions could reduce consumer spending at retail locations. Control activities: Continue to develop private label product categories, such as the 365 Everyday Value category mentioned on page 8 of the 10-K/A, that are less expensive but meet rigorous quality standards.

Research and Application 1-9 (continued)

- Extended power outages could cause severe inventory losses because of the company's emphasis on perishable products. Control activities: Implement a contingency plan that specifies responses in the event of a power outage.

3. There are no absolute right and wrong answers to this question because the information available in the annual report is piecemeal. Nonetheless, students could make the following observations based on available information. First, the CEO (John P. Mackey) has a layer of senior managers that report to him including two Co-Presidents/Chief Operating Officers, and three Executive Vice Presidents. Second, there are ten Regional Presidents. In the organization chart shown below, we assume that the Regional Presidents report to the Chief Operating Officers. Third, each Regional President has a layer of management that reports to him or her. For example, the Global All-Stars include David Schwartz, who is the Vice President of the Midwest Region. He would report to the President of the Midwest Region. John Simrell is the Director of Finance for the South Region and he would report to the South Region President. Robin Graf is the Team Member Services Director for the Southern Pacific Region. She would report to the President of the Southern Pacific Region.

   Fourth, each region has a manager/coordinator for each product category. For example, Theo Weening is the Meat Category Manager for the Mid-Atlantic Region and Bobby Turner is the Bakery Coordinator for the Midwest Region. In the organization chart shown below, we assume that these regional managers/coordinators report to a Vice-President at the regional level. Fifth, each region has Store Team Leaders for each retail location within the region. For example, John Robertson is the Store Team Leader in Charlottesville, Va. We have assumed that the store team leaders report to the regional vice-president level. Finally, each store location has various team leaders that report to the store team leader. For example, Rolando Alas is the Produce Team Leader at the Mill Valley Store location.

Research and Application 1-9 (continued)

Based on insights such as these, students should be able to prepare an organization chart that resembles the one shown at the end of this solution.

The Global All-Stars include numerous line and staff employees. Three staff employees are Roberta Lang, General Counsel, Chris Pine, Vice President of Real Estate, and Jennifer McFarlin, Payroll Benefit Specialist, Madison. Three line employees are Rocco Terrazano, Meat Team Leader, Yorkville, Don Hosfeld, Grocery Team Leader, Ft. Lauderdale, and Joel Leonard, Prepared Foods Team Leader, Fresh Pond.

4. Both documents emphasize that the respective companies serve a broad range of stakeholders (e.g., customers, employees, suppliers, communities, and stockholders). Both companies mention that their most important stakeholder is the customer. The first sentence of the Johnson & Johnson Credo says "We believe our first responsibility is to the doctors, nurses, and patients, to mothers and fathers and all others who use our products and services." Whole Foods Market says "Our customers are the most important stakeholder in our business. Therefore, we go to extraordinary lengths to satisfy and delight our customers."

   The Whole Foods Market Declaration of Interdependence explicitly recognizes that satisfying all stakeholders' interests will require balance and making trade-offs. In fact, the company says "One of the most important responsibilities of Whole Foods Market's leadership is to make sure the interests, desires and needs of our various stakeholders are kept in balance… Any conflicts must be mediated and win-win solutions found." The Johnson & Johnson Credo does not explicitly acknowledge the need to strike a balance when managing the needs of its various stakeholders.

Research and Application 1-9 (continued)

5. Whole Foods Market's mission statement differs from its Code of Conduct and Ethics in three important respects. First, the mission statement sets forth goals that the company strives to achieve. The tone of the document is positive because it focuses on goals the company hopes to achieve. The Code of Conduct and Ethics defines prohibited conduct. The tone of the document is appropriately negative because it describes those behaviors that are "out of bounds."

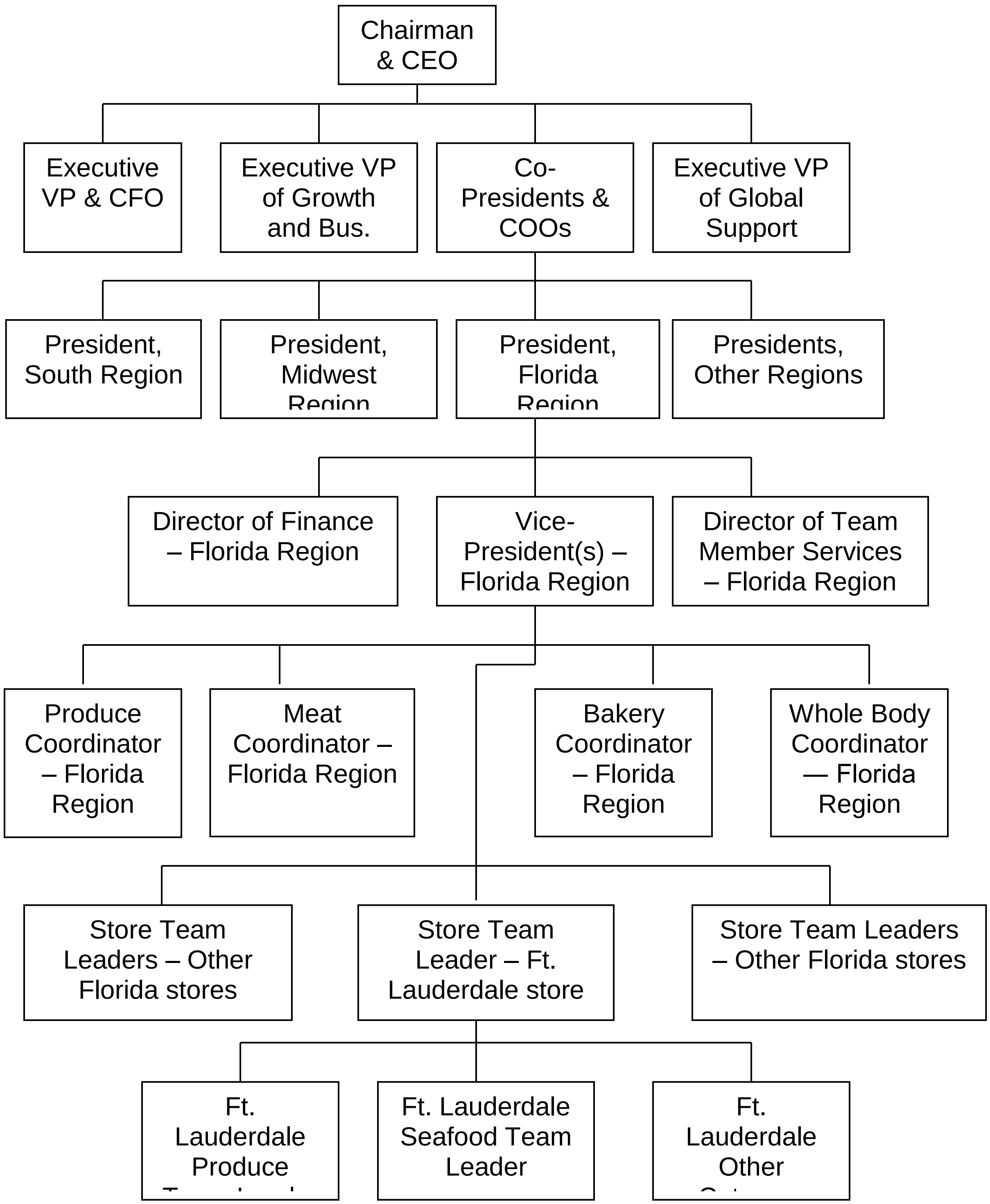
   Second, the mission statement refers to a broader set of stakeholders (e.g., suppliers, customers, and communities) than the Code of Conduct and Ethics, which pertains primarily to Whole Foods Market Team Members and Directors. Third, the mission statement is values-based. It reflects a vision of what the company stands for. The Code of Conduct and Ethics is rule-based. The majority of the code is based on the rules of governing bodies such as the Securities and Exchange Commission (SEC), the Nasdaq stock exchange, and the Financial Accounting Standards Board (FASB).

6. The annual report and 10-K/A is primarily a financial accounting document. First, a 10-K (or 10-K/A as in the case of Whole Foods Market) is prepared for an external regulator—The Securities and Exchange Commission. Management accounting focuses on providing data to internal decision makers. Second, the financial statements included in the 10-K/A summarize transactions from the prior year. Management accounting focuses on decisions affecting the future. Third, the financial results presented in the 10-K/A have been "verified" by an independent auditor (Ernst & Young). Management accountants do not rely on auditors to verify the usefulness of information. Fourth, the financial results shown in the 10-K/A are presented for the company as a whole. Management accountants would be interested in segmented data such as year-to-year same store profitability. Fifth, the financial statements have been prepared according to GAAP. Managerial accounting does not have to conform to GAAP.

Research and Application 1-9 (continued)

Note to the instructor: To help motivate the course, you may want to point out how Whole Foods Markets might benefit from managerial accounting information. We will provide five such examples.

1. Whole Foods Market is expanding by opening new stores. Capital budgeting techniques, such as those covered in Chapter 14, could be used to help decide which site locations should be chosen for new store openings.
2. The company is seeking to grow its private label product lines. Segmented income statements, such as those covered in Chapter 12, could be used to help analyze the profitability of business segments such as the 365 Everyday Value product line or the Whole Kids Organic product line.
3. Relevant cost analysis, as discussed in Chapter 13, could be used to make keep/drop decisions with respect to these private label product lines.
4. Responsibility accounting principles could be useful to Whole Foods Market. The company operates two produce procurement centers, three seafood processing and distribution facilities, a specialty coffee roaster and distributor, six regional commissaries, 12 bakehouse facilities, 10 regional distribution centers, and 163 retail locations. Each of the aforementioned could be managed and evaluated as a separate responsibility center.
5. The cost-volume-profit concepts discussed in Chapter 6 could be useful to the company as it contemplates the financial impact of adjusting selling prices or the overall product mix offered in its stores.


Chairman & CEO
Executive VP & CFO
Executive VP of Growth and Bus.
Co-Presidents & COOs
Executive VP of Global Support
President, South Region
President, Midwest Region
President, Florida Region
Presidents, Other Regions
Director of Finance – Florida Region
Vice-President(s) – Florida Region
Director of Team Member Services – Florida Region
Produce Coordinator – Florida Region
Meat Coordinator – Florida Region
Bakery Coordinator – Florida Region
Whole Body Coordinator — Florida Region
Store Team Leaders – Other Florida stores
Store Team Leader – Ft. Lauderdale store
Store Team Leaders – Other Florida stores
Ft. Lauderdale Produce
Ft. Lauderdale Seafood Team Leader
Ft. Lauderdale Other

Chapter 2

Cost Terms, Concepts, and Classifications

Solutions to Questions

2-1 The three major elements of product costs in a manufacturing company are direct materials, direct labor, and manufacturing overhead.

2-2

a. Direct materials are an integral part of a finished product and their costs can be conveniently traced to it.

b. Indirect materials are generally small items of material such as glue and nails. They may be an integral part of a finished product but their costs can be traced to the product only at great cost or inconvenience.

c. Direct labor includes those labor costs that can be easily traced to particular products. Direct labor is also called "touch labor."

d. Indirect labor includes the labor costs of janitors, supervisors, materials handlers, and other factory workers that cannot be conveniently traced to particular products. These labor costs are incurred to support production, but the workers involved do not directly work on the product.

e. Manufacturing overhead includes all manufacturing costs except direct materials and direct labor. Consequently, manufacturing overhead includes indirect materials and indirect labor as well as other manufacturing costs.

2-3 A product cost is any cost involved in purchasing or manufacturing goods. In the case of manufactured goods, these costs consist of direct materials, direct labor, and manufacturing overhead. A period cost is a cost that is taken directly to the income statement as an expense in the period in which it is incurred.

2-4 The income statement of a manufacturing company differs from the income statement of a merchandising company in the cost of goods sold section. A merchandising company sells finished goods that it has purchased from a supplier. These goods are listed as "purchases" in the cost of goods sold section. Since a manufacturing company produces its goods rather than buying them from a supplier, it lists "cost of goods manufactured" in place of "purchases." Also, the manufacturing company identifies its inventory in this section as Finished Goods inventory, rather than as Merchandise Inventory.

2-5 The schedule of cost of goods manufactured lists the manufacturing costs that have been incurred during the period. These costs are organized under the three categories of direct materials, direct labor, and manufacturing overhead. The total costs incurred are adjusted for any change in the Work in Process inventory to determine the cost of goods manufactured (i.e. finished) during the period.

The schedule of cost of goods manufactured ties into the income statement through the cost of goods sold section. The cost of goods manufactured is added to the beginning Finished Goods inventory to determine the goods available for sale. In effect, the cost of goods manufactured takes the place of the Purchases account in a merchandising firm.

2-6 A manufacturing company has three inventory accounts: Raw Materials, Work in Process, and Finished Goods. A merchandising company generally identifies its inventory account simply as Merchandise Inventory.

2-7 Product costs are assigned to units as they are processed and hence are included in inventories. The flow is from direct materials, direct labor, and manufacturing overhead to Work in Process inventory. As goods are completed, their cost is removed from Work in Process inventory and transferred to Finished Goods inventory. As goods are sold, their cost is removed from Finished Goods inventory and transferred to Cost of Goods Sold. Cost of Goods Sold is an expense on the income statement.

2-8 Yes, costs such as salaries and depreciation can end up as part of assets on the balance sheet if these are manufacturing costs. Manufacturing costs are inventoried until the associated finished goods are sold. Thus, if some units are still in inventory, such costs may be part of either Work in Process inventory or Finished Goods inventory at the end of a period.

2-9 Cost behavior refers to how a cost reacts to changes in the level of activity.

2-10 No. A variable cost is a cost that varies, in total, in direct proportion to changes in the level of activity. A variable cost is constant per unit of product. A fixed cost is fixed in total, but the average cost per unit changes with the level of activity.

2-11 When fixed costs are involved, the average cost of a unit of product will depend on the number of units being manufactured. As production increases, the average cost per unit will fall as the fixed cost is spread over more units. Conversely, as production declines, the average cost per unit will rise as the fixed cost is spread over fewer units.

2-12 Manufacturing overhead is an indirect cost since these costs cannot be easily and conveniently traced to particular units of products.

2-13 A differential cost is a cost that differs between alternatives in a decision. An opportunity cost is the potential benefit that is given up when one alternative is selected over another. A sunk cost is a cost that has already been incurred and cannot be altered by any decision taken now or in the future.

2-14 No; differential costs can be either variable or fixed. For example, the alternatives might consist of purchasing one machine rather than another to make a product. The difference in the fixed costs of purchasing the two machines would be a differential cost.

2-15

Direct labor cost	
(34 hours × $15 per hour)	$510
Manufacturing overhead cost	
(6 hours × $15 per hour)	90
Total wages earned	$600

2-16

Direct labor cost	
(45 hours × $14 per hour)	$630
Manufacturing overhead cost	
(5 hours × $7 per hour)	35
Total wages earned	$665

2-17 Costs associated with the quality of conformance can be broken down into prevention costs, appraisal costs, internal failure costs, and external failure costs. Prevention costs are incurred in an effort to keep defects from occurring. Appraisal costs are incurred to detect defects before they can create further problems. Internal and external failure costs are incurred as a result of producing defective units.

2-18 Total quality costs are usually minimized by *increasing* prevention and appraisal costs in order to reduce internal and external failure costs. Total quality costs usually decrease as prevention and appraisal costs increase.

2-19 Shifting the focus to prevention and away from appraisal is usually the most effective way to reduce total quality costs. It is usually more effective to prevent defects than to attempt to fix them after they have occurred.

2-20 First, a quality cost report helps managers see the financial consequences of defects. Second, the report may help managers identify the most important areas for improvement. Third, the report helps managers see whether quality costs are appropriately distributed among prevention, appraisal, internal failure, and external failure costs.

2-21 Most accounting systems do not track and accumulate the costs of quality. It is particularly difficult to get a feel for the magnitude of quality costs since they are incurred in many departments throughout the organization.

Exercise 2-1 (15 minutes)

1. The wages of employees who build the sailboats: direct labor cost.

2. The cost of advertising in the local newspapers: marketing and selling cost.

3. The cost of an aluminum mast installed in a sailboat: direct materials cost.

4. The wages of the assembly shop's supervisor: manufacturing overhead cost.

5. Rent on the boathouse: a combination of manufacturing overhead, administrative, and marketing and selling cost. The rent would most likely be prorated on the basis of the amount of space occupied by manufacturing, administrative, and marketing operations.

6. The wages of the company's bookkeeper: administrative cost.

7. Sales commissions paid to the company's salespeople: marketing and selling cost.

8. Depreciation on power tools: manufacturing overhead cost.

Exercise 2-2 (15 minutes)

	Product (Inventoriable) Cost	Period Cost
1. The cost of the memory chips used in a radar set	X	
2. Factory heating costs	X	
3. Factory equipment maintenance costs	X	
4. Training costs for new administrative employees		X
5. The cost of the solder that is used in assembling the radar sets	X	
6. The travel costs of the company's salespersons		X
7. Wages and salaries of factory security personnel	X	
8. The cost of air-conditioning executive offices		X
9. Wages and salaries in the department that handles billing customers		X
10. Depreciation on the equipment in the fitness room used by factory workers	X	
11. Telephone expenses incurred by factory management	X	
12. The costs of shipping completed radar sets to customers		X
13. The wages of the workers who assemble the radar sets	X	
14. The president's salary		X
15. Health insurance premiums for factory personnel	X	

Exercise 2-3 (15 minutes)

Mountain High
Income Statement

Sales		$3,200,000
Cost of goods sold:		
Beginning merchandise inventory	$ 140,000	
Add: Purchases	2,550,000	
Goods available for sale	2,690,000	
Deduct: Ending merchandise inventory	180,000	2,510,000
Gross margin		690,000
Selling and administrative expenses:		
Selling expense	110,000	
Administrative expense	470,000	580,000
Net operating income		$ 110,000

Exercise 2-4 (15 minutes)

Mannerman Fabrication
Schedule of Cost of Goods Manufactured

Direct materials:		
Beginning raw materials inventory	$ 55,000	
Add: Purchases of raw materials	440,000	
Raw materials available for use	495,000	
Deduct: Ending raw materials inventory	65,000	
Raw materials used in production		$ 430,000
Direct labor		215,000
Manufacturing overhead		380,000
Total manufacturing costs		1,025,000
Add: Beginning work in process inventory		190,000
		1,215,000
Deduct: Ending work in process inventory		220,000
Cost of goods manufactured		$ 995,000

Exercise 2-5 (15 minutes)

Cost (Measure of Activity)	Cost Behavior Variable	Fixed
1. The cost of small glass plates used for lab tests in a hospital (Number of lab tests performed)	X	
2. A boutique jewelry store's cost of leasing retail space in a mall (Dollar sales)		X
3. Top management salaries at FedEx (Total sales)		X
4. Electrical costs of running production equipment at a Toyota factory (Number of vehicles produced)	X	
5. The cost of insuring a dentist's office against fire (Patient-visits)		X
6. The cost of commissions paid to salespersons at a Honda dealer (Total sales)	X	
7. The cost of heating the intensive care unit at Swedish Hospital (Patient-days)..........................		X
8. The cost of batteries installed in trucks produced at a GM factory (Number of trucks produced)......	X	
9. The salary of a university professor (Number of students taught by the professor).......................		X
10. The costs of cleaning supplies used at a fast-food restaurant to clean the kitchen and dining areas at the end of the day (Number of customers served)	*	X

*May include a small variable element.

Exercise 2-6 (15 minutes)

	Cost	*Cost Object*	*Direct Cost*	*Indirect Cost*
1.	The salary of the head chef	The hotel's restaurant	X	
2.	The salary of the head chef	A particular restaurant customer		X
3.	Room cleaning supplies	A particular hotel guest		X
4.	Flowers for the reception desk	A particular hotel guest		X
5.	The wages of the doorman	A particular hotel guest		X
6.	Room cleaning supplies	The housecleaning department	X	
7.	Fire insurance on the hotel building	The hotel's gym		X
8.	Towels used in the gym	The hotel's gym	X	

Note: The room cleaning supplies would most likely be considered an indirect cost of a particular hotel guest because it would not be practical to keep track of exactly how much of each cleaning supply was used in the guest's room.

Exercise 2-7 (15 minutes)

Item	*Differential Cost*	*Opportunity Cost*	*Sunk Cost*
1. Cost of the new flat-panel displays...............................	X		
2. Cost of the old computer terminals.............................			X
3. Rent on the space occupied by the registration desk............			
4. Wages of registration desk personnel............................			
5. Benefits from a new freezer.....		X	
6. Costs of maintaining the old computer terminals..............	X		
7. Cost of removing the old computer terminals..............	X		
8. Cost of existing registration desk wiring..........................			X

Note: The costs of the rent on the space occupied by the registration desk and the wages of registration desk personnel are neither differential costs, opportunity costs, nor sunk costs. These are costs that do not differ between the alternatives and are therefore irrelevant in the decision, but they are not sunk costs since they occur in the future.

Exercise 2-8 (15 minutes)

1. No. It appears that the overtime spent completing the job was simply a matter of how the job happened to be scheduled. Under these circumstances, an overtime premium probably should not be charged to a customer whose job happens to fall at the tail end of the day's schedule.

2.

Direct labor cost: 9 hours × \$20 per hour	\$180
General overhead cost: 1 hour × \$10 per hour ..	10
Total labor cost	\$190

3. A charge for an overtime premium might be justified if the customer requested that the work be done on a "rush" basis.

Exercise 2-9 (15 minutes)

1.

	Prevention Costs	*Appraisal Costs*	*Internal Failure Costs*	*External Failure Costs*
a. Repairs of goods still under warranty				X
b. Customer returns due to defects				X
c. Statistical process control .	X			
d. Disposal of spoiled goods .			X	
e. Maintaining testing equipment		X		
f. Inspecting finished goods		X		
g. Downtime caused by quality problems			X	
h. Debugging errors in software			X	
i. Recalls of defective products				X
j. Training quality engineers.....................	X			
k. Re-entering data due to typing errors			X	
l. Inspecting materials received from suppliers..		X		
m. Audits of the quality system.........................	X			
n. Supervision of testing personnel.....................		X		
o. Rework labor			X	

2. Prevention costs and appraisal costs are incurred to keep poor quality of conformance from occurring. Internal and external failure costs are incurred because poor quality of conformance has occurred.

Exercise 2-10 (30 minutes)

1. a.	Emblems purchased	35,000
	Emblems drawn from inventory	31,000
	Emblems remaining in inventory	4,000
	Cost per emblem	× $2
	Cost in Raw Materials Inventory at May 31	$ 8,000
b.	Emblems used in production (31,000 – 1,000)	30,000
	Units completed and transferred to Finished Goods (90% × 30,000)	27,000
	Units still in Work in Process at May 31	3,000
	Cost per emblem	× $2
	Cost in Work in Process Inventory at May 31	$ 6,000
c.	Units completed and transferred to Finished Goods (above)	27,000
	Units sold during the month (75% × 27,000)	20,250
	Units still in Finished Goods at May 31	6,750
	Cost per emblem	× $2
	Cost in Finished Goods Inventory at May 31	$13,500
d.	Units sold during the month (above)	20,250
	Cost per emblem	× $2
	Cost in Cost of Goods Sold at May 31	$40,500
e.	Emblems used in advertising	1,000
	Cost per emblem	× $2
	Cost in Advertising Expense at May 31	$ 2,000

2. Raw Materials Inventory—balance sheet
   Work in Process Inventory—balance sheet
   Finished Goods Inventory—balance sheet
   Cost of Goods Sold—income statement
   Advertising Expense—income statement

Exercise 2-11 (30 minutes)

1.

Eccles Company
Schedule of Cost of Goods Manufactured

Direct materials:		
Raw materials inventory, beginning	$ 8,000	
Add: Purchases of raw materials	132,000	
Raw materials available for use	140,000	
Deduct: Raw materials inventory, ending	10,000	
Raw materials used in production		$130,000
Direct labor		90,000
Manufacturing overhead:		
Rent, factory building	80,000	
Indirect labor	56,300	
Utilities, factory	9,000	
Maintenance, factory equipment	24,000	
Supplies, factory	700	
Depreciation, factory equipment	40,000	
Total manufacturing overhead costs		210,000
Total manufacturing costs		430,000
Add: Work in process, beginning		5,000
		435,000
Deduct: Work in process, ending		20,000
Cost of goods manufactured		$415,000

2. The cost of goods sold section would be:

Finished goods inventory, beginning	$ 70,000
Add: Cost of goods manufactured	415,000
Goods available for sale	485,000
Deduct: Finished goods inventory, ending	25,000
Cost of goods sold	$460,000

Exercise 2-12 (15 minutes)

Cost Item	Cost Behavior: Variable	Cost Behavior: Fixed	Selling and Administrative Cost	Product Cost
1. The costs of turn signal switches used at a General Motors plant........................	X			X
2. Interest expense on CBS's long-term debt		X	X	
3. Salesperson's commissions at Avon Products	X		X	
4. Insurance on one of Cincinnati Milacron's factory buildings		X		X
5. The costs of shipping brass fittings to customers in California	X		X	
6. Depreciation on the bookshelves at Reston Bookstore...........................		X	X	
7. The costs of X-ray film at the Mayo Clinic's radiology lab....	X			X
8. The cost of leasing an 800 telephone number at L.L. Bean..................................		X	X	
9. The depreciation on the playground equipment at a McDonald's outlet		X	X	
10. The cost of the mozzarella cheese used at a Pizza Hut outlet.................................	X			X

Exercise 2-13 (15 minutes)

1. Direct labor cost: 34 hours × \$12 per hour	\$408
Manufacturing overhead cost: 6 hours × \$12 per hour	72
Total cost	\$480

2. Direct labor cost: 50 hours × \$12 per hour	\$600
Manufacturing overhead cost: 10 hours × \$6 per hour	60
Total cost	\$660

3. The company could treat the cost of fringe benefits relating to direct labor workers as part of manufacturing overhead. This approach spreads the cost of such fringe benefits over all units of output. Alternatively, the company could treat the cost of fringe benefits relating to direct labor workers as additional direct labor cost. This latter approach charges the costs of fringe benefits to specific jobs rather than to all units of output.

Problem 2-14 (30 minutes)

Note to the Instructor: Some of the answers below are debatable.

Cost Item	Variable or Fixed	Selling Cost	Administrative Cost	Manufacturing (Product) Cost: Direct	Manufacturing (Product) Cost: Indirect
1. Depreciation, executive jet	F		X		
2. Costs of shipping finished goods to customers	V	X			
3. Wood used in manufacturing furniture	V			X	
4. Sales manager's salary	F	X			
5. Electricity used in manufacturing furniture	V				X
6. Secretary to the company president	F		X		
7. Aerosol attachment placed on a spray can produced by the company	V			X	
8. Billing costs	V	X*			
9. Packing supplies for shipping products overseas	V	X			
10. Sand used in manufacturing concrete	V			X	
11. Supervisor's salary, factory	F				X
12. Executive life insurance	F		X		
13. Sales commissions	V	X			
14. Fringe benefits, assembly line workers	V			X**	
15. Advertising costs	F	X			
16. Property taxes on finished goods warehouses	F	X			
17. Lubricants for production equipment	V				X

*Could be an administrative cost.

**Could be an indirect cost.

Problem 2-15 (30 minutes)

1. Total wages for the week:

Regular time: 40 hours × $24 per hour		$ 960
Overtime: 5 hours × $36 per hour		180
Total wages		$1,140
Allocation of total wages:		
Direct labor: 45 hours × $24 per hour		$1,080
Manufacturing overhead: 5 hours × $12 per hour		60
Total wages		$1,140

2. Total wages for the week:

Regular time: 40 hours × $24 per hour		$ 960
Overtime: 10 hours × $36 per hour		360
Total wages		$1,320
Allocation of total wages:		
Direct labor: 46 hours × $24 per hour		$1,104
Manufacturing overhead:		
Idle time: 4 hours × $24 per hour	$ 96	
Overtime premium: 10 hours × $12 per hour	120	216
Total wages		$1,320

3. Total wages and fringe benefits for the week:

Regular time: 40 hours × $24 per hour		$ 960
Overtime: 8 hours × $36 per hour		288
Fringe benefits: 48 hours × $8 per hour		384
Total wages and fringe benefits		$1,632
Allocation of wages and fringe benefits:		
Direct labor: 45 hours × $24 per hour		$1,080
Manufacturing overhead:		
Idle time: 3 hours × $24 per hour	$ 72	
Overtime premium: 8 hours × $12 per hour	96	
Fringe benefits: 48 hours × $8 per hour	384	552
Total wages and fringe benefits		$1,632

Problem 2-15 (continued)

4. Allocation of wages and fringe benefits:

Direct labor:		
Wage cost: 45 hours × \$24 per hour	\$1,080	
Fringe benefits: 45 hours × \$8 per hour	360	\$1,440
Manufacturing overhead:		
Idle time: 3 hours × \$24 per hour	72	
Overtime premium: 8 hours × \$12 per hour	96	
Fringe benefits: 3 hours × \$8 per hour	24	192
Total wages and fringe benefits		\$1,632

Problem 2-16 (30 minutes)

Name of the Cost	*Variable Cost*	*Fixed Cost*	*Product Cost: Direct Materials*	*Product Cost: Direct Labor*	*Product Cost: Mfg. Overhead*	*Period (Selling and Admin.) Cost*	*Opportunity Cost*	*Sunk Cost*
Rental revenue forgone, $40,000 per year							X	
Direct materials cost, $40 per unit .	X		X					
Supervisor's salary, $2,500 per month		X			X			
Direct labor cost, $18 per unit	X			X				
Rental cost of warehouse, $1,000 per month		X				X		
Rental cost of equipment, $3,000 per month		X			X			
Depreciation of the building, $10,000 per year		X			X			X
Advertising cost, $50,000 per year		X				X		
Shipping cost, $10 per unit...........	X					X		
Electrical costs, $2 per unit...........	X				X			
Return earned on investments, $6,000 per year							X	

Problem 2-17 (20 minutes)

Cost Item	Cost Behavior: Variable	Cost Behavior: Fixed	To Units of Product: Direct	To Units of Product: Indirect
1. Plastic washers used to assemble autos*...	X			X
2. Production superintendent's salary		X		X
3. Wages of workers who assemble a product...	X		X	
4. Electricity to run production equipment	X			X
5. Janitorial salaries		X		X
6. Clay used to make bricks.........................	X		X	
7. Rent on a factory building........................		X		X
8. Wood used to make skis..........................	X		X	
9. Screws used to make furniture*...............	X			X
10. A supervisor's salary................................		X		X
11. Cloth used to make shirts	X		X	
12. Depreciation of cafeteria equipment.........		X		X
13. Glue used to make textbooks*	X			X
14. Lubricants for production equipment	X			X
15. Paper used to make textbooks	X		X	

*These materials would usually be considered indirect materials because their costs are relatively insignificant. It would not be worth the effort to trace their costs to individual units of product and therefore they would usually be classified as indirect materials.

Problem 2-18 (60 minutes)

1.

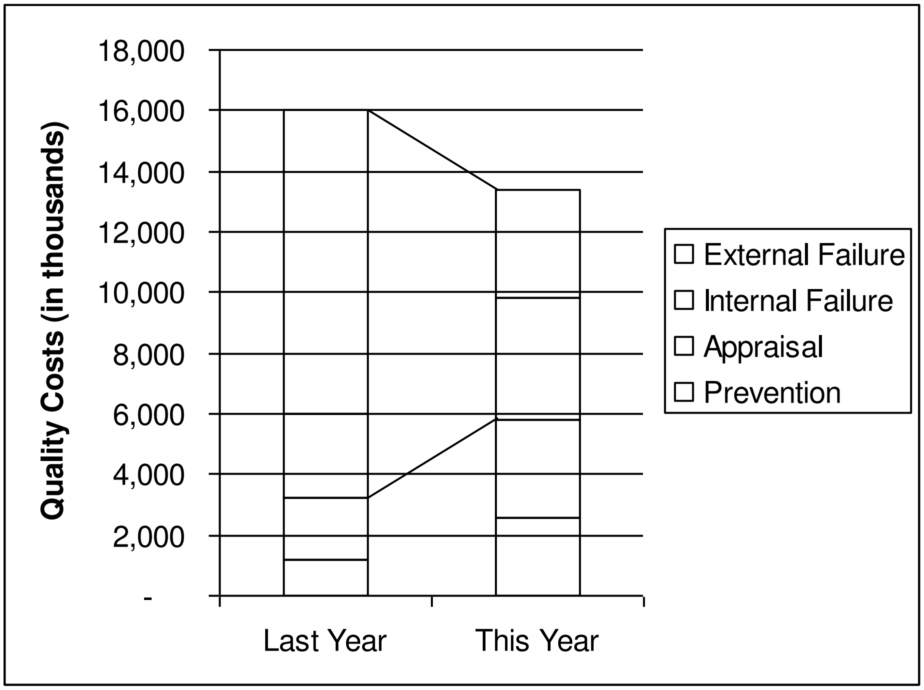
Yedder Enterprises
Quality Cost Report (in thousands of dollars)

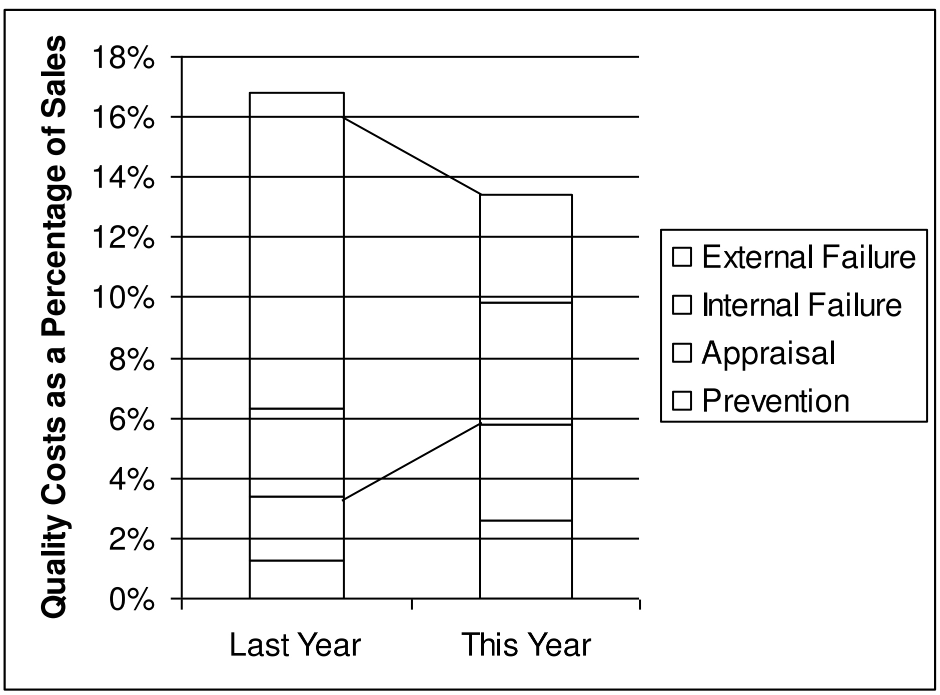
	Last Year		This Year	
	Amount	*Percent*	*Amount*	*Percent*
Prevention costs:				
Systems development	$ 120	0.13 %	$ 680	0.68 %
Statistical process control	—	0.00 %	270	0.27 %
Quality engineering	1,080	1.14 %	1,650	1.65 %
Total prevention cost	1,200	1.27 %	2,600	2.60 %
Appraisal costs:				
Inspection	1,700	1.79 %	2,770	2.77 %
Supplies used in testing	30	0.03 %	40	0.04 %
Cost of testing equipment	270	0.28 %	390	0.39 %
Total appraisal cost	2,000	2.10 %	3,200	3.20 %
Internal failure costs:				
Net cost of scrap	800	0.84 %	1,300	1.30 %
Rework labor	1,400	1.47 %	1,600	1.60 %
Downtime due to quality problems	600	0.63 %	1,100	1.10 %
Total internal failure cost	2,800	2.94 %	4,000	4.00 %
External failure costs:				
Product recalls	3,500	3.68 %	600	0.60 %
Warranty repairs	3,300	3.47 %	2,800	2.80 %
Customer returns of defective goods	3,200	3.37 %	200	0.20 %
Total external failure cost	10,000	10.52 %	3,600	3.60 %
Total quality cost	$16,000	16.84 %	$13,400	13.40 %

* As a percentage of total sales in each year.
Note: Figures in the percent columns are subject to rounding error.

2. See the graph on the following page.

Problem 2-18 (continued)





Problem 2-18 (continued)

3. During the past year the company has more than doubled its spending on prevention and it has increased its spending on appraisal activities by 60%. This increased emphasis on prevention and appraisal has resulted in a decline of total quality costs from 16.84% of sales last year to 13.4% of sales this year. While the situation has improved, internal and external failure costs still constitute the majority of the quality costs—and this does not include the lost sales due to customer perceptions of poor quality. However, if the company continues to emphasize prevention and appraisal, the internal and external failure costs should further decline until they are no longer dominant.

   Probably due to the increased emphasis on appraisal activities, internal failure costs have actually increased. This is because the increased appraisal activities catch more defects before they are shipped to customers. Thus, the company is incurring more costs for scrap and rework, but it is saving large amounts on external failure costs as a consequence of not releasing defective goods to customers. As better quality is built into products and better defect prevention systems are developed, defects should decrease and appraisal and internal failure costs should also fall.

Problem 2-19 (60 minutes)

1.

Medco, Inc.
Schedule of Cost of Goods Manufactured

Direct materials:		
Raw materials inventory, beginning	$ 10,000	
Add: Purchases of raw materials	90,000	
Raw materials available for use	100,000	
Deduct: Raw materials inventory, ending	17,000	
Raw materials used in production		$ 83,000
Direct labor		60,000
Manufacturing overhead:		
Depreciation, factory	42,000	
Insurance, factory	5,000	
Maintenance, factory	30,000	
Utilities, factory	27,000	
Supplies, factory	1,000	
Indirect labor	65,000	
Total overhead costs		170,000
Total manufacturing costs		313,000
Add: Work in process inventory, beginning		7,000
		320,000
Deduct: Work in process inventory, ending		30,000
Cost of goods manufactured		$290,000

Problem 2-19 (continued)

2.

Medco, Inc.
Income Statement

Sales		$450,000
Cost of goods sold:		
Finished goods inventory, beginning	$ 10,000	
Add: Cost of goods manufactured	290,000	
Goods available for sale	300,000	
Deduct: Finished goods inventory, ending	40,000	260,000
Gross margin		190,000
Selling and administrative expenses:		
Selling expenses	80,000	
Administrative expenses	70,000	150,000
Net operating income		$ 40,000

3. Direct materials: $83,000 ÷ 10,000 units = $8.30 per unit.
   Depreciation: $42,000 ÷ 10,000 units = $4.20 per unit.

4. Direct materials:
   Unit cost: $8.30 (unchanged)
   Total cost: 15,000 units × $8.30 per unit = $124,500.
   Depreciation:
   Unit cost: $42,000 ÷ 15,000 units = $2.80 per unit.
   Total cost: $42,000 (unchanged)

5. Unit cost for depreciation dropped from $4.20 to $2.80, because of the increase in production between the two years. Since fixed costs do not change *in total* as the activity level changes, they will decrease on a unit basis as the activity level rises.

Problem 2-20 (15 minutes)

1. The controller is correct that the salary cost should be classified as a selling (marketing) cost. The duties described in the problem have nothing to do with manufacturing the product, but rather deal with order-taking and shipping finished goods to customers. As stated in the text, selling costs include all costs necessary to secure customer orders and get the finished product into the hands of customers.

2. No, the president is not correct; how the salary cost is classified can affect the reported net operating income for the year. If the salary cost is classified as a selling expense all of it will appear on the income statement as a period cost. However, if the salary cost is classified as a manufacturing (product) cost, then it will be added to Work in Process Inventory along with other manufacturing costs for the period. To the extent that goods are still in process at the end of the period, part of the salary cost will remain with these goods in the Work in Process Inventory account. Only that portion of the salary cost that has been assigned to finished units will leave the Work in Process Inventory account and be transferred into the Finished Goods Inventory account. In like manner, to the extent that goods are unsold at the end of the period, part of the salary cost will remain with these goods in the Finished Goods Inventory account. Only that portion of the salary that has been assigned to finished units *that are sold during the period* will appear on the income statement as an expense (part of Cost of Goods Sold) for the period.

Problem 2-21 (30 minutes)

1.

			Product Cost			Period (Selling and Admin.)		
Name of the Cost	*Variable Cost*	*Fixed Cost*	*Direct Materials*	*Direct Labor*	*Mfg. Overhead*	*Cost*	*Opportunity Cost*	*Sunk Cost*
Frieda's present salary of $4,000 per month							X	
Rent on the garage, $150 per month ..		X			X			
Rent of production equipment, $500 per month		X			X			
Materials for producing flyswatters, at $0.30 each	X		X					
Labor cost of producing flyswatters, at $0.50 each	X			X				
Rent of room for a sales office, $75 per month		X				X		
Answering device attachment, $20 per month		X				X		
Interest lost on savings account, $1,000 per year							X	
Advertising cost, $400 per month		X				X		
Sales commission, at $0.10 per flyswatter	X					X		
Legal and filing fees, $600.................								X

Problem 2-21 (continued)

2. The $600 legal and filing fees are not a differential cost. These legal and filing fees have already been paid and are a sunk cost. Thus, the cost will not differ depending on whether Frieda decides to produce flyswatters or to stay with the consulting firm. All other costs listed above are differential costs since they will be incurred only if Frieda leaves the consulting firm and produces the flyswatters.

Problem 2-22 (45 minutes)

1. A percentage analysis of the company's quality cost report is presented below:

	Year 1			*Year 2*		
	Amount	*Percentage**		*Amount*	*Percentage**	
Prevention costs:						
Machine maintenance.........	$ 215	5.2 %	22.3 %	$ 160	3.5 %	27.1 %
Training suppliers	5	0.1	0.5	15	0.3	2.5
Design reviews	20	0.5	2.1	95	2.1	16.1
Total prevention cost	240	5.8	24.9	270	6.0	45.7
Appraisal costs:						
Incoming inspection	45	1.1	4.7	22	0.5	3.7
Final testing......................	160	3.9	16.6	94	2.1	15.9
Total appraisal cost	205	5.0	21.3	116	2.6	19.6
Internal failure costs:						
Rework	120	2.9	12.4	62	1.4	10.5
Scrap	68	1.7	7.1	40	0.9	6.8
Total internal failure cost	188	4.6	19.5	102	2.3	17.3
External failure costs:						
Warranty repairs	69	1.7	7.2	23	0.5	3.9
Customer returns	262	6.4	27.2	80	1.8	13.5
Total external failure cost......	331	8.0	34.3	103	2.3	17.4
Total quality cost..................	$ 964	23.4 %	100.0 %	$ 591	13.1 %	100.0 %
Total production cost	$4,120			$4,510		

*Percentage figures are subject to rounding error.

Problem 2-22 (continued)

From the above analysis it would appear that Bergen, Inc.'s program has been successful, because:

- total quality costs as a percentage of total production have declined from 23.4% to 13.1%.
- external failure costs, those costs signaling customer dissatisfaction, have declined from 8% of total production to 2.3%. These declines in warranty repairs and customer returns should translate into increased sales in the future.
- internal failure costs have been reduced from 4.6% to 2.3% of production costs, which represents a 50% drop.
- appraisal costs have decreased from 5.0% to 2.6% of total production—a drop of 48%. Higher quality is reducing the demand for final testing.
- quality costs have shifted to the area of prevention where problems are solved before the customer becomes involved. Maintenance, training, and design reviews have increased from 5.8% of total production cost to 6% and from 24.9% of total quality costs to 45.7%. The $30,000 increase is more than offset by decreases in other quality costs.

2. Tony Reese's current reaction to the quality improvement program is more favorable as he is seeing the benefits of having the quality problems investigated and solved before they reach the production floor. Because of improved designs, quality training, and additional pre-production inspections, scrap and rework costs have declined. Consequently, fewer resources are now required for customer service. Throughput has increased and throughput time has decreased; work is now moving much faster through the department.

3. To measure the opportunity cost of not implementing the quality program, Bergen Inc. could assume that:
    - sales and market share would continue to decline and then calculate the revenue and income lost.
    - the company would have to compete on price rather than quality and calculate the impact of having to lower product prices.

Problem 2-23 (45 minutes)

1.

Cost Item	Cost Behavior Variable	Cost Behavior Fixed	Selling or Administrative Cost	Product Cost Direct	Product Cost Indirect
Direct materials used (wood, glass)	$430,000			$430,000	
General office salaries		$110,000	$110,000		
Factory supervision		70,000			$ 70,000
Sales commissions	60,000		60,000		
Depreciation, factory building		105,000			105,000
Depreciation, office equipment		2,000	2,000		
Indirect materials, factory	18,000				18,000
Factory labor (cutting and assembly) ...	90,000			90,000	
Advertising		100,000	100,000		
Insurance, factory..............................		6,000			6,000
General office supplies	4,000		4,000		
Property taxes, factory.......................		20,000			20,000
Utilities, factory	45,000				45,000
Total costs	$647,000	$413,000	$276,000	$520,000	$264,000

Problem 2-23 (continued)

2. Only the product costs will be included in the cost of a bookcase. The cost per bookcase will be:

Direct product costs	$520,000
Indirect product costs	264,000
Total product costs	$784,000

$784,000 ÷ 4,000 bookcases = $196 per bookcase

3. The cost per bookcase would increase. This is because the fixed costs would be spread over fewer units, causing the cost per unit to rise.

4. a. Yes, there probably would be a disagreement. The president is likely to want a price of at least $196, which is the average cost per unit to manufacture 4,000 bookcases. He may expect an even higher price than this to cover a portion of the administrative costs as well. The neighbor will probably be thinking of cost as including only materials used, or perhaps materials and direct labor.

   b. The term is opportunity cost. Since the company is operating at full capacity, the president must give up the full, regular price of a set to sell a bookcase to the neighbor. Therefore, the president's cost is really the full, regular price of a set.

Problem 2-24 (15 minutes)

Item	Description	Direct or Indirect Cost of the Immunization Center: Direct	Indirect	Direct or Indirect Cost of Particular Patients: Direct	Indirect	Variable or Fixed with Respect to the Number of Immunizations Administered: Variable	Fixed
a.	The salary of the head nurse in the Immunization Center	X			X		X
b.	Costs of incidental supplies consumed in the Immunization Center such as paper towels	X			X	X	
c.	The cost of lighting and heating the Immunization Center	X			X		X
d.	The cost of disposable syringes used in the Immunization Center	X		X		X	
e.	The salary of the Central Area Well-Baby Clinic's Information Systems manager		X		X		X
f.	The costs of mailing letters soliciting donations to the Central Area Well-Baby Clinic		X		X		X
g.	The wages of nurses who work in the Immunization Center*	X			X		X
h.	The cost of medical malpractice insurance for the Central Area Well-Baby Clinic		X		X		X
i.	Depreciation on the fixtures and equipment in the Immunization Center	X			X		X

* The wages of the nurses could be variable and a direct cost of serving particular patients.

Problem 2-25 (60 minutes)

1.

Skyler Company
Schedule of Cost of Goods Manufactured
For the Month Ended June 30

Direct materials:		
Raw materials inventory, June 1	$ 17,000	
Add: Purchases of raw materials	190,000	
Raw materials available for use	207,000	
Deduct: Raw materials inventory, June 30	42,000	
Raw materials used in production		$165,000
Direct labor		90,000
Manufacturing overhead:		
Rent on facilities (80% × $40,000)	32,000	
Insurance (75% × $8,000)	6,000	
Utilities (90% × $50,000)	45,000	
Indirect labor	108,000	
Maintenance, factory	7,000	
Depreciation, factory equipment	12,000	
Total overhead costs		210,000
Total manufacturing costs		465,000
Add: Work in process inventory, June 1		70,000
		535,000
Deduct: Work in process inventory, June 30		85,000
Cost of goods manufactured		$450,000

Problem 2-25 (continued)

2.

Skyler Company
Income Statement
For the Month Ended June 30

Sales		$600,000
Cost of goods sold:		
Finished goods inventory, June 1	$ 20,000	
Add: Cost of goods manufactured	450,000	
Goods available for sale	470,000	
Deduct: Finished goods inventory, June 30	60,000	410,000
Gross margin		190,000
Selling and administrative expenses:		
Selling and administrative salaries	35,000	
Rent on facilities (20% × $40,000)	8,000	
Depreciation, sales equipment	10,000	
Insurance (25% × $8,000)	2,000	
Utilities (10% × $50,000)	5,000	
Advertising	80,000	140,000
Net operating income		$ 50,000

3. In preparing the income statement shown in the text, the accountant failed to distinguish between product costs and period costs, and also failed to recognize the change in inventories between the beginning and end of the month. Once these errors have been corrected, the financial condition of the company looks much better and selling the company may not be advisable.

Problem 2-26 (30 minutes)

1. Mr. Richart's first action was to direct that discretionary expenditures be delayed until the first of the new year. Providing that these "discretionary expenditures" can be delayed without hampering operations, this is a good business decision. By delaying expenditures, the company can keep its cash a bit longer and thereby earn a bit more interest. There is nothing unethical about such an action. The second action was to ask that the order for the parts be cancelled. Since the clerk's order was a mistake, there is nothing unethical about this action either.

   The third action was to ask the accounting department to delay recognition of the delivery until the bill is paid in January. This action is dubious. Asking the accounting department to ignore transactions strikes at the heart of the integrity of the accounting system. If the accounting system cannot be trusted, it is very difficult to run a business or obtain funds from outsiders. However, in Mr. Richart's defense, the purchase of the raw materials really shouldn't be recorded as an expense. He has been placed in an extremely awkward position because the company's accounting policy is flawed.

2. The company's accounting policy with respect to raw materials is incorrect. Raw materials should be recorded as an asset when delivered rather than as an expense. If the correct accounting policy were followed, there would be no reason for Mr. Richart to ask the accounting department to delay recognition of the delivery of the raw materials. This flawed accounting policy creates incentives for managers to delay deliveries of raw materials until after the end of the fiscal year. This could lead to raw materials shortages and poor relations with suppliers who would like to record *their* sales before the end of the year.

   The company's "manage-by-the-numbers" approach does not foster ethical behavior—particularly when managers are told to "do anything so long as you hit the target profits for the year." Such "no excuses" pressure from the top too often leads to unethical behavior when managers have difficulty meeting target profits.

Problem 2-27 (60 minutes)

1.

Valenko Company
Schedule of Cost of Goods Manufactured

Direct materials:			
Raw materials inventory, beginning	$ 50,000		
Add: Purchases of raw materials	260,000		
Raw materials available for use	310,000		
Deduct: Raw materials inventory, ending	40,000		
Raw materials used in production		$270,000	
Direct labor		65,000	*
Manufacturing overhead:			
Insurance, factory	8,000		
Rent, factory building	90,000		
Utilities, factory	52,000		
Cleaning supplies, factory	6,000		
Depreciation, factory equipment	110,000		
Maintenance, factory	74,000		
Total overhead costs		340,000	
Total manufacturing costs		675,000	(given)
Add: Work in process inventory, beginning		48,000	*
		723,000	
Deduct: Work in process inventory, ending		33,000	
Cost of goods manufactured		$690,000	

Problem 2-27 (continued)

The cost of goods sold section of the income statement follows:

Finished goods inventory, beginning	$ 30,000	
Add: Cost of goods manufactured	690,000	*
Goods available for sale	720,000	(given)
Deduct: Finished goods inventory, ending	85,000	*
Cost of goods sold	$635,000	(given)

*These items must be computed by working backwards up through the statements. An effective way of doing this is to place the form and known balances on the chalkboard, and then work toward the unknown figures.

2. Direct materials: $270,000 ÷ 30,000 units = $9.00 per unit.
   Rent, factory building: $90,000 ÷ 30,000 units = $3.00 per unit.

3. Direct materials:
   Per unit: $9.00 (unchanged)
   Total: 50,000 units × $9.00 per unit = $450,000.

   Rent, factory building:
   Per unit: $90,000 ÷ 50,000 units = $1.80 per unit.
   Total: $90,000 (unchanged).

4. The average cost per unit for rent dropped from $3.00 to $1.80, because of the increase in production between the two years. Since fixed costs do not change *in total* as the activity level changes, the *average* unit cost will decrease as the activity level rises.

Problem 2-28 (60 minutes)

	Case 1		Case 2		Case 3		Case 4	
Direct materials	$ 7,000		$ 9,000		$ 6,000		$ 8,000	
Direct labor	2,000		4,000		5,000	*	3,000	
Manufacturing overhead	10,000		12,000	*	7,000		21,000	
Total manufacturing costs	19,000	*	25,000		18,000		32,000	*
Beginning work in process inventory	3,000	*	1,000		2,000		1,500	*
Ending work in process inventory	(4,000)		(3,500)		(4,000)	*	(2,000)	
Cost of goods manufactured	$18,000		$22,500	*	$16,000		$31,500	
Sales	$25,000		$40,000		$30,000		$50,000	
Beginning finished goods inventory	6,000		8,000	*	7,000		9,000	
Cost of goods manufactured	18,000		22,500	*	16,000		31,500	
Goods available for sale	24,000	*	30,500	*	23,000	*	40,500	*
Ending finished goods inventory	9,000		4,000		5,000	*	7,000	
Cost of goods sold	15,000	*	26,500		18,000		33,500	*
Gross margin	10,000	*	13,500	*	12,000	*	16,500	*
Selling and administrative expenses	6,000		8,000	*	9,000	*	10,000	
Net operating income	$ 4,000	*	$ 5,500		$ 3,000		$ 6,500	*

*Missing data in the problem.

Problem 2-29 (45 minutes)

1.

Hickey Corporation
Schedule of Cost of Goods Manufactured

Direct materials:		
Raw materials inventory, beginning	$ 20,000	
Add: Purchases of raw materials	160,000	
Raw materials available for use	180,000	
Deduct: Raw materials inventory, ending	10,000	
Raw materials used in production		$170,000
Direct labor		80,000
Manufacturing overhead:		
Indirect labor	60,000	
Building rent (80% × $50,000)	40,000	
Utilities, factory	35,000	
Royalty on patent ($1 per unit × 30,000 units)	30,000	
Maintenance, factory	25,000	
Rent on equipment: $6,000 + ($0.10 per unit × 30,000 units)	9,000	
Other factory overhead costs	11,000	
Total overhead costs		210,000
Total manufacturing costs		460,000
Add: Work in process inventory, beginning		30,000
		490,000
Deduct: Work in process inventory, ending		40,000
Cost of goods manufactured		$450,000

Problem 2-29 (continued)

2\. a. To compute the number of units in the finished goods inventory at the end of the year, we must first compute the number of units sold during the year.

$$\frac{\text{Total sales}}{\text{Unit selling price}} = \frac{\$650{,}000}{\$25\text{ per unit}} = 26{,}000\text{ units sold}$$

Units in the finished goods inventory, beginning	0
Units produced during the year	30,000
Units available for sale	30,000
Units sold during the year (above)	26,000
Units in the finished goods inventory, ending	4,000

b. The average production cost per unit during the year would be:

$$\frac{\text{Cost of goods manufactured}}{\text{Number of units produced}} = \frac{\$450{,}000}{30{,}000\text{ units}} = \$15\text{ per unit.}$$

Thus, the cost of the units in the finished goods inventory at the end of the year would be: 4,000 units × $15 per unit = $60,000.

3\.

Hickey Corporation
Income Statement

Sales		$650,000
Cost of goods sold:		
Finished goods inventory, beginning	$ 0	
Add: Cost of goods manufactured	450,000	
Goods available for sale	450,000	
Finished goods inventory, ending	60,000	390,000
Gross margin		260,000
Selling and administrative expenses:		
Advertising	50,000	
Building rent (20% × $50,000)	10,000	
Selling and administrative salaries	140,000	
Other selling and administrative expense	20,000	220,000
Net operating income		$ 40,000

Case 2-30 (60 minutes)

1. No distinction has been made between period expenses and product costs on the income statement. Product costs (e.g., direct materials, direct labor, and manufacturing overhead) should be assigned to inventory accounts and flow through to the income statement as cost of goods sold only when finished products are sold. Since there were ending inventories, some of the product costs should appear on the balance sheet as assets rather than on the income statement as expenses.

2.

Medical Technology, Inc.
Schedule of Cost of Goods Manufactured
For the Quarter Ended June 30

Direct materials:		
Raw materials inventory, beginning	$ 0	
Add: Purchases of raw materials	310,000	
Raw materials available for use	310,000	
Deduct: Raw materials inventory, ending	40,000	
Raw materials used in production		$270,000
Direct labor		80,000
Manufacturing overhead:		
Cleaning supplies, factory	6,000	
Indirect labor cost	135,000	
Maintenance, factory	47,000	
Rental cost, facilities (80% × $65,000)	52,000	
Insurance, factory	9,000	
Utilities (90% × $40,000)	36,000	
Depreciation, factory equipment	75,000	
Total overhead costs		360,000
Total manufacturing costs		710,000
Add: Work in process inventory, beginning		0
		710,000
Deduct: Work in process inventory, ending		30,000
Cost of goods manufactured		$680,000

Case 2-30 (continued)

3. Before an income statement can be prepared, the cost of the 4,000 monitors in the ending finished goods inventory must be determined. Altogether, the company produced 20,000 units during the quarter; thus, the production cost per unit would be:

$$\frac{\text{Cost of goods manufactured}}{\text{Units produced during the quarter}} = \frac{\$680{,}000}{20{,}000 \text{ units}} = \$34 \text{ per unit}$$

Since 4,000 monitors (20,000 – 16,000 = 4,000) were in the ending finished goods inventory, the total cost of this inventory would be:

4,000 units × $34 per unit = $136,000.

With this figure and other data from the case, the company's income statement for the quarter can be prepared as follows:

Medical Technology, Inc.
Income Statement
For the Quarter Ended June 30

Sales		$975,000
Cost of goods sold:		
Finished goods inventory, beginning	$ 0	
Add: Cost of goods manufactured	680,000	
Goods available for sale	680,000	
Deduct: Finished goods inventory, ending	136,000	544,000
Gross margin		431,000
Selling and administrative expenses:		
Selling and administrative salaries	90,000	
Advertising	200,000	
Rental cost, facilities (20% × $65,000)	13,000	
Depreciation, office equipment	18,000	
Utilities (10% × $40,000)	4,000	
Travel, salespersons	60,000	385,000
Net operating income		$ 46,000

Case 2-30 (continued)

4. No, the insurance company probably does not owe Medical Technology $227,000. The key question is how "cost" was defined in the insurance contract. It is most likely that the insurance contract limits reimbursement for losses to those costs that would normally be considered product costs—in other words, direct materials, direct labor, and manufacturing overhead. The $227,000 figure is overstated since it includes elements of selling and administrative expenses as well as all of the product costs. The $227,000 figure also does not recognize that some costs incurred during the period are in the ending Raw Materials and Work in Process inventory accounts, as explained in part (1) above. The insurance company's liability is probably just $136,000, which is the amount of cost associated with the ending Finished Goods inventory as shown in part (3) above.

Case 2-31 (60 minutes)

The following cost items are needed before any schedules or statements can be prepared:

Direct labor cost:

¼ × Manufacturing overhead = Direct labor cost

¼ × $520,000 = $130,000

Materials used in production:

Direct labor and direct materials	$510,000
Less direct labor cost	130,000
Direct materials cost	$380,000

Cost of goods manufactured:

Goods available for sale	$960,000
Less finished goods inventory, beginning	90,000
Cost of goods manufactured	$870,000

The easiest way to proceed from this point is to place all known amounts on the chalkboard in a partially completed schedule of cost of goods manufactured and a partially completed income statement. Then fill in the missing amounts by analysis of the available data.

Direct materials:	
Raw materials inventory, beginning	$ 30,000
Add: Purchases of raw materials	420,000
Raw materials available for use	450,000
Deduct: Raw materials inventory, ending	A
Raw materials used in production (see above)	380,000
Direct labor cost (see above)	130,000
Manufacturing overhead cost	520,000
Total manufacturing costs	1,030,000
Add: Work in process inventory, beginning	50,000
	1,080,000
Deduct: Work in process inventory, ending	B
Cost of goods manufactured (see above)	$ 870,000

Case 2-31 (continued)

Therefore, "A" (Raw materials inventory, ending) would be $70,000; and "B" (Work in process inventory, ending) would be $210,000.

Sales		$1,350,000
Cost of goods sold:		
Finished goods inventory, beginning	$ 90,000	
Add: Cost of goods manufactured (see above)	870,000	
Goods available for sale	960,000	
Deduct: Finished goods inventory, ending	C	810,000 *
Gross margin		$ 540,000

*$1,350,000 × (100% – 40%) = $810,000.

Therefore, "C" (Finished goods inventory, ending) would be $150,000. The procedure outlined above is just one way in which the solution to the case can be approached. Some students may wish to start at the bottom of the income statement (with gross margin) and work upwards from that point. Also, the solution can be obtained by use of T-accounts.

Research and Application 2-32 (240 minutes)

1. Dell succeeds because of its operational excellence customer value proposition. Page 1 of the 10-K (under the heading Business Strategy) lists the key tenets of Dell's business strategy. The first three tenets focus on operational excellence. The first tenet discusses the direct business model, which "eliminates wholesale and retail dealers that add unnecessary time and cost or diminish Dell's understanding of customer expectations." The second tenet is Dell's build-to-order manufacturing process that "enables Dell to turn over inventory every four days on average, and reduce inventory levels." The third tenet is "Dell's relentless focus on reducing its costs [which] allows it to consistently provide customers with superior value." Also, the first bullet point on Page 8 of the 10-K says "Dell's success is based on its ability to profitably offer its products at a lower price than its competitors."

2. Dell faces numerous business risks as described in pages 7-10 of the 10-K. Students may mention other risks beyond those specifically mentioned in the 10-K. Here are four risks faced by Dell with suggested control activities:
   - Risk: Profits may fall short of investor expectations if Dell's product, customer, and geographic mix is substantially different than anticipated. Control activities: Maintain a budgeting program that forecasts sales by product line, customer segment, and geographic region. While the budget is not going to be perfectly accurate, a reasonably accurate forecast would help Dell manage investor expectations.
   - Risk: Disruptions in component availability from suppliers could infringe on Dell's ability to meet customer orders. This is of particular concern for Dell because its lean production practices result in minimal inventory levels and because Dell relies on several single-sourced suppliers. Control activities: Develop a plan with singe-sourced suppliers to ensure that they can produce the necessary components at more than one plant location and to ensure that each location has more than one means of delivering the parts to Dell's assembly facilities.

Research and Application 2-32 (continued)

- Risk: Infrastructure failures (e.g., computer viruses, intentional disruptions of IT systems and website outages) may threaten Dell's ability to book or process orders, manufacture products, or ship products in a timely manner. Control activities: Install controls such as physical security, data storage backup sites, firewalls and passwords that protect technology assets.
- Risk: Losing government contracts could adversely affect the company's revenues. Control activities: Develop a formal review process, supervised by legal counsel, to ensure that Dell complies with governmental regulations.

3. Pages 34-35 of Dell's Form 10-K contain the audit report issued by PricewaterhouseCoopers (PWC). The audit report makes reference to the role of the Public Company Accounting Oversight Board (PCAOB) that was created by the Sarbanes-Oxley Act of 2002 (SOX). PWC's audit report also contains two opinions dealing with internal control. The first opinion relates to management's assessment of its internal controls. The second opinion relates to PWC's assessment of the effectiveness of Dell's internal controls. These two opinions are required by SOX. Page 59 includes management's report on internal control over financial reporting. This report includes a reference to SOX. Finally, pages 76-78 contain the signed certifications from the CEO (Kevin Rollins) and the CFO (James Schneider). SOX requires the CEO and CFO to certify that the 10-K and its accompanying financial statements do not contain any untrue statements and are fairly stated in all material respects.

4. Based solely on the inventories number on the balance sheet, students cannot determine the answer to this question. Furthermore, given that Dell's total amount of inventories is so small, the company does not report the break down of its inventories between raw materials, work-in-process, and finished goods. Nonetheless, students should be able to readily ascertain that Dell is a manufacturer. Page 2 of the 10-K says "Dell designs, develops, manufactures, markets, sells, and supports a wide range of products that are customized to customer requirements." Page 5 states "Dell's manufacturing process consists of assembly, software installation, functional testing, and quality control." Page 7 states

that Dell has manufacturing facilities in Austin, Texas, Eldorado do Sul, Brazil, Nashville and Lebanon, Tennessee, Limerick, Ireland, Penang, Malaysia, and Xiamen, China.

5. Examples of direct inventoriable costs include the component parts that go into making Dell's main product families, which include enterprise systems, client systems, printing and imaging systems, software and peripherals. The "touch" laborers that work in each of the aforementioned plants would also be a direct inventoriable cost. Examples of indirect inventoriable costs include the costs to sustain the manufacturing plants that cannot be conveniently traced to specific products. The utility bills, insurance premiums, plant management salaries, equipment-related costs, etc. that are incurred to sustain plant operations would all be indirect inventoriable costs.

   The gross margin (in dollars) has steadily increased and the gross margin as a percent of sales has remained fairly steady for two reasons. First, the cost of goods sold consists largely of variable costs (e.g., direct materials and direct labor costs). As sales grow, these variable costs increase in total, but as a percentage of sales, they remain fairly stable over time.

   Some students may ask about the fixed overhead costs that are incurred to run the plants. Spreading fixed overhead costs over a higher volume of sales would increase the gross margin percentage. However, the fixed overhead costs are relatively small in relation to the dollar value of raw materials that flows through Dell's plants each year.

   Second, pages 22-23 mention that Dell plans to reduce product costs in four areas: manufacturing costs, warranty costs, design costs, and overhead costs. The company says that its "general practice is to aggressively pass on declines in costs to its customers in order to add customer value while increasing global market share." In other words, rather than holding price constant when costs decline, thereby increasing the gross margin percentage, the company lowers prices. Using terminology that will be defined in Chapter 12, Dell grows profits by increasing turnover while holding margin reasonably constant.

Research and Application 2-32 (continued)

6. The inventory balance on January 28, 2005 is $459 million. As discussed on Page 2 of the 10-K, the balance is low because of Dell's build-to-order (lean) manufacturing process that enables the company to "turn over inventory every four days on average, and reduce inventory levels." When units are built-to-order rather than built-to-stock, it not only reduces finished goods inventory, it reduces work-in-process inventory because large batches of partially completed goods do not accumulate in front of workstations or in temporary storage areas. It also reduces raw materials inventory because suppliers provide just-in-time delivery of the quantities needed to satisfy customer orders.

   As stated on page 2, this offers Dell a competitive advantage because it allows the company to "rapidly introduce the latest relevant technology more quickly than companies with slow-moving, indirect distribution channels, and to rapidly pass on component cost savings directly to customers."

   The negative cash conversion cycle is a good sign for Dell. Although this term is not defined in the chapter, students can ascertain from page 27 of the 10-K that it is computed as follows: days sales outstanding + days of supply in inventory – days in accounts payable. As stated on pages 26-27, the negative cash conversion cycle means that Dell is "collecting amounts due from customers before paying vendors, thus allowing the company to generate annual cash flows from operating activities that typically exceed net income."

7. As shown on page 23, Dell's two main categories of operating expenses are selling, general, and administrative ($4,298 million) and research, development, and engineering ($463 million). Page 42 explains that Dell's selling, general, and administrative expenses "include items such as sales commissions, marketing and advertising costs, and contractor services." It also mentions that advertising costs totaled $576 million in fiscal 2005. General and administrative costs include "Finance, Legal, Human Resources and information technology support." Dell's website development costs are included in Research, Development, and Engineering costs along with payroll, infrastructure, and administrative costs related directly to research and development.

Research and Application 2-32 (continued)

For GAAP reporting purposes, costs are classified as either product costs or period costs. Product costs include those costs involved with making or acquiring the product. Period costs include all costs that are not product costs. The expenses mentioned in the paragraph above are not involved with making the product so they are expensed as incurred. It is worth mentioning that when the focus changes from external reporting to internal decision making the need to comply with GAAP disappears. So for example, on page 42 it says "Research, development, and engineering costs are expensed as incurred, in accordance with SFAS No. 2, *Accounting for Research and Development Costs*." However, for internal reporting purposes it may be entirely appropriate to assign some research and development costs to particular products.

8. Here are four examples of cost objects for Dell including one direct and one indirect cost for each cost object.
    - Cost object: Any product line, such as a particular type of server (a direct cost would be the cost of raw material component parts and an indirect cost would be factory utility costs).
    - Cost object: Any particular product family, such as enterprise systems, which according to page 2 includes servers, storage, workstations, and networking products (a direct cost would be the component parts used to make these products and an indirect cost would be factory insurance costs that are assigned to these products).
    - Cost object: Any particular geographic region, such Asia Pacific-Japan, which is mentioned on page 55 (a direct cost would be the salary of William Amelio, Senior Vice-President, Asia Pacific-Japan (see page 11) and an indirect cost would be the salary of Martin J. Garvin, Senior Vice President, Worldwide Procurement and Global Customer Experience (see page 11), given that he oversees worldwide procurement operations).
    - Cost object: Any particular customer segment, such as the government segment as mentioned on page 4 (a direct cost would be a sales representative who is dedicated to serving the government segment and an indirect cost would be research and development costs that are expended on products purchased by more than one customer segment).

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Chapter 3
Systems Design: Job-Order Costing

Solutions to Questions

3-1 By definition, manufacturing overhead consists of costs that cannot be practically traced to products or jobs. Therefore, if these costs are to be assigned to products or jobs, they must be allocated rather than traced.

3-2 Job-order costing is used in situations where many different products or services that require separate costing are produced each period. Process costing is used in situations where a single, homogeneous product, such as cement, bricks, or gasoline, is produced for long periods.

3-3 The job cost sheet is used to record all costs that are assigned to a particular job. These costs include direct materials costs traced to the job, direct labor costs traced to the job, and manufacturing overhead costs applied to the job. When a job is completed, the job cost sheet is used to compute the unit product cost.

3-4 A predetermined overhead rate is used to apply overhead to jobs. It is computed before a period begins by dividing the period's estimated total manufacturing overhead by the period's estimated total amount of the allocation base. Thereafter, overhead is applied to jobs by multiplying the predetermined overhead rate by the actual amount of the allocation base that is incurred for each job. The most common allocation base is direct labor-hours.

3-5 A sales order is issued after an agreement has been reached with a customer on quantities, prices, and shipment dates for goods. The sales order forms the basis for the production order. The production order specifies what is to be produced and forms the basis for the job cost sheet. The job cost sheet, in turn, is used to summarize the various production costs incurred to complete the job. These costs are entered on the job cost sheet from materials requisition forms, direct labor time tickets, and by applying overhead.

3-6 Some production costs such as a factory manager's salary cannot be traced to a particular product or job, but rather are incurred as a result of overall production activities. In addition, some production costs such as indirect materials cannot be easily traced to jobs. If these costs are to be assigned to products, they must be allocated to the products.

3-7 If actual manufacturing overhead cost is applied to jobs, then the company must wait until the end of the accounting period to apply overhead and to cost jobs. If the company computes actual overhead rates more frequently to get around this problem, the rates may fluctuate widely. Overhead cost tends to be incurred somewhat evenly from month to month (due to the presence of fixed costs), whereas production activity often fluctuates. The result would be high overhead rates in periods with low activity and low overhead rates in periods with high activity. For these reasons, most companies use predetermined overhead rates to apply manufacturing overhead costs to jobs.

3-8 The measure of activity used as the allocation base should drive the overhead cost; that is, the base should cause the overhead cost. If the allocation base does not really cause the overhead, then costs will be incorrectly attributed to products and jobs and product costs will be distorted.

3-9 Assigning manufacturing overhead costs to jobs does not ensure a profit. The units produced may not be sold and if they are sold, they may not be sold at prices sufficient to cover all costs. It is a myth that assigning costs to products or jobs ensures that those costs will be recovered. Costs are recovered only by selling to customers—not by allocating costs.

3-10 The Manufacturing Overhead account is credited when overhead cost is applied to Work in Process. Generally, the amount of overhead applied will not be the same as the amount of actual cost incurred, since the predetermined overhead rate is based on estimates.

3-11 Underapplied overhead occurs when the actual overhead cost exceeds the amount of overhead cost applied to Work in Process inventory during the period. Overapplied overhead occurs when the actual overhead cost is less than the amount of overhead cost applied to Work in Process inventory during the period. Underapplied or overapplied overhead is disposed of by either closing out the amount to Cost of Goods Sold or by allocating the amount among Cost of Goods Sold and ending inventories in proportion to the applied overhead in each account. The adjustment for underapplied overhead increases Cost of Goods Sold (and inventories) whereas the adjustment for overapplied overhead decreases Cost of Goods Sold (and inventories).

3-12 Manufacturing overhead may be underapplied for several reasons. Control over overhead spending may be poor. Or, some of the overhead may be fixed and the actual amount of the allocation base was less than estimated at the beginning of the period. In this situation, the amount of overhead applied to inventory will be less than the actual overhead cost incurred.

3-13 Underapplied overhead implies that not enough overhead was assigned to jobs during the period and therefore cost of goods sold was understated. Therefore, underapplied overhead is added to cost of goods sold. Likewise, overapplied overhead is deducted from cost of goods sold.

3-14 Yes, overhead should be applied to value the Work in Process inventory at year-end. Since $6,000 of overhead was applied to Job A on the basis of $8,000 of direct labor cost, the company's predetermined overhead rate must be 75% of direct labor cost. Thus, $3,000 of overhead should be applied to Job B at year-end: $4,000 direct labor cost × 75% = $3,000 applied overhead cost.

3-15

Direct material	$10,000
Direct labor	12,000
Manufacturing overhead:	
$12,000 × 125%	15,000
Total manufacturing cost	$37,000
Unit product cost: $37,000 ÷ 1,000 units	$37

3-16 A plantwide overhead rate is a single overhead rate used throughout all production departments in a plant. Some companies use multiple overhead rates rather than plantwide rates to more appropriately allocate overhead costs among products. Multiple overhead rates should be used, for example, in situations where one department is machine intensive and another department is labor intensive.

3-17 When automated equipment replaces direct labor, overhead increases and direct labor decreases. This results in an increase in the predetermined overhead rate—particularly if it is based on direct labor.

3-18 When the predetermined overhead rate is based on the amount of the allocation base at capacity and the plant is operated at less than capacity, overhead will ordinarily be underapplied. This occurs because actual activity is less than the activity the predetermined overhead rate is based on.

3-19 Critics of current practice advocate disclosing underapplied overhead on the income statement as Cost of Unused Capacity—a period expense. This would highlight the amount rather than burying it in other accounts.

Exercise 3-1 (10 minutes)

a. Job-order costing
b. Job-order costing
c. Process costing
d. Job-order costing
e. Process costing*
f. Process costing*
g. Job-order costing
h. Job-order costing
i. Job-order costing
j. Job-order costing
k. Process costing
l. Process costing

* Some of the listed companies might use either a process costing or a job-order costing system, depending on the nature of their operations and how homogeneous the final product is. For example, a plywood manufacturer might use job-order costing if it has a number of different plywood products that are constructed of different woods or come in markedly different sizes.

Exercise 3-2 (15 minutes)

1. The direct materials and direct labor costs listed in the exercise would have been recorded on four different documents: the materials requisition form for Job ES34, the time ticket for Harry Kerst, the time ticket for Mary Rosas, and the job cost sheet for Job ES34.

2. The costs for Job ES34 would have been recorded as follows:

Materials requisition form:

	Quantity	*Unit Cost*	*Total Cost*
Blanks	40	$8.00	$320
Nibs	960	$0.60	576
			$896

Time ticket for Harry Kerst

Started	*Ended*	*Time Completed*	*Rate*	*Amount*	*Job Number*
9:00 AM	12:15 PM	3.25	$12.00	$39.00	ES34

Time ticket for Mary Rosas

Started	*Ended*	*Time Completed*	*Rate*	*Amount*	*Job Number*
2:15 PM	4:30 PM	2.25	$14.00	$31.50	ES34

Job Cost Sheet for Job ES34

Direct materials...	$896.00
Direct labor:	
Harry Kerst.......	39.00
Mary Rosas	31.50
	$966.50

Exercise 3-3 (10 minutes)

The predetermined overhead rate is computed as follows:

Estimated total manufacturing overhead	$586,000	
÷ Estimated total direct labor hours (DLHs) ..	40,000	DLHs
= Predetermined overhead rate....................	$14.65	per DLH

Exercise 3-4 (15 minutes)

a.	Raw Materials	86,000	
	Accounts Payable		86,000
b.	Work in Process	72,000	
	Manufacturing Overhead........	12,000	
	Raw Materials		84,000
c.	Work in Process	105,000	
	Manufacturing Overhead........	3,000	
	Wages Payable......................		108,000
d.	Manufacturing Overhead........	197,000	
	Various Accounts..................		197,000

Exercise 3-5 (10 minutes)

Actual direct labor-hours	12,600
× Predetermined overhead rate	$23.10
= Manufacturing overhead applied	$291,060

Exercise 3-6 (15 minutes)

1.

Actual manufacturing overhead costs		$ 48,000
Manufacturing overhead applied:		
10,000 MH × $5 per MH		50,000
Overapplied overhead cost		$ 2,000

2.

Direct materials:		
Raw materials inventory, beginning	$ 8,000	
Add purchases of raw materials	32,000	
Raw materials available for use	40,000	
Deduct raw materials inventory, ending	7,000	
Raw materials used in production		$ 33,000
Direct labor		40,000
Manufacturing overhead cost applied to work in process		50,000
Total manufacturing cost		123,000
Add: Work in process, beginning		6,000
		129,000
Deduct: Work in process, ending		7,500
Cost of goods manufactured		$121,500

Exercise 3-7 (20 minutes)

Parts 1 and 2.

Cash

		(a)	75,000
		(c)	152,000
		(d)	126,000

Raw Materials

(a)	75,000	(b)	73,000

Work in Process

(b)	67,000		
(c)	134,000		
(e)	178,000		
	379,000	(f)	379,000

Finished Goods

(f)	379,000		
	379,000	(f)	379,000

Manufacturing Overhead

(b)	6,000	(e)	178,000
(c)	18,000		
(d)	126,000		
(g)	28,000		28,000

Cost of Goods Sold

(f)	379,000	(g)	28,000
	351,000		

Exercise 3-8 (10 minutes)

1.

Actual direct labor-hours	8,250
× Predetermined overhead rate	$21.40
= Manufacturing overhead applied	$176,550
Less: Manufacturing overhead incurred	172,500
	$ 4,050
Manufacturing overhead overapplied	$4,050

2. Because manufacturing overhead is overapplied, the cost of goods sold would decrease by $4,050 and the gross margin would increase by $4,050.

Exercise 3-9 (30 minutes)

1. Since $320,000 of studio overhead cost was applied to Work in Process on the basis of $200,000 of direct staff costs, the apparent predetermined overhead rate was 160%:

$$\frac{\text{Studio overhead applied}}{\text{Total amount of the allocation base}} = \frac{\$320{,}000}{\$200{,}000\text{ direct staff costs}}$$

$$= 160\%\text{ of direct staff costs}$$

2. The Krimmer Corporation Headquarters project is the only job remaining in Work in Process at the end of the month; therefore, the entire $40,000 balance in the Work in Process account at that point must apply to it. Recognizing that the predetermined overhead rate is 160% of direct staff costs, the following computation can be made:

Total cost added to the Krimmer Corporation Headquarters project		$40,000
Less: Direct staff costs	$13,500	
Studio overhead cost ($13,500 × 160%)................	21,600	35,100
Costs of subcontracted work		$ 4,900

With this information, we can now complete the job cost sheet for the Krimmer Corporation Headquarters project:

Costs of subcontracted work	$ 4,900
Direct staff costs	13,500
Studio overhead	21,600
Total cost to January 31	$40,000

Exercise 3-10 (30 minutes)

1. a.	Raw Materials Inventory	210,000	
	Accounts Payable		210,000
b.	Work in Process	152,000	
	Manufacturing Overhead	38,000	
	Raw Materials Inventory		190,000
c.	Work in Process	49,000	
	Manufacturing Overhead	21,000	
	Salaries and Wages Payable		70,000
d.	Manufacturing Overhead	105,000	
	Accumulated Depreciation		105,000
e.	Manufacturing Overhead	130,000	
	Accounts Payable		130,000
f.	Work in Process	300,000	
	Manufacturing Overhead		300,000
	75,000 machine-hours × $4 per machine-hour = $300,000.		
g.	Finished Goods	510,000	
	Work in Process		510,000
h.	Cost of Goods Sold	450,000	
	Finished Goods		450,000
	Accounts Receivable	675,000	
	Sales		675,000
	$450,000 × 1.5 = $675,000		

2.

Manufacturing Overhead

(b)	38,000	(f)	300,000
(c)	21,000		
(d)	105,000		
(e)	130,000		
			6,000 (Overapplied overhead)

Work in Process

Bal.	35,000	(g)	510,000
(b)	152,000		
(c)	49,000		
(f)	300,000		
Bal.	26,000		

Exercise 3-11 (30 minutes)

1.

	Williams	*Chandler*	*Nguyen*
Designer-hours	200	80	120
Predetermined overhead rate	× $45	× $45	× $45
Overhead applied	$9,000	$3,600	$5,400

2.

	Williams	*Chandler*
Direct materials cost	$ 4,800	$1,800
Direct labor cost	2,400	1,000
Overhead applied	9,000	3,600
Total cost	$16,200	$6,400

Completed Projects	22,600*	
Work in Process		22,600*

* $16,200 + $6,400

3. The balance in the Work in Process account consists entirely of the costs associated with the Nguyen project:

Direct materials cost	$ 3,600
Direct labor cost	1,500
Overhead applied	5,400
Total cost in work in process	$10,500

4. The balance in the Overhead account is determined as follows:

Overhead

Actual overhead costs	16,000	18,000	Applied overhead costs
		2,000	Overapplied overhead

As indicated above, the credit balance in the Overhead account is called overapplied overhead.

Exercise 3-12 (30 minutes)

Note to the instructor: This exercise is a good vehicle for introducing the concept of predetermined overhead rates. This exercise can also be used as a launching pad for a discussion of the appendix to the chapter.

1. As suggested, the costing problem does indeed lie with manufacturing overhead cost. Since manufacturing overhead is mostly fixed, the cost per unit increases as the level of production decreases. The problem can be "solved" by using a predetermined overhead rate, which should be based on expected activity for the entire year. Many students will use units of product in computing the predetermined overhead rate, as follows:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$840{,}000}{200{,}000 \text{ units}}$$

$$= \$4.20 \text{ per unit.}$$

The predetermined overhead rate could also be set on the basis of direct labor cost or direct materials cost. The computations are:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$840{,}000}{\$240{,}000 \text{ direct labor cost}}$$

$$= 350\% \text{ of direct labor cost.}$$

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$840{,}000}{\$600{,}000 \text{ direct materials cost}}$$

$$= 140\% \text{ of direct materials cost.}$$

Exercise 3-12 (continued)

2. Using a predetermined overhead rate, the unit costs would be:

	Quarter			
	First	*Second*	*Third*	*Fourth*
Direct materials	$240,000	$120,000	$ 60,000	$180,000
Direct labor	96,000	48,000	24,000	72,000
Manufacturing overhead:				
Applied at $4.20 per unit, 350% of direct labor cost, or 140% of direct materials cost	336,000	168,000	84,000	252,000
Total cost	$672,000	$336,000	$168,000	$504,000
Number of units produced	80,000	40,000	20,000	60,000
Estimated unit product cost	$8.40	$8.40	$8.40	$8.40

Exercise 3-13 (15 minutes)

1. Item (a): Actual manufacturing overhead costs for the year.
   Item (b): Overhead cost applied to work in process for the year.
   Item (c): Cost of goods manufactured for the year.
   Item (d): Cost of goods sold for the year.

2. | | | |
   |---|---|---|
   | Manufacturing Overhead .... | 30,000 | |
   | Cost of Goods Sold .... | | 30,000 |

3. The overapplied overhead will be allocated to the other accounts on the basis of the amount of overhead applied during the year in the ending balance of each account:

Work in process	$ 32,800	8 %
Finished goods..................................	41,000	10
Cost of goods sold	336,200	82
Total cost	$410,000	100 %

   Using these percentages, the journal entry would be as follows:

Manufacturing Overhead	30,000	
Work in Process (8% × $30,000)..........		2,400
Finished Goods (10% × $30,000)		3,000
Cost of Goods Sold (82% × $30,000)....		24,600

Exercise 3-14 (30 minutes)

1. The overhead applied to Ms. Miyami's account would be computed as follows:

	2005	*2006*
Estimated overhead cost (a)	$144,000	$144,000
Estimated professional staff hours (b)	2,400	2,250
Predetermined overhead rate (a) ÷ (b)	$60	$64
Professional staff hours charged to Ms. Miyami's account	× 5	× 5
Overhead applied to Ms. Miyami's account	$300	$320

2. If the actual overhead cost and the actual professional hours charged turn out to be exactly as estimated there would be no underapplied or overapplied overhead.

	2005	*2006*
Predetermined overhead rate (see above)	$60	$64
Actual professional staff hours charged to clients' accounts (by assumption)	× 2,400	× 2,250
Overhead applied	$144,000	$144,000
Actual overhead cost incurred (by assumption)	144,000	144,000
Under- or overapplied overhead	$ 0	$ 0

3. If the predetermined overhead rate is based on the professional staff hours available, the computations would be:

Estimated overhead cost (a)	$144,000	$144,000
Professional staff hours available (b)	3,000	3,000
Predetermined overhead rate (a) ÷ (b)	$48	$48
Professional staff hours charged to Ms. Miyami's account	× 5	× 5
Overhead applied to Ms. Miyami's account	$240	$240

Problem 3-14 (continued)

4. If the actual overhead cost and the actual professional staff hours charged to clients' accounts turn out to be exactly as estimated overhead would be underapplied as shown below.

	2005	*2006*
Predetermined overhead rate (see 3 above) (a)...	$48	$48
Actual professional staff hours charged to clients' accounts (by assumption) (b)	× 2,400	× 2,250
Overhead applied (a) × (b)	$115,200	$108,000
Actual overhead cost incurred (by assumption)....	144,000	144,000
Underapplied overhead	$ 28,800	$ 36,000

The underapplied overhead is best interpreted in this situation as the cost of idle capacity. Proponents of this method of computing predetermined overhead rates suggest that the underapplied overhead be treated as a period expense that would be separately disclosed on the income statement as Cost of Unused Capacity.

Exercise 3-15 (15 minutes)

1. Milling Department:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$510{,}000}{60{,}000 \text{ machine-hours}} = \$8.50 \text{ per machine-hour}$$

Assembly Department:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$800{,}000}{\$640{,}000 \text{ direct labor cost}} = 125\% \text{ of direct labor cost}$$

2.

	Overhead Applied
Milling Department: 90 MHs × $8.50 per MH..	$765
Assembly Department: $160 × 125%............	200
Total overhead cost applied..........................	$965

3. Yes; if some jobs require a large amount of machine time and little labor cost, they would be charged substantially less overhead cost if a plantwide rate based on direct labor cost were used. It appears, for example, that this would be true of Job 407 which required considerable machine time to complete, but required only a small amount of labor cost.

Exercise 3-16 (30 minutes)

1. The predetermined overhead rate is computed as follows:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$170{,}000}{85{,}000 \text{ machine-hours}} = \$2.00 \text{ per machine-hour}$$

2. The amount of overhead cost applied to Work in Process for the year would be: 80,000 machine-hours × \$2.00 per machine-hour = \$160,000. This amount is shown in entry (a) below:

	Manufacturing Overhead		
(Utilities)	14,000	(a)	160,000
(Insurance)	9,000		
(Maintenance)	33,000		
(Indirect materials)	7,000		
(Indirect labor)	65,000		
(Depreciation)	40,000		
Balance	8,000		

		Work in Process	
(Direct materials)		530,000	
(Direct labor)		85,000	
(Overhead)	(a)	160,000	

3. Overhead is underapplied by \$8,000 for the year, as shown in the Manufacturing Overhead account above. The entry to close out this balance to Cost of Goods Sold would be:

Cost of Goods Sold	8,000	
Manufacturing Overhead		8,000

Exercise 3-16 (continued)

4. When overhead is applied using a predetermined rate based on machine-hours, it is assumed that overhead cost is proportional to machine-hours. When the actual level of activity turns out to be 80,000 machine-hours, the costing system assumes that the overhead will be 80,000 machine-hours × $2.00 per machine-hour, or $160,000. This is a drop of $10,000 from the initial estimated total manufacturing overhead cost of $170,000. However, the actual total manufacturing overhead did not drop by this much. The actual total manufacturing overhead was $168,000—a drop of only $2,000 from the estimate. The manufacturing overhead did not decline by the full $10,000 because of the existence of fixed costs and/or because overhead spending was not under control. These issues will be covered in more detail in later chapters.

Exercise 3-17 (30 minutes)

1\. a. Raw Materials 315,000

a. Raw Materials	315,000	
Accounts Payable		315,000
b. Work in Process	216,000	
Manufacturing Overhead	54,000	
Raw Materials		270,000
c. Work in Process	80,000	
Manufacturing Overhead	110,000	
Wages and Salaries Payable		190,000
d. Manufacturing Overhead	63,000	
Accumulated Depreciation		63,000
e. Manufacturing Overhead	85,000	
Accounts Payable		85,000
f. Work in Process	300,000	
Manufacturing Overhead		300,000

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$4{,}320{,}000}{576{,}000 \text{ machine-hours}} = \$7.50 \text{ per machine-hour}$$

40,000 MHs × \$7.50 per MH = \$300,000.

2\.

Manufacturing Overhead				Work in Process			
(b)	54,000	(f)	300,000	(b)	216,000		
(c)	110,000			(c)	80,000		
(d)	63,000			(f)	300,000		
(e)	85,000						

3\. The cost of the completed job would be \$596,000 as shown in the Work in Process T-account above. The entry for item (g) would be:

Finished Goods	596,000	
Work in Process		596,000

4\. The unit product cost on the job cost sheet would be:
\$596,000 ÷ 8,000 units = \$74.50 per unit.

Problem 3-18 (45 minutes)

1. a.	Raw Materials	160,000	
	Accounts Payable		160,000
b.	Work in Process	120,000	
	Manufacturing Overhead	20,000	
	Raw Materials		140,000
c.	Work in Process	90,000	
	Manufacturing Overhead	60,000	
	Sales Commissions Expense	20,000	
	Salaries Expense	50,000	
	Salaries and Wages Payable		220,000
d.	Manufacturing Overhead	13,000	
	Insurance Expense	5,000	
	Prepaid Insurance		18,000
e.	Manufacturing Overhead	10,000	
	Accounts Payable		10,000
f.	Advertising Expense	15,000	
	Accounts Payable		15,000
g.	Manufacturing Overhead	20,000	
	Depreciation Expense	5,000	
	Accumulated Depreciation		25,000
h.	Work in Process	110,000	
	Manufacturing Overhead		110,000

$$\frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}} = \frac{£99{,}000}{45{,}000 \text{ MHs}} = £2.20 \text{ per MH}$$

50,000 actual MHs × £2.20 per MH = £110,000 overhead applied.

Problem 3-18 (continued)

i.	Finished Goods	310,000	
	Work in Process		310,000
j.	Accounts Receivable	498,000	
	Sales		498,000
	Cost of Goods Sold	308,000	
	Finished Goods		308,000

2.

Raw Materials

Bal.	10,000	(b)	140,000
(a)	160,000		
Bal.	30,000		

Work in Process

Bal.	4,000	(i)	310,000
(b)	120,000		
(c)	90,000		
(h)	110,000		
Bal.	14,000		

Finished Goods

Bal.	8,000	(j)	308,000
(i)	310,000		
Bal.	10,000		

Manufacturing Overhead

(b)	20,000	(h)	110,000
(c)	60,000		
(d)	13,000		
(e)	10,000		
(g)	20,000		
Bal.	13,000		

Cost of Goods Sold

(j)	308,000		

3. Manufacturing overhead is underapplied by £13,000 for the year. The entry to close this balance to Cost of Goods Sold would be:

Cost of Goods Sold	13,000	
Manufacturing Overhead		13,000

Problem 3-18 (continued)

4.

Sovereign Millwork, Ltd.
Income Statement
For the Year Ended June 30

Sales		£498,000
Cost of goods sold (£308,000 + £13,000)		321,000
Gross margin		177,000
Selling and administrative expenses:		
Sales commissions	£20,000	
Administrative salaries	50,000	
Insurance expense	5,000	
Advertising expenses	15,000	
Depreciation expense	5,000	95,000
Net operating income		£ 82,000

Problem 3-19 (60 minutes)

1.	a. Raw Materials	200,000	
	Accounts Payable		200,000
	b. Work in Process	152,000	
	Manufacturing Overhead	38,000	
	Raw Materials		190,000
	c. Work in Process	160,000	
	Manufacturing Overhead	27,000	
	Sales Commissions Expense	36,000	
	Administrative Salaries Expense	80,000	
	Salaries and Wages Payable		303,000
	d. Manufacturing Overhead	42,000	
	Accounts Payable		42,000
	e. Manufacturing Overhead	9,000	
	Insurance Expense	1,000	
	Prepaid Insurance		10,000
	f. Advertising Expense	50,000	
	Accounts Payable		50,000
	g. Manufacturing Overhead	51,000	
	Depreciation Expense	9,000	
	Accumulated Depreciation		60,000
	h. Work in Process	170,000	
	Manufacturing Overhead		170,000

$$\frac{\$153{,}000}{36{,}000 \text{ MHs}} = \$4.25 \text{ per MH; } 40{,}000 \text{ MHs} \times \$4.25 \text{ per MH} = \$170{,}000.$$

Problem 3-19 (continued)

i.	Finished Goods	480,000	
	Work in Process		480,000
j.	Accounts Receivable	700,000	
	Sales		700,000
	Cost of Goods Sold	475,000	
	Finished Goods		475,000

2.

Raw Materials

Bal.	16,000	(b)	190,000
(a)	200,000		
Bal.	26,000		

Manufacturing Overhead

(b)	38,000	(h)	170,000
(c)	27,000		
(d)	42,000		
(e)	9,000		
(g)	51,000		
		Bal.	3,000

Work in Process

Bal.	10,000	(i)	480,000
(b)	152,000		
(c)	160,000		
(h)	170,000		
Bal.	12,000		

Cost of Goods Sold

(j)	475,000		

Finished Goods

Bal.	30,000	(j)	475,000
(i)	480,000		
Bal.	35,000		

3. Manufacturing overhead is overapplied by $3,000. The journal entry to close this balance to Cost of Goods Sold is:

Manufacturing Overhead	3,000	
Cost of Goods Sold		3,000

Problem 3-19 (continued)

4.

Ravsten Company
Income Statement
For the Year Ended December 31

Sales		$700,000
Cost of goods sold ($475,000 – $3,000)		472,000
Gross margin		228,000
Selling and administrative expenses:		
Sales commissions	$36,000	
Administrative salaries	80,000	
Insurance	1,000	
Advertising	50,000	
Depreciation	9,000	176,000
Net operating income		$ 52,000

Problem 3-20 (60 minutes)

1. and 2.

Cash

Bal.	8,000	(l)	190,000
(k)	197,000		
Bal.	15,000		

Accounts Receivable

Bal.	13,000	(k)	197,000
(j)	200,000		
Bal.	16,000		

Raw Materials

Bal.	7,000	(b)	40,000
(a)	45,000		
Bal.	12,000		

Work in Process

Bal.	18,000	(i)	130,000
(b)	32,000		
(e)	40,000		
(h)	60,000		
Bal.	20,000		

Finished Goods

Bal.	20,000	(j)	120,000
(i)	130,000		
Bal.	30,000		

Prepaid Insurance

Bal.	4,000	(f)	3,000
Bal.	1,000		

Plant and Equipment

Bal.	230,000		

Accumulated Depreciation

		Bal.	42,000
		(d)	28,000
		Bal.	70,000

Manufacturing Overhead

(b)	8,000	(h)*	60,000
(c)	14,600		
(d)	21,000		
(e)	18,000		
(f)	2,400		
Bal.	4,000	(m)	4,000

*$40,000 × 150% = $60,000.

Accounts Payable

(l)	100,000	Bal.	30,000
		(a)	45,000
		(c)	14,600
		(g)	18,000
		Bal.	7,600

Salaries & Wages Payable

(l)	90,000	(e)	93,400
		Bal.	3,400

Retained Earnings

		Bal.	78,000

Problem 3-20 (continued)

Capital Stock			
		Bal.	150,000

Sales Commissions Expense			
(e)	10,400		

Administrative Salaries Expense			
(e)	25,000		

Depreciation Expense			
(d)	7,000		

Insurance Expense			
(f)	600		

Miscellaneous Expense			
(g)	18,000		

Cost of Goods Sold			
(j)	120,000		
(m)	4,000		

Sales			
		(j)	200,000

3. Overhead is underapplied by $4,000. Entry (m) above records the closing of this underapplied overhead balance to Cost of Goods Sold.

4.

Durham Company
Income Statement
For the Year Ended December 31

Sales		$200,000
Cost of goods sold ($120,000 + $4,000)		124,000
Gross margin		76,000
Selling and administrative expenses:		
Depreciation expense	$ 7,000	
Sales commissions expense	10,400	
Administrative salaries expense	25,000	
Insurance expense	600	
Miscellaneous expense	18,000	61,000
Net operating income		$ 15,000

Problem 3-21 (60 minutes)

1. and 2.

Cash

Bal.	15,000	(c)	225,000
(l)	445,000	(m)	150,000
Bal.	85,000		

Accounts Receivable

Bal.	40,000	(l)	445,000
(k)	450,000		
Bal.	45,000		

Raw Materials

Bal.	25,000	(b)	90,000
(a)	80,000		
Bal.	15,000		

Work in Process

Bal.	30,000	(j)	310,000
(b)	85,000		
(c)	120,000		
(i)	96,000		
Bal.	21,000		

Finished Goods

Bal.	45,000	(k)	300,000
(j)	310,000		
Bal.	55,000		

Prepaid Insurance

Bal.	5,000	(f)	4,800
Bal.	200		

Buildings & Equipment

Bal.	500,000		

Accumulated Depreciation

		Bal.	210,000
		(e)	30,000
		Bal.	240,000

Manufacturing Overhead

(b)	5,000	(i)*	96,000
(c)	30,000		
(d)	12,000		
(e)	25,000		
(f)	4,000		
(h)	17,000		
		Bal.	3,000

Accounts Payable

(m)	150,000	Bal.	75,000
		(a)	80,000
		(d)	12,000
		(g)	40,000
		(h)	17,000
		Bal.	74,000

$$* \frac{\$80,000}{\$100,000} = 80\% \text{ of direct labor cost; } \$120,000 \times 0.80 = \$96,000.$$

Retained Earnings

		Bal.	125,000

Capital Stock

		Bal.	250,000

Problem 3-21 (continued)

Salaries Expense			
(c)	75,000		

Depreciation Expense			
(e)	5,000		

Insurance Expense			
(f)	800		

Shipping Expense			
(g)	40,000		

Cost of Goods Sold			
(k)	300,000		

Sales			
		(k)	450,000

3. Manufacturing overhead was overapplied by $3,000 for the year. This balance would be allocated between Work in Process, Finished Goods, and Cost of Goods Sold in proportion to the ending balances in these accounts. The allocation would be:

Work in Process, 12/31	$ 21,000	5.6 %
Finished Goods, 12/31..................	55,000	14.6
Cost of Goods Sold, 12/31	300,000	79.8
	$376,000	100.0 %

Manufacturing Overhead	3,000	
Work in Process (5.6% × $3,000)...........		168
Finished Goods (14.6% × $3,000)		438
Cost of Goods Sold (79.8% × $3,000)......		2,394

4.

Fantastic Props, Inc.
Income Statement
For the Year Ended December 31

Sales		$450,000
Cost of goods sold ($300,000 – $2,394)..........		297,606
Gross margin..		152,394
Selling and administrative expenses:		
Salaries expense	$75,000	
Depreciation expense..................................	5,000	
Insurance expense......................................	800	
Shipping expense.......................................	40,000	120,800
Net operating income		$ 31,594

Problem 3-22 (60 minutes)

1.

Raw Materials

Bal.	40,000	(a)	33,500

Work in Process

Bal.	77,800*	(e)	60,700
(a)	29,500		
(b)	20,000		
(d)	32,000		
Bal.	98,600		

Finished Goods

Bal.	85,000		
(e)	60,700		

Manufacturing Overhead

(a)	4,000	(d)	32,000
(b)	8,000		
(c)	19,000		

Salaries & Wages Payable

		(b)	28,000

Accounts Payable

		(c)	19,000

*	Job 105 materials, labor, and overhead at November 30 ..	$50,300
	Job 106 materials, labor, and overhead at November 30 ..	27,500
	Total Work in Process inventory at November 30	$77,800

2. a.

Work in Process	29,500 *	
Manufacturing Overhead	4,000	
Raw Materials		33,500

*$8,200 + $21,300 = $29,500.

This entry is posted to the T-accounts as entry (a) above.

b.

Work in Process.......................................	20,000 *	
Manufacturing Overhead...........................	8,000	
Salaries and Wages Payable.................		28,000

*$4,000 + $6,000 + $10,000 = $20,000.

This entry is posted to the T-accounts as entry (b) above.

c.

Manufacturing Overhead	19,000	
Accounts Payable................................		19,000

This entry is posted to the T-accounts as entry (c) above.

Problem 3-22 (continued)

3. Apparently, the company uses a predetermined overhead rate of 160% of direct labor cost. This figure can be determined by relating the November applied overhead cost on the job cost sheets to the November direct labor cost shown on these sheets. For example, in the case of Job 105:

$$\frac{\text{November overhead cost}}{\text{November direct labor cost}} = \frac{\$20{,}800}{\$13{,}000} = 160\% \text{ of direct labor cost}$$

The overhead cost applied to each job during December was:

Job 105: $4,000 × 160%	$ 6,400
Job 106: $6,000 × 160%	9,600
Job 107: $10,000 × 160%	16,000
Total applied overhead	$32,000

The entry to record the application of overhead cost to jobs would be as follows:

Work in Process..............................	32,000	
Manufacturing Overhead............		32,000

The entry is posted to the T-accounts as entry (d) above.

4. The total cost of Job 105 was:

Direct materials	$16,500
Direct labor ($13,000 + $4,000)....................................	17,000
Manufacturing overhead applied ($17,000 × 160%)........	27,200
Total cost..	$60,700

The entry to record the transfer of the completed job would be as follows:

Finished Goods...	60,700	
Work in Process		60,700

This entry is posted to the T-accounts as entry (e) above.

Problem 3-22 (continued)

5. As shown in the above T-accounts, the balance in Work in Process at December 31 was $98,600. The breakdown of this amount between Jobs 106 and 107 is:

	Job 106	*Job 107*	*Total*
Direct materials	$17,500	$21,300	$38,800
Direct labor	13,000	10,000	23,000
Manufacturing overhead	20,800	16,000	36,800
Total cost	$51,300	$47,300	$98,600

Problem 3-23 (30 minutes)

1. Research & Documents predetermined overhead rate:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$700{,}000}{20{,}000 \text{ hours}} = \$35 \text{ per hour}$$

Litigation predetermined overhead rate:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$320{,}000}{\$800{,}000 \text{ direct attorney cost}} = \text{40\% of direct attorney cost}$$

2.

Research & Documents overhead applied:	
18 hours × $35 per hour	$ 630
Litigation overhead applied: $2,100 × 40%	840
Total overhead cost	$1,470

3. Total cost of Case 618–3:

	Departments		
	Research & Documents	*Litigation*	*Total*
Materials and supplies	$ 50	$ 30	$ 80
Direct attorney cost	410	2,100	2,510
Overhead cost applied	630	840	1,470
Total cost	$1,090	$2,970	$4,060

Problem 3-23 (continued)

4.

	Department	
	Research & Documents	*Litigation*
Departmental overhead cost incurred	$770,000	$300,000
Departmental overhead cost applied:		
23,000 hours × $35 per hour	805,000	
$725,000 × 40%		290,000
Underapplied (or overapplied) overhead	$ (35,000)	$ 10,000

Problem 3-24 (90 minutes)

1. a.	Raw Materials	820,000	
	Accounts Payable		820,000
b.	Work in Process	817,000	
	Manufacturing Overhead	13,000	
	Raw Materials		830,000
c.	Work in Process	140,000	
	Manufacturing Overhead	60,000	
	Salaries and Wages Payable		200,000
d.	Salaries Expense	150,000	
	Salaries and Wages Payable		150,000
e.	Prepaid Insurance	38,000	
	Cash		38,000
	Manufacturing Overhead	39,400	
	Insurance Expense	600	
	Prepaid Insurance		40,000
f.	Marketing Expense	100,000	
	Accounts Payable		100,000
g.	Manufacturing Overhead	28,000	
	Depreciation Expense	12,000	
	Accumulated Depreciation		40,000
h.	Manufacturing Overhead	12,600	
	Accounts Payable		12,600
i.	Work in Process	156,000	
	Manufacturing Overhead		156,000

$\frac{\$135,000}{18,000 \text{ DLH}}$ =\$7.50 per DLH; 20,800 DLH × \$7.50 per DLH = \$156,000.

Problem 3-24 (continued)

j.	Finished Goods	1,106,000	
	Work in Process		1,106,000
k.	Accounts Receivable	1,420,000	
	Sales		1,420,000
	Cost of Goods Sold	1,120,000	
	Finished Goods		1,120,000
l.	Cash	1,415,000	
	Accounts Receivable		1,415,000
m.	Accounts Payable	970,000	
	Salaries and Wages Payable	348,000	
	Cash		1,318,000

2.

Cash

Bal.	9,000	(e)	38,000
(l)	1,415,000	(m)	1,318,000
Bal.	68,000		

Accounts Receivable

Bal.	30,000	(l)	1,415,000
(k)	1,420,000		
Bal.	35,000		

Raw Materials

Bal.	16,000	(b)	830,000
(a)	820,000		
Bal.	6,000		

Work in Process

Bal.	21,000	(j)	1,106,000
(b)	817,000		
(c)	140,000		
(i)	156,000		
Bal.	28,000		

Finished Goods

Bal.	38,000	(k)	1,120,000
(j)	1,106,000		
Bal.	24,000		

Prepaid Insurance

Bal.	7,000	(e)	40,000
(e)	38,000		
Bal.	5,000		

Buildings and Equipment

Bal.	300,000		

Accumulated Depreciation

		Bal.	128,000
		(g)	40,000
		Bal.	168,000

Problem 3-24 (continued)

Manufacturing Overhead

(b)	13,000	(i)	156,000
(c)	60,000		
(e)	39,400		
(g)	28,000		
(h)	12,600		
		Bal.	3,000

Salaries & Wages Payable

(m)	348,000	Bal.	3,000
		(c)	200,000
		(d)	150,000
		Bal.	5,000

Accounts Payable

(m)	970,000	Bal.	60,000
		(a)	820,000
		(f)	100,000
		(h)	12,600
		Bal.	22,600

Retained Earnings

		Bal.	30,000

Capital Stock

		Bal.	200,000

Marketing Expense

(f)	100,000		

Depreciation Expense

(g)	12,000		

Insurance Expense

(e)	600		

Salaries Expense

(d)	150,000		

Cost of Goods Sold

(k)	1,120,000		

Sales

		(k)	1,420,000

Problem 3-24 (continued)

3. Manufacturing overhead is overapplied by $3,000 for the year. The entry to close this balance to Cost of Goods Sold would be:

Manufacturing Overhead	3,000	
Cost of Goods Sold		3,000

4.

Celestial Displays, Inc.
Income Statement
For the Year Ended December 31

Sales		$1,420,000
Cost of goods sold ($1,120,000 – $3,000)........		1,117,000
Gross margin..		303,000
Selling and administrative expenses:		
Salaries expense	$150,000	
Insurance expense.......................................	600	
Marketing expense.......................................	100,000	
Depreciation expense	12,000	262,600
Net operating income		$ 40,400

Problem 3-25 (30 minutes)

1. Preparation Department predetermined overhead rate:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$416{,}000}{80{,}000 \text{ machine-hours}} = \$5.20 \text{ per machine-hour}$$

Fabrication Department predetermined overhead rate:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$720{,}000}{\$400{,}000 \text{ materials cost}} = 180\% \text{ of materials cost}$$

2. Preparation Department overhead applied:

Preparation Department overhead applied:	
350 machine-hours × \$5.20 per machine-hour	\$1,820
Fabrication Department overhead applied:	
\$1,200 direct materials cost × 180%	2,160
Total overhead cost	\$3,980

3. Total cost of Job 127:

	Preparation	*Fabrication*	*Total*
Direct materials	\$ 940	\$1,200	\$2,140
Direct labor	710	980	1,690
Manufacturing overhead	1,820	2,160	3,980
Total cost	\$3,470	\$4,340	\$7,810

Unit product cost for Job 127:

$$\text{Average cost per unit} = \frac{\$7{,}810}{25 \text{ units}} = \$312.40 \text{ per unit}$$

Problem 3-25 (continued)

4.

	Preparation	*Fabrication*
Manufacturing overhead cost incurred	$390,000	$740,000
Manufacturing overhead cost applied:		
73,000 machine-hours × $5.20 per machine-hour	379,600	
$420,000 direct materials cost × 180%		756,000
Underapplied (or overapplied) overhead	$ 10,400	$(16,000)

Problem 3-26 (60 minutes)

1. The overhead applied to the Slug Fest job would be computed as follows:

	2005	*2006*
Estimated studio overhead cost (a)	$90,000	$90,000
Estimated hours of studio service (b)	1,000	750
Predetermined overhead rate (a) ÷ (b)	$90	$120
Slug Fest job's studio hours	× 30	× 30
Overhead applied to the Slug Fest job	$2,700	$3,600

Overhead is underapplied for both years as computed below:

	2005	*2006*
Predetermined overhead rate (see above) (a)	$90	$120
Actual hours of studio service provided (b)	900	600
Overhead applied (a) × (b)	$81,000	$72,000
Actual studio cost incurred	90,000	90,000
Underapplied overhead	$ 9,000	$18,000

2. If the predetermined overhead rate is based on the hours of studio service at capacity, the computations would be:

	2005	*2006*
Estimated studio overhead cost (a)	$90,000	$90,000
Hours of studio service at capacity (b)	1,800	1,800
Predetermined overhead rate (a) ÷ (b)	$50	$50
Slug Fest job's studio hours	× 30	× 30
Overhead applied to the Slug Fest job	$1,500	$1,500

Overhead is underapplied for both years under this method as well:

	2005	*2006*
Predetermined overhead rate (see above) (a)	$50	$50
Actual hours of studio service provided (b)	900	600
Overhead applied (a) × (b)	$45,000	$30,000
Actual studio cost incurred	90,000	90,000
Underapplied overhead	$45,000	$60,000

Problem 3-26 (continued)

3. When the predetermined overhead rate is based on capacity, underapplied overhead is interpreted as the cost of idle capacity. Indeed, proponents of this method suggest that underapplied overhead be treated as a period expense that would be separately disclosed on the income statement as Cost of Unused Capacity.

4. Skid Road Recording's fundamental problem is the competition that is drawing customers away. The competition is able to offer the latest equipment, excellent service, and attractive prices. The company must do something to counter this threat or it will ultimately face failure.

   Under the conventional approach in which the predetermined overhead rate is based on the estimated studio hours, the apparent cost of the Slug Fest job has increased between 2005 and 2006. That happens because the company is losing business to competitors and therefore the company's fixed overhead costs are being spread over a smaller base. This results in costs that seem to increase as the volume declines. Skid Road Recording's managers may be misled into thinking that the problem is rising costs and they may be tempted to raise prices to recover their apparently increasing costs. This would almost surely accelerate the company's decline.

   Under the alternative approach, the overhead cost of the Slug Fest job is stable at $1,500 and lower than the costs reported under the conventional method. Under the conventional method, managers may be misled into thinking that they are actually losing money on the Slug Fest job and they might refuse such jobs in the future—another sure road to disaster. This is much less likely to happen if the lower cost of $1,500 is reported. It is true that the underapplied overhead under the alternative approach is much larger than under the conventional approach and is growing. However, if it is properly labeled as the cost of idle capacity, management is much more likely to draw the appropriate conclusion that the real problem is the loss of business (and therefore more idle capacity) rather than an increase in costs.

   While basing the predetermined rate on capacity rather than on estimated activity will not solve the company's basic problems, at least this method will be less likely to send managers misleading signals.

Problem 3-27 (45 minutes)

1. The cost of raw materials put into production was:

Raw materials inventory, 1/1	$ 30,000
Debits (purchases of materials)	420,000
Materials available for use	450,000
Raw materials inventory, 12/31	60,000
Materials requisitioned for production	$390,000

2. Of the $390,000 in materials requisitioned for production, $320,000 was debited to Work in Process as direct materials. Therefore, the difference of $70,000 ($390,000 – $320,000 = $70,000) would have been debited to Manufacturing Overhead as indirect materials.

3.

Total factory wages accrued during the year (credits to the Factory Wages Payable account)	$175,000
Less direct labor cost (from Work in Process)	110,000
Indirect labor cost	$ 65,000

4. The cost of goods manufactured for the year was $810,000—the credits to Work in Process.

5. The Cost of Goods Sold for the year was:

Finished goods inventory, 1/1	$ 40,000
Add: Cost of goods manufactured (from Work in Process)	810,000
Goods available for sale	850,000
Finished goods inventory, 12/31	130,000
Cost of goods sold	$720,000

6. The predetermined overhead rate was:

$$\text{Predetermined overhead rate} = \frac{\text{Manufacturing overhead cost applied}}{\text{Direct materials cost}}$$

$$= \frac{\$400,000}{\$320,000} = 125\% \text{ of direct materials cost}$$

Problem 3-27 (continued)

7. Manufacturing overhead was overapplied by $15,000, computed as follows:

Actual manufacturing overhead cost for the year (debits)	$385,000
Applied manufacturing overhead cost (from Work in Process—this would be the credits to the Manufacturing Overhead account)	400,000
Overapplied overhead	$(15,000)

8. The ending balance in Work in Process is $90,000. Direct labor makes up $18,000 of this balance, and manufacturing overhead makes up $40,000. The computations are:

Balance, Work in Process, 12/31	$90,000
Less: Direct materials cost (given)	(32,000)
Manufacturing overhead cost ($32,000 × 125%)	(40,000)
Direct labor cost (remainder)	$18,000

Problem 3-28 (60 minutes)

1. a.

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$126{,}000}{\$84{,}000 \text{ direct labor cost}} = 150\% \text{ of direct labor cost}$$

b. Actual manufacturing overhead costs:

Insurance, factory	$ 7,000
Depreciation of equipment	18,000
Indirect labor	42,000
Property taxes	9,000
Maintenance	11,000
Rent, building	36,000
Total actual costs	123,000
Applied manufacturing overhead costs:	
$80,000 × 150%	120,000
Underapplied overhead	$ 3,000

2.

Pacific Manufacturing Company
Schedule of Cost of Goods Manufactured

Direct materials:		
Raw materials inventory, beginning	$ 21,000	
Add purchases of raw materials	133,000	
Total raw materials available	154,000	
Deduct raw materials inventory, ending	16,000	
Raw materials used in production		$138,000
Direct labor		80,000
Manufacturing overhead applied to work in process		120,000
Total manufacturing cost		338,000
Add: Work in process, beginning		44,000
		382,000
Deduct: Work in process, ending		40,000
Cost of goods manufactured		$342,000

Problem 3-28 (continued)

3. Cost of goods sold:

Finished good inventory, beginning	$ 68,000
Add: Cost of goods manufactured	342,000
Goods available for sale	410,000
Deduct: Finished goods inventory, ending	60,000
Cost of goods sold	$350,000

Underapplied or overapplied overhead may be closed directly to Cost of Goods Sold or allocated among Work in Process, Finished Goods, and Cost of Goods Sold in proportion to the overhead applied during the year in the ending balance of each of these accounts.

4.

Direct materials	$ 3,200
Direct labor	4,200
Overhead applied (150% × 4,200)	6,300
Total manufacturing cost	$13,700

$13,700 × 140% = $19,180 price to customer.

5. The amount of overhead cost in Work in Process was:

$8,000 direct labor cost × 150% =$12,000

The amount of direct materials cost in Work in Process was:

Total ending work in process		$40,000
Deduct:		
Direct labor	$ 8,000	
Manufacturing overhead	12,000	20,000
Direct materials		$20,000

The completed schedule of costs in Work in Process was:

Direct materials	$20,000
Direct labor	8,000
Manufacturing overhead	12,000
Work in process inventory	$40,000

Problem 3-29 (30 minutes)

1. The predetermined overhead rate was:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$1{,}530{,}000}{85{,}000 \text{ computer hours}} = \$18 \text{ per computer hour}$$

2.

Actual manufacturing overhead cost	$1,350,000
Manufacturing overhead cost applied to Work in Process during the year: 60,000 actual computer hours × $18 per computer hour	1,080,000
Underapplied overhead cost	$ 270,000

3.

Cost of Goods Sold	270,000	
Manufacturing Overhead		270,000

4. The underapplied overhead would be allocated using the following percentages:

Overhead applied during the year in:		
Work in process	$ 43,200	4 %
Finished goods	280,800	26
Cost of goods sold	756,000	70
Total	$1,080,000	100 %

The entry to record the allocation of the underapplied overhead is:

Work In Process (4% × $270,000)	10,800	
Finished Goods (26% × $270,000)	70,200	
Cost of Goods Sold (70% × $270,000)	189,000	
Manufacturing Overhead		270,000

Problem 3-29 (continued)

5.

Cost of goods sold if the underapplied overhead is closed directly to cost of goods sold ($2,800,000 + $270,000)	$3,070,000
Cost of goods sold if the underapplied overhead is allocated among the accounts ($2,800,000 + $189,000)	2,989,000
Difference in cost of goods sold	$ 81,000

Thus, net operating income will be $81,000 greater if the underapplied overhead is allocated among Work In Process, Finished Goods, and Cost of Goods Sold rather than closed directly to Cost of Goods Sold.

Problem 3-30 (120 minutes)

1. a.	Raw Materials	142,000	
	Accounts Payable		142,000
b.	Work in Process	150,000	
	Raw Materials		150,000
c.	Manufacturing Overhead	21,000	
	Accounts Payable		21,000
d.	Work in Process	216,000	
	Manufacturing Overhead	90,000	
	Salaries Expense	145,000	
	Salaries and Wages Payable		451,000
e.	Manufacturing Overhead	15,000	
	Accounts Payable		15,000
f.	Advertising Expense	130,000	
	Accounts Payable		130,000
g.	Manufacturing Overhead	45,000	
	Depreciation Expense	5,000	
	Accumulated Depreciation		50,000
h.	Manufacturing Overhead	72,000	
	Rent Expense	18,000	
	Accounts Payable		90,000
i.	Miscellaneous Expense	17,000	
	Accounts Payable		17,000
j.	Work in Process	240,000	
	Manufacturing Overhead		240,000

$$\frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated direct materials cost}} = \frac{\$248,000}{\$155,000}$$

= 160% of direct materials cost.

$150,000 direct materials cost × 160% = $240,000 applied.

Problem 3-30 (continued)

k.	Finished Goods	590,000	
	Work in Process		590,000
l.	Accounts Receivable	1,000,000	
	Sales		1,000,000
	Cost of Goods Sold	600,000	
	Finished Goods		600,000

2.

Accounts Receivable

(l)	1,000,000		

Raw Materials

Bal.	18,000	(b)	150,000
(a)	142,000		
Bal.	10,000		

Work in Process

Bal.	24,000	(k)	590,000
(b)	150,000		
(d)	216,000		
(j)	240,000		
Bal.	40,000		

Finished Goods

Bal.	35,000	(l)	600,000
(k)	590,000		
Bal.	25,000		

Manufacturing Overhead

(c)	21,000	(j)	240,000
(d)	90,000		
(e)	15,000		
(g)	45,000		
(h)	72,000		
Bal.	3,000		

Accounts Payable

		(a)	142,000
		(c)	21,000
		(e)	15,000
		(f)	130,000
		(h)	90,000
		(i)	17,000

Accumulated Depreciation

		(g)	50,000

Depreciation Expense

(g)	5,000		

Salaries & Wages Payable

		(d)	451,000

Salaries Expense

(d)	145,000		

Miscellaneous Expense

(i)	17,000		

Advertising Expense

(f)	130,000		

Problem 3-30 (continued)

Rent Expense			
(h)	18,000		

Cost of Goods Sold			
(l)	600,000		

Sales			
		(l)	1,000,000

3.

Southworth Company
Schedule of Cost of Goods Manufactured

Direct materials:		
Raw materials inventory, beginning	$ 18,000	
Purchases of raw materials	142,000	
Materials available for use	160,000	
Raw materials inventory, ending	10,000	
Materials used in production		$150,000
Direct labor		216,000
Manufacturing overhead applied to work in process		240,000
Total manufacturing cost		606,000
Add: Work in process, beginning		24,000
		630,000
Deduct: Work in process, ending		40,000
Cost of goods manufactured		$590,000

4.

Cost of Goods Sold	3,000	
Manufacturing Overhead		3,000

Schedule of cost of goods sold:	
Finished goods inventory, beginning	$ 35,000
Add: Cost of goods manufactured	590,000
Goods available for sale	625,000
Finished goods inventory, ending	25,000
Unadjusted cost of goods sold	600,000
Add underapplied overhead	3,000
Adjusted cost of goods sold	$603,000

Problem 3-30 (continued)

5.

Southworth Company
Income Statement

Sales		$1,000,000
Cost of goods sold		603,000
Gross margin		397,000
Selling and administrative expenses:		
Salaries expense	$145,000	
Advertising expense	130,000	
Depreciation expense	5,000	
Rent expense	18,000	
Miscellaneous expense	17,000	315,000
Net operating income		$ 82,000

6.

Direct materials	$ 3,600
Direct labor (400 hours × $11 per hour)	4,400
Manufacturing overhead cost applied (160% × $3,600)	5,760
Total manufacturing cost	13,760
Add markup (75% × $13,760)	10,320
Total billed price of Job 218	$24,080

$24,080 ÷ 500 units = $48.16 per unit.

Problem 3-31 (60 minutes)

1. a.

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$1{,}440{,}000}{\$900{,}000 \text{ direct labor cost}} = 160\% \text{ of direct labor cost}$$

b. $21,200 × 160% = $33,920.

2. a.

	Cutting Department	*Machining Department*	*Assembly Department*
Estimated manufacturing overhead cost (a)	$540,000	$800,000	$100,000
Estimated direct labor cost (b).........................	$300,000	$200,000	$400,000
Predetermined overhead rate (a) ÷ (b)................	180%	400%	25%

b.

Cutting Department:	
$6,500 × 180%.................................	$11,700
Machining Department:	
$1,700 × 400%.................................	6,800
Assembly Department:	
$13,000 × 25%.................................	3,250
Total applied overhead	$21,750

3. The bulk of the labor cost on the Hastings job is in the Assembly Department, which incurs very little overhead cost. The department has an overhead rate of only 25% of direct labor cost as compared to much higher rates in the other two departments. Therefore, as shown above, use of departmental overhead rates results in a relatively small amount of overhead cost charged to the job.

Problem 3-31 (continued)

However, use of a plantwide overhead rate in effect redistributes overhead costs proportionately between the three departments (at 160% of direct labor cost) and results in a large amount of overhead cost being charged to the Hastings job, as shown in Part 1. This may explain why the company bid too high and lost the job. Too much overhead cost was assigned to the job for the kind of work being done on the job in the plant.

If a plantwide overhead rate is being used, the company will tend to charge too little overhead cost to jobs that require a large amount of labor in the Cutting or Machining Departments. The reason is that the plantwide overhead rate (160%) is much lower than the rates if these departments were considered separately.

4. The company's bid price was:

Direct materials	$ 18,500
Direct labor	21,200
Manufacturing overhead applied (above)	33,920
Total manufacturing cost	73,620
Bidding rate	× 1.5
Total bid price	$110,430

If departmental overhead rates had been used, the bid price would have been:

Direct materials	$ 18,500
Direct labor	21,200
Manufacturing overhead applied (above)	21,750
Total manufacturing cost	61,450
Bidding rate	× 1.5
Total bid price	$ 92,175

Note that if departmental overhead rates had been used, Lenko Products would have been the low bidder on the Hastings job since the competitor underbid Lenko by only $10,000.

Problem 3-31 (continued)

5. a.

Actual overhead cost	$1,482,000
Applied overhead cost ($870,000 × 160%)	1,392,000
Underapplied overhead cost	$ 90,000

b.

	Department			
	Cutting	*Machining*	*Assembly*	*Total Plant*
Actual overhead cost	$560,000	$830,000	$92,000	$1,482,000
Applied overhead cost:				
$320,000 × 180%	576,000			
$210,000 × 400%		840,000		
$340,000 × 25%			85,000	1,501,000
Underapplied (overapplied) overhead cost	$(16,000)	$(10,000)	$ 7,000	$ (19,000)

Case 3-32 (120 minutes)

1. **Traditional approach:**

Actual total manufacturing overhead cost incurred (assumed to equal the original estimate)	$2,000,000
Manufacturing overhead applied (80,000 units × $25 per unit)	2,000,000
Overhead underapplied or overapplied	$ 0

TurboDrives, Inc.
Income Statement: Traditional Approach

Revenue (75,000 units × $70 per unit)		$5,250,000
Cost of goods sold:		
Variable manufacturing (75,000 units × $18 per unit)	$1,350,000	
Manufacturing overhead applied (75,000 units × $25 per unit)	1,875,000	3,225,000
Gross margin		2,025,000
Selling and administrative expenses		1,950,000
Net operating income		$ 75,000

New approach:

TurboDrives, Inc.
Income Statement: New Approach

Revenue (75,000 units × $70 per unit)		$5,250,000
Cost of goods sold:		
Variable manufacturing (75,000 units × $18 per unit)	$1,350,000	
Manufacturing overhead applied (75,000 units × $20 per unit)	1,500,000	2,850,000
Gross margin		2,400,000
Cost of unused capacity [(100,000 units – 80,000 units) × $20 per unit]		400,000
Selling and administrative expenses		1,950,000
Net operating income		$ 50,000

Case 3-32 (continued)

2. **Traditional approach:**
   Under the traditional approach, the reported net operating income can be increased by increasing the production level, which then results in overapplied overhead that is deducted from Cost of Goods Sold.

Additional net operating income required to attain target net operating income ($210,000 - $75,000) (a)..	$135,000
Overhead applied per unit of output (b)	$25 per unit
Additional output required to attain target net operating income (a) ÷ (b)	5,400 units
Actual total manufacturing overhead cost incurred	$2,000,000
Manufacturing overhead applied [(80,000 units + 5,400 units) × $25 per unit]	2,135,000
Overhead overapplied	$ 135,000

TurboDrives, Inc.
Income Statement: Traditional Approach

Revenue (75,000 units × $70 per unit)		$5,250,000
Cost of goods sold:		
Variable manufacturing (75,000 units × $18 per unit)	$1,350,000	
Manufacturing overhead applied (75,000 units × $25 per unit)	1,875,000	
Less: Manufacturing overhead overapplied	135,000	3,090,000
Gross margin		2,160,000
Selling and administrative expenses		1,950,000
Net operating income		$ 210,000

Note: If the overapplied manufacturing overhead were prorated between ending inventories and Cost of Goods Sold, more units would have to be produced to attain the target net profit of $210,000.

Case 3-32 (continued)

New approach:
Under the new approach, the reported net operating income can be increased by increasing the production level which then results in less of a deduction on the income statement for the Cost of Unused Capacity.

Additional net operating income required to attain target net operating income ($210,000 - $50,000) (a)	$160,000
Overhead applied per unit of output (b)	$20 per unit
Additional output required to attain target net operating income (a) ÷ (b)	8,000 units
Estimated number of units produced	80,000 units
Actual number of units to be produced	88,000 units

TurboDrives, Inc.
Income Statement: New Approach

Revenue (75,000 units × $70 per unit)		$5,250,000
Cost of goods sold:		
Variable manufacturing (75,000 units × $18 per unit)	$1,350,000	
Manufacturing overhead applied (75,000 units × $20 per unit)	1,500,000	2,850,000
Gross margin		2,400,000
Cost of unused capacity [(100,000 units - 88,000 units) × $20 per unit]		240,000
Selling and administrative expenses		1,950,000
Net operating income		$ 210,000

3. Net operating income is more volatile under the new method than under the old method. The reason for this is that the reported profit per unit sold is higher under the new method by $5, the difference in the predetermined overhead rates. As a consequence, swings in sales in either direction will have a more dramatic impact on reported profits under the new method.

Case 3-32 (continued)

4. As the computations in part (2) above show, the "hat trick" is a bit harder to perform under the new method. Under the old method, the target net operating income can be attained by producing an additional 5,400 units. Under the new method, the production would have to be increased by 8,000 units. This is a consequence of the difference in predetermined overhead rates. The drop in sales has had a more dramatic effect on net operating income under the new method as noted above in part (3). In addition, since the predetermined overhead rate is lower under the new method, producing excess inventories has less of an effect per unit on net operating income than under the traditional method and hence more excess production is required.

5. One can argue that whether the "hat trick" is unethical depends on the level of sophistication of the owners of the company and others who read the financial statements. If they understand the effects of excess production on net operating income and are not misled, it can be argued that the hat trick is ethical. However, if that were the case, there does not seem to be any reason to use the hat trick. Why would the owners want to tie up working capital in inventories just to artificially attain a target net operating income for the period? And increasing the rate of production toward the end of the year is likely to increase overhead costs due to overtime and other costs. Building up inventories all at once is very likely to be much more expensive than increasing the rate of production uniformly throughout the year. In the case, we assumed that there would not be an increase in overhead costs due to the additional production, but that is likely not to be true.

   In our opinion the hat trick is unethical unless there is a good reason for increasing production other than to artificially boost the current period's net operating income. It is certainly unethical if the purpose is to fool users of financial reports such as owners and creditors or if the purpose is to meet targets so that bonuses will be paid to top managers.

Case 3-33 (45 minutes)

1. The revised predetermined overhead rate is determined as follows:

Original estimated total manufacturing overhead....	$2,475,000
Plus: Lease cost of the new machine....................	300,000
Plus: Cost of new technician/programmer.............	45,000
Estimated total manufacturing overhead...............	$2,820,000

Original estimated total direct labor-hours	52,000
Less: Estimated reduction in direct labor-hours......	6,000
Estimated total direct labor-hours.........................	46,000

$$\text{Predetetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$2,820,000}{46,000\text{ DLHs}}$$

$$= \$61.30 \text{ per DLH}$$

The revised predetermined overhead rate is higher than the original rate because the automated milling machine will increase the overhead for the year (the numerator in the rate) and will decrease the direct labor-hours (the denominator in the rate). This double-whammy effect increases the predetermined overhead rate.

2. Acquisition of the automated milling machine will increase the apparent costs of all jobs—not just those that use the new facility. This is because the company uses a plantwide overhead rate. If there were a different overhead rate for each department, this would not happen.

3. The predetermined overhead rate is now considerably higher than it was. This will penalize products that continue to use the same amount of direct labor-hours. Such products will now appear to be less profitable and the managers of these products will appear to be doing a poorer job. There may be pressure to increase the prices of these products even though there has in fact been no increase in their real costs.

Case 3-33 (continued)

4. While it may have been a good idea to acquire the new equipment because of its greater capabilities, the calculations of the cost savings were in error. The original calculations implicitly assumed that overhead would decrease because of the reduction in direct labor-hours. In reality, the overhead increased because of the additional costs of the new equipment. A differential cost analysis would reveal that the automated equipment would *increase* total cost by about $285,000 a year if the labor reduction is only 2,000 hours.

Cost consequences of leasing the automated equipment:	
Increase in manufacturing overhead cost:	
Lease cost of the new machine	$300,000
Cost of new technician/programmer	45,000
	345,000
Less: labor cost savings (2,000 hours × $30 per hour)	60,000
Net increase in annual costs	$285,000

Even if the entire 6,000-hour reduction in direct labor-hours occurred, that would have added only $120,000 (4,000 hours × $30 per hour) in cost savings. The net increase in annual costs would have been $165,000 and the machine would still be an unattractive proposal. The entire 6,000-hour reduction may ultimately be realized as workers retire or quit. However, this is by no means automatic.

There are two morals to this tale. First, predetermined overhead rates should not be misinterpreted as variable costs. They are not. Second, a reduction in direct labor *requirements* does not necessarily lead to a reduction in direct labor hours *paid*. It is often very difficult to actually reduce the direct labor force and may be virtually impossible in some countries except through natural attrition.

Case 3-34 (45 minutes)

1. Shaving 5% off the estimated direct labor-hours in the predetermined overhead rate will result in an artificially high overhead rate, which is likely to result in overapplied overhead for the year. The cumulative effect of overapplying the overhead throughout the year is all recognized in December when the balance in the Manufacturing Overhead account is closed out to Cost of Goods Sold. If the balance were closed out every month or every quarter, this effect would be dissipated over the course of the year.

2. This question may generate lively debate. Where should Cristin Madsen's loyalties lie? Is she working for the general manager of the division or for the corporate controller? Is there anything wrong with the "Christmas bonus"? How far should Cristin go in bucking her boss on a new job?

   While individuals can certainly disagree about what Cristin should do, some of the facts are indisputable. First, the practice of understating direct labor-hours results in artificially inflating the overhead rate. This has the effect of inflating the cost of goods sold figures in all months prior to December and overstating the costs of inventories. In December, the adjustment for overapplied overhead provides a big boost to net operating income. Therefore, the practice results in distortions in the pattern of net operating income over the year. In addition, since all of the adjustment is taken to Cost of Goods Sold, inventories are still overstated at year-end. This means that retained earnings is also overstated.

   While Cristin is in an extremely difficult position, her responsibilities under the IMA's Statement of Ethical Professional Practice seem to be clear. The Credibility standard states that management accountants have a responsibility to "disclose all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, analyses, or recommendations." Cristin should discuss this situation with her immediate supervisor in the controller's office at corporate headquarters. This step may bring her into direct conflict with the general manager of the division, so it would be a very difficult decision for her to make.

Case 3-34 (continued)

In the actual situation that this case is based on, the corporate controller's staff were aware of the general manager's accounting tricks, but top management of the company supported the general manager because "he comes through with the results" and could be relied on to hit the annual profit targets for his division. Personally, we would be very uncomfortable supporting a manager who will resort to deliberate distortions to achieve "results." If the manager will pull tricks in this area, what else might he be doing that is questionable or even perhaps illegal?

Research and Application 3-35 (240 minutes)

1. Toll Brothers succeeds first and foremost because of its product leadership customer value proposition. The annual report mentions in numerous places that Toll Brothers focuses on Luxury Homes and Communities and high quality construction. Page 8 of the 10-K says ‘We believe our marketing strategy, which emphasizes our more expensive "Estate" and "Executive" lines of homes, has enhanced our reputation as a builder-developer of high-quality upscale housing." Page 2 of the 10-K says "We are the only publicly traded national home builder to have won all three of the industry's highest honors: America's Best Builder (1996), the National Housing Quality Award (1995), and Builder of the Year (1988)." Toll Brothers seeks to realize manufacturing efficiencies for the benefit of its shareholders, but its customers choose Toll Brothers for its leadership position in the luxury home market.

2. Toll Brothers faces numerous business risks as described in pages 10-11 of the 10-K. Students may mention other risks beyond those specifically mentioned in the 10-K. Here are four risks faced by Toll Brothers with suggested control activities:
   - Risk: Downturns in the real estate market could adversely impact Toll Brothers' sales. Control activities: Diversify geographic markets served so that a downturn in one region of the country will not cripple the company.
   - Risk: Large sums of money may be spent buying land that, geologically speaking, cannot support home construction. For example, soil conditions may be too unstable to support the weight of a home. Control activities: Pay engineers to certify that targeted properties can support home construction.
   - Risk: Raw material costs may increase thereby depressing profit margins. Control activities: Vertically integrate by operating manufacturing facilities (see page 12 of the 10-K for a discussion of Toll Brothers' manufacturing facilities). Buying raw materials at wholesale prices cuts out a middleman in the value chain. In addition, Toll Brothers can purchase raw materials in large volumes to realize purchase price discounts.

Research and Application 3-35 (continued)

- Risk: Subcontractors may perform substandard work resulting in warranty claims and dissatisfied customers. Control activities: Employ a project manager within each community who serves in a quality assurance capacity.

3. Toll Brothers would use job-order costing because its homes are unique rather than homogeneous. Each home being built would be a considered a job. Toll Brothers' standard floor plans differ from one another particularly across its main product lines such as Move-Up, Empty Nester, Active Adult, Urban In-Fill, High-Density Suburban, and Second Homes (see pages 5 and 9 of the annual report). In 2004, Toll Brothers introduced 87 new home models (see page 4 of the 10-K).

   Beyond the fact that Toll Brothers offers a wide variety of floor plans, homes are further distinguished from one another by customer upgrades that add an average of $103,000 to the price of a home (see page 1 of the annual report). Upgrades include items such as additional garages, guest suites, extra fireplaces, and finished lofts (see page 4 of 10-K).

4. Examples of direct materials used in Toll Brothers' manufacturing facilities include lumber and plywood for wall panels, roofs, and floor trusses, as well as other items such as windows and doors (see page 12 of the 10-K). Examples of direct materials used at the home sites include shingles, exterior finishes such as stone, stucco, siding, or brick, kitchen cabinets, cement for the foundation, bathroom fixtures, etc.

   The standard bill of materials (e.g., prior to considering a specific customer's upgrade requests) for each home would differ. For example, differences in the square footage of homes would drive numerous differences in their bills of materials. Bigger homes would require more lumber, sheet rock, electrical wiring, etc. Bills of materials are also likely to differ across geographic regions of the country. For example, homes in Florida typically do not have basements whereas homes in New England are likely to have basements. Front porches may be more prevalent in South Carolina than in Ohio. Different grades of windows and insulation may be used in homes in the North than in the South.

Research and Application 3-35 (continued)

5. Toll Brothers incurs two types of direct labor costs. The company employs its own direct laborers in its manufacturing facilities in Morrisville, Pa. and Emporia, Va. The costs of these workers can be traced to specific items such as roof trusses that can in turn be traced to particular houses. Work at the home sites is performed by subcontractors. The labor cost embedded in a subcontractor's fixed price contract is directly traceable to the home being built. However, the direct laborers are not employed by Toll Brothers. Toll Brothers would not use employee time tickets at its home sites because the subcontractors are not employees of Toll Brothers, Inc. and they are paid a fixed price that is unaffected by the amount of hours worked.

6. There are numerous examples of overhead costs mentioned in the annual report and 10-K. Some examples are: land acquisition costs, land development costs (e.g., grading and clearing), road construction costs, underground utility installation costs, swimming pools, golf courses, tennis courts, marinas, community entrances, model home costs (including construction, furnishing and staffing), and project manager salaries. These costs are incurred to create housing communities but they cannot be easily and conveniently traced to specific homes.

7. It appears that Toll Brothers does not use cost-plus pricing to establish selling prices for its base models. Page 8 of the 10-K says "In determining the prices for our homes, we utilize, in addition to management's extensive experience, an internally developed value analysis program that compares our homes with homes offered by other builders in each local marketing area." In other words, the value to the customer and competitive conditions determine prices—not the cost of building a particular home.

   Page 5 of the annual report says "When there is strong demand, we benefit from exceptional pricing power because we have greater ability to raise prices than those builders who target buyers on tight budgets: it's easier to hit doubles, triples and home runs selling to luxury buyers." This quote implies that pricing is driven by the customers' willingness and ability to pay and not by the cost of building a particular house.

8. Based on information contained in the 10-K, it appears that Toll Brothers assigns overhead to cost objects in two ways. First, page 16 of the 10-K says "Land, land development and related costs (both incurred and estimated to be incurred in the future) are amortized to the cost of homes closed based upon the total number of homes to be constructed in each community." In other words, each home is assigned an equal share of overhead costs. Page 16 also says, "The estimated land, common area development and related costs of master planned communities (including the cost of golf courses, net of their estimated residual value) are allocated to individual communities within a master planned community on a relative sales value basis." In other words, higher priced communities within a master planned community are assigned a greater portion of master planned community overhead costs.

   In master planned communities, the allocation of overhead appears to take place in two stages. First, the overhead costs common to all communities contained with the master planned community are assigned to communities based on relative sales value. Then, all overhead costs related to a particular community within the master planned community are assigned equally to each home site.

   The company needs to assign overhead costs to homes so that it can derive a cost of sales number for the income statement and an inventory number for the balance sheet. Page 29 of the annual report shows the components of the company's ending inventory balance of $3.878 billion. Inventoriable costs include land and land development costs ($1.242 billion), construction in progress ($2.178 billion), sample homes and sales offices ($208 million), land deposits and costs of future development ($237 million), and other ($12 million). Construction in progress is similar to work in process for a manufacturing company. Overhead costs (as well as direct costs) flow through the construction in progress account and hit cost of home sales when a customer has a closing and takes possession of the home.

Chapter 4
Systems Design: Process Costing

Solutions to Questions

4-1 A process costing system should be used in situations where a homogeneous product is produced on a continuous basis.

4-2

1. Job-order costing and process costing have the same basic purposes—to assign materials, labor, and overhead cost to products and to provide a mechanism for computing unit product costs.
2. Both systems use the same basic manufacturing accounts.
3. Costs flow through the accounts in basically the same way in both systems.

4-3 Costs are accumulated by department in a process costing system.

4-4 In a process costing system, the activity performed in a department must be performed uniformly on all units moving through it and the output of the department must be homogeneous.

4-5 Cost accumulation is simpler under process costing because costs only need to be assigned to departments—not separate jobs. A company usually has a small number of processing departments, whereas a job-order costing system often must keep track of the costs of hundreds or even thousands of jobs.

4-6 In a process costing system, a Work in Process account is maintained for each separate processing department.

4-7 The journal entry would be:

Work in Process, Firing........	XXXX	
Work in Process, Mixing.........................		XXXX

4-8 The costs that might be added in the Firing Department include: (1) costs transferred in from the Mixing Department; (2) materials costs added in the Firing Department; (3) labor costs added in the Firing Department; and (4) overhead costs added in the Firing Department.

4-9 Under the weighted-average method, equivalent units of production consist of units transferred to the next department (or to finished goods) during the period plus the equivalent units in the department's ending work in process inventory.

4-10 A quantity schedule summarizes the physical flow of units through a department during a period. It serves several purposes. First, it provides information about activity in the department and also shows the stage of completion of any in-process units. Second, it provides data for computing the equivalent units and for preparing the other parts of the production report.

4-11 In process costing a unit of product accumulates cost in each department that it passes through, with the costs of one department added to the costs of the preceding department in a snowballing fashion.

4-12 The company will want to distinguish between the costs of the metals used to make the medallions, but the medals are otherwise identical and go through the same production processes. Thus, operation costing is ideally suited for the company's needs.

4-13 Any company that manufactures products that have some common characteristics and some individual characteristics may want to use operation costing. Examples include textiles, shoes, electronic parts, and clothing.

4-14 Under the FIFO method, units transferred out are divided into two parts. One part consists of the units in the beginning inventory. Only the work needed *to complete* these units is shown as part of the equivalent units for the current period. The other part of the units transferred out consists of the units *started and completed* during the current period; these units are shown as a separate amount in the equivalent units computation under the FIFO method.

4-15 Under the FIFO method, units transferred out are divided into two groups. The first group consists of units from the beginning work in process inventory. The second group consists of units started and completed during the period.

4-16 The FIFO method is superior to the weighted-average method for cost control because current performance should be measured in relation to costs of the current period only, and the weighted-average method mixes these costs in with costs of the prior period. Thus, under the weighted-average method, the department's apparent performance in the current period is influenced to some extent by what happened in a prior period.

Exercise 4-1 (20 minutes)

a. To record issuing raw materials for use in production:

Work in Process—Molding Department		23,000
Work in Process—Firing Department		8,000
Raw Materials		31,000

b. To record direct labor costs incurred:

Work in Process—Molding Department		12,000
Work in Process—Firing Department		7,000
Wages Payable		19,000

c. To record applying manufacturing overhead:

Work in Process—Molding Department		25,000
Work in Process—Firing Department		37,000
Manufacturing Overhead		62,000

d. To record transfer of unfired, molded bricks from the Molding Department to the Firing Department:

Work in Process—Firing Department		57,000
Work in Process—Molding Department		
57,000		

e. To record transfer of finished bricks from the Firing Department to the finished bricks warehouse:

Finished Goods............................	103,000	
Work in Process—Firing Department		
103,000		

f. To record Cost of Goods Sold:

Cost of Goods Sold	101,000	
Finished Goods		101,000

Exercise 4-2 (10 minutes)

Weighted-Average Method

	Equivalent Units (EU)	
	Materials	*Conversion*
Units transferred out	190,000	190,000
Work in process, ending:		
15,000 units × 80%	12,000	
15,000 units × 40%		6,000
Equivalent units	202,000	196,000

Exercise 4-3 (10 minutes)

FIFO Method

	Equivalent Units (EU)	
	Materials	*Conversion*
Work in process, beginning:		
30,000 units × 35%*	10,500	
30,000 units × 70%*		21,000
Started and completed during October**	160,000	160,000
Work in process, ending:		
15,000 units × 80%	12,000	
15,000 units × 40%		6,000
Equivalent units	182,500	187,000

* Work needed to complete these units.

** 175,000 units started – 15,000 units in ending work in process = 160,000 started and completed

Exercise 4-4 (15 minutes)

Weighted-Average Method

		Tons
1.	Work in process, June 1	20,000
	Started into production during the month	190,000
	Total tons in process	210,000
	Deduct work in process, June 30	30,000
	Completed and transferred out during the month	180,000
2.	Tons to be accounted for:	
	Work in process, June 1 (materials 90% complete, labor and overhead 80% complete)	20,000
	Started into production during the month	190,000
	Total tons to be accounted for	210,000
	Tons accounted for as follows:	
	Transferred out during the month	180,000
	Work in process, June 30 (materials 60% complete, labor and overhead 40% complete)	30,000
	Total tons accounted for	210,000

Exercise 4-5 (15 minutes)

FIFO Method

1. The number of tons completed and transferred out during the month is the same regardless of the costing method used. Thus, as in the similar exercise that is based on the weighted-average method, 180,000 tons would have been completed and transferred out. However, under the FIFO method we must break this down between the tons that were completed from the beginning inventory and the tons started and completed during the current period. This breakdown is shown in Part 2 below:

2. Tons to be accounted for:

Work in process, June 1 (materials 90% complete; labor and overhead 80% complete)	20,000
Started into production during the month	190,000
Total tons to be accounted for	210,000
Tons accounted for as follows:	
Transferred out during the month:	
Tons from the beginning inventory	20,000
Tons started and completed during the month	160,000 *
Work in process, June 30 (materials 60% complete; labor and overhead 40% complete)	30,000
Total tons accounted for	210,000

* 190,000 tons started into production – 30,000 tons in ending work in process = 160,000 tons started and completed.

Exercise 4-6 (15 minutes)

Weighted-Average Method

1.

	Materials	*Labor*	*Overhead*
Work in process, May 1	$ 18,000	$ 5,500	$ 27,500
Cost added during May	238,900	80,300	401,500
Total cost (a)	$256,900	$85,800	$429,000
Equivalent units of production (b)	35,000	33,000	33,000
Cost per equivalent unit (a) ÷ (b)	$7.34	$2.60	$13.00

2.

Cost per EU for materials	$ 7.34
Cost per EU for labor	2.60
Cost per EU for overhead	13.00
Total cost per EU	$22.94

Exercise 4-7 (20 minutes)

Weighted-Average Method

1. Computation of the total cost per EU:

Cost per EU for materials	$12.50
Cost per EU for labor	3.20
Cost per EU for overhead	6.40
Total cost per EU	$22.10

2. Computation of equivalent units in ending inventory:

	Materials	*Labor*	*Overhead*
Units in ending inventory	3,000	3,000	3,000
Percentage completed	80%	60%	60%
Equivalent units of production	2,400	1,800	1,800

3. Cost Reconciliation

	Total Cost	*Materials*	*Labor*	*Over-head*
Cost accounted for as follows:				
Transferred to the next department: 25,000 units at $22.10 per unit	$552,500	25,000	25,000	25,000
Work in process, ending:				
Materials, at $12.50 per EU	30,000	2,400		
Labor, at $3.20 per EU	5,760		1,800	
Overhead, at $6.40 per EU	11,520			1,800
Total work in process	47,280			
Total cost accounted for	$599,780			

Exercise 4-8 (10 minutes)

FIFO Method

1.

	Materials	*Labor*	*Overhead*
Cost added during May (a).............	$193,320	$62,000	$310,000
Equivalent units of production (b) ...	27,000	25,000	25,000
Cost per equivalent unit (a) ÷ (b)....	$7.16	$2.48	$12.40

2.

Cost per EU for materials......	$ 7.16
Cost per EU for labor...........	2.48
Cost per EU for overhead......	12.40
Total cost per EU..................	$22.04

Exercise 4-9 (45 minutes)

FIFO Method

1. Computation of the total cost per EU:

Cost per EU for material	$25.40
Cost per EU for conversion........	18.20
Total cost per EU.....................	$43.60

2. Computation of equivalent units in ending inventory:

	Materials	*Conversion*
Units in ending inventory	300	300
Percentage completed	70%	60%
Equivalent units of production...	210	180

3. Computation of equivalent units required to complete the beginning inventory:

	Materials	*Conversion*
Units in beginning inventory......	400	400
Percentage uncompleted	20%	60%
Equivalent units of production...	80	240

4.

Units transferred to the next department.............	3,100
Units from the beginning inventory......................	400
Units started and completed during the period......	2,700

Exercise 4-9 (continued)

5. Cost Reconciliation

	Total Cost	Equivalent Units: Materials	Equivalent Units: Conversion
Cost accounted for as follows:			
Transferred to the next department:			
From the beginning inventory:			
Cost in the beginning inventory	$ 11,040		
Cost to complete these units:			
Materials at $25.40 per EU	2,032	80	
Conversion at $18.20 per EU	4,368		240
Total cost from beginning inventory	17,440		
Units started and completed this month at $43.60 per unit	117,720	2,700	2,700
Total cost transferred to the next department	135,160		
Work in process, ending:			
Materials at $25.40 per EU	5,334	210	
Conversion at $18.20 per EU	3,276		180
Total work in process, ending	8,610		
Total cost accounted for	$143,770		

Exercise 4-10 (10 minutes)

Work in Process—Cooking	42,000	
Raw Materials Inventory		42,000
Work in Process—Cooking	50,000	
Work in Process—Molding	36,000	
Wages Payable		86,000
Work in Process—Cooking	75,000	
Work in Process—Molding	45,000	
Manufacturing Overhead		120,000
Work in Process—Molding	160,000	
Work in Process—Cooking		160,000
Finished Goods	240,000	
Work in Process—Molding		240,000

Exercise 4-11 (15 minutes)

Weighted-Average Method

	Quantity Schedule
Pounds to be accounted for:	
Work in process, July 1 (materials 100% complete, conversion 30% complete)	20,000
Started into production during July	380,000
Total pounds to be accounted for	400,000

		Equivalent Units (EU)	
		Materials	Conversion
Pounds accounted for as follows:			
Transferred to next department during July*	375,000	375,000	375,000
Work in process, July 31 (materials 100% complete, conversion 60% complete)	25,000	25,000	15,000
Total pounds accounted for	400,000	400,000	390,000

* 20,000 + 380,000 – 25,000 = 375,000

Exercise 4-12 (15 minutes)

FIFO Method

	Quantity Schedule
Pounds to be accounted for:	
Work in process, July 1 (materials 100% complete, conversion 30% complete)........	20,000
Started into production during July	380,000
Total pounds to be accounted for ...	400,000

		Equivalent Units (EU)	
		Materials	*Conversion*
Pounds accounted for as follows			
Transferred to next department:			
From the beginning inventory....	20,000	0	14,000 *
Started and completed this month**	355,000	355,000	355,000
Work in process, July 31 (materials 100% complete, conversion 60% complete)........	25,000	25,000	15,000
Total pounds accounted for	400,000	380,000	384,000

* Work required to complete these units:
20,000 pounds × (100% – 30%) = 14,000 pounds.

** 380,000 pounds started – 25,000 pounds in ending work in process inventory = 355,000 pounds started and completed this month.

Exercise 4-13 (20 minutes)

Weighted-Average Method

1. For the sake of brevity, only the portion of the quantity schedule from which the equivalent units are computed is shown below.

	Quantity Schedule	*Equivalent Units (EU)* *Materials*	*Conversion*
Units accounted for as follows:			
Transferred to the next process	175,000	175,000	175,000
Work in process, May 31 (materials 100% complete, conversion 30% complete)	10,000	10,000	3,000
Total units accounted for	185,000	185,000	178,000

2.

	Total Cost	*Materials*		*Conversion*		*Whole Unit*
Cost to be accounted for:						
Work in process, May 1	$ 5,500	$ 1,500		$ 4,000		
Cost added by the department	406,000	54,000		352,000		
Total cost to be accounted for (a)	$411,500	$55,500		$356,000		
Equivalent units (b)		185,000		178,000		
Cost per equivalent unit (a) ÷ (b)		$0.30	+	$2.00	=	$2.30

Exercise 4-14 (15 minutes)

Weighted-Average Method

	Total Cost	Equivalent Units (EU) Materials	Conversion
Cost accounted for as follows:			
Transferred to the next process (175,000 units × $2.30 per unit)	$402,500	175,000	175,000
Work in process, May 31:			
Materials, at $0.30 per EU	3,000	10,000	
Conversion, at $2.00 per EU	6,000		3,000
Total work in process	9,000		
Total cost accounted for	$411,500		

Exercise 4-15 (20 minutes)

FIFO Method

1. Quantity schedule and equivalent units:

	Quantity Schedule		
Units to be accounted for:			
Work in process, May 1 (materials 100% complete, conversion 40% complete)	5,000		
Started into production	180,000		
Total units to be accounted for	185,000		
		Equivalent Units (EU)	
		Materials	*Conversion*
Units accounted for as follows:			
Transferred to the next process:			
From the beginning inventory	5,000	0	3,000 *
Started and completed this month**	170,000	170,000	170,000
Work in process, May 31 (materials 100% complete, conversion 30% complete)	10,000	10,000	3,000
Total units accounted for	185,000	180,000	176,000

* Work needed to complete the units in beginning inventory.

** 180,000 units started into production – 10,000 units in ending work in process = 170,000 units started and completed

Exercise 4-15 (continued)

2.

	Total Cost	*Materials*	*Conversion*	*Whole Unit*
Cost to be accounted for:				
Work in process, May 1	$ 5,500			
Cost added by the department (a)	406,000	$54,000	$352,000	
Total cost to be accounted for	$411,500			
Equivalent units (b)		180,000	176,000	
Cost per equivalent unit (a) ÷ (b)		$0.30 +	$2.00 =	$2.30

Exercise 4-16 (20 minutes)

FIFO Method

	Total Cost	Equivalent Units (EU) Materials	Conversion
Cost accounted for as follows:			
Transferred to the next process:			
From the beginning inventory:			
Cost in the beginning inventory.....	$ 5,500		
Cost to complete these units:			
Materials, at $0.30 per EU	0	0	
Conversion, at $2.00 per EU	6,000		3,000
Total cost from beginning inventory..	11,500		
Units started and completed this month: 170,000 units × $2.30 per unit	391,000	170,000	170,000
Total cost transferred	402,500		
Work in process, May 31:			
Materials, at $0.30 per EU................	3,000	10,000	
Conversion, at $2.00 per EU............	6,000		3,000
Total work in process	9,000		
Total cost accounted for.......................	$411,500		

Exercise 4-17 (20 minutes)

Weighted-Average Method

1.

	Quantity Schedule
Units to be accounted for:	
Work in process, beginning (materials 80% complete, labor and overhead 60% complete)	5,000
Started into production...........	45,000
Total units to be accounted for...	50,000

		Equivalent Units (EU)		
Units accounted for as follows:		*Materials*	*Labor*	*Overhead*
Transferred to the next department.........................	42,000	42,000	42,000	42,000
Work in process, ending (materials 75% complete, labor and overhead 50% complete)	8,000	6,000	4,000	4,000
Total units accounted for...........	50,000	48,000	46,000	46,000

Exercise 4-17 (continued)

2.

	Total Cost	*Materials*	*Labor*		*Overhead*		*Whole Unit*
Cost to be accounted for:							
Work in process, beginning	$ 7,150	$ 4,320	$ 1,040		$ 1,790		
Cost added by the department	106,550	52,800	21,500		32,250		
Total cost to be accounted for (a) ..	$113,700	$57,120	$22,540		$34,040		
Equivalent units (b)		48,000	46,000		46,000		
Cost per equivalent unit (a) ÷ (b)...		$1.19	$0.49	+	$0.74	=	$2.42

Exercise 4-18 (20 minutes)

FIFO Method

1.

	Quantity Schedule
Units to be accounted for:	
Work in process, beginning (materials 80% complete, labor and overhead 60% complete)......	5,000
Started into production..	45,000
Total units accounted for..	50,000

		Equivalent Units (EU)		
		Materials	*Labor*	*Overhead*
Units accounted for as follows:				
Transferred to the next department:				
From the beginning inventory..............................	5,000	1,000 *	2,000 *	2,000 *
Started and completed this month**	37,000	37,000	37,000	37,000
Work in process, ending (materials 75% complete, labor and overhead 50% complete).....................	8,000	6,000	4,000	4,000
Total units accounted for..	50,000	44,000	43,000	43,000

* Work required to complete the beginning inventory.

** 45,000 units started into production – 8,000 units in ending work in process = 37,000 started and completed

Exercise 4-18 (continued)

2.

	Total Cost	*Materials*		*Labor*		*Overhead*		*Whole Unit*
Cost to be accounted for:								
Work in process, beginning	$ 7,150							
Cost added during the month (a)..	106,550	$52,800		$21,500		$32,250		
Total cost to be accounted for.........	$113,700							
Equivalent units (b)		44,000		43,000		43,000		
Cost per equivalent unit (a) ÷ (b)....		$1.20	+	$0.50	+	$0.75	=	$2.45

Problem 4-19 (45 minutes)

Weighted-Average Method

1., 2., and 3.

Quantity Schedule and Equivalent Units

	Quantity Schedule
Units to be accounted for:	
Work in process, May 1 (materials 100% complete; labor and overhead 80% complete) .	10,000
Started into production	100,000
Total units to be accounted for	110,000

		Equivalent Units (EU)		
		Materials	*Labor*	*Overhead*
Units accounted for as follows:				
Transferred out	95,000	95,000	95,000	95,000
Work in process, May 31 (materials 60% complete; labor and overhead 20% complete) .	15,000	9,000	3,000	3,000
Total units accounted for....................................	110,000	104,000	98,000	98,000

Problem 4-19 (continued)

Cost per Equivalent Unit

	Total Cost	*Materials*	*Labor*	*Overhead*	*Whole Unit*
Cost to be accounted for:					
Work in process, May 1	$ 8,700	$ 1,500	$ 1,800	$ 5,400	
Cost added during the month	245,300	154,500	22,700	68,100	
Total cost to be accounted for (a)	$254,000	$156,000	$24,500	$73,500	
Equivalent units (b)		104,000	98,000	98,000	
Cost per equivalent unit (a) ÷ (b)		$1.50 +	$0.25 +	$0.75 =	$2.50

Cost Reconciliation

	Total Cost	*Equivalent Units (EU)* *Materials*	*Labor*	*Overhead*
Cost accounted for as follows:				
Transferred out: 95,000 units × $2.50 per unit	$237,500	95,000	95,000	95,000
Work in process, May 31:				
Materials, at $1.50 per EU	13,500	9,000		
Labor, at $0.25 per EU	750		3,000	
Overhead, at $0.75 per EU	2,250			3,000
Total work in process	16,500			
Total cost accounted for	$254,000			

Problem 4-20 (45 minutes)

FIFO Method

1. 2., and 3.

Quantity Schedule and Equivalent Units

	Quantity Schedule		
Units to be accounted for:			
Work in process, July 1 (materials 100% complete; conversion 30% complete)	10,000		
Started into production	170,000		
Total units to be accounted for	180,000		
		Equivalent Units	
		Materials	*Conversion*
Units accounted for as follows:			
Transferred to packaging:			
From the beginning inventory	10,000	0	7,000*
Started and completed this month**	150,000	150,000	150,000
Work in process, July 31 (materials 100% complete; conversion 40% complete)	20,000	20,000	8,000
Total units accounted for	180,000	170,000	165,000

* 10,000 × (100% – 30%) = 7,000

** 170,000 units started into production – 20,000 units in ending work in process = 150,000 units started and completed

Problem 4-20 (continued)

Cost per Equivalent Unit

	Total Cost	*Materials*	*Conversion*	*Whole Unit*
Cost to be accounted for:				
Work in process, July 1	$ 13,400			
Cost added by the department (a)	383,600	$139,400	$244,200	
Total cost to be accounted for	$397,000			
Equivalent units (b)		170,000	165,000	
Cost per equivalent unit (a) ÷ (b)		$0.82 +	$1.48 =	$2.30

Problem 4-20 (continued)

Cost Reconciliation

	Total Cost	*Equivalent Units (EU)*	
		Materials	*Conversion*
Cost accounted for as follows:			
Transferred to packaging:			
From the beginning inventory:			
Cost in the beginning inventory	$ 13,400		
Cost to complete these units:			
Materials, at $0.82 per EU	0	0	
Conversion, at $1.48 per EU	10,360		7,000
Total cost from beginning inventory	23,760		
Started and completed this month:			
150,000 units × $2.30 per unit	345,000	150,000	150,000
Total cost transferred	368,760		
Work in process, July 31:			
Materials, at $0.82 per EU	16,400	20,000	
Conversion, at $1.48 per EU	11,840		8,000
Total work in process	28,240		
Total cost accounted for	$397,000		

Problem 4-21 (45 minutes)

Weighted-Average Method

Quantity Schedule and Equivalent Units

	Quantity Schedule		
Units to be accounted for:			
Work in process, June 1 (materials 100% complete, conversion 75% complete)	20,000		
Started into production	180,000		
Total units to be accounted for	200,000		
		Equivalent Units (EU)	
		Materials	*Conversion*
Units accounted for as follows:			
Transferred to bottling:	160,000	160,000	160,000
Work in process, June 30 (materials 100% complete, conversion 25% complete)	40,000	40,000	10,000
Total units accounted for	200,000	200,000	170,000

Problem 4-21 (continued)

Costs per Equivalent Unit

	Total Cost	*Materials*		*Conversion*		*Whole Unit*
Cost to be accounted for:						
Work in process, June 1	$ 50,000	$ 25,200		$ 24,800		
Cost added during June	573,500	334,800		238,700		
Total cost to be accounted for (a)	$623,500	$360,000		$263,500		
Equivalent units (b)		200,000		170,000		
Cost per equivalent unit (a) ÷ (b)		$1.80	+	$1.55	=	$3.35

Cost Reconciliation

	Total Cost	*Equivalent Units (EU)*	
		Materials	*Conversion*
Cost accounted for as follows:			
Transferred to bottling:			
160,000 units × $3.35 per unit	$536,000	160,000	160,000
Work in process, June 30:			
Materials, at $1.80 per EU	72,000	40,000	
Conversion, at $1.55 per EU	15,500		10,000
Total work in process	87,500		
Total cost accounted for	$623,500		

Problem 4-22 (45 minutes)

FIFO Method

Quantity Schedule and Equivalent Units

	Quantity Schedule		
Units to be accounted for:			
Work in process, June 1 (materials 100% complete, conversion 75% complete)	20,000		
Started into production	180,000		
Total units to be accounted for	200,000		
		Equivalent Units (EU)	
		Materials	*Conversion*
Units accounted for as follows:			
Transferred to bottling:			
From the beginning inventory	20,000	0	5,000 *
Started and completed this month**	140,000	140,000	140,000
Work in process, June 30 (materials 100% complete, conversion 25% complete)	40,000	40,000	10,000
Total units accounted for	200,000	180,000	155,000

* 20,000 × (100% – 75%) = 5,000

** 180,000 units started into production – 40,000 units in ending work in process = 140,000 units started and completed

Problem 4-22 (continued)

Cost per Equivalent Unit

	Total Cost	*Materials*		*Conversion*		*Whole Unit*
Cost to be accounted for:						
Work in process, June 1	$ 50,000					
Cost added during June (a)	573,500	$334,800		$238,700		
Total cost to be accounted for	$623,500					
Equivalent units (b)		180,000		155,000		
Cost per equivalent unit (a) ÷ (b)		$1.86	+	$1.54	=	$3.40

Problem 4-22 (continued)

Cost Reconciliation

	Total Cost	*Equivalent Units (EU)* *Materials*	*Conversion*
Cost accounted for as follows:			
Transferred to bottling:			
From the beginning inventory:			
Cost in the beginning inventory	$ 50,000		
Cost to complete these units:			
Materials, at $1.86 per EU	0	0	
Conversion, at $1.54 per EU	7,700		5,000
Total cost from beginning inventory	57,700		
Units started and completed during June:			
140,000 units × $3.40 per unit	476,000	140,000	140,000
Total cost transferred to bottling	533,700		
Work in process, June 30:			
Materials, at $1.86 per EU	74,400	40,000	
Conversion, at $1.54 per EU	15,400		10,000
Total work in process	89,800		
Total cost accounted for	$623,500		

Problem 4-23 (45 minutes)

Weighted-Average Method

1. A completed production report follows:

Quantity Schedule and Equivalent Units

	Quantity Schedule		
Pounds to be accounted for:			
Work in process, May 1 (materials 100% complete, labor and overhead 1/3 complete)	18,000		
Started into production	167,000		
Total pounds to be accounted for	185,000		
		Equivalent Units (EU)	
		Materials	*Labor & Overhead*
Pounds accounted for as follows:			
Transferred to mixing	170,000	170,000	170,000
Work in process, May 31 (materials 100% complete, labor and overhead 2/3 complete)	15,000	15,000	10,000
Total pounds accounted for	185,000	185,000	180,000

Problem 4-23 (continued)

Costs per Equivalent Unit

	Total Cost	*Materials*		*Labor & Overhead*		*Whole Unit*
Cost to be accounted for:						
Work in process, May 1	$ 21,800	$ 14,600		$ 7,200		
Cost added during May	360,200	133,400		226,800		
Total cost to be accounted for (a)	$382,000	$148,000		$234,000		
Equivalent units (b)		185,000		180,000		
Cost per equivalent unit (a) ÷ (b)		$0.80	+	$1.30	=	$2.10

Cost Reconciliation

		Equivalent Units (EU)	
	Total Cost	*Materials*	*Labor & Overhead*
Cost accounted for as follows:			
Transferred to mixing: 170,000 units × $2.10 per unit	$357,000	170,000	170,000
Work in process, May 31:			
Materials, at $0.80 per EU	12,000	15,000	
Labor and overhead, at $1.30 per EU	13,000		10,000
Total work in process	25,000		
Total cost accounted for	$382,000		

Problem 4-23 (continued)

2. The weighted-average method mixes costs of the prior period with current period costs. Thus, under the weighted-average method, unit costs are influenced to some extent by what happened in a prior period. This problem becomes particularly significant when attempting to measure performance in the current period. Good cost control in the current period might be concealed to some degree by the unit costs that have been brought forward in the beginning inventory. The reverse could also be true in that poor cost control might be concealed by the costs of the prior period that have been brought forward and added in with current period costs.

Problem 4-24 (45 minutes)

FIFO Method

The completed production report follows:

Quantity Schedule and Equivalent Units

	Quantity Schedule		
Gallons to be accounted for:			
Work in process, April 1 (materials 100% complete, conversion 80% complete)	10,000		
Started into production	140,000		
Total gallons to be accounted for	150,000		
		Equivalent Units (EU)	
		Materials	*Conversion*
Gallons accounted for as follows:			
Transferred to mixing:			
From the beginning inventory	10,000	0	2,000 *
Started and completed this month**	110,000	110,000	110,000
Work in process, April 30 (materials 100% complete, conversion 60% complete)	30,000	30,000	18,000
Total gallons accounted for	150,000	140,000	130,000

* Work required to complete units in beginning inventory

** 140,000 units started – 30,000 units in ending work in process = 110,000 started and completed

Problem 4-24 (continued)

Costs per Equivalent Unit

	Total Cost	*Materials*	*Conversion*		*Whole Unit*
Cost to be accounted for:					
Work in process, April 1	$ 39,000				
Cost added during April (a)	571,000	$259,000	$312,000		
Total cost to be accounted for	$610,000				
Equivalent units (b)		140,000	130,000		
Cost per equivalent unit (a) ÷ (b)		$1.85 +	$2.40	=	$4.25

Problem 4-24 (continued)

Cost Reconciliation

	Total Cost	*Equivalent Units (EU)*	
		Materials	*Conversion*
Cost accounted for as follows:			
Transferred to Mixing:			
From the beginning inventory:			
Cost in the beginning inventory	$ 39,000		
Cost to complete these units:			
Materials, at $1.85 per EU	0	0	
Conversion, at $2.40 per EU	4,800		2,000
Total cost from beginning inventory	43,800		
Gallons started and completed during April:			
110,000 × $4.25 per unit	467,500	110,000	110,000
Total cost transferred to Mixing	511,300		
Work in process, April 30:			
Materials, at $1.85 per EU	55,500	30,000	
Conversion, at $2.40 per EU	43,200		18,000
Total work in process	98,700		
Total cost accounted for	$610,000		

Problem 4-25 (30 minutes)

Weighted-Average Method

1. The equivalent units for the month would be:

	Quantity Schedule	Equivalent Units (EU)	
		Materials	Conversion
Units accounted for as follows:			
Transferred to next department	190,000	190,000	190,000
Work in process, April 30 (materials 75% complete, conversion 60% complete)	40,000	30,000	24,000
Total units accounted for	230,000	220,000	214,000

2.

	Total Cost	Materials		Conversion		Whole Unit
Work in process, April 1	$ 98,000	$ 67,800		$ 30,200		
Cost added during the month	827,000	579,000		248,000		
Total cost (a)	$925,000	$646,800		$278,200		
Equivalent units (b)		220,000		214,000		
Cost per equivalent unit (a) ÷ (b)		$2.94	+	$1.30	=	$4.24

3.

Total units transferred	190,000
Less units in the beginning inventory	30,000
Units started and completed during April	160,000

Problem 4-25 (continued)

4. No, the manager should not be rewarded for good cost control. The Mixing Department's low unit cost for April occurred because the costs of the prior month have been averaged in with April's costs. This is a major criticism of the weighted-average method in that the costs computed for product costing purposes can't be used to evaluate cost control or to measure performance for the *current* period.

Problem 4-26 (90 minutes)

Weighted-Average Method

1. a.	Work in Process—Refining Department	495,000	
	Work in Process—Blending Department	115,000	
	Raw Materials		610,000
b.	Work in Process—Refining Department	72,000	
	Work in Process—Blending Department	18,000	
	Salaries and Wages Payable		90,000
c.	Manufacturing Overhead	225,000	
	Accounts Payable		225,000
d.	Work in Process—Refining Department	181,000	
	Manufacturing Overhead		181,000
d.	Work in Process—Blending Department	42,000	
	Manufacturing Overhead		42,000
e.	Work in Process—Blending Department	740,000	
	Work in Process—Refining Department		740,000
f.	Finished Goods	950,000	
	Work in Process—Blending Department		950,000
g.	Accounts Receivable	1,500,000	
	Sales		1,500,000
	Cost of Goods Sold	900,000	
	Finished Goods		900,000

Problem 4-26 (continued)

2.

Accounts Receivable

(g)	1,500,000		

Raw Materials

Bal.	618,000	610,000	(a)
Bal.	8,000		

Work in Process
Refining Department

Bal.	38,000	740,000	(e)
(a)	495,000		
(b)	72,000		
(d)	181,000		
Bal.	46,000		

Work in Process
Blending Department

Bal.	65,000	950,000	(f)
(a)	115,000		
(b)	18,000		
(d)	42,000		
(e)	740,000		
Bal.	30,000		

Finished Goods

Bal.	20,000	900,000	(g)
(f)	950,000		
Bal.	70,000		

Manufacturing Overhead

(c)	225,000	223,000	(d)
Bal.	2,000		

Accounts Payable

		225,000	(c)

Salaries and Wages Payable

		90,000	(b)

Sales

		1,500,000	(g)

Cost of Goods Sold

(g)	900,000		

Problem 4-26 (continued)

3. The production report for the refining department follows:

Quantity Schedule and Equivalent Units

	Quantity Schedule			
Gallons to be accounted for:				
Work in process, March 1 (materials 100% complete, labor and overhead 90% complete).......	20,000			
Started into production	390,000			
Total gallons to be accounted for	410,000			
		Equivalent Units (EU)		
		Materials	*Labor*	*Overhead*
Gallons accounted for as follows:				
Transferred to blending*	370,000	370,000	370,000	370,000
Work in process, March 31 (materials 75% complete, labor and overhead 25% complete).......	40,000	30,000	10,000	10,000
Total gallons accounted for	410,000	400,000	380,000	380,000

* 410,000 gallons – 40,000 gallons = 370,000 gallons

Problem 4-26 (continued)

Costs per Equivalent Unit

	Total Cost	*Materials*	*Labor*	*Overhead*	*Whole Unit*
Cost to be accounted for:					
Work in process, March 1	$ 38,000	$ 25,000	$ 4,000	$ 9,000	
Cost added during March	748,000	495,000	72,000	181,000	
Total cost to be accounted for (a)........	$786,000	$520,000	$76,000	$190,000	
Equivalent units (b)		400,000	380,000	380,000	
Cost per equivalent unit (a) ÷ (b)........		$1.30 +	$0.20 +	$0.50 =	$2.00

Cost Reconciliation

	Total Cost	*Equivalent Units (EU)* *Materials*	*Labor*	*Overhead*
Cost accounted for as follows:				
Transferred to blending: 370,000 gallons × $2.00 per gallon	$740,000	370,000	370,000	370,000
Work in process, March 31:				
Materials, at $1.30 per EU.............	39,000	30,000		
Labor, at $0.20 per EU..................	2,000		10,000	
Overhead, at $0.50 per EU............	5,000			10,000
Total work in process	46,000			
Total cost accounted for.....................	$786,000			

Problem 4-27 (60 minutes)

Weighted-Average Method

1. The equivalent units would be:

	Materials	*Labor*	*Overhead*
Units completed during the year.........	900,000	900,000	900,000
Work in process, Dec. 31:			
300,000 units × 100%	300,000		
300,000 units × 50%		150,000	150,000
Total equivalent units (a)	1,200,000	1,050,000	1,050,000

The costs per equivalent unit would be:

	Materials		*Labor*		*Overhead*		*Whole Unit*
Work in process, January 1	$ 200,000		$ 315,000		$ 189,000 *		
Cost added during the year	1,300,000		1,995,000		1,197,000 **		
Total costs (b).................................	$1,500,000		$2,310,000		$1,386,000		
Cost per equivalent unit (b) ÷ (a).......	$1.25	+	$2.20	+	$1.32	=	$4.77

* 60% × $315,000 = $189,000
** 60% × $1,995,000 = $1,197,000

Problem 4-27 (continued)

2. The amount of cost that should be assigned to the ending inventories is:

	Work in Process	*Finished Goods*	*Total*
Work in process:			
Materials: 300,000 units × $1.25 per unit	$375,000		$ 375,000
Labor: 150,000 EU × $2.20 per unit	330,000		330,000
Overhead: 150,000 EU × $1.32 per unit	198,000		198,000
Finished goods: 200,000 units × $4.77 per unit		$954,000	954,000
Total cost to be assigned to inventories	$903,000	$954,000	$1,857,000

3. The necessary adjustments would be:

	Work in Process	*Finished Goods*	*Total*
Cost to be assigned to inventories (above)	$903,000	$ 954,000	$1,857,000
Year-end balances in the accounts	660,960	1,009,800	1,670,760
Difference	$242,040	$ (55,800)	$ 186,240

Work in Process Inventory	242,040	
Finished Goods Inventory		55,800
Cost of Goods Sold		186,240

Problem 4-27 (continued)

4. The simplest computation of the cost of goods sold would be:

Beginning finished goods inventory	0
Units completed during the year	900,000
Units available for sale	900,000
Less units in ending finished goods inventory	200,000
Units sold during the year	700,000
Cost per equivalent unit (from part 1)	× $4.77
Cost of goods sold	$3,339,000

Alternative computation:

Total manufacturing cost incurred:	
Materials (part 1)	$1,500,000
Labor (part 1)	2,310,000
Overhead (part 1)	1,386,000
Total manufacturing cost	5,196,000
Less cost assigned to inventories (part 2)	1,857,000
Cost of goods sold	$3,339,000

Problem 4-28 (90 minutes)

Weighted-Average Method

		Debit	Credit
1. a.	Work in Process—Cooking Department	570,000	
	Work in Process—Bottling Department	130,000	
	Raw Materials		700,000
b.	Work in Process—Cooking Department	100,000	
	Work in Process—Bottling Department	80,000	
	Salaries and Wages Payable		180,000
c.	Manufacturing Overhead	400,000	
	Accounts Payable		400,000
d.	Work in Process—Cooking Department	235,000	
	Work in Process—Bottling Department	158,000	
	Manufacturing Overhead		393,000
e.	Work in Process—Bottling Department	900,000	
	Work in Process—Cooking Department		900,000
f.	Finished Goods	1,300,000	
	Work in Process—Bottling Department		1,300,000
g.	Accounts Receivable	2,000,000	
	Sales		2,000,000
	Cost of Goods Sold	1,250,000	
	Finished Goods		1,250,000

Problem 4-28 (continued)

2.

Accounts Receivable

(g)	2,000,000		

Raw Materials

Bal.	710,000	700,000	(a)
Bal.	10,000		

Work in Process Cooking Department

Bal.	61,000	900,000	(e)
(a)	570,000		
(b)	100,000		
(d)	235,000		
Bal.	66,000		

Work in Process Bottling Department

Bal.	85,000	1,300,000	(f)
(a)	130,000		
(b)	80,000		
(d)	158,000		
(e)	900,000		
Bal.	53,000		

Finished Goods

Bal.	45,000	1,250,000	(g)
(f)	1,300,000		
Bal.	95,000		

Manufacturing Overhead

(c)	400,000	393,000	(d)
Bal.	7,000		

Accounts Payable

		400,000	(c)

Salaries and Wages Payable

		180,000	(b)

Sales

		2,000,000	(g)

Cost of Goods Sold

(g)	1,250,000		

Problem 4-28 (continued)

3. The production report for the cooking department follows:

Quantity Schedule and Equivalent Units

	Quantity Schedule
Quarts to be accounted for:	
Work in process, May 1 (materials 60% complete, labor and overhead 30% complete).....	70,000
Started into production*	380,000
Total quarts accounted for	450,000

		Equivalent Units (EU)		
		Materials	*Labor*	*Overhead*
Quarts accounted for as follows:				
Transferred to bottling:	400,000	400,000	400,000	400,000
Work in process, May 31 (materials 70% complete, labor and overhead 40% complete).....	50,000	35,000	20,000	20,000
Total quarts accounted for	450,000	435,000	420,000	420,000

* (400,000 + 50,000) – 70,000 = 380,000

Problem 4-28 (continued)

Costs per Equivalent Unit

	Total Cost	*Materials*		*Labor*		*Overhead*		*Whole Unit*
Cost to be accounted for:								
Work in process, May 1	$ 61,000	$ 39,000		$ 5,000		$ 17,000		
Cost added during May	905,000	570,000		100,000		235,000		
Total cost to be accounted for (a)	$966,000	$609,000		$105,000		$252,000		
Equivalent units (b)		435,000		420,000		420,000		
Cost per equivalent unit (a) ÷ (b)		$1.40	+	$0.25	+	$0.60	=	$2.25

Cost Reconciliation

	Total Cost	*Equivalent Units (EU)*		
		Materials	*Labor*	*Overhead*
Cost accounted for as follows:				
Transferred to bottling: 400,000 quarts @ $2.25 per quart	$900,000	400,000	400,000	400,000
Work in process, May 31:				
Materials @ $1.40 per EU	49,000	35,000		
Labor @ $0.25 per EU	5,000		20,000	
Overhead @ $0.60 per EU	12,000			20,000
Total work in process	66,000			
Total cost accounted for	$966,000			

Case 4-29 (90 minutes)

- This case is difficult—particularly part 3, which requires analytical skills.
- Since there are no beginning inventories, it makes no difference whether the weighted-average or FIFO method is used by the company. You may choose to assign the problem specifying that the FIFO method be used rather than the weighted-average method.

1. The computation of the cost of goods sold follows:

	Transferred In	*Conversion*
Estimated completion	100%	30%
Computation of equivalent units:		
Completed and transferred out	200,000	200,000
Work in process, ending:		
Transferred in,		
10,000 units × 100%	10,000	
Conversion,		
10,000 units × 30%		3,000
Total equivalent units	210,000	203,000

	Transferred In	*Conversion*	*Whole Unit*
Cost to be accounted for:			
Work in process	0	0	
Cost added during the month	$39,375,000	$20,807,500	
Total cost to be accounted for (a)	$39,375,000	$20,807,500	
Equivalent units (above) (b)	210,000	203,000	
Cost per equivalent unit, (a) ÷ (b)	$187.50 +	$102.50	= $290.00

Cost of goods sold = 200,000 units × $290 per unit = $58,000,000

Case 4-29 (continued)

2. The estimate of the percentage completion of ending work in process inventories affects the unit costs of finished goods and therefore of the cost of goods sold. Gary Stevens would like the estimated percentage completion figures to be increased for the ending work in process. The higher the percentage of completion of ending work in process, the higher the equivalent units for the period and the lower the unit costs.

3. Increasing the percentage of completion can increase net operating income by reducing the cost of goods sold. To increase net operating income by \$200,000, the cost of goods sold would have to be decreased by \$200,000 from \$58,000,000 down to \$57,800,000.

   The percentage of completion, X, affects the cost of goods sold by its effect on the unit cost, which can be determined as follows:

$$\text{Unit cost} = \$187.50 + \frac{\$20{,}807{,}500}{200{,}000+10{,}000X}$$

   And the cost of goods sold can be computed as follows:

$$\text{Cost of goods sold} = 200{,}000 \times \text{Unit cost}$$

   Since cost of goods sold must be reduced down to \$57,800,000, the unit cost must be \$289.00 (\$57,800,000 ÷ 200,000 units). Thus, the required percentage completion, X, to obtain the \$200,000 reduction in cost of goods sold can be found by solving the following equation:

$$\$187.50 + \frac{\$20{,}807{,}500}{200{,}000 + 10{,}000X} = \$289.00$$

Case 4-29 (continued)

$$\frac{\$20,807,500}{200,000 + 10,000X} = \$289.00 - \$187.50$$

$$\frac{\$20,807,500}{200,000 + 10,000X} = \$101.50$$

$$\frac{200,000 + 10,000X}{\$20,807,500} = \frac{1}{\$101.50}$$

$$200,000 + 10,000X = \frac{\$20,807,500}{\$101.50}$$

$$200,000 + 10,000X = 205,000$$

$$10,000X = 205,000 - 200,000$$

$$10,000X = 5,000$$

$$X = \frac{5,000}{10,000} = 50\%$$

Thus, changing the percentage completion to 50% will decrease cost of goods sold and increase net operating income by $200,000 as verified on the next page.

Case 4-29 (continued)

3. (continued)

	Transferred In	*Conversion*
Estimated completion	100%	50%

Computation of equivalent units:		
Completed and transferred out	200,000	200,000
Work in process, ending:		
Transferred in, 10,000 units × 100%	10,000	
Conversion, 10,000 units × 50%		5,000
Total equivalent units	210,000	205,000

	Transferred In	*Conversion*	*Whole Unit*
Cost to be accounted for:			
Work in process	0	0	
Cost added during the month	$39,375,000	$20,807,500	
Total cost to be accounted for (a)	$39,375,000	$20,807,500	
Equivalent units (above) (b)	210,000	205,000	
Cost per equivalent unit, (a) ÷ (b)	$187.50 +	$101.50	=$289.00

Cost of goods sold = 200,000 units × $289 per unit = $57,800,000

Case 4-29 (continued)

3. (continued)
   The following is an alternative approach to solving this problem:
   - The additional income needed = \$200,000 ÷ 200,000 units = \$1 per unit
   - The cost transferred in cannot be changed, so the conversion cost must be reduced from \$102.50 to \$101.50 per EU.
   - Therefore, the equivalent units for conversion need to be: \$20,807,500 ÷ \$101.50 per EU = 205,000 EUs.
   - 205,000 EUs – 200,000 units transferred out = 5,000 EU in WIP
   - 5,000 EU ÷ 10,000 units in WIP = 50% complete

Case 4-29 (continued)

4. Mary is in a very difficult position. Collaborating with Gary Stevens in subverting the integrity of the accounting system is unethical by almost any standard. To put the situation in its starkest light, Stevens is suggesting that the production managers lie to get their bonus. Having said that, the peer pressure to go along in this situation may be intense. It is difficult on a personal level to ignore such peer pressure. Moreover, Mary probably prefers not to risk alienating people she might need to rely on in the future. On the other hand, Mary should be careful not to accept at face value Gary Stevens' assertion that all of the other managers are "doing as much as they can to pull this bonus out of the hat." Those who engage in unethical or illegal acts often rationalize their own behavior by exaggerating the extent to which others engage in the same kind of behavior. Other managers may actually be very uncomfortable "pulling strings" to make the target profit for the year.

   From a broader perspective, if the net profits reported by the managers in a division cannot be trusted, then the company would be foolish to base bonuses on the net profit figures. A bonus system based on divisional net profits presupposes the integrity of the accounting system. However, the company should perhaps reconsider how it determines the bonus. It is quite common for companies to pay an "all or nothing" bonus contingent on making a particular target. This inevitably creates powerful incentives to bend the rules when the target has not quite been attained. It might be better to have a bonus without this "all or nothing" feature. For example, managers could be paid a bonus of x% of profits above target profits rather than a bonus that is a preset percentage of their base salary. Under such a policy, the effect of adding that last dollar of profits that just pushes the divisional net profits over the target profit will add a few pennies to the manager's compensation rather than thousands of dollars. Therefore, the incentives to misstate the net operating income are reduced. Why tempt people unnecessarily?

Case 4-30 (45 minutes)

Weighted-Average Method

1. The production report follows:

Quantity Schedule and Equivalent Units

	Quantity Schedule
Units to be accounted for:	
Work in process, April 1 (materials 100% complete, conversion 60% complete)	450
Received from the preceding department ...	1,950
Total units accounted for	2,400

		Equivalent Units (EU)		
		Transferred In	*Materials*	*Conversion*
Units accounted for as follows:				
Transferred to finished goods	1,800	1,800	1,800	1,800
Work in process, April 30 (materials 0% complete, conversion 35% complete)	600	600	0	210
Total units accounted for	2,400	2,400	1,800	2,010

Case 4-30 (continued)

Costs per Equivalent Unit

	Total Cost	*Transferred In*		*Materials*		*Conversion*		*Whole Unit*
Cost to be accounted for:								
Work in process, April 1	$ 8,208	$ 4,068		$1,980		$ 2,160		
Cost transferred in or added........	38,070	17,940		6,210		13,920		
Total cost to be accounted for (a) ..	$46,278	$22,008		$8,190		$16,080		
Equivalent units (b)......................		2,400		1,800		2,010		
Cost per equivalent unit (a) ÷ (b)...		$9.17	+	$4.55	+	$8.00	=	$21.72

Case 4-30 (continued)

Cost Reconciliation

	Total Cost	*Equivalent Units (EU)* Transferred In	*Materials*	*Conversion*
Cost accounted for as follows:				
Transferred to finished goods:				
1,800 units × $21.72 per unit	$39,096	1,800	1,800	1,800
Work in process, April 30:				
Transferred in cost, at $9.17 per EU	5,502	600		
Materials, at $4.55 per EU	0		0	
Conversion, at $8.00 per EU	1,680			210
Total work in process	7,182			
Total cost accounted for	$46,278			

2. The unit cost figure in the report prepared by the new assistant controller is high because none of the cost incurred during the month was assigned to the units in the ending work in process inventory.

Case 4-31 (60 minutes)

1. The production report follows:

Quantity Schedule and Equivalent Units

	Quantity Schedule			
Units to be accounted for:				
Work in process, April 1 (materials 100% complete, conversion 60% complete)	450			
Received from the preceding dept.	1,950			
Total units to be accounted for	2,400			
		Equivalent Units (EU)		
		Transferred In	*Materials*	*Conversion*
Units accounted for as follows:				
Transferred to finished goods:				
From the beginning inventory	450		0	180*
Received and completed this month**	1,350	1,350	1,350	1,350
Work in process, April 30 (materials 0% complete, conversion 35% complete)	600	600	0	210
Total units accounted for	2,400	1,950	1,350	1,740

* 450 × (100% – 60%) = 180
** 1,950 units – 600 units = 1,350 units

Case 4-31 (continued)

Costs per Equivalent Unit

	Total Cost	*Transferred In*		*Materials*		*Conversion*		*Whole Unit*
Cost to be accounted for:								
Work in process, April 1	$ 8,208							
Cost transferred in or added (a)	38,070	$17,940		$6,210		$13,920		
Total cost to be accounted for	$46,278							
Equivalent units (b)		1,950		1,350		1,740		
Cost per equivalent unit (a) ÷ (b)		$9.20	+	$4.60	+	$8.00	=	$21.80

Case 4-31 (continued)

Cost Reconciliation

	Total Cost	*Equivalent Units (EU)* *Transferred In*	*Materials*	*Conversion*
Cost accounted for as follows:				
Transferred to finished goods:				
From the beginning inventory:				
Cost in the beginning inventory.....	$ 8,208			
Cost to complete these units:				
Conversion, at $8 per EU	1,440			180
Total cost from beginning inventory..	9,648			
Units started and completed: 1,350 units × $21.80 per unit	29,430	1,350	1,350	1,350
Total cost transferred to finished goods	39,078			
Work in process, April 30:				
Transferred in, at $9.20 per EU	5,520	600		
Materials, at $4.60 per EU................	0		0	
Conversion, at $8.00 per EU............	1,680			210
Total work in process	7,200			
Total cost accounted for........................	$46,278			

Case 4-31 (continued)

2. The effects of the cost-cutting will tend to show up more under the FIFO method. The reason is that the FIFO method keeps the costs of the current period separate from the costs of prior periods. Thus, under the FIFO method, management will be able to see the effect of price increases on unit costs without any distorting influence from what has happened in the past.

   Under the weighted-average method, however, costs carried over from the prior period are averaged in with costs of the current period, which will tend to reduce somewhat the impact of increased materials prices on current period unit costs.

Group Exercise 4-32

The answer to this exercise will depend on the industry that the students select to study.

Chapter 5
Cost Behavior: Analysis and Use

Solutions to Questions

5-1

a. Variable cost: A variable cost remains constant on a per unit basis, but changes in *total* in direct relation to changes in volume.
b. Fixed cost: A fixed cost remains constant in total amount. The *average* fixed cost per unit varies inversely with changes in volume.
c. Mixed cost: A mixed cost contains both variable and fixed cost elements.

5-2

a. Unit fixed costs decrease as volume increases.
b. Unit variable costs remain constant as volume increases.
c. Total fixed costs remain constant as volume increases.
d. Total variable costs increase as volume increases.

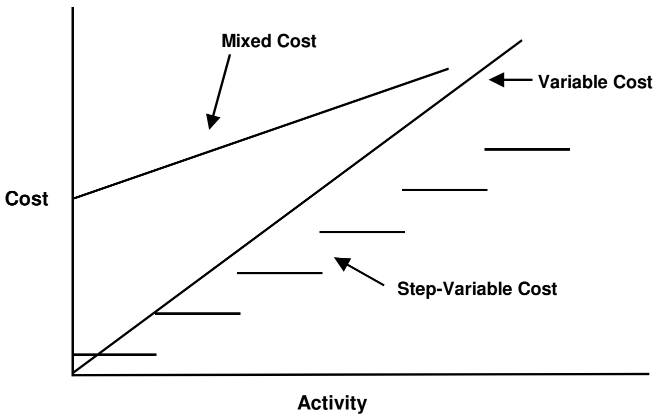
5-3

a. Cost behavior: Cost behavior refers to the way in which costs change in response to changes in a measure of activity such as sales volume, production volume, or orders processed.
b. Relevant range: The relevant range is the range of activity within which assumptions about variable and fixed cost behavior are valid.

5-4 An activity base is a measure of whatever causes the incurrence of a variable cost. Examples of activity bases include units produced, units sold, letters typed, beds in a hospital, meals served in a cafe, service calls made, etc.

5-5

a. Variable cost: A variable cost remains constant on a per unit basis, but increases or decreases *in total* in direct relation to changes in activity.
b. Mixed cost: A mixed cost is a cost that contains both variable and fixed cost elements.
c. Step-variable cost: A step-variable cost is a cost that is incurred in large chunks, and which increases or decreases only in response to fairly wide changes in activity.



5-6 The linear assumption is reasonably valid providing that the cost formula is used only within the relevant range.

5-7 A discretionary fixed cost has a fairly short planning horizon—usually a year. Such costs arise from annual decisions by management to spend on certain fixed cost items, such as advertising, research, and management development. A committed fixed cost has a long planning horizon—generally many years. Such costs relate to a company's investment in facilities, equipment, and basic organization. Once such costs have been incurred, they are "locked in" for many years.

5-8

a. Committed	d. Committed
b. Discretionary	e. Committed
c. Discretionary	f. Discretionary

5-9 Yes. As the anticipated level of activity changes, the level of fixed costs needed to support operations may also change. Most fixed costs are adjusted upward and downward in large steps, rather than being absolutely fixed at one level for all ranges of activity.

5-10 The high-low method uses only two points to determine a cost formula. These two points are likely to be less than typical since they represent extremes of activity.

5-11 The formula for a mixed cost is Y = a + bX. In cost analysis, the “a” term represents the fixed cost, and the “b” term represents the variable cost per unit of activity.

5-12 The term “least-squares regression” means that the sum of the squares of the deviations from the plotted points on a graph to the regression line is smaller than could be obtained from any other line that could be fitted to the data.

5-13 Ordinary single least-squares regression analysis is used when a variable cost is a function of only a single factor. If a cost is a function of more than one factor, multiple regression analysis should be used to analyze the behavior of the cost.

5-14 The contribution approach income statement organizes costs by behavior, first deducting variable expenses to obtain contribution margin, and then deducting fixed expenses to obtain net operating income. The traditional approach organizes costs by function, such as production, selling, and administration. Within a functional area, fixed and variable costs are intermingled.

5-15 The contribution margin is total sales revenue less total variable expenses.

Exercise 5-1 (15 minutes)

1.

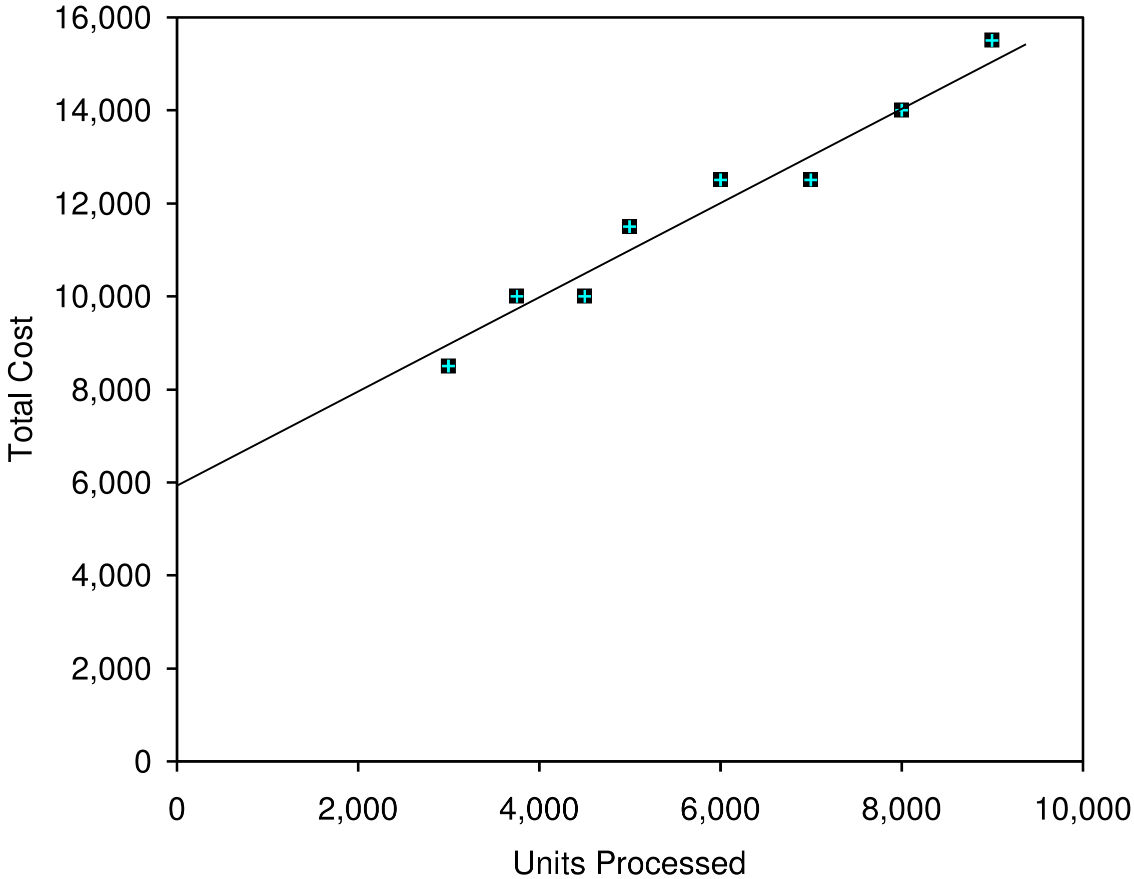
	Cups of Coffee Served in a Week		
	1,800	*1,900*	*2,000*
Fixed cost	$1,100	$1,100	$1,100
Variable cost	468	494	520
Total cost	$1,568	$1,594	$1,620
Cost per cup of coffee served *	$0.871	$0.839	$0.810

* Total cost ÷ cups of coffee served in a week

2. The average cost of a cup of coffee declines as the number of cups of coffee served increases because the fixed cost is spread over more cups of coffee.

Exercise 5-2 (30 minutes)

1. The completed scattergraph is presented below:



Exercise 5-2 (continued)

2. (Students' answers will vary considerably due to the inherent imprecision and subjectivity of the quick-and-dirty scattergraph method of estimating variable and fixed costs.)

   The approximate monthly fixed cost is $6,000—the point where the straight line intersects the cost axis.

   The variable cost per unit processed can be estimated as follows using the 8,000-unit level of activity, which falls on the straight line:

Total cost at the 8,000-unit level of activity	$14,000
Less fixed costs	6,000
Variable costs at the 8,000-unit level of activity	$ 8,000

   $8,000 ÷ 8,000 units = $1 per unit.

   Observe from the scattergraph that if the company used the high-low method to determine the slope of the line, the line would be too steep. This would result in underestimating the fixed cost and overestimating the variable cost per unit.

Exercise 5-3 (20 minutes)

1.

Month	*Occupancy-Days*	*Electrical Costs*
High activity level (August) ..	3,608	$8,111
Low activity level (October)..	186	1,712
Change..............................	3,422	$6,399

Variable cost = Change in cost ÷ Change in activity
= $6,399 ÷ 3,422 occupancy-days
= $1.87 per occupancy-day

Total cost (August)..	$8,111
Variable cost element ($1.87 per occupancy-day × 3,608 occupancy-days)	6,747
Fixed cost element	$1,364

2. Electrical costs may reflect seasonal factors other than just the variation in occupancy days. For example, common areas such as the reception area must be lighted for longer periods during the winter. This will result in seasonal effects on the fixed electrical costs.

   Additionally, fixed costs will be affected by how many days are in a month. In other words, costs like the costs of lighting common areas are variable with respect to the number of days in the month, but are fixed with respect to how many rooms are occupied during the month.

   Other, less systematic, factors may also affect electrical costs such as the frugality of individual guests. Some guests will turn off lights when they leave a room. Others will not.

Exercise 5-4 (20 minutes)

1.

The Haaki Shop, Inc.
Income Statement—Surfboard Department
For the Quarter Ended May 31

Sales		$800,000
Variable expenses:		
Cost of goods sold ($150 per surfboard × 2,000 surfboards*)	$300,000	
Selling expenses ($50 per surfboard × 2,000 surfboards)	100,000	
Administrative expenses (25% × $160,000)	40,000	440,000
Contribution margin		360,000
Fixed expenses:		
Selling expenses	150,000	
Administrative expenses	120,000	270,000
Net operating income		$ 90,000

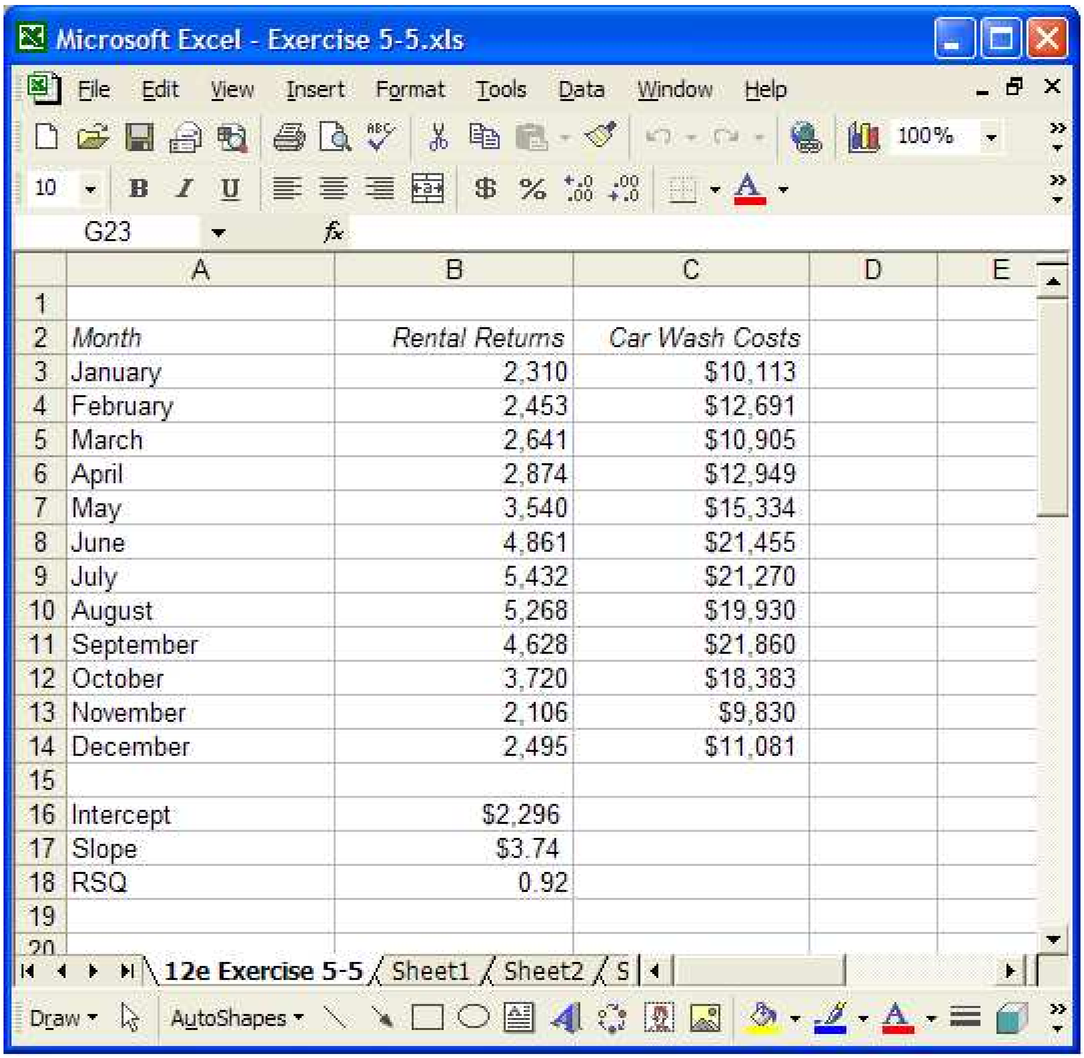
*$800,000 sales ÷ $400 per surfboard = 2,000 surfboards.

2. Since 2,000 surfboards were sold and the contribution margin totaled $360,000 for the quarter, the contribution of each surfboard toward fixed expenses and profits was $180 ($360,000 ÷ 2,000 surfboards = $180 per surfboard). Another way to compute the $180 is:

Selling price per surfboard		$400
Less variable expenses:		
Cost per surfboard	$150	
Selling expenses	50	
Administrative expenses ($40,000 ÷ 2,000 surfboards)	20	220
Contribution margin per surfboard		$180

Exercise 5-5 (20 minutes)

The least-squares regression estimates of fixed and variable costs can be computed using any of a variety of statistical and mathematical software packages or even by hand. The solution below uses Microsoft® Excel as illustrated in the text.



	A	B	C
1			
2	*Month*	*Rental Returns*	*Car Wash Costs*
3	January	2,310	$10,113
4	February	2,453	$12,691
5	March	2,641	$10,905
6	April	2,874	$12,949
7	May	3,540	$15,334
8	June	4,861	$21,455
9	July	5,432	$21,270
10	August	5,268	$19,930
11	September	4,628	$21,860
12	October	3,720	$18,383
13	November	2,106	$9,830
14	December	2,495	$11,081
15			
16	Intercept	$2,296	
17	Slope	$3.74	
18	RSQ	0.92	

The intercept provides the estimate of the fixed cost element, $2,296 per month, and the slope provides the estimate of the variable cost element, $3.74 per rental return. Expressed as an equation, the relation between car wash costs and rental returns is

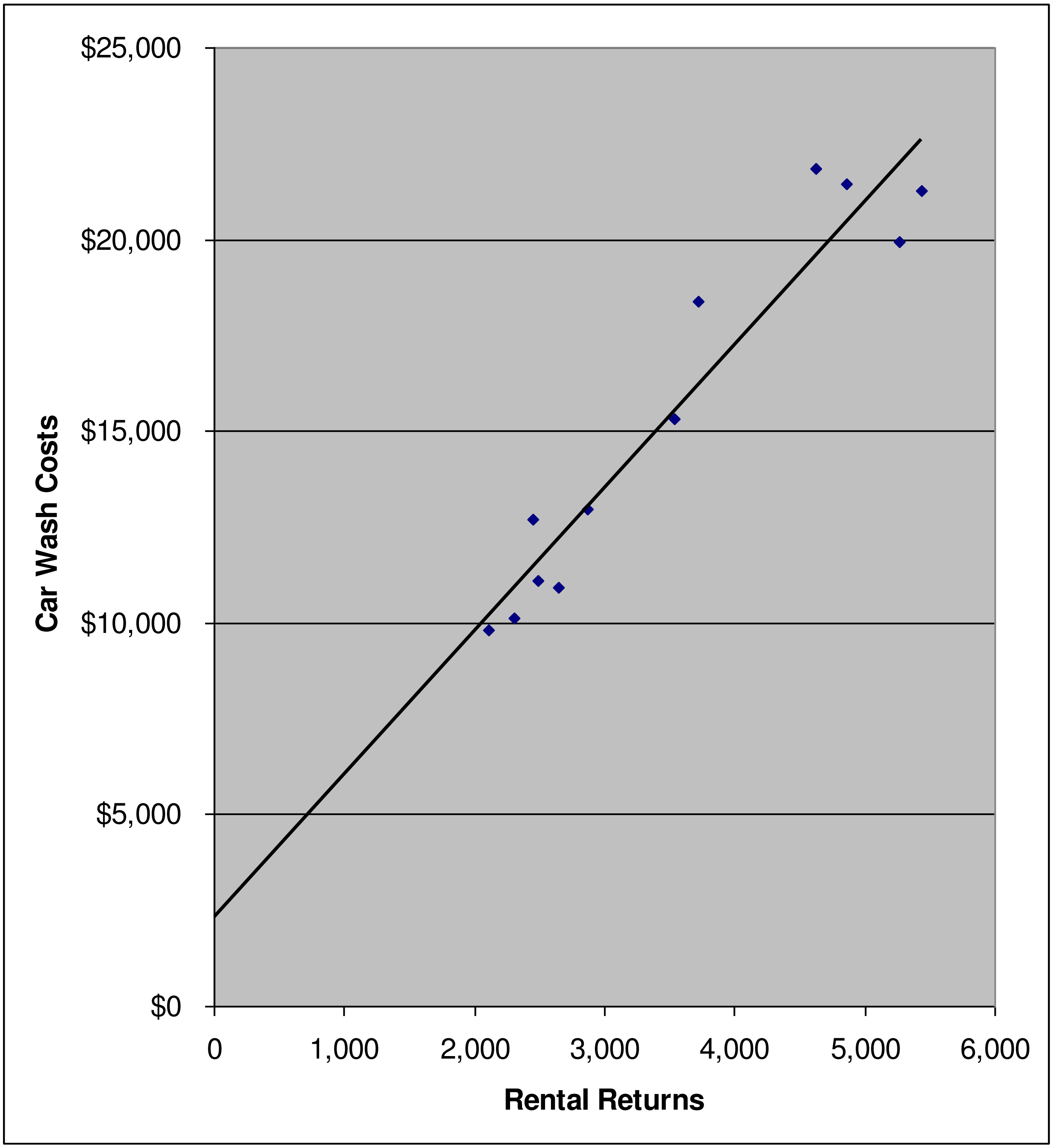
$$Y = \$2,296 + \$3.74X$$

where X is the number of rental returns.

Note that the R^2 is 0.92, which is quite high, and indicates a strong linear relationship between car wash costs and rental returns.

Exercise 5-5 (continued)

While not a requirement of the exercise, it is always a good to plot the data on a scattergraph. The scattergraph can help spot nonlinearities or other problems with the data. In this case, the regression line (shown below) is a reasonably good approximation to the relationship between car wash costs and rental returns.



Exercise 5-6 (20 minutes)

1. The company's variable cost per unit would be:

$$\frac{\$150{,}000}{60{,}000 \text{ units}} = \$2.50 \text{ per unit.}$$

Taking into account the difference in behavior between variable and fixed costs, the completed schedule would be:

	Units produced and sold		
	60,000	80,000	100,000
Total costs:			
Variable costs	$150,000 *	$200,000	$250,000
Fixed costs	360,000 *	360,000	360,000
Total costs	$510,000 *	$560,000	$610,000
Cost per unit:			
Variable cost	$2.50	$2.50	$2.50
Fixed cost	6.00	4.50	3.60
Total cost per unit	$8.50	$7.00	$6.10

*Given.

2. The company's income statement in the contribution format would be:

Sales (90,000 units × $7.50 per unit)	$675,000
Variable expenses (90,000 units × $2.50 per unit)	225,000
Contribution margin	450,000
Fixed expenses	360,000
Net operating income	$ 90,000

Exercise 5-7 (45 minutes)

1.

	Units Shipped	*Shipping Expense*
High activity level	8	$3,600
Low activity level.............	2	1,500
Change	6	$2,100

Variable cost element:

$$\frac{\text{Change in cost}}{\text{Change in activity}} = \frac{\$2,100}{6 \text{ units}} = \$350 \text{ per unit}$$

Fixed cost element:

Shipping expense at the high activity level	$3,600
Less variable cost element ($350 per unit × 8 units).....	2,800
Total fixed cost..	$ 800

The cost formula is $800 per month plus $350 per unit shipped or

Y = $800 + $350X,

where X is the number of units shipped.

2. a. See the scattergraph on the following page.

b. (Note: Students' answers will vary due to the imprecision and subjective nature of this method of estimating variable and fixed costs.)

Total cost at 5 units shipped per month [a point falling on the line in (a)].....................................	$2,600
Less fixed cost element (intersection of the Y axis)..	1,100
Variable cost element...	$1,500

$1,500 ÷ 5 units = $300 per unit.

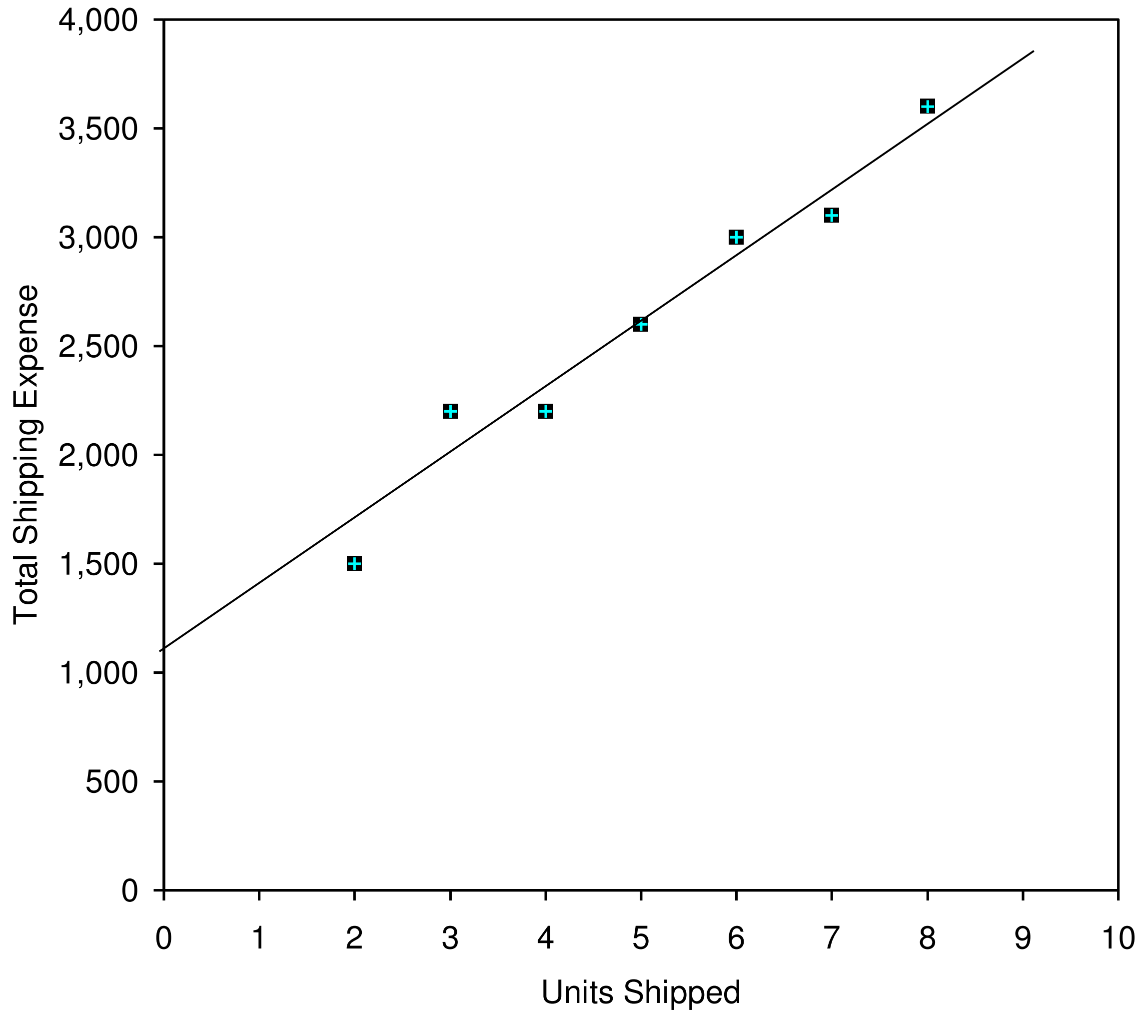
The cost formula is $1,100 per month plus $300 per unit shipped or

Y = $1,100 + 300X,

where X is the number of units shipped.

Exercise 5-7 (continued)

2. a. The scattergraph appears below:



3. The cost of shipping units is likely to depend on the weight and volume of the units shipped and the distance traveled as well as on the number of units shipped. In addition, higher cost shipping might be necessary to meet a deadline.

Exercise 5-8 (30 minutes)

1.

Month	*Units Shipped (X)*	*Shipping Expense (Y)*
January	4	$2,200
February	7	$3,100
March	5	$2,600
April	2	$1,500
May	3	$2,200
June	6	$3,000
July	8	$3,600

A spreadsheet application such as Excel or a statistical software package can be used to compute the slope and intercept of the least-squares regression line for the above data. The results are:

Intercept (fixed cost)	$1,011
Slope (variable cost per unit)	$318
R^2	0.96

Therefore, the cost formula is $1,011 per month plus $318 per unit shipped or

Y = $1,011 + $318X.

Note that the R^2 is 0.96, which means that 96% of the variation in shipping costs is explained by the number of units shipped. This is a very high R^2 and indicates a very good fit.

2.

	Variable Cost per Unit	*Fixed Cost per Month*
Quick-and-dirty scattergraph method...	$300	$1,100
High-low method................................	$350	$800
Least-squares regression method	$318	$1,011

Note that the high-low method gives estimates that are quite different from the estimates provided by least-squares regression.

Exercise 5-9 (20 minutes)

1.

	Miles Driven	*Total Annual Cost**
High level of activity	120,000	$13,920
Low level of activity	80,000	10,880
Change	40,000	$ 3,040

* 120,000 miles × $0.116 per mile = $13,920
80,000 miles × $0.136 per mile = $10,880

Variable cost per mile:

$$\frac{\text{Change in cost}}{\text{Change in activity}} = \frac{\$3,040}{40,000 \text{ miles}} = \$0.076 \text{ per mile}$$

Fixed cost per year:

Total cost at 120,000 miles	$13,920
Less variable cost element:	
120,000 miles × $0.076 per mile	9,120
Fixed cost per year	$ 4,800

2. Y = $4,800 + $0.076X

3.

Fixed cost	$ 4,800
Variable cost: 100,000 miles × $0.076 per mile	7,600
Total annual cost	$12,400

Exercise 5-10 (20 minutes)

1.

	X-rays Taken	*X-ray Costs*
High activity level (February)........	7,000	$29,000
Low activity level (June)	3,000	17,000
Change......................................	4,000	$12,000

Variable cost per X-ray:

$$\frac{\text{Change in cost}}{\text{Change in activity}} = \frac{\$12,000}{4,000 \text{ X-rays}} = \$3.00 \text{ per X-ray}$$

Fixed cost per month:

X-ray cost at the high activity level	$29,000
Less variable cost element:	
7,000 X-rays × $3.00 per X-ray	21,000
Total fixed cost..	$ 8,000

The cost formula is $8,000 per month plus $3.00 per X-ray taken or, in terms of the equation for a straight line:

Y = $8,000 + $3.00X

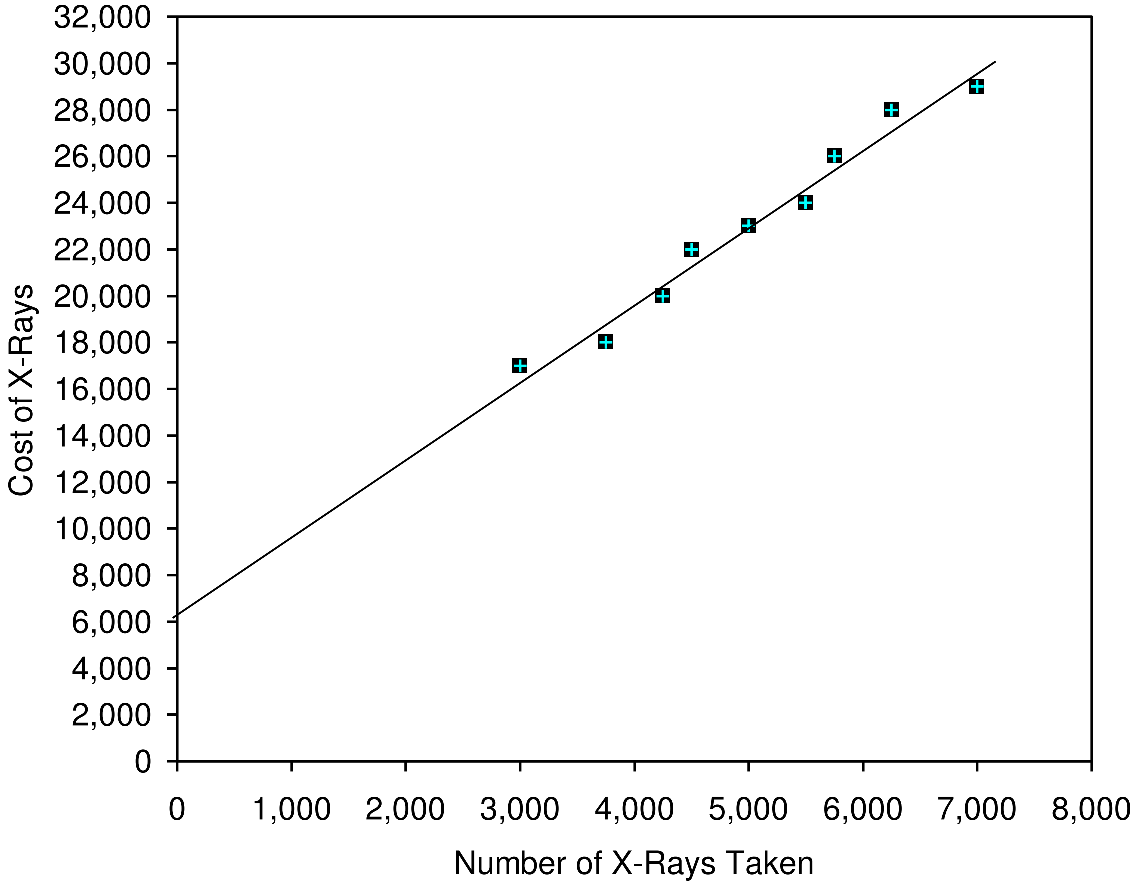
where X is the number of X-rays taken.

2. Expected X-ray costs when 4,600 X-rays are taken:

Variable cost: 4,600 X-rays × $3.00 per X-ray............	$13,800
Fixed cost	8,000
Total cost	$21,800

Exercise 5-11 (30 minutes)

1. The scattergraph appears below.



Exercise 5-11 (continued)

2. (Note: Students' answers will vary considerably due to the inherent lack of precision and subjectivity of the quick-and-dirty method.)

Total costs at 5,000 X-rays per month [a point falling on the line in (1)]	$23,000
Less fixed cost element (intersection of the Y axis)	6,500
Variable cost element	$16,500

$$\$16,500 \div 5,000 \text{ X-rays} = \$3.30 \text{ per X-ray.}$$

The cost formula is therefore $6,500 per month plus $3.30 per X-ray taken. Written in equation form, the cost formula is:

$$Y = \$6,500 + \$3.30X,$$

where X is the number of X-rays taken.

3. The high-low method would not provide an accurate cost formula in this situation, since a line drawn through the high and low points would have a slope that is too flat. Consequently, the high-low method would overestimate the fixed cost and underestimate the variable cost per unit.

Exercise 5-12 (30 minutes)

1. Monthly operating costs at 70% occupancy:

2,000 rooms × 70% = 1,400 rooms;	
1,400 rooms × $21 per room per day × 30 days ..	$882,000
Monthly operating costs at 45% occupancy (given) .	792,000
Change in cost	$ 90,000

Difference in rooms occupied:	
70% occupancy (2,000 rooms × 70%)................	1,400
45% occupancy (2,000 rooms × 45%)................	900
Difference in rooms (change in activity).................	500

$$\text{Variable cost}=\frac{\text{Change in cost}}{\text{Change in activity}}=\frac{\$90{,}000}{500\text{ rooms}}=\$180\text{ per room.}$$

$180 per room ÷ 30 days = $6 per room per day.

2.

Monthly operating costs at 70% occupancy (above) ..	$882,000
Less variable costs:	
1,400 rooms × $6 per room per day × 30 days	252,000
Fixed operating costs per month	$630,000

3. 2,000 rooms × 60% = 1,200 rooms occupied.

Fixed costs	$630,000
Variable costs:	
1,200 rooms × $6 per room per day × 30 days	216,000
Total expected costs	$846,000

Exercise 5-13 (30 minutes)

1.

Units (X)	*Total Glazing Cost (Y)*
8	$270
5	$200
10	$310
4	$190
6	$240
9	$290

A spreadsheet application such as Excel or a statistical software package can be used to compute the slope and intercept of the least-squares regression line for the above data. The results are:

Intercept (fixed cost)	$107.50
Slope (variable cost per unit)	$20.36
R^2	0.98

Therefore, the cost formula is $107.50 per week plus $20.36 per unit.

Note that the R^2 is 0.98, which means that 98% of the variation in glazing costs is explained by the number of units glazed. This is a very high R^2 and indicates a very good fit.

2. Y = $107.50 + $20.36X, where X is the number of units glazed.

3. Total expected glazing cost if 7 units are processed:

Variable cost: 7 units × $20.36 per unit	$142.52
Fixed cost	107.50
Total expected cost...	$250.02

Problem 5-14 (45 minutes)

1.

Number of Leagues (X)	*Total Cost (Y)*
5	$13,000
2	$7,000
4	$10,500
6	$14,000
3	$10,000

A spreadsheet application such as Excel or a statistical software package can be used to compute the slope and intercept of the least-squares regression line for the above data. The results are:

Intercept (fixed cost)	$4,100
Slope (variable cost per unit)	$1,700
R^2	0.96

Therefore, the variable cost per league is $1,700 and the fixed cost is $4,100 per year.

Note that the R^2 is 0.96, which means that 96% of the variation in cost is explained by the number of leagues. This is a very high R^2 and indicates a very good fit.

2. Y = $4,100 + $1,700X

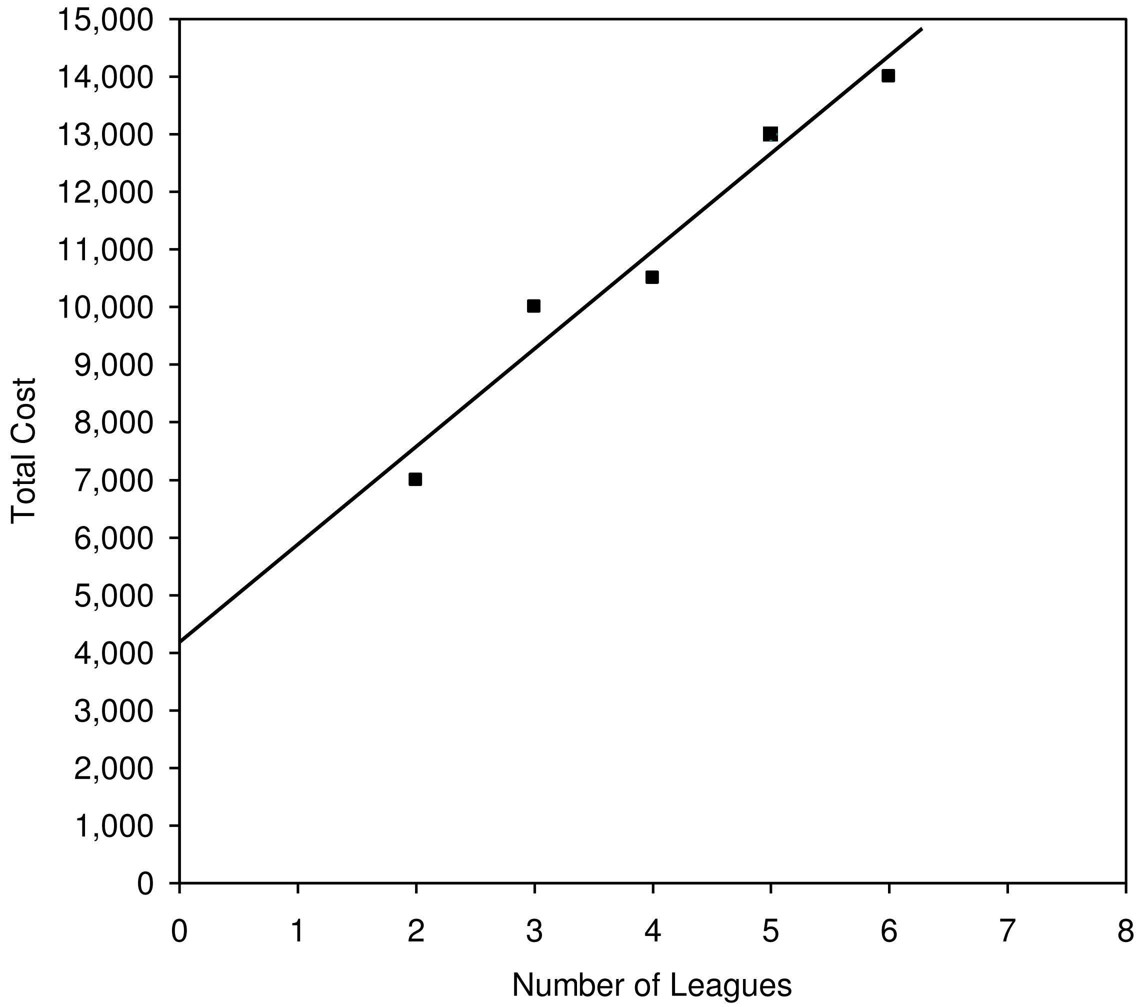
3. The expected total cost for 7 leagues would be:

Fixed cost	$ 4,100
Variable cost (7 leagues × $1,700 per league).....	11,900
Total cost	$16,000

The problem with using the cost formula from (2) to estimate total cost in this particular case is that an activity level of 7 leagues may be outside the relevant range—the range of activity within which the fixed cost is approximately $4,100 per year and the variable cost is approximately $1,700 per league. These approximations appear to be reasonably accurate within the range of 2 to 6 leagues, but they may be invalid outside this range.

Problem 5-14 (continued)

4.



Problem 5-15 (45 minutes)

1.

House Of Organs, Inc.
Income Statement
For the Month Ended November 30

Sales (60 organs × $2,500 per organ)		$150,000
Cost of goods sold		
(60 organs × $1,500 per organ)		90,000
Gross margin		60,000
Selling and administrative expenses:		
Selling expenses:		
Advertising	$ 950	
Delivery of organs		
(60 organs × $60 per organ)	3,600	
Sales salaries and commissions		
[$4,800 + (4% × $150,000)]	10,800	
Utilities	650	
Depreciation of sales facilities	5,000	
Total selling expenses	21,000	
Administrative expenses:		
Executive salaries	13,500	
Depreciation of office equipment	900	
Clerical		
[$2,500 + (60 organs × $40 per organ)]	4,900	
Insurance	700	
Total administrative expenses	20,000	
Total selling and administrative expenses		41,000
Net operating income		$ 19,000

Problem 5-15 (continued)

2. House Of Organs, Inc.
Income Statement
For the Month Ended November 30

	Total	Per Unit
Sales (60 organs × $2,500 per organ)	$150,000	$2,500
Variable expenses:		
Cost of goods sold		
(60 organs × $1,500 per organ)	90,000	1,500
Delivery of organs		
(60 organs × $60 per organ)	3,600	60
Sales commissions (4% × $150,000)	6,000	100
Clerical (60 organs × $40 per organ)	2,400	40
Total variable expenses	102,000	1,700
Contribution margin	48,000	$ 800
Fixed expenses:		
Advertising	950	
Sales salaries	4,800	
Utilities	650	
Depreciation of sales facilities	5,000	
Executive salaries	13,500	
Depreciation of office equipment	900	
Clerical	2,500	
Insurance	700	
Total fixed expenses	29,000	
Net operating income	$ 19,000	

3. Fixed costs remain constant in total but vary on a per unit basis with changes in the activity level. For example, as the activity level increases, fixed costs decrease on a per unit basis. Showing fixed costs on a per unit basis on the income statement make them appear to be variable costs. That is, management might be misled into thinking that the per unit fixed costs would be the same regardless of how many organs were sold during the month. For this reason, fixed costs should be shown only in totals on a contribution-type income statement.

Problem 5-16 (45 minutes)

1.

Cost of goods sold	Variable
Shipping expense	Mixed
Advertising expense	Fixed
Salaries and commissions	Mixed
Insurance expense	Fixed
Depreciation expense	Fixed

2. Analysis of the mixed expenses:

	Units	*Shipping Expense*	*Salaries and Comm. Expense*
High level of activity	4,500	£56,000	£143,000
Low level of activity	3,000	44,000	107,000
Change	1,500	£12,000	£ 36,000

Variable cost element:

$$\text{Variable cost per unit} = \frac{\text{Change in cost}}{\text{Change in activity}}$$

$$\text{Shipping expense: } \frac{£12{,}000}{1{,}500 \text{ units}} = £8 \text{ per unit}$$

$$\text{Salaries and comm. expense: } \frac{£36{,}000}{1{,}500 \text{ units}} = £24 \text{ per unit}$$

Fixed cost element:

	Shipping Expense	*Salaries and Comm. Expense*
Cost at high level of activity ...	£56,000	£143,000
Less variable cost element:		
4,500 units × £8 per unit	36,000	
4,500 units × £24 per unit...		108,000
Fixed cost element	£20,000	£ 35,000

Problem 5-16 (continued)

The cost formulas are:

Shipping expense: £20,000 per month plus £8 per unit or
$$Y = £20,000 + £8X.$$

Salaries and Comm. expense: £35,000 per month plus £24 per unit or
$$Y = £35,000 + £24X.$$

3.

Frankel Ltd.
Income Statement
For the Month Ended June 30

Sales revenue		£630,000
Variable expenses:		
Cost of goods sold (4,500 units × £56 per unit)	£252,000	
Shipping expense (4,500 units × £8 per unit)	36,000	
Salaries and commissions expense (4,500 units × £24 per unit)	108,000	396,000
Contribution margin		234,000
Fixed expenses:		
Shipping expense	20,000	
Advertising	70,000	
Salaries and commissions	35,000	
Insurance	9,000	
Depreciation	42,000	176,000
Net operating income		£ 58,000

Problem 5-17 (30 minutes)

1. a. 6
   b. 11
   c. 1
   d. 4
   e. 2
   f. 10
   g. 3
   h. 7
   i. 9

2. Without a knowledge of underlying cost behavior patterns, it would be difficult if not impossible for a manager to properly analyze the firm's cost structure. The reason is that all costs don't behave in the same way. One cost might move in one direction as a result of a particular action, and another cost might move in an opposite direction. Unless the behavior pattern of each cost is clearly understood, the impact of a firm's activities on its costs will not be known until *after* the activity has occurred.

Problem 5-18 (45 minutes)

1. High-low method:

	Number of Ingots	*Power Cost*
High activity level	130	$6,000
Low activity level	40	2,400
Change	90	$3,600

$$\text{Variable cost per unit} = \frac{\text{Change in cost}}{\text{Change in activity}}$$

$$= \frac{\$3{,}600}{90 \text{ ingots}} = \$40 \text{ per ingot}$$

Fixed cost:	Total power cost at high activity level	$6,000
	Less variable element:	
	130 ingots × $40 per ingot	5,200
	Fixed cost element	$ 800

Therefore, the cost formula is: Y = $800 + $40X.

2. Scattergraph method (see the scattergraph on the following page):

(Note: Students' answers will vary due to the inherent imprecision and subjectivity of the quick-and-dirty scattergraph method of estimating fixed and variable costs.)

The line intersects the cost axis at about $1,200. The variable cost can be estimated as follows:

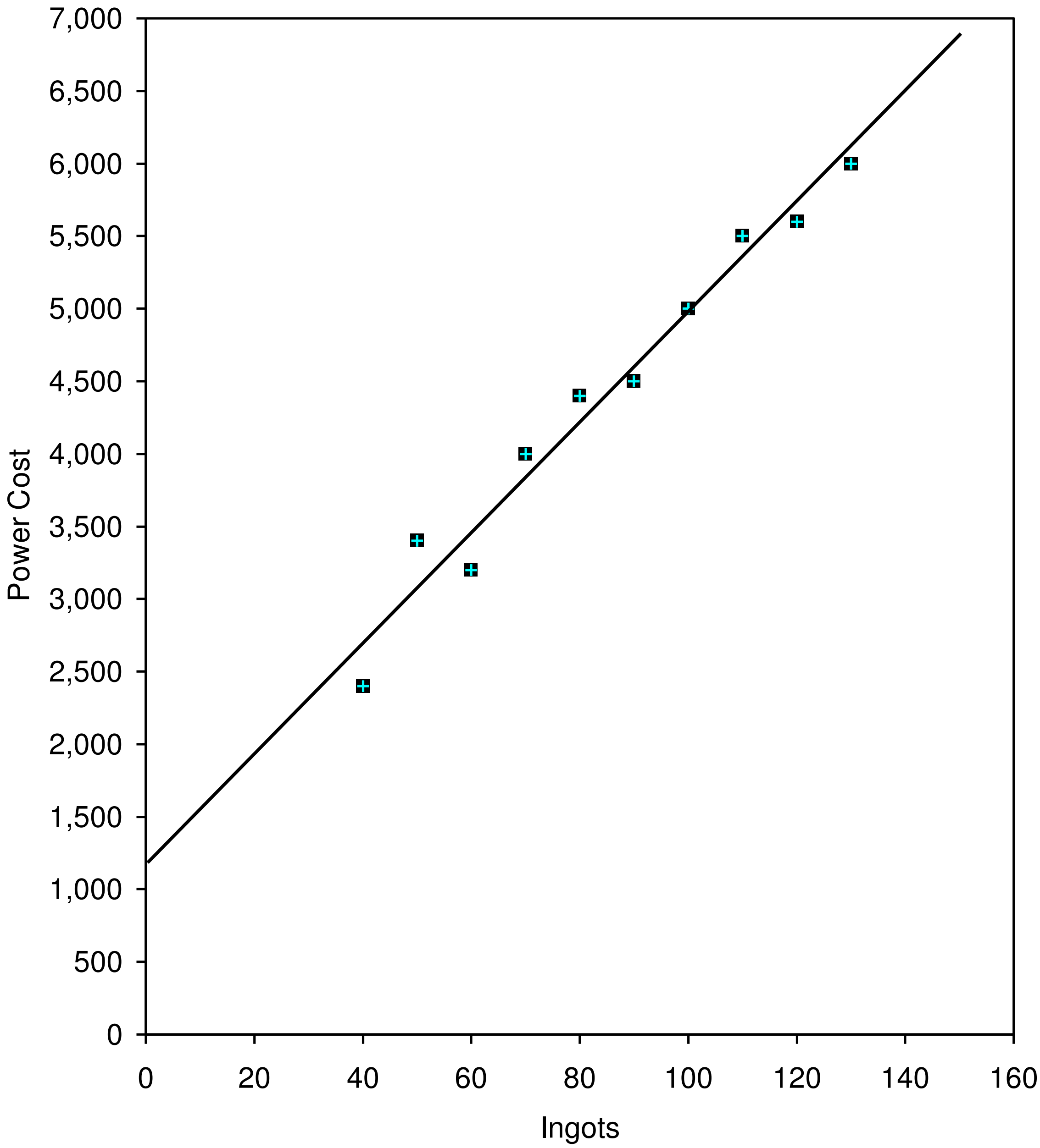
Total cost at 100 ingots (a point that falls on the line)	$5,000
Less the fixed cost element (intersection of the Y axis on the graph)	1,200
Variable cost element at 100 ingots (total)	$3,800

$3,800 ÷ 100 ingots = $38 per ingot.

Therefore, the cost formula is: Y = $1,200 + $38X.

Problem 5-18 (continued)

The completed scattergraph follows:



Problem 5-19 (30 minutes)

1. The least squares regression method:

Number of Ingots (X)	*Power Cost (Y)*
110	\$5,500
90	\$4,500
80	\$4,400
100	\$5,000
130	\$6,000
120	\$5,600
70	\$4,000
60	\$3,200
50	\$3,400
40	\$2,400

A spreadsheet application such as Excel or a statistical software package can be used to compute the slope and intercept of the least-squares regression line for the above data. The results are:

Intercept (fixed cost)	\$1,185
Slope (variable cost per unit)	\$37.82
R^2	0.97

Therefore, the variable cost of power per ingot is \$37.82 and the fixed cost of power is \$1,185 per month and the cost formula is:

$$Y = \$1,185 + \$37.82X.$$

Note that the R^2 is 0.97, which means that 97% of the variation in power cost is explained by the number of ingots. This is a very high R^2 and indicates a very good fit.

Problem 5-19 (continued)

2.

Method	*Total Fixed Cost*	*Variable Cost per Ingot*
High-low	$800	$40.00
Quick-and-dirty scattergraph	$1,200	$38.00
Least squares	$1,185	$37.82

The high-low method is accurate only in those situations where the variable cost is truly constant, or where the high and the low points *happen* to fall on the correct regression line. Due to the high degree of potential inaccuracy, this method is less useful than the least-squares regression method.

The quick-and-dirty scattergraph method is imprecise and the results will depend on where the analyst chooses to place the line. However, the scattergraph plot can provide invaluable clues about nonlinearities and other problems with the data.

The least squares regression method is generally considered to be the most accurate method of cost analysis. However, it should always be used in conjunction with a scattergraph plot to ensure that the underlying relation really is linear.

Problem 5-20 (45 minutes)

1.

Units Sold (000s) (X)	*Shipping Expense (Y)*
16	$160,000
18	$175,000
23	$210,000
19	$180,000
17	$170,000
20	$190,000
25	$230,000
22	$205,000

A spreadsheet application such as Excel or a statistical software package can be used to compute the slope and intercept of the least-squares regression line for the above data. The results are:

Intercept (fixed cost)	$40,000
Slope (variable cost per unit)	$7,500
R^2	0.99

Therefore the cost formula for shipping expense is $40,000 per quarter plus $7,500 per thousand units sold ($7.50 per unit), or

Y = $40,000 + $7.50X,

where X is the number of units sold.

Note that the R^2 is 0.99, which means that 99% of the variation in shipping cost is explained by the number of meals served. This is a very high R^2 and indicates a very good fit.

Problem 5-20 (continued)

2.

Alden Company
Budgeted Income Statement
For the First Quarter of Year 3

Sales (21,000 units × $50 per unit)		$1,050,000
Variable expenses:		
Cost of goods sold (21,000 units × $20 per unit)	$420,000	
Shipping expense (21,000 units × $7.50 per unit)	157,500	
Sales commission ($1,050,000 × 0.05)	52,500	
Total variable expenses		630,000
Contribution margin		420,000
Fixed expenses:		
Shipping expenses	40,000	
Advertising expense	170,000	
Administrative salaries	80,000	
Depreciation expense	50,000	
Total fixed expenses		340,000
Net operating income		$ 80,000

Problem 5-21 (45 minutes)

1. Maintenance cost at the 70,000 machine-hour level of activity can be isolated as follows:

	Level of Activity	
	40,000 MH	*70,000 MH*
Total factory overhead cost	$170,200	$241,600
Deduct:		
Utilities cost @ $1.30 per MH*	52,000	91,000
Supervisory salaries	60,000	60,000
Maintenance cost	$ 58,200	$ 90,600

*$52,000 ÷ 40,000 MHs = $1.30 per MH

2. High-low analysis of maintenance cost:

	Maintenance Cost	*Machine-Hours*
High activity level	$90,600	70,000
Low activity level	58,200	40,000
Change	$32,400	30,000

Variable cost per unit of activity:

$$\frac{\text{Change in cost}}{\text{Change in activity}} = \frac{\$32{,}400}{30{,}000\text{ MHs}} = \$1.08\text{ per MH}$$

Total fixed cost:

Total maintenance cost at the low activity level	$58,200
Less the variable cost element	
(40,000 MHs × $1.08 per MH)	43,200
Fixed cost element	$15,000

Therefore, the cost formula is $15,000 per month plus $1.08 per machine-hour or Y = $15,000 + $1.08X, where X represents machine-hours.

Problem 5-21 (continued)

3.

	Variable Rate per Machine-Hour	*Fixed Cost*
Maintenance cost	$1.08	$15,000
Utilities cost	1.30	
Supervisory salaries cost		60,000
Totals	$2.38	$75,000

Therefore, the cost formula would be $75,000 plus $2.38 per machine-hour, or Y = $75,000 + $2.38X.

4.

Fixed costs	$ 75,000
Variable costs: $2.38 per MH × 45,000 MHs	107,100
Total overhead costs	$182,100

Problem 5-22 (45 minutes)

1.

	July—Low 9,000 Units	*October—High 12,000 Units*
Direct materials cost @ $15 per unit	$135,000	$180,000
Direct labor cost @ $6 per unit........	54,000	72,000
Manufacturing overhead cost	107,000 *	131,000 *
Total manufacturing costs	296,000	383,000
Add: Work in process, beginning	14,000	22,000
	310,000	405,000
Deduct: Work in process, ending.....	25,000	15,000
Cost of goods manufactured	$285,000	$390,000

*Computed by working upwards through the statements.

2.

	Units Produced	*Cost Observed*
October—High level of activity	12,000	$131,000
July—Low level of activity	9,000	107,000
Change..	3,000	$ 24,000

$$\text{Variable cost} = \frac{\text{Change in cost}}{\text{Change in activity}}$$

$$= \frac{\$24{,}000}{3{,}000\text{ units}} = \$8\text{ per unit}$$

Total cost at the high level of activity	$131,000
Less variable cost element ($8 per unit × 12,000 units)	96,000
Fixed cost element..	$ 35,000

Therefore, the cost formula is: $35,000 per month plus $8 per unit produced, or Y = $35,000 + $8X, where X represents the number of units produced.

Problem 5-22 (continued)

3. The cost of goods manufactured if 9,500 units are produced:

Direct materials cost (9,500 units × $15 per unit)..		$142,500
Direct labor cost (9,500 units × $6 per unit)		57,000
Manufacturing overhead cost:		
Fixed portion	$35,000	
Variable portion (9,500 units × $8 per unit)........	76,000	111,000
Total manufacturing costs		310,500
Add: Work in process, beginning		16,000
		326,500
Deduct: Work in process, ending		19,000
Cost of goods manufactured		$307,500

Problem 5-23 (30 minutes)

1. Maintenance cost at the 80,000 machine-hour level of activity can be isolated as follows:

	Level of Activity	
	60,000 MH	*80,000 MH*
Total factory overhead cost ..	274,000 pesos	312,000 pesos
Deduct:		
Indirect materials @ 1.50 pesos per MH*	90,000	120,000
Rent................................	130,000	130,000
Maintenance cost	54,000 pesos	62,000 pesos

* 90,000 pesos ÷ 60,000 MHs = 1.50 pesos per MH

2. High-low analysis of maintenance cost:

	Maintenance Cost	*Machine-Hours*
High activity level	62,000 pesos	80,000
Low activity level	54,000	60,000
Change observed...............	8,000 pesos	20,000

$$\text{Variable cost} = \frac{\text{Change in cost}}{\text{Change in activity}}$$

$$= \frac{8{,}000 \text{ pesos}}{20{,}000 \text{ MHs}} = 0.40 \text{ peso per MH}$$

Fixed cost element = Total cost - Variable cost element

= 54,000 pesos - (60,000 MHs × 0.40 pesos)

= 30,000 pesos

Therefore, the cost formula is 30,000 pesos per year, plus 0.40 peso per machine-hour or

Y = 30,000 pesos + 0.40 peso X.

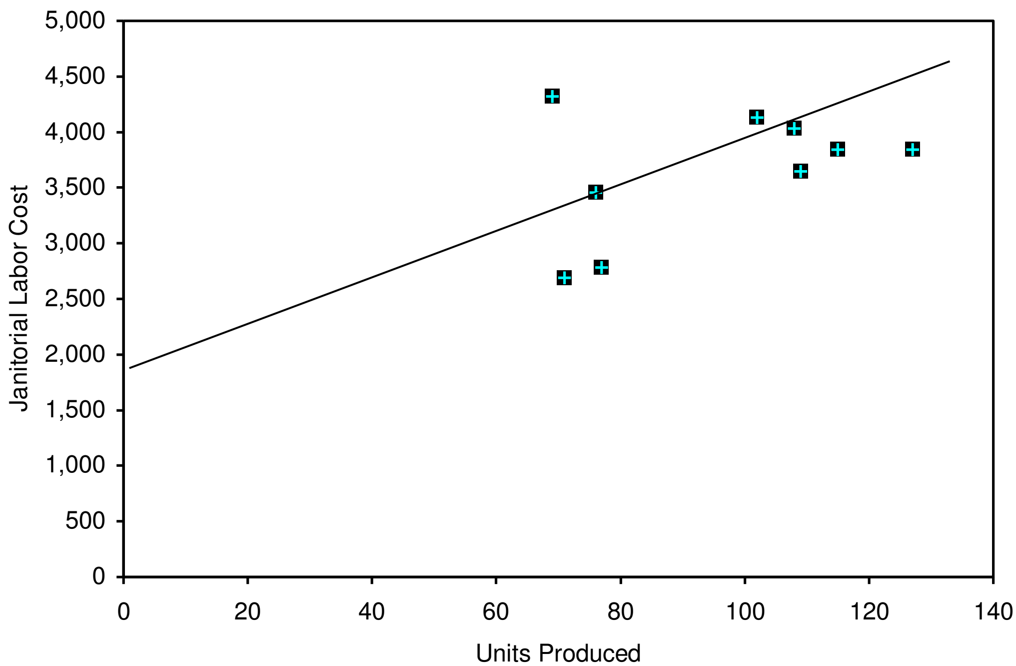
Problem 5-23 (continued)

3.

Indirect materials (65,000 MHs × 1.50 pesos per MH)		97,500 pesos
Rent		130,000
Maintenance:		
Variable cost element (65,000 MHs × 0.40 peso per MH)	26,000 pesos	
Fixed cost element	30,000	56,000
Total factory overhead cost		283,500 pesos

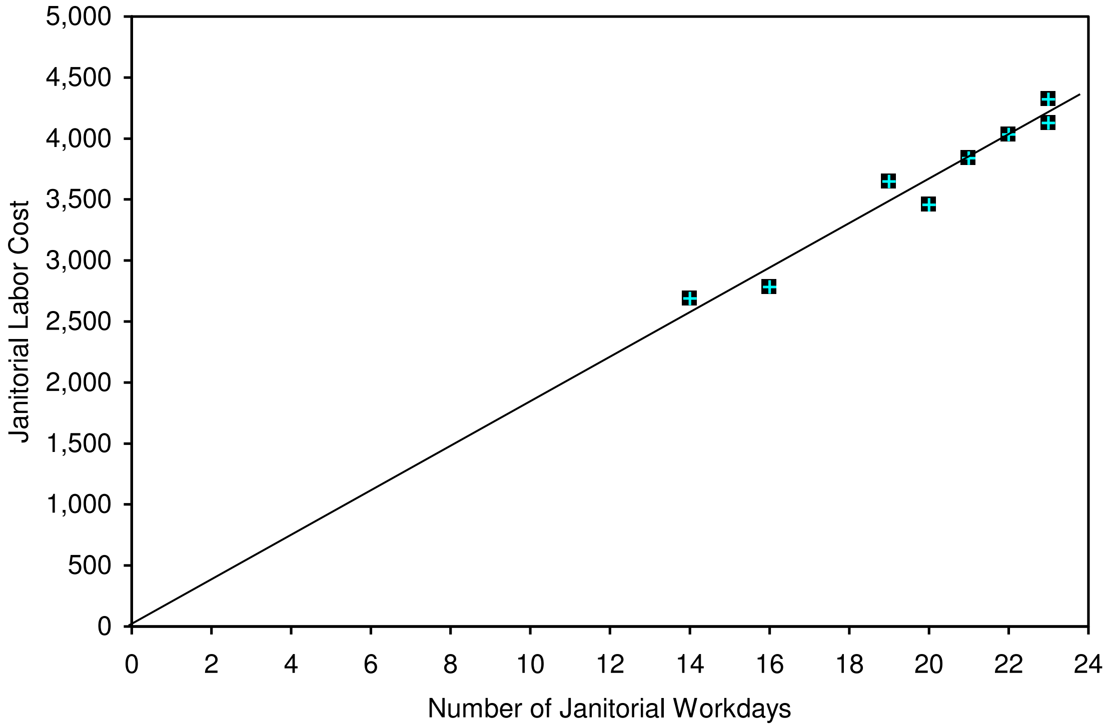
Case 5-24 (30 minutes)

1. The completed scattergraph for the number of units produced as the activity base is presented below:



Case 5-24 (continued)

2. The completed scattergraph for the number of workdays as the activity base is presented below:



Case 5-24 (continued)

3. The number of workdays should be used as the activity base rather than the number of units produced. There are several reasons for this. First, the scattergraphs reveal that there is a much stronger relationship (i.e., higher correlation) between janitorial costs and number of workdays than between janitorial costs and number of units produced. Second, from the description of the janitorial costs, one would expect that variations in those costs have little to do with the number of units produced. Two janitors each work an eight-hour shift—apparently irrespective of the number of units produced or how busy the company is. Variations in the janitorial labor costs apparently occur because of the number of workdays in the month and the number of days the janitors call in sick. Third, for planning purposes, the company is likely to be able to predict the number of working days in the month with much greater accuracy than the number of units that will be produced.

   Note that the scattergraph in part (1) seems to suggest that the janitorial labor costs are variable with respect to the number of units produced. This is false. Janitorial labor costs do vary, but the number of units produced isn't the cause of the variation. However, since the number of units produced tends to go up and down with the number of workdays and since the janitorial labor costs are driven by the number of workdays, it *appears* on the scattergraph that the number of units drives the janitorial labor costs to some extent. Analysts must be careful not to fall into this trap of using the wrong measure of activity as the activity base just because it appears there is some relationship between cost and the measure of activity. Careful thought and analysis should go into the selection of the activity base.

Case 5-25 (90 minutes)

1. a.

Tons Mined (000s) (X)	*Utilities Cost (Y)*
15	$50,000
11	$45,000
21	$60,000
12	$75,000
18	$100,000
25	$105,000
30	$85,000
28	$120,000

A spreadsheet application such as Excel or a statistical software package can be used to compute the slope and intercept of the least-squares regression line for the above data. The results are:

Intercept (fixed cost)	$28,352
Slope (variable cost per unit)	$2,582
R^2	0.47

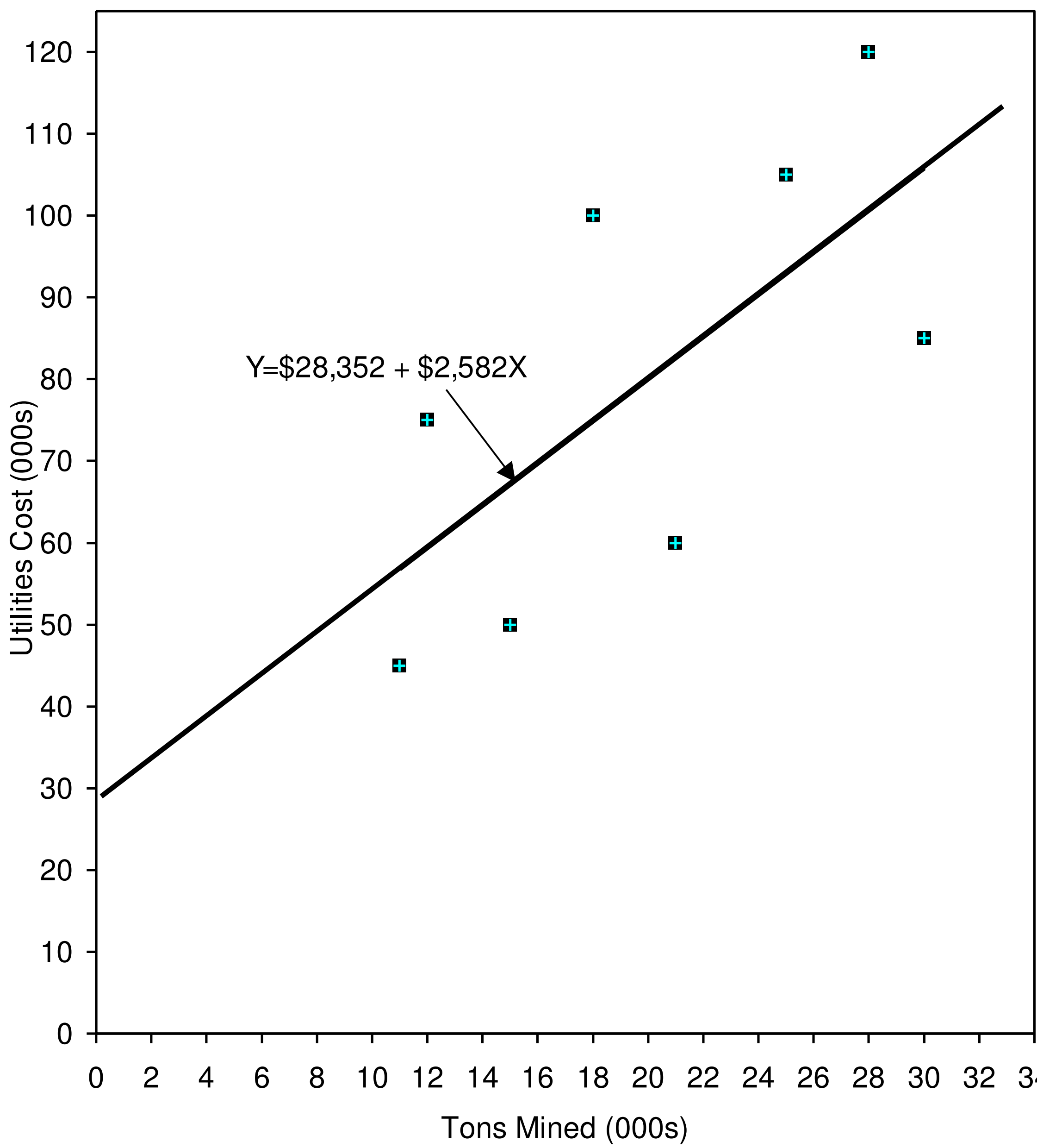
Therefore, the cost formula using tons mined as the activity base is $28,352 per quarter plus $2,582 per thousand tons mined, or

Y = $28,352 + $2,582X.

Note that the R^2 is 0.47, which means that only 47% of the variation in utility costs is explained by the number of tons mined.

Case 5-25 (continued)

b. The scattergraph plot of utility costs versus tons mined appears below:



Case 5-25 (continued)

2. a.

DLHs (000) (X)	*Utilities Cost (Y)*
5	$50,000
3	$45,000
4	$60,000
6	$75,000
10	$100,000
9	$105,000
8	$85,000
11	$120,000

A spreadsheet application such as Excel or a statistical software package can be used to compute the slope and intercept of the least-squares regression line for the above data. The results are:

Intercept (fixed cost)	$17,000
Slope (variable cost per unit)	$9,000
R^2	0.93

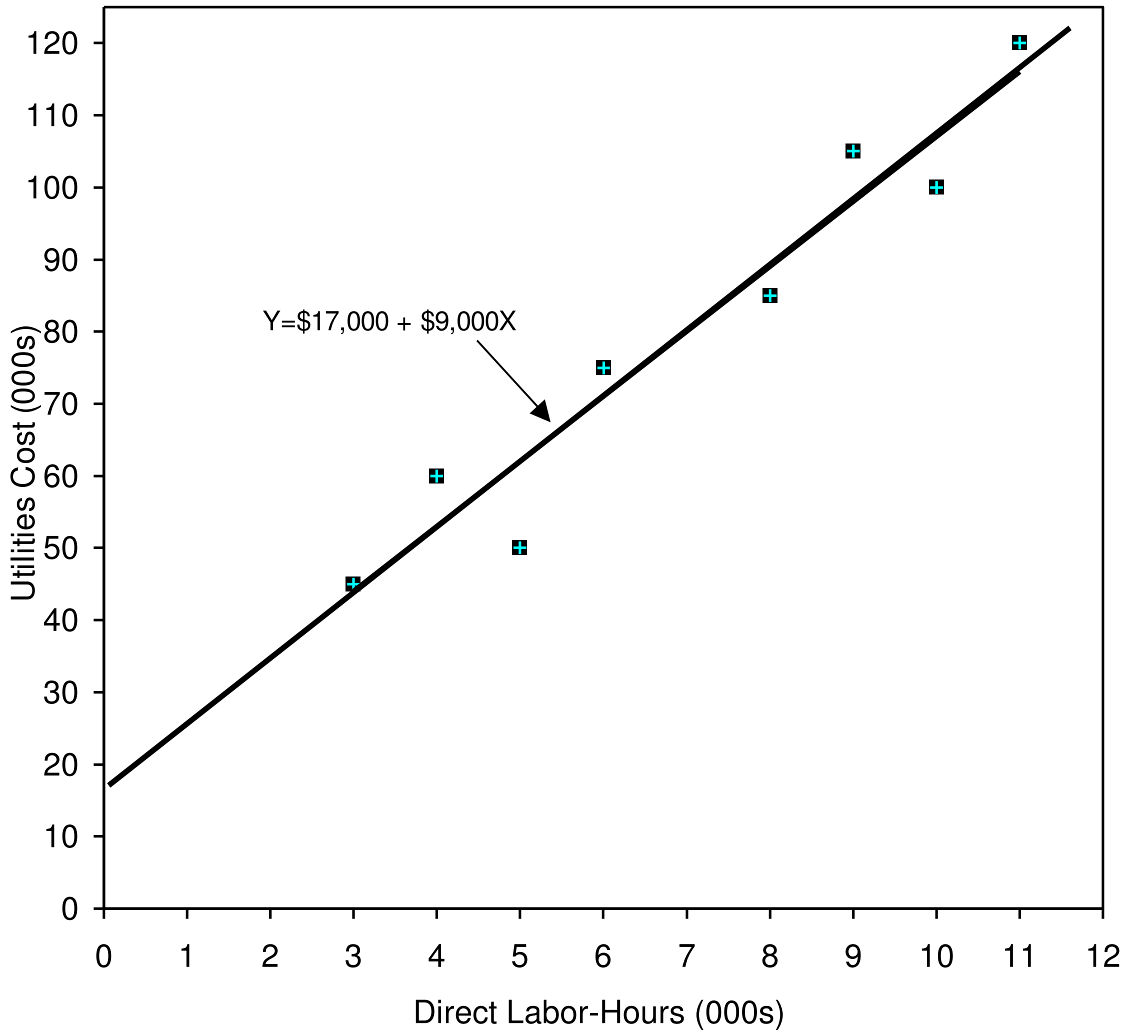
Therefore, the cost formula using direct labor-hours as the activity base is $17,000 per quarter plus $9,000 per thousand direct labor-hours, or

Y = $17,000 + $9,000X.

Note that the R^2 is 0.93, which means that 93% of the variation in utility costs is explained by the number of direct labor-hours. This is a very high R^2 and is an indication of a good fit.

Case 5-25 (continued)

b. The scattergraph plot of utility costs versus direct labor-hours appears below:



3. The company should probably use direct labor-hours as the activity base, since the fit of the regression line to the data is much tighter than it is with tons mined. The R^2 for the regression using direct labor-hours as the activity base is twice as large as for the regression using tons mined as the activity base. However, managers should look more closely at the costs and try to determine why utilities costs are more closely tied to direct labor-hours than to the number of tons mined.

CASE 5-26 (90 minutes)

1. Direct labor-hour allocation base:

Electrical costs (a)	SFr 3,865,800	
Direct labor-hours (b)	427,500	DLHs
Predetermined overhead rate (a) ÷ (b)	SFr 9.04	per DLH

Machine-hour allocation base:

Electrical costs (a)	SFr 3,865,800	
Machine-hours (b)	365,400	MHs
Predetermined overhead rate (a) ÷ (b)	SFr 10.58	per MH

2. Electrical cost for the custom tool job using direct labor-hours:

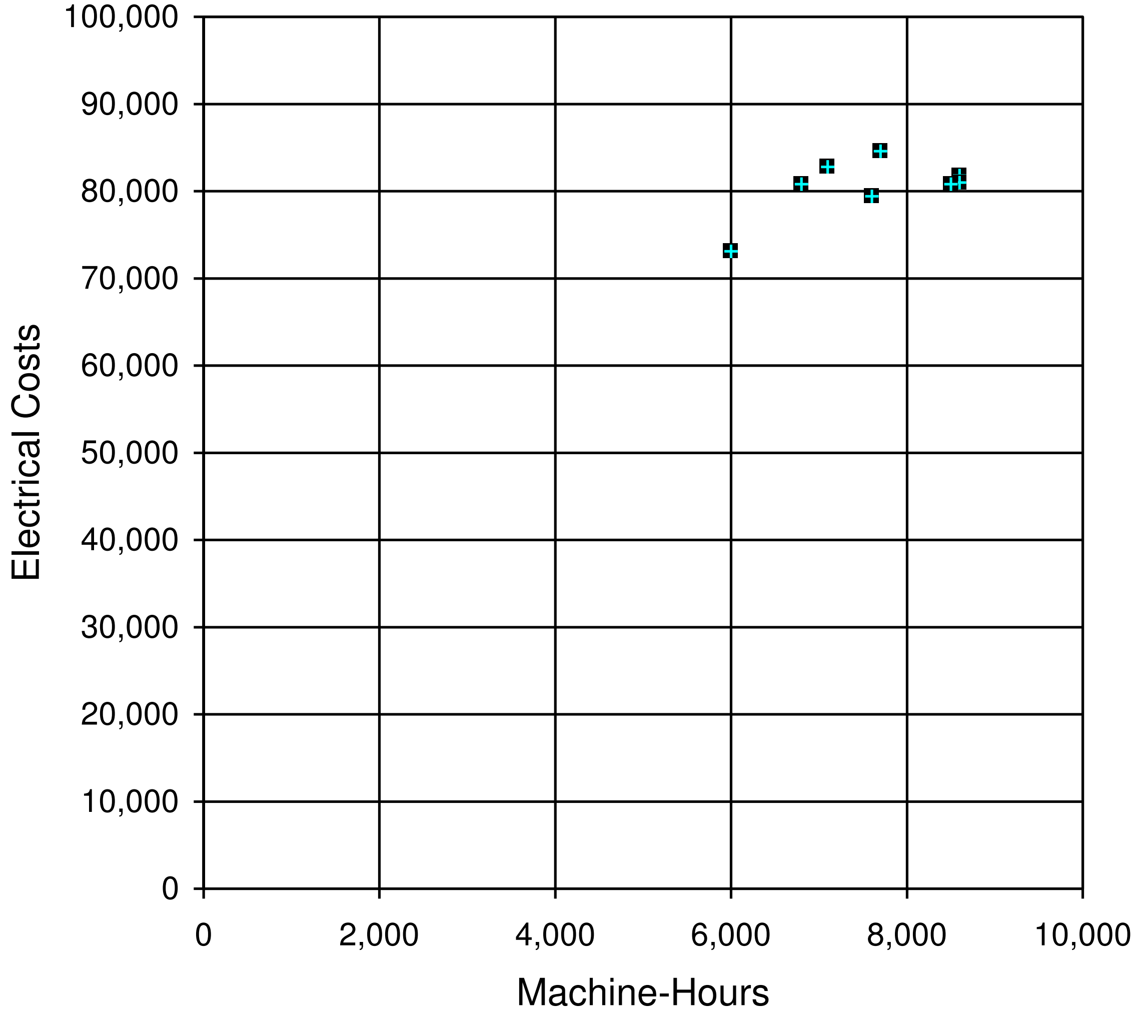
Predetermined overhead rate (a)	SFr 9.04	per DLH
Direct labor-hours for the job (b)	30	DLHs
Electrical cost applied to the job (a) × (b)	SFr 271.20	

Electrical cost for the custom tool job using machine-hours:

Predetermined overhead rate (a)	SFr 10.58	per MH
Machine-hours for the job (b)	25	MHs
Electrical cost applied to the job (a) × (b)	SFr 264.50	

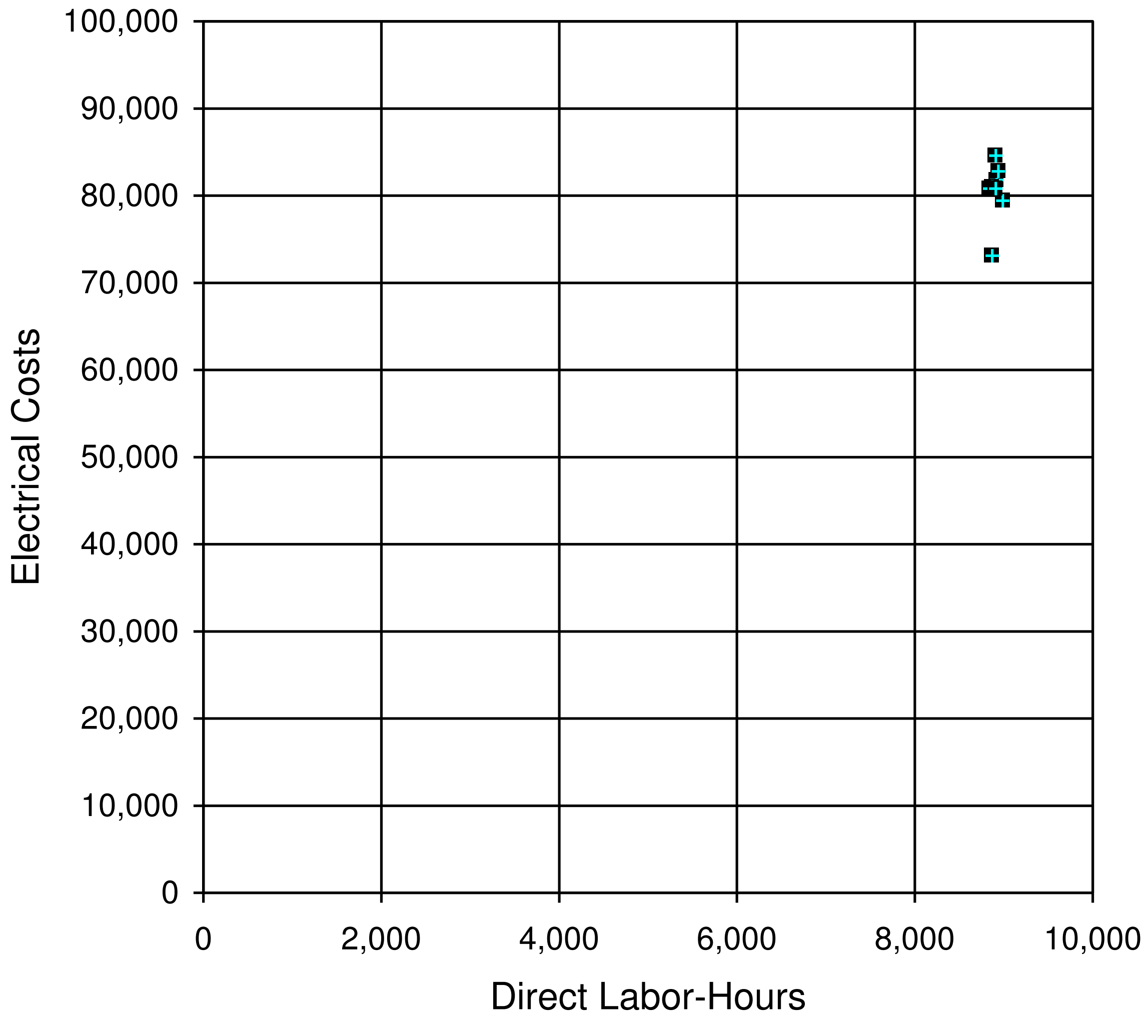
CASE 5-26 (continued)

3. The scattergraph for electrical costs and machine-hours appears below:



CASE 5-26 (continued)

The scattergraph for electrical costs and direct labor-hours appears below:



CASE 5-26 (continued)

In general, the allocation base should actually cause the cost being allocated. If it doesn't, costs will be incorrectly assigned to jobs. Incorrectly assigned costs are worse than useless for decision-making.

Examining the two scattergraphs reveals that electrical costs do not appear to be related to direct labor-hours. Electrical costs do vary, but apparently not in response to changes in direct labor-hours. On the other hand, looking at the scattergraph for machine-hours, electrical costs do tend to increase as the machine-hours increase. So if one must choose between machine-hours and direct labor-hours as an allocation base, machine-hours seems to be the better choice. Even so, it looks like little of the overhead cost is really explained even by machine hours. Electrical cost has a large fixed component and much of the variation in the cost is unrelated to machine hours.

4.

Machine-Hours	*Electrical Costs*
7,700	84,600
8,600	81,800
8,600	81,000
8,500	80,800
7,600	79,400
7,100	82,800
6,000	73,100
6,800	80,800

Using statistical software or a spreadsheet application such as Excel to compute estimates of the intercept and the slope for the above data, the results are:

Intercept (fixed cost)................	SFr 64,840
Slope (variable cost per unit)....	SFr 2.06
R^2	0.33

Therefore the cost formula for electrical costs is SFr 64,840 per week plus SFr 2.06 per machine-hour, or

Y = SFr 64,840 + SFr 2.06 X, where X is machine-hours.

CASE 5-26 (continued)

Note that the R^2 is 0.33, which means that only 33% of the variation in electrical cost is explained by machine-hours. Other factors, discussed in part (6) below, are responsible for most of the variation in electrical costs from week to week.

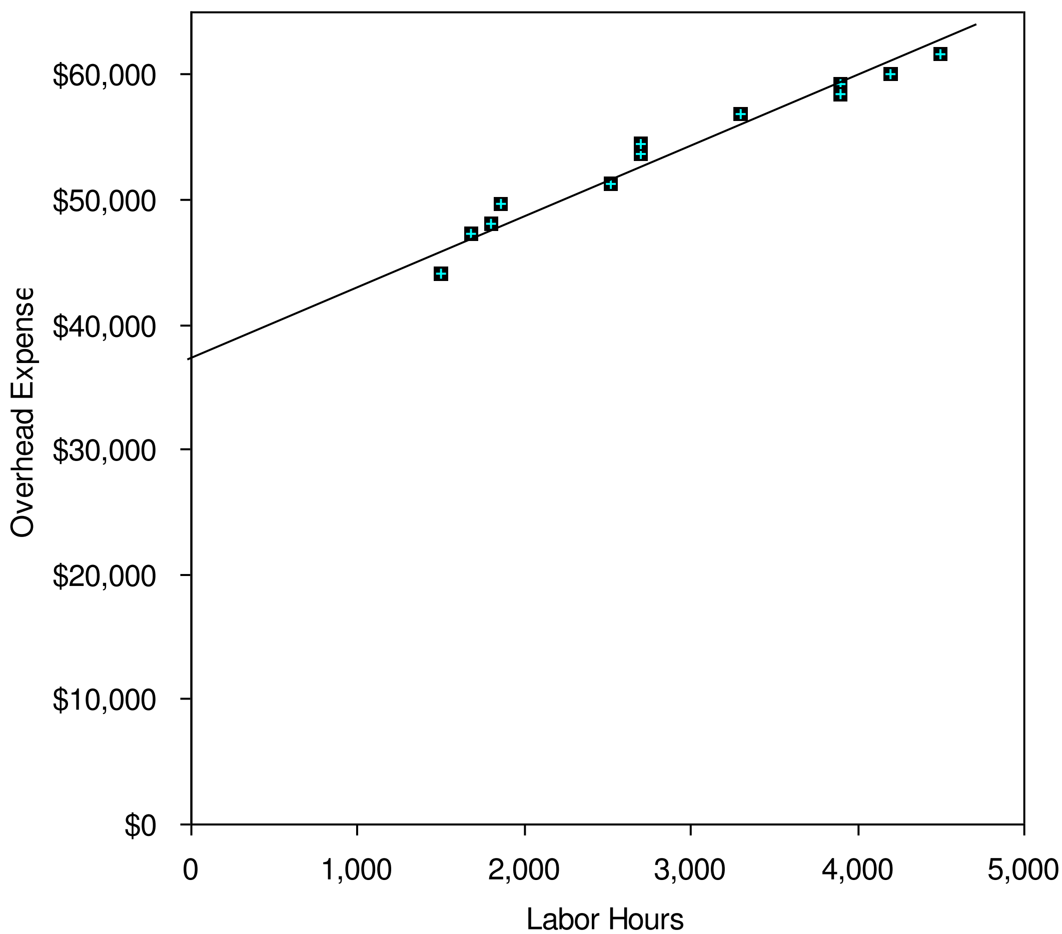
5. The custom tool job requires 25 machine-hours. At SFr 2.06 per machine-hour, the electrical cost actually caused by the job would be only SFr 51.5. This contrasts with the electrical cost of SFr 271.20 under the old cost system and SFr 264.50 under the new ABC system. Both the old cost system and the new ABC system grossly overstate the electrical costs of the job. This is because under both cost systems, the large fixed electrical costs of SFr 64,840 per week are allocated to jobs along with the electrical costs that actually vary with the amount of work being done. In practice, almost all categories of overhead costs pose similar problems. As a consequence, the costs of individual jobs are likely to be seriously overstated for decision-making purposes under both traditional and ABC systems. Both systems provide acceptable cost data for external reporting, but both provide potentially misleading data for internal decision-making unless suitable adjustments are made.

6. Electricity is used for heating and lighting the building as well as to run equipment. Therefore, consumption of electrical power is likely to be affected at least by the weather and by the time of the year as well as by how many hours the equipment is run. (Shorter days mean the lights have to be on longer.)

CASE 5-27 (90 minutes)

Note to the instructor: This case requires the ability to build on concepts that are introduced only briefly in the text. To some degree, this case anticipates issues that will be covered in more depth in later chapters.

1. In order to estimate the contribution to profit of the charity event, it is first necessary to estimate the variable costs of catering the event. The costs of food and beverages and labor are all apparently variable with respect to the number of guests. However, the situation with respect overhead expenses is less clear. A good first step is to plot the labor hour and overhead expense data in a scattergraph as shown below.



CASE 5-27 (continued)

This scattergraph reveals several interesting points about the behavior of overhead costs:

- The relation between overhead expense and labor hours is approximated reasonably well by a straight line. (However, there appears to be a slight downward bend in the plot as the labor hours increase—evidence of increasing returns to scale. This is a common occurrence in practice. See Noreen & Soderstrom, "Are overhead costs strictly proportional to activity?" *Journal of Accounting and Economics*, vol. 17, 1994, pp. 255-278.)
- The data points are all fairly close to the straight line. This indicates that most of the variation in overhead expenses is explained by labor hours. As a consequence, there probably wouldn't be much benefit to investigating other possible cost drivers for the overhead expenses.
- Most of the overhead expense appears to be fixed. Jasmine should ask herself if this is reasonable. Does the company have large fixed expenses such as rent, depreciation, and salaries?

The overhead expenses can be decomposed into fixed and variable elements using the high-low method, least-squares regression method, or even the quick-and-dirty method based on the scattergraph.

- The high-low method throws away most of the data and bases the estimates of variable and fixed costs on data for only two months. For that reason, it is a decidedly inferior method in this situation. Nevertheless, if the high-low method were used, the estimates would be computed as follows:

	Labor Hours	*Overhead Expense*
High level of activity	4,500	$61,600
Low level of activity	1,500	44,000
Change	3,000	$17,600

$$\text{Variable cost} = \frac{\text{Change in cost}}{\text{Change in activity}}$$

$$= \frac{\$17{,}600}{3{,}000 \text{ labor hours}} = \$5.87 \text{ per labor hour}$$

Fixed cost element = Total cost - Variable cost element

= $61,600 - ($5.87 × 4,500)

= $35,185

- In contrast, the least-squares regression method yields estimates of $5.27 per labor hour for the variable cost and $38,501 per month for the fixed cost using statistical software. (The adjusted R^2 is 96%.) To obtain these estimates, use a statistical software package or a spreadsheet application such as Excel.

Using the least-squares regression estimates of the variable overhead cost, the total variable cost per guest is computed as follows:

Food and beverages............................	$17.00
Labor (0.5 hour @ $10 per hour)..........	5.00
Overhead (0.5 hour @ $5.27 per hour) .	2.64
Total variable cost per guest................	$24.64

The total contribution from 120 guests paying $45 each is computed as follows:

Revenue (120 guests @ $45.00 per guest).........	$5,400.00
Variable cost (120 guests @ $24.64 per guest)...	2,956.80
Contribution to profit	$2,443.20

Fixed costs are not included in the above computation because there is no indication that any additional fixed costs would be incurred as a consequence of catering the cocktail party. If additional fixed costs were incurred, they should also be subtracted from revenue.

CASE 5-27 (continued)

2. Assuming that no additional fixed costs are incurred as a result of catering the charity event, any price greater than the variable cost per guest of $24.64 would contribute to profits.

3. We would favor bidding slightly less than $42 to get the contract. Any bid above $24.64 would contribute to profits and a bid at the normal price of $45 is unlikely to land the contract. And apart from the contribution to profit, catering the event would show off the company's capabilities to potential clients. The danger is that a price that is lower than the normal bid of $45 might set a precedent for the future or it might initiate a price war among caterers. However, the price need not be publicized and the lower price could be justified to future clients because this is a charity event. Another possibility would be for Jasmine to maintain her normal price but throw in additional services at no cost to the customer. Whether to compete on price or service is a delicate issue that Jasmine will have to decide after getting to know the personality and preferences of the customer.

Research and Application 5-28 (240 minutes)

1. Blue Nile succeeds first and foremost because of its operational excellence customer value proposition. Page 3 of the 10-K says "we have developed an efficient online cost structure … that eliminates traditional layers of diamond wholesalers and brokers, which allows us to generally purchase most of our product offerings at lower prices by avoiding markups imposed by those intermediaries. Our supply solution generally enables us to purchase only those diamonds that our customers have ordered. As a result, we are able to minimize the costs associated with carrying diamond inventory." On page 4 of the 10-K, Blue Nile's growth strategy hinges largely on increasing what it calls supply chain efficiencies and operational efficiencies. Blue Nile also emphasizes jewelry customization and customer service, but these attributes do not differentiate Blue Nile from its competitors.

2. Blue Nile faces numerous business risks as described in pages 8-19 of the 10-K. Students may mention other risks beyond those specifically mentioned in the 10-K. Here are four risks faced by Blue Nile with suggested control activities:

   - Risk: Customer may not purchase an expensive item such as a diamond over the Internet because of concerns about product quality (given that customers cannot see the product in person prior to purchasing it.)
     Control activities: Sell only independently certified diamonds and market this fact heavily. Also, design a web site that enables customers to easily learn more about the specific products that they are interested in purchasing.
   - Risk: Customers may avoid Internet purchases because of fears that security breaches will enable criminals to have access to their confidential information.
     Control activities: Invest in state-of-the-art encryption technology and other safeguards.

Research and Application 5-28 (continued)

- Risk: Because Blue Nile sells luxury products that are often purchased on a discretionary basis, sales may decline significantly in an economic downturn as people have access to less disposable income.
  Control activities: Expand product offerings and expand the number of geographic markets served.
- Risk: The financial reporting process may fail to function properly (e.g., it may not comply with the Sarbanes-Oxley Act of 2002) as the business grows.
  Control activities: Implement additional financial accounting systems and internal control over those systems.

Blue Nile faces various risks that are not easily reduced through control activities. Three such examples include:

- If Blue Nile is required by law to charge sales tax on purchases it will reduce Blue Nile's price advantage over bricks-and-mortar retailers (see page 17 of the 10-K).
- Restrictions on the supply of diamonds would harm Blue Nile's financial results (see page 9 of the 10-K).
- Other Internet retailers, such as Amazon.com, could offer the same efficiencies and low price as Blue Nile, while leveraging their stronger brand recognition to attract Blue Nile's customers (see page 10 of the 10-K).

3. Blue Nile is a merchandiser. The first sentence of the overview on page 3 of the 10-K says "Blue Nile Inc. is a leading online retailer of high quality diamonds and fine jewelry." While Blue Niles does some assembly work to support its "Build Your Own" feature, the company essentially buys jewelry directly from suppliers and resells it to customers. In fact, Blue Nile never takes possession of some of the diamonds it sells. Page 4 of the 10-K says "our diamond supplier relationships allow us to display suppliers' diamond inventories on the Blue Nile web site for sale to consumers without holding the diamonds in our inventory until the products are ordered by customers." This sentence suggests that items are shipped directly from the supplier to the consumer.

Research and Application 5-28 (continued)

4. There is no need to calculate any numbers to ascertain that cost of sales is almost entirely a variable cost. Page 25 of the 10-K says "our cost of sales consists of the cost of diamonds and jewelry products sold to customers, inbound and outbound shipping costs, insurance on shipments and the costs incurred to set diamonds into ring, earring and pendant settings, including labor and related facilities costs." The overwhelming majority of these costs are variable costs. Assuming the workers that set diamonds into ring, earring, and pendant settings are not paid on a piece rate, the labor cost would be step-variable in nature. The facilities costs are likely to be committed fixed in nature; however, the overwhelming majority of the cost of sales is variable.

   Similarly, there is no need to calculate any numbers to ascertain that selling, general and administrative expense is a mixed cost. Page 25 of the 10-K says "our selling, general and administrative expenses consist primarily of payroll and related benefit costs for our employees, marketing costs, credit card fees and costs associated with being a publicly traded company. These expenses also include certain facilities, fulfillment, customer service, technology and depreciation expenses, as well as professional fees and other general corporate expenses." At the bottom of page 25, the 10-K says "the increase in selling, general and administrative expenses in 2004 was due primarily to…higher credit card processing fees based on increased volume." This indicates that credit card processing fees is a variable cost. At the top of page 26 of the 10-K it says "the decrease in selling, general and administrative expenses as a percentage of sales in 2004 resulted primarily from our ability to leverage our fixed cost base." This explicitly recognizes that selling, general and administrative expense includes a large portion of fixed costs.

   Examples of the various costs include:

   - Variable costs: cost of sales, credit card processing fees
   - Step-variable costs: diamond setting labor, fulfillment labor
   - Discretionary fixed costs: marketing costs, employee training costs
   - Committed fixed costs: general corporate expenses, facilities costs

Research and Application 5-28 (continued)

5. The data needed to complete the table as shown below is found on page 49 of the 10-K:

	2004 Quarter 1	*2004* Quarter 2	*2004* Quarter 3	*2004* Quarter 4	*2005* Quarter 1	*2005* Quarter 2
Net sales	$35,784	$35,022	$33,888	$64,548	$44,116	$43,826
Cost of sales	27,572	27,095	26,519	50,404	34,429	33,836
Gross profit	8,212	7,927	7,369	14,144	9,687	9,990
Selling, general and administrative expense.......	5,308	5,111	5,033	7,343	6,123	6,184
Operating income.................	$ 2,904	$ 2,816	$ 2,336	$ 6,801	$ 3,564	$ 3,806

	Net sales	*Selling, General, and Administrative*
High Quarter (‘04 Q4).......	$64,548	$7,343
Low Quarter (’04 Q3)	$33,888	$5,033
Change	$30,660	$2,310

Variable cost = \$2,310/\$30,660 = 0.075342 per dollar of revenue

Fixed cost estimate (using the low level of activity):

\$5,033 − (\$33,888 × 0.075342) = \$2,480 (rounded up)

The linear equation is: Y = \$2,480 + 0.075342X, where X is revenue.

Research and Application 5-28 (continued)

6. Using least-squares regression, the estimates are as follows:

   SLOPE (variable cost) = 0.075206
   INTERCEPT (fixed cost) = $2,627 (rounded up)
   RSQ (goodness of fit) = 0.9587

   The cost formula is: Y = $2,627 + 0.075206X

   These estimates differ from the high-low method because least squares regression uses all of the data rather than just the data pertaining to the high and low quarters of activity.

7. The contribution format income statement using the high-low method for the third quarter of 2005 would be as follows:

	2005 Third Quarter	
Net sales		$45,500
Cost of sales	$35,128	
Variable selling, general and administrative	3,428	38,556
Contribution margin		6,944
Fixed selling, general and administrative		2,480
Operating income		$ 4,464

   The contribution format income statement using least-squares regression for the third quarter of 2005 would be as follows:

2005

Third Quarter

Net sales		$45,500
Cost of sales	$35,128	
Variable selling, general and		
administrative	3,422	38,550
Contribution margin		6,950
Fixed selling, general and		
administrative		2,627
Operating income...........................		$ 4,323

Research and Application 5-28 (continued)

8. Blue Nile's cost structure is heavily weighted towards variable costs. Less than 10% of Blue Nile's costs are fixed. Blue Nile's cost of sales as a percentage of sales is higher than bricks and mortar retailers. Page 22 of the 10-K says "As an online retailer, we do not incur most of the operating costs associated with physical retail stores, including the costs of maintaining significant inventory and related overhead. As a result, while our gross profit margins are lower than those typically maintained by traditional diamond and fine jewelry retailers, we are able to realize relatively higher operating income as a percentage of net sales. In 2004, we had a 22.2% gross profit margin, as compared to gross profit margins of up to 50% by some traditional retailers. We believe our lower gross profit margins result from lower retail prices that we offer to our customers."

Chapter 6
Cost-Volume-Profit Relationships

Solutions to Questions

6-1 The contribution margin (CM) ratio is the ratio of the total contribution margin to total sales revenue. It can be used in a variety of ways. For example, the change in total contribution margin from a given change in total sales revenue can be estimated by multiplying the change in total sales revenue by the CM ratio. If fixed costs do not change, then a dollar increase in contribution margin will result in a dollar increase in net operating income. The CM ratio can also be used in break-even analysis. Therefore, knowledge of a product's CM ratio is extremely helpful in forecasting contribution margin and net operating income.

6-2 Incremental analysis focuses on the changes in revenues and costs that will result from a particular action.

6-3 All other things equal, Company B, with its higher fixed costs and lower variable costs, will have a higher contribution margin ratio than Company A. Therefore, it will tend to realize a larger increase in contribution margin and in profits when sales increase.

6-4 Operating leverage measures the impact on net operating income of a given percentage change in sales. The degree of operating leverage at a given level of sales is computed by dividing the contribution margin at that level of sales by the net operating income at that level of sales.

6-5 The break-even point is the level of sales at which profits are zero. It can also be defined as the point where total revenue equals total cost or as the point where total contribution margin equals total fixed cost.

6-6 Three approaches to break-even analysis are (a) the graphical method, (b) the equation method, and (c) the contribution margin method.

In the graphical method, total cost and total revenue data are plotted on a graph. The intersection of the total cost and the total revenue lines indicates the break-even point.

The graph shows the break-even point in both units and dollars of sales.

The equation method uses some variation of the equation Sales = Variable expenses + Fixed expenses + Profits, where profits are zero at the break-even point. The equation is solved to determine the break-even point in units or dollar sales.

In the contribution margin method, total fixed cost is divided by the contribution margin per unit to obtain the break-even point in units. Alternatively, total fixed cost can be divided by the contribution margin ratio to obtain the break-even point in sales dollars.

6-7 (a) If the selling price decreased, then the total revenue line would rise less steeply, and the break-even point would occur at a higher unit volume. (b) If the fixed cost increased, then both the fixed cost line and the total cost line would shift upward and the break-even point would occur at a higher unit volume. (c) If the variable cost increased, then the total cost line would rise more steeply and the break-even point would occur at a higher unit volume.

6-8 The margin of safety is the excess of budgeted (or actual) sales over the break-even volume of sales. It states the amount by which sales can drop before losses begin to be incurred.

6-9 The sales mix is the relative proportions in which a company's products are sold. The usual assumption in cost-volume-profit analysis is that the sales mix will not change.

6-10 A higher break-even point and a lower net operating income could result if the sales mix shifted from high contribution margin products to low contribution margin products. Such a shift would cause the average contribution margin ratio in the company to decline, resulting in less total contribution margin for a given amount of sales. Thus, net operating income would decline. With a lower contribution margin ratio, the break-even point would be higher because more sales would be required to cover the same amount of fixed costs.

Exercise 6-1 (20 minutes)

1. The new income statement would be:

	Total	*Per Unit*
Sales (8,050 units)	$209,300	$26.00
Variable expenses	144,900	18.00
Contribution margin	64,400	$ 8.00
Fixed expenses	56,000	
Net operating income	$ 8,400	

You can get the same net operating income using the following approach.

Original net operating income	$8,000
Change in contribution margin (50 units × $8.00 per unit)	400
New net operating income	$8,400

2. The new income statement would be:

	Total	*Per Unit*
Sales (7,950 units)	$206,700	$26.00
Variable expenses	143,100	18.00
Contribution margin	63,600	$ 8.00
Fixed expenses	56,000	
Net operating income	$ 7,600	

You can get the same net operating income using the following approach.

Original net operating income	$8,000
Change in contribution margin (-50 units × $8.00 per unit)	(400)
New net operating income	$7,600

Exercise 6-1 (continued)

3. The new income statement would be:

	Total	*Per Unit*
Sales (7,000 units)	$182,000	$26.00
Variable expenses	126,000	18.00
Contribution margin......	56,000	$ 8.00
Fixed expenses	56,000	
Net operating income ...	$ 0	

Note: This is the company's break-even point.

Exercise 6-2 (20 minutes)

1. The CVP graph can be plotted using the three steps outlined in the text. The graph appears on the next page.

   Step 1. Draw a line parallel to the volume axis to represent the total fixed expense. For this company, the total fixed expense is $12,000.

   Step 2. Choose some volume of sales and plot the point representing total expenses (fixed and variable) at the activity level you have selected. We'll use the sales level of 2,000 units.

Fixed expense	$12,000
Variable expense (2,000 units × $24 per unit)	48,000
Total expense	$60,000

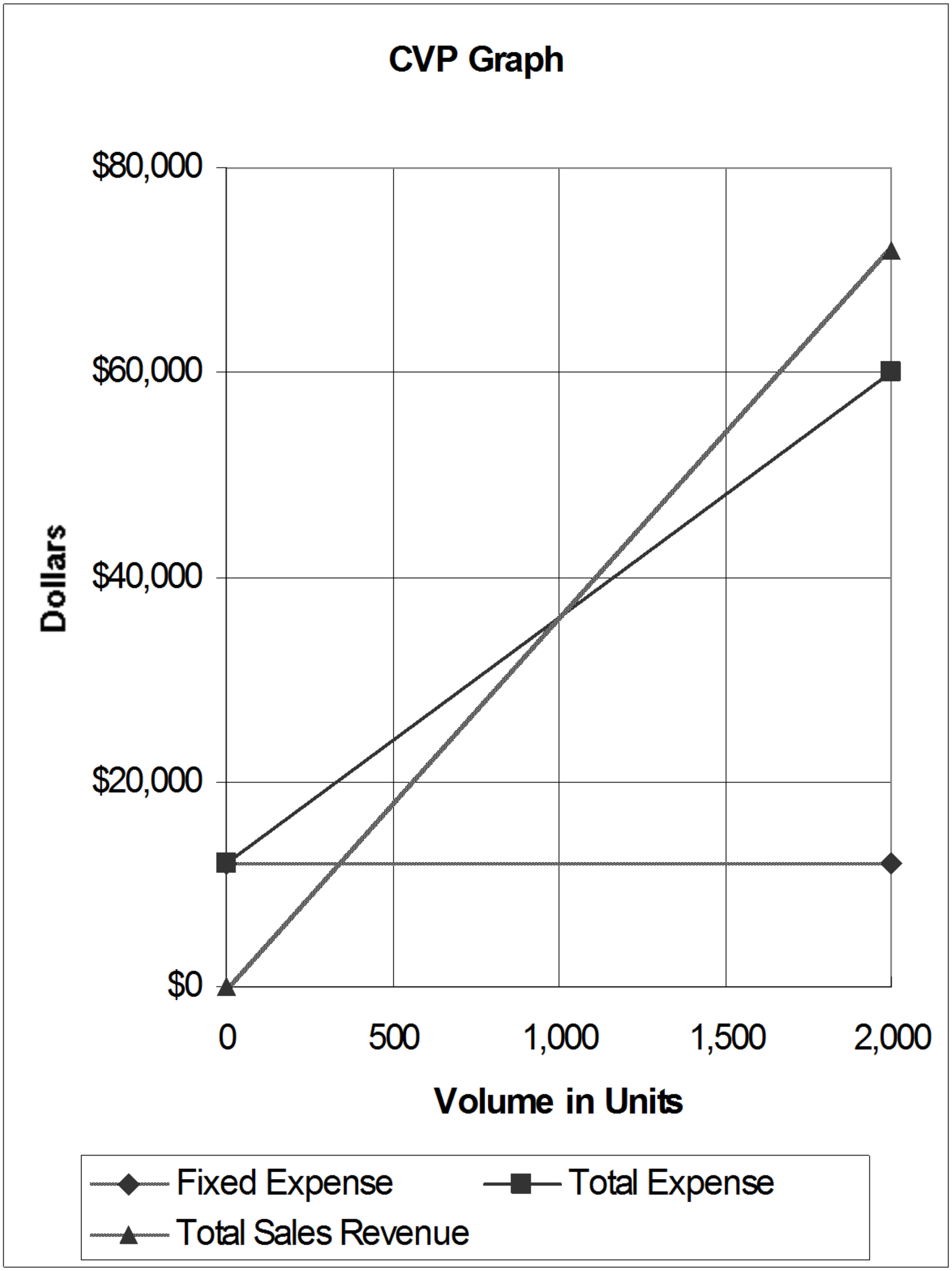
   Step 3. Choose some volume of sales and plot the point representing total sales dollars at the activity level you have selected. We'll use the sales level of 2,000 units again.

Total sales revenue (2,000 units × $36 per unit)	$72,000

2. The break-even point is the point where the total sales revenue and the total expense lines intersect. This occurs at sales of 1,000 units. This can be verified by solving for the break-even point in unit sales, Q, using the equation method as follows:

   Sales = Variable expenses + Fixed expenses + Profits
   $36Q = $24Q + $12,000 + $0
   $12Q = $12,000
   Q = $12,000 ÷ $12 per unit
   Q = 1,000 units

Exercise 6-2 (continued)



Exercise 6-3 (10 minutes)

1. The company's contribution margin (CM) ratio is:

Total sales	$300,000
Total variable expenses	240,000
= Total contribution margin	60,000
÷ Total sales	$300,000
= CM ratio	20%

2. The change in net operating income from an increase in total sales of $1,500 can be estimated by using the CM ratio as follows:

Change in total sales	$1,500
× CM ratio	20%
= Estimated change in net operating income	$ 300

This computation can be verified as follows:

Total sales	$300,000	
÷ Total units sold	40,000	units
= Selling price per unit	$7.50	per unit

Increase in total sales	$1,500	
÷ Selling price per unit	$7.50	per unit
= Increase in unit sales	200	units
Original total unit sales	40,000	units
New total unit sales	40,200	units

	Original	*New*
Total unit sales	40,000	40,200
Sales	$300,000	$301,500
Variable expenses	240,000	241,200
Contribution margin	60,000	60,300
Fixed expenses	45,000	45,000
Net operating income	$ 15,000	$ 15,300

Exercise 6-4 (20 minutes)

1. The following table shows the effect of the proposed change in monthly advertising budget:

	Current Sales	*Sales With Additional Advertising Budget*	*Difference*
Sales	$225,000	$240,000	$15,000
Variable expenses	135,000	144,000	9,000
Contribution margin	90,000	96,000	6,000
Fixed expenses	75,000	83,000	8,000
Net operating income	$ 15,000	$ 13,000	$(2,000)

Assuming that there are no other important factors to be considered, the increase in the advertising budget should not be approved since it would lead to a decrease in net operating income of $2,000.

Alternative Solution 1

Expected total contribution margin:	
$240,000 × 40% CM ratio	$96,000
Present total contribution margin:	
$225,000 × 40% CM ratio	90,000
Incremental contribution margin	6,000
Change in fixed expenses:	
Less incremental advertising expense	8,000
Change in net operating income	$(2,000)

Alternative Solution 2

Incremental contribution margin:	
$15,000 × 40% CM ratio	$ 6,000
Less incremental advertising expense	8,000
Change in net operating income	$(2,000)

Exercise 6-4 (continued)

2. The $3 increase in variable costs will cause the unit contribution margin to decrease from $30 to $27 with the following impact on net operating income:

Expected total contribution margin with the higher-quality components:	
3,450 units × $27 per unit	$93,150
Present total contribution margin:	
3,000 units × $30 per unit	90,000
Change in total contribution margin....................	$ 3,150

Assuming no change in fixed costs and all other factors remain the same, the higher-quality components should be used.

Exercise 6-5 (20 minutes)

1. The equation method yields the break-even point in unit sales, Q, as follows:

   Sales = Variable expenses + Fixed expenses + Profits
   $8Q = $6Q + $5,500 + $0
   $2Q = $5,500
   Q = $5,500 ÷ $2 per basket
   Q = 2,750 baskets

2. The equation method can be used to compute the break-even point in sales dollars, X, as follows:

	Per Unit	*Percent of Sales*
Sales price	$8	100%
Variable expenses	6	75%
Contribution margin.........	$2	25%

   Sales = Variable expenses + Fixed expenses + Profits
   X = 0.75X + $5,500 + $0
   0.25X = $5,500
   X = $5,500 ÷ 0.25
   X = $22,000

3. The contribution margin method gives an answer that is identical to the equation method for the break-even point in unit sales:

   Break-even point in units sold = Fixed expenses ÷ Unit CM
   = $5,500 ÷ $2 per basket
   = 2,750 baskets

4. The contribution margin method also gives an answer that is identical to the equation method for the break-even point in dollar sales:

   Break-even point in sales dollars = Fixed expenses ÷ CM ratio
   = $5,500 ÷ 0.25
   =$22,000

Exercise 6-6 (10 minutes)

1. The equation method yields the required unit sales, Q, as follows:

$$
\begin{aligned}
\text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\
\$140Q &= \$60Q + \$40{,}000 + \$6{,}000 \\
\$80Q &= \$46{,}000 \\
Q &= \$46{,}000 \div \$80 \text{ per unit} \\
Q &= 575 \text{ units}
\end{aligned}
$$

2. The contribution margin yields the required unit sales as follows:

$$
\begin{aligned}
\text{Units sold to attain the target profit} &= \frac{\text{Fixed expenses} + \text{Target profit}}{\text{Unit contribution margin}} \\
&= \frac{\$40{,}000 + \$8{,}000}{\$80 \text{ per unit}} \\
&= \frac{\$48{,}000}{\$80 \text{ per unit}} \\
&= 600 \text{ units}
\end{aligned}
$$

Exercise 6-7 (10 minutes)

1. To compute the margin of safety, we must first compute the break-even unit sales.

   Sales = Variable expenses + Fixed expenses + Profits
   $25Q = $15Q + $8,500 + $0
   $10Q = $8,500
   Q = $8,500 ÷ $10 per unit
   Q = 850 units

Sales (at the budgeted volume of 1,000 units)	$25,000
Break-even sales (at 850 units)	21,250
Margin of safety (in dollars)	$ 3,750

2. The margin of safety as a percentage of sales is as follows:

Margin of safety (in dollars)	$3,750
÷ Sales	$25,000
Margin of safety as a percentage of sales	15.0%

Exercise 6-8 (20 minutes)

1. The company's degree of operating leverage would be computed as follows:

Contribution margin	$36,000
÷ Net operating income	$12,000
Degree of operating leverage	3.0

2. A 10% increase in sales should result in a 30% increase in net operating income, computed as follows:

Degree of operating leverage	3.0
× Percent increase in sales	10%
Estimated percent increase in net operating income	30%

3. The new income statement reflecting the change in sales would be:

	Amount	*Percent of Sales*
Sales	$132,000	100%
Variable expenses	92,400	70%
Contribution margin	39,600	30%
Fixed expenses	24,000	
Net operating income	$ 15,600	

Net operating income reflecting change in sales	$15,600
Original net operating income	$12,000
Percent change in net operating income	30%

Exercise 6-9 (20 minutes)

1. The overall contribution margin ratio can be computed as follows:

$$\text{Overall CM ratio} = \frac{\text{Total contribution margin}}{\text{Total sales}}$$

$$= \frac{\$120{,}000}{\$150{,}000} = 80\%$$

2. The overall break-even point in sales dollars can be computed as follows:

$$\text{Overall break-even} = \frac{\text{Total fixed expenses}}{\text{Overall CM ratio}}$$

$$= \frac{\$90{,}000}{80\%} = \$112{,}500$$

3. To construct the required income statement, we must first determine the relative sales mix for the two products:

	Predator	*Runway*	*Total*
Original dollar sales	$100,000	$50,000	$150,000
Percent of total	67%	33%	100%
Sales at break-even	$75,000	$37,500	$112,500

	Predator	*Runway*	*Total*
Sales	$75,000	$37,500	$112,500
Variable expenses*	18,750	3,750	22,500
Contribution margin	$56,250	$33,750	90,000
Fixed expenses			90,000
Net operating income ...			$ 0

*Predator variable expenses: ($75,000/$100,000) × $25,000 = $18,750
Runway variable expenses: ($37,500/$50,000) × $5,000 = $3,750

Exercise 6-10 (30 minutes)

1. $$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$40Q &= \$28Q + \$150{,}000 + \$0 \\ \$12Q &= \$150{,}000 \\ Q &= \$150{,}000 \div \$12 \text{ per unit} \\ Q &= 12{,}500 \text{ units, or at } \$40 \text{ per unit, } \$500{,}000 \end{aligned}$$

   Alternatively:

   $$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

   $$= \frac{\$150{,}000}{\$12 \text{ per unit}} = 12{,}500 \text{ units}$$

   or, at $40 per unit, $500,000.

2. The contribution margin at the break-even point is $150,000 since at that point it must equal the fixed expenses.

3. $$\text{Units sold to attain target profit} = \frac{\text{Fixed expenses} + \text{Target profit}}{\text{Unit contribution margin}}$$

   $$= \frac{\$150{,}000 + \$18{,}000}{\$12 \text{ per unit}} = 14{,}000 \text{ units}$$

	Total	*Unit*
Sales (14,000 units × $40 per unit)	$560,000	$40
Variable expenses (14,000 units × $28 per unit)	392,000	28
Contribution margin (14,000 units × $12 per unit)	168,000	$12
Fixed expenses	150,000	
Net operating income	$ 18,000	

Exercise 6-10 (continued)

4. Margin of safety in dollar terms:

$$\text{Margin of safety in dollars} = \text{Total sales - Break-even sales}$$

$$= \$600{,}000 - \$500{,}000 = \$100{,}000$$

Margin of safety in percentage terms:

$$\text{Margin of safety percentage} = \frac{\text{Margin of safety in dollars}}{\text{Total sales}}$$

$$= \frac{\$100{,}000}{\$600{,}000} = 16.7\% \text{ (rounded)}$$

5. The CM ratio is 30%.

Expected total contribution margin: $680,000 × 30%	$204,000
Present total contribution margin: $600,000 × 30%	180,000
Increased contribution margin	$ 24,000

Alternative solution:
$80,000 incremental sales × 30% CM ratio = $24,000

Since in this case the company's fixed expenses will not change, monthly net operating income will increase by the amount of the increased contribution margin, $24,000.

Exercise 6-11 (30 minutes)

1. The contribution margin per person would be:

Price per ticket		$30
Variable expenses:		
Dinner	$7	
Favors and program	3	10
Contribution margin per person		$20

The fixed expenses of the Extravaganza total $8,000; therefore, the break-even point would be computed as follows:

Sales = Variable expenses + Fixed expense + Profits

$$\$30Q = \$10Q + \$8,000 + \$0$$
$$\$20Q = \$8,000$$
$$Q = \$8,000 \div \$20 \text{ per person}$$
$$Q = 400 \text{ persons; or, at \$30 per person, \$12,000}$$

Alternative solution:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \frac{\$8,000}{\$20 \text{ per person}} = 400 \text{ persons}$$

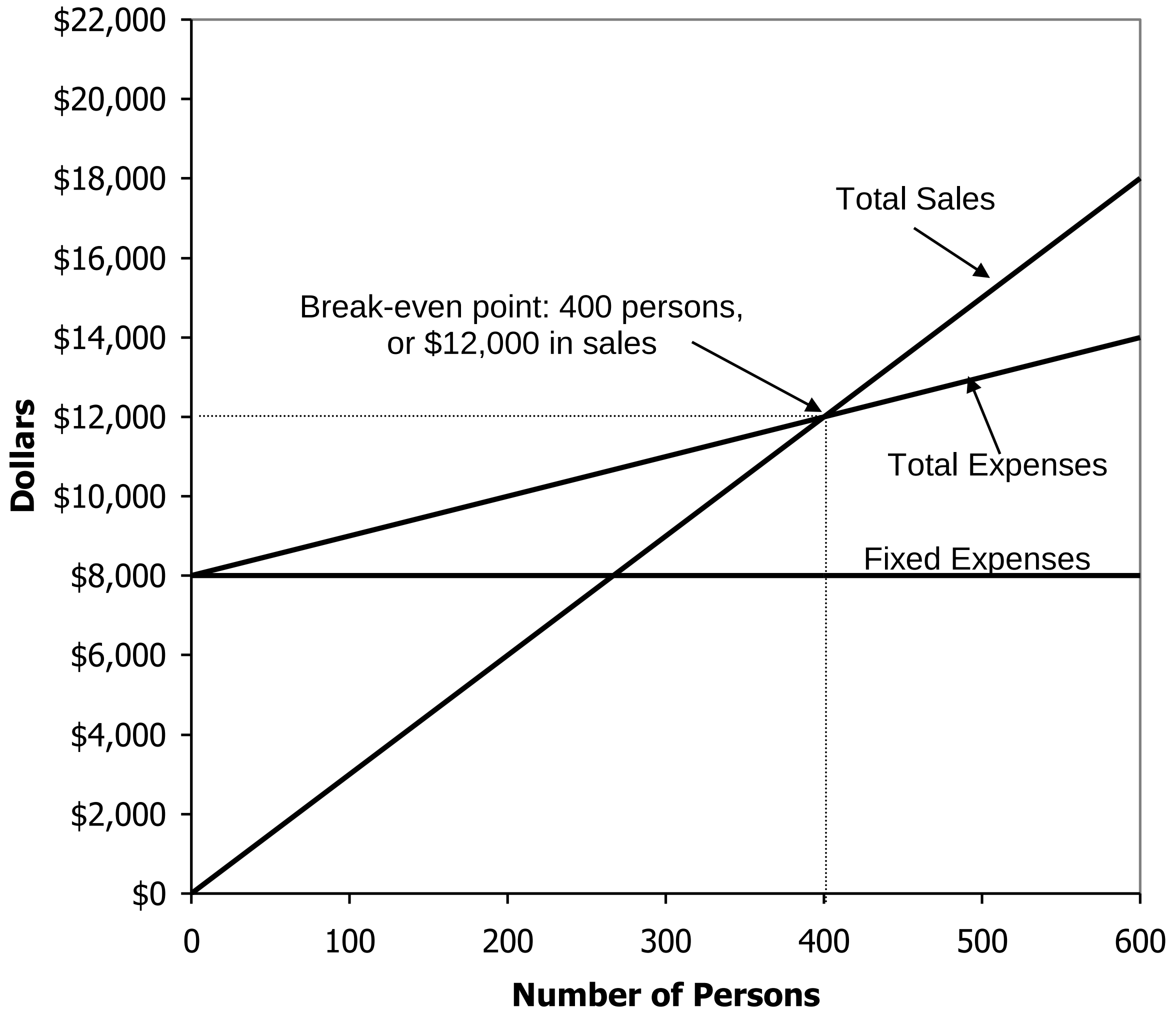
or, at $30 per person, $12,000.

2.

Variable cost per person ($7 + $3)	$10
Fixed cost per person ($8,000 ÷ 250 persons)	32
Ticket price per person to break even	$42

Exercise 6-11 (continued)

3. Cost-volume-profit graph:



Exercise 6-12 (20 minutes)

	Total	Per Unit
1. Sales (30,000 units × 1.15 = 34,500 units)..	$172,500	$5.00
Variable expenses	103,500	3.00
Contribution margin....................................	69,000	$2.00
Fixed expenses	50,000	
Net operating income	$ 19,000	
2. Sales (30,000 units × 1.20 = 36,000 units)..	$162,000	$4.50
Variable expenses	108,000	3.00
Contribution margin....................................	54,000	$1.50
Fixed expenses	50,000	
Net operating income	$ 4,000	
3. Sales (30,000 units × 0.95 = 28,500 units)..	$156,750	$5.50
Variable expenses	85,500	3.00
Contribution margin....................................	71,250	$2.50
Fixed expenses ($50,000 + $10,000)	60,000	
Net operating income	$ 11,250	
4. Sales (30,000 units × 0.90 = 27,000 units)..	$151,200	$5.60
Variable expenses	86,400	3.20
Contribution margin....................................	64,800	$2.40
Fixed expenses	50,000	
Net operating income	$ 14,800	

Exercise 6-13 (20 minutes)

a.

	Case #1		Case #2	
Number of units sold	9,000 *		14,000	
Sales	$270,000 *	$30	$350,000 *	$25
Variable expenses	162,000 *	18	140,000	10
Contribution margin......	108,000	$12	210,000	$15 *
Fixed expenses	90,000 *		170,000 *	
Net operating income ...	$ 18,000		$ 40,000 *	

	Case #3		Case #4	
Number of units sold	20,000 *		5,000 *	
Sales	$400,000	$20	$160,000 *	$32
Variable expenses	280,000 *	14	90,000	18
Contribution margin......	120,000	$ 6 *	70,000	$14
Fixed expenses	85,000		82,000 *	
Net operating income ...	$ 35,000 *		$(12,000) *	

b.

	Case #1		Case #2	
Sales	$450,000 *	100%	$200,000 *	100 %
Variable expenses	270,000	60	130,000 *	65
Contribution margin......	180,000	40%*	70,000	35 %
Fixed expenses	115,000		60,000 *	
Net operating income ...	$ 65,000 *		$ 10,000	

	Case #3		Case #4	
Sales	$700,000	100%	$300,000 *	100 %
Variable expenses	140,000	20	90,000 *	30
Contribution margin......	560,000	80%*	210,000	70 %
Fixed expenses	470,000 *		225,000	
Net operating income ...	$ 90,000 *		$ (15,000) *	

*Given

Exercise 6-14 (30 minutes)

1. Variable expenses: $60 × (100% – 40%) = $36.

2. a.

Selling price	$60	100%
Variable expenses	36	60%
Contribution margin	$24	40%

Let Q = Break-even point in units.

$$
\begin{aligned}
\text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\
\$60Q &= \$36Q + \$360{,}000 + \$0 \\
\$24Q &= \$360{,}000 \\
Q &= \$360{,}000 \div \$24 \text{ per unit} \\
Q &= 15{,}000 \text{ units}
\end{aligned}
$$

In sales dollars: 15,000 units × $60 per unit = $900,000

Alternative solution:

$$
\begin{aligned}
\text{Let } X &= \text{Break-even point in sales dollars.} \\
X &= 0.60X + \$360{,}000 + \$0 \\
0.40X &= \$360{,}000 \\
X &= \$360{,}000 \div 0.40 \\
X &= \$900{,}000
\end{aligned}
$$

In units: $900,000 ÷ $60 per unit = 15,000 units

b.

$$
\begin{aligned}
\$60Q &= \$36Q + \$360{,}000 + \$90{,}000 \\
\$24Q &= \$450{,}000 \\
Q &= \$450{,}000 \div \$24 \text{ per unit} \\
Q &= 18{,}750 \text{ units}
\end{aligned}
$$

In sales dollars: 18,750 units × $60 per unit = $1,125,000

Exercise 6–14 (continued)

Alternative solution:

$$
\begin{aligned}
X &= 0.60X + \$360,000 + \$90,000 \\
0.40X &= \$450,000 \\
X &= \$450,000 \div 0.40 \\
X &= \$1,125,000
\end{aligned}
$$

In units: $1,125,000 ÷ $60 per unit = 18,750 units

c. The company's new cost/revenue relationships will be:

Selling price	$60	100%
Variable expenses ($36 – $3)	33	55%
Contribution margin	$27	45%

$$
\begin{aligned}
\$60Q &= \$33Q + \$360,000 + \$0 \\
\$27Q &= \$360,000 \\
Q &= \$360,000 \div \$27 \text{ per unit} \\
Q &= 13,333 \text{ units (rounded).}
\end{aligned}
$$

In sales dollars: 13,333 units × $60 per unit = $800,000 (rounded)

Alternative solution:

$$
\begin{aligned}
X &= 0.55X + \$360,000 + \$0 \\
0.45X &= \$360,000 \\
X &= \$360,000 \div 0.45 \\
X &= \$800,000
\end{aligned}
$$

In units: $800,000 ÷ $60 per unit = 13,333 units (rounded)

Exercise 6–14 (continued)

3 a. $$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \$360{,}000 \div \$24 \text{ per unit} = 15{,}000 \text{ units}$$

In sales dollars: 15,000 units × $60 per unit = $900,000

Alternative solution:

$$\text{Break-even point in sales dollars} = \frac{\text{Fixed expenses}}{\text{CM ratio}}$$

$$= \$360{,}000 \div 0.40 = \$900{,}000$$

In units: $900,000 ÷ $60 per unit = 15,000 units

b. $$\text{Unit sales to attain target profit} = \frac{\text{Fixed expenses + Target profit}}{\text{Unit contribution margin}}$$

$$= (\$360{,}000 + \$90{,}000) \div \$24 \text{ per unit}$$

$$= 18{,}750 \text{ units}$$

In sales dollars: 18,750 units × $60 per unit = $1,125,000

Alternative solution:

$$\text{Dollar sales to attain target profit} = \frac{\text{Fixed expenses + Target profit}}{\text{CM ratio}}$$

$$= (\$360{,}000 + \$90{,}000) \div 0.40$$

$$= \$1{,}125{,}000$$

In units: $1,125,000 ÷ $60 per unit = 18,750 units

Exercise 6-14 (continued)

c. $$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

= \$360,000 ÷ \$27 per unit

= 13,333 units (rounded)

In sales dollars: 13,333 units × \$60 per unit = \$800,000 (rounded)

Alternative solution:

$$\text{Break-even point in sales dollars} = \frac{\text{Fixed expenses}}{\text{CM ratio}}$$

= \$360,000 ÷ 0.45 = \$800,000

In units: \$800,000 ÷ \$60 per unit = 13,333 (rounded)

Exercise 6-15 (15 minutes)

1.

Sales (30,000 doors)	$1,800,000	$60
Variable expenses	1,260,000	42
Contribution margin	540,000	$18
Fixed expenses	450,000	
Net operating income	$ 90,000	

$$\text{Degree of operating leverage} = \frac{\text{Contribution margin}}{\text{Net operating income}}$$

$$= \frac{\$540,000}{\$90,000} = 6$$

2. a. Sales of 37,500 doors represents an increase of 7,500 doors, or 25%, over present sales of 30,000 doors. Since the degree of operating leverage is 6, net operating income should increase by 6 times as much, or by 150% (6 × 25%).

   b. Expected total dollar net operating income for the next year is:

Present net operating income	$ 90,000
Expected increase in net operating income next year (150% × $90,000)	135,000
Total expected net operating income	$225,000

Exercise 6-16 (30 minutes)

1.
$$\begin{aligned}
\text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits}\\
\$90Q &= \$63Q + \$135{,}000 + \$0\\
\$27Q &= \$135{,}000\\
Q &= \$135{,}000 \div \$27 \text{ per lantern}\\
Q &= 5{,}000 \text{ lanterns, or at \$90 per lantern, \$450,000 in sales}
\end{aligned}$$

Alternative solution:

$$\begin{aligned}
\begin{array}{c}\text{Break-even point}\\ \text{in unit sales}\end{array} &= \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}\\
&= \frac{\$135{,}000}{\$27 \text{ per lantern}} = 5{,}000 \text{ lanterns,}
\end{aligned}$$

or at $90 per lantern, $450,000 in sales

2. An increase in the variable expenses as a percentage of the selling price would result in a higher break-even point. The reason is that if variable expenses increase as a percentage of sales, then the contribution margin will decrease as a percentage of sales. A lower CM ratio would mean that more lanterns would have to be sold to generate enough contribution margin to cover the fixed costs.

Exercise 6-16 (continued)

3.

	Present: 8,000 Lanterns		*Proposed: 10,000 Lanterns**	
	Total	*Per Unit*	*Total*	*Per Unit*
Sales	$720,000	$90	$810,000	$81 **
Variable expenses	504,000	63	630,000	63
Contribution margin	216,000	$27	180,000	$18
Fixed expenses	135,000		135,000	
Net operating income	$ 81,000		$ 45,000	

* 8,000 lanterns × 1.25 = 10,000 lanterns

** $90 per lantern × 0.9 = $81 per lantern

As shown above, a 25% increase in volume is not enough to offset a 10% reduction in the selling price; thus, net operating income decreases.

4. Sales = Variable expenses + Fixed expenses + Profits

$81Q = $63Q + $135,000 + $72,000

$18Q = $207,000

Q = $207,000 ÷ $18 per lantern

Q = 11,500 lanterns

Alternative solution:

$$\text{Unit sales to attain target profit} = \frac{\text{Fixed expenses + Target profit}}{\text{Unit contribution margin}}$$

$$= \frac{\$135{,}000 + \$72{,}000}{\$18 \text{ per lantern}} = 11{,}500 \text{ lanterns}$$

Exercise 6-17 (30 minutes)

1.

	Model A100		Model B900		Total Company	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*
Sales	$700,000	100	$300,000	100	$1,000,000	100
Variable expenses.......	280,000	40	90,000	30	370,000	37
Contribution margin	$420,000	60	$210,000	70	630,000	63 *
Fixed expenses					598,500	
Net operating income..........					$ 31,500	

*630,000 ÷ $1,000,000 = 63%.

2. The break-even point for the company as a whole would be:

$$\text{Break-even point in total dollar sales} = \frac{\text{Fixed expenses}}{\text{Overall CM ratio}}$$

$$= \frac{\$598{,}500}{0.63} = \$950{,}000 \text{ in sales}$$

3. The additional contribution margin from the additional sales can be computed as follows:

$50,000 × 63% CM ratio = $31,500

Assuming no change in fixed expenses, all of this additional contribution margin should drop to the bottom line as increased net operating income.

This answer assumes no change in selling prices, variable costs per unit, fixed expenses, or sales mix.

Problem 6-18 (60 minutes)

1. The CM ratio is 60%:

Selling price	$15	100%
Variable expenses.............	6	40%
Contribution margin...........	$ 9	60%

2. $$\text{Break-even point in total sales dollars} = \frac{\text{Fixed expenses}}{\text{CM ratio}}$$

$$= \frac{\$180{,}000}{0.60} = \$300{,}000 \text{ sales}$$

3. $45,000 increased sales × 60% CM ratio = $27,000 increased contribution margin. Since fixed costs will not change, net operating income should also increase by $27,000.

4 a. $$\text{Degree of operating leverage} = \frac{\text{Contribution margin}}{\text{Net operating income}}$$

$$= \frac{\$216{,}000}{\$36{,}000} = 6$$

b. 6 × 15% = 90% increase in net operating income. In dollars, this increase would be 90% × $36,000 = $32,400.

Problem 6-18 (continued)

5.

	Last Year: 28,000 units		Proposed: 42,000 units*	
	Total	*Per Unit*	*Total*	*Per Unit*
Sales	$420,000	$15.00	$567,000	$13.50**
Variable expenses	168,000	6.00	252,000	6.00
Contribution margin	252,000	$ 9.00	315,000	$ 7.50
Fixed expenses	180,000		250,000	
Net operating income	$ 72,000		$ 65,000	

* 28,000 units × 1.5 = 42,000 units

** $15 per unit × 0.90 = $13.50 per unit

No, the changes should not be made.

6.

Expected total contribution margin: 28,000 units × 200% × $7 per unit*	$392,000
Present total contribution margin: 28,000 units × $9 per unit	252,000
Incremental contribution margin, and the amount by which advertising can be increased with net operating income remaining unchanged	$140,000

*$15 – ($6 + $2) = $7

Problem 6-19 (60 minutes)

1. The CM ratio is 30%.

	Total	*Per Unit*	*Percentage*
Sales (13,500 units).........	$270,000	$20	100%
Variable expenses............	189,000	14	70%
Contribution margin.........	$ 81,000	$ 6	30%

The break-even point is:

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$20Q &= \$14Q + \$90{,}000 + \$0 \\ \$\,6Q &= \$90{,}000 \\ Q &= \$90{,}000 \div \$6 \text{ per unit} \\ Q &= 15{,}000 \text{ units} \end{aligned}$$

15,000 units × $20 per unit = $300,000 in sales

Alternative solution:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \frac{\$90{,}000}{\$6 \text{ per unit}} = 15{,}000 \text{ units}$$

$$\text{Break-even point in sales dollars} = \frac{\text{Fixed expenses}}{\text{CM ratio}}$$

$$= \frac{\$90{,}000}{0.30} = \$300{,}000 \text{ in sales}$$

2. Incremental contribution margin:

$70,000 increased sales × 30% CM ratio	$21,000
Less increased fixed costs:	
Increased advertising cost................................	8,000
Increase in monthly net operating income	$13,000

Since the company presently has a loss of $9,000 per month, if the changes are adopted, the loss will turn into a profit of $4,000 per month.

Problem 6-19 (continued)

3.

Sales (27,000 units × \$18 per unit*)	\$486,000
Variable expenses	
(27,000 units × \$14 per unit)	378,000
Contribution margin	108,000
Fixed expenses (\$90,000 + \$35,000)	125,000
Net operating loss	\$(17,000)

*\$20 – (\$20 × 0.10) = \$18

4.

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$20Q &= \$14.60Q^{*} + \$90{,}000 + \$4{,}500 \\ \$5.40Q &= \$94{,}500 \\ Q &= \$94{,}500 \div \$5.40 \text{ per unit} \\ Q &= 17{,}500 \text{ units} \end{aligned}$$

*\$14.00 + \$0.60 = \$14.60.

Alternative solution:

$$\text{Unit sales to attain target profit} = \frac{\text{Fixed expenses + Target profit}}{\text{CM per unit}}$$

$$= \frac{\$90{,}000 + \$4{,}500}{\$5.40 \text{ per unit}^{**}}$$

$$= 17{,}500 \text{ units}$$

**\$6.00 – \$0.60 = \$5.40.

5. a. The new CM ratio would be:

	Per Unit	*Percentage*
Sales	\$20	100%
Variable expenses	7	35%
Contribution margin	\$13	65%

Problem 6-19 (continued)

The new break-even point would be:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \frac{\$208{,}000}{\$13 \text{ per unit}} = 16{,}000 \text{ units}$$

$$\text{Break-even point in sales dollars} = \frac{\text{Fixed expenses}}{\text{CM ratio}}$$

$$= \frac{\$208{,}000}{0.65} = \$320{,}000 \text{ in sales}$$

b. Comparative income statements follow:

	Not Automated			*Automated*		
	Total	*Per Unit*	*%*	*Total*	*Per Unit*	*%*
Sales (20,000 units)....	$400,000	$20	100	$400,000	$20	100
Variable expenses.......	280,000	14	70	140,000	7	35
Contribution margin....	120,000	$ 6	30	260,000	$13	65
Fixed expenses...........	90,000			208,000		
Net operating income..	$ 30,000			$ 52,000		

Problem 6-19 (continued)

c. Whether or not one would recommend that the company automate its operations depends on how much risk he or she is willing to take, and depends heavily on prospects for future sales. The proposed changes would increase the company's fixed costs and its break-even point. However, the changes would also increase the company's CM ratio (from 30% to 65%). The higher CM ratio means that once the break-even point is reached, profits will increase more rapidly than at present. If 20,000 units are sold next month, for example, the higher CM ratio will generate $22,000 more in profits than if no changes are made.

   The greatest risk of automating is that future sales may drop back down to present levels (only 13,500 units per month), and as a result, losses will be even larger than at present due to the company's greater fixed costs. (Note the problem states that sales are erratic from month to month.) In sum, the proposed changes will help the company if sales continue to trend upward in future months; the changes will hurt the company if sales drop back down to or near present levels.

   Note to the Instructor: Although it is not asked for in the problem, if time permits you may want to compute the point of indifference between the two alternatives in terms of units sold; i.e., the point where profits will be the same under either alternative. At this point, total revenue will be the same; hence, we include only costs in our equation:

$$\begin{aligned}
\text{Let } Q &= \text{Point of indifference in units sold} \\
\$14Q + \$90{,}000 &= \$7Q + \$208{,}000 \\
\$7Q &= \$118{,}000 \\
Q &= \$118{,}000 \div \$7 \text{ per unit} \\
Q &= 16{,}857 \text{ units (rounded)}
\end{aligned}$$

   If more than 16,857 units are sold, the proposed plan will yield the greatest profit; if less than 16,857 units are sold, the present plan will yield the greatest profit (or the least loss).

Problem 6-20 (30 minutes)

1.

	Product						*Total*	
	Sinks		*Mirrors*		*Vanities*			
Percentage of total sales	32%		40%		28%		100%	
Sales	$160,000	100%	$200,000	100%	$140,000	100%	$500,000	100%
Variable expenses	48,000	30%	160,000	80%	77,000	55%	285,000	57%
Contribution margin	$112,000	70%	$ 40,000	20%	$ 63,000	45%	215,000	43%*
Fixed expenses							223,600	
Net operating income (loss)							$(8,600)	

*$215,000 ÷ $500,000 = 43%.

Problem 6-20 (continued)

2. Break-even sales:

$$\text{Break-even point in total dollar sales} = \frac{\text{Fixed expenses}}{\text{CM ratio}}$$

$$= \frac{\$223{,}600}{0.43} = \$520{,}000 \text{ in sales}$$

3. Memo to the president:

   Although the company met its sales budget of $500,000 for the month, the mix of products sold changed substantially from that budgeted. This is the reason the budgeted net operating income was not met, and the reason the break-even sales were greater than budgeted. The company's sales mix was planned at 48% Sinks, 20% Mirrors, and 32% Vanities. The actual sales mix was 32% Sinks, 40% Mirrors, and 28% Vanities.

   As shown by these data, sales shifted away from Sinks, which provides our greatest contribution per dollar of sales, and shifted strongly toward Mirrors, which provides our least contribution per dollar of sales. Consequently, although the company met its budgeted level of sales, these sales provided considerably less contribution margin than we had planned, with a resulting decrease in net operating income. Notice from the attached statements that the company's overall CM ratio was only 43%, as compared to a planned CM ratio of 52%. This also explains why the break-even point was higher than planned. With less average contribution margin per dollar of sales, a greater level of sales had to be achieved to provide sufficient contribution margin to cover fixed costs.

Problem 6-21 (60 minutes)

1. Sales = Variable expenses + Fixed expenses + Profits

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$40Q &= \$25Q + \$300{,}000 + \$0 \\ \$15Q &= \$300{,}000 \\ Q &= \$300{,}000 \div \$15 \text{ per shirt} \\ Q &= 20{,}000 \text{ shirts} \end{aligned}$$

20,000 shirts × $40 per shirt = $800,000

Alternative solution:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \frac{\$300{,}000}{\$15 \text{ per shirt}} = 20{,}000 \text{ shirts}$$

$$\text{Break-even point in sales dollars} = \frac{\text{Fixed expenses}}{\text{CM ratio}}$$

$$= \frac{\$300{,}000}{0.375} = \$800{,}000 \text{ in sales}$$

2. See the graph on the following page.

3. The simplest approach is:

Break-even sales	20,000 shirts
Actual sales.........................	19,000 shirts
Sales short of break-even	1,000 shirts

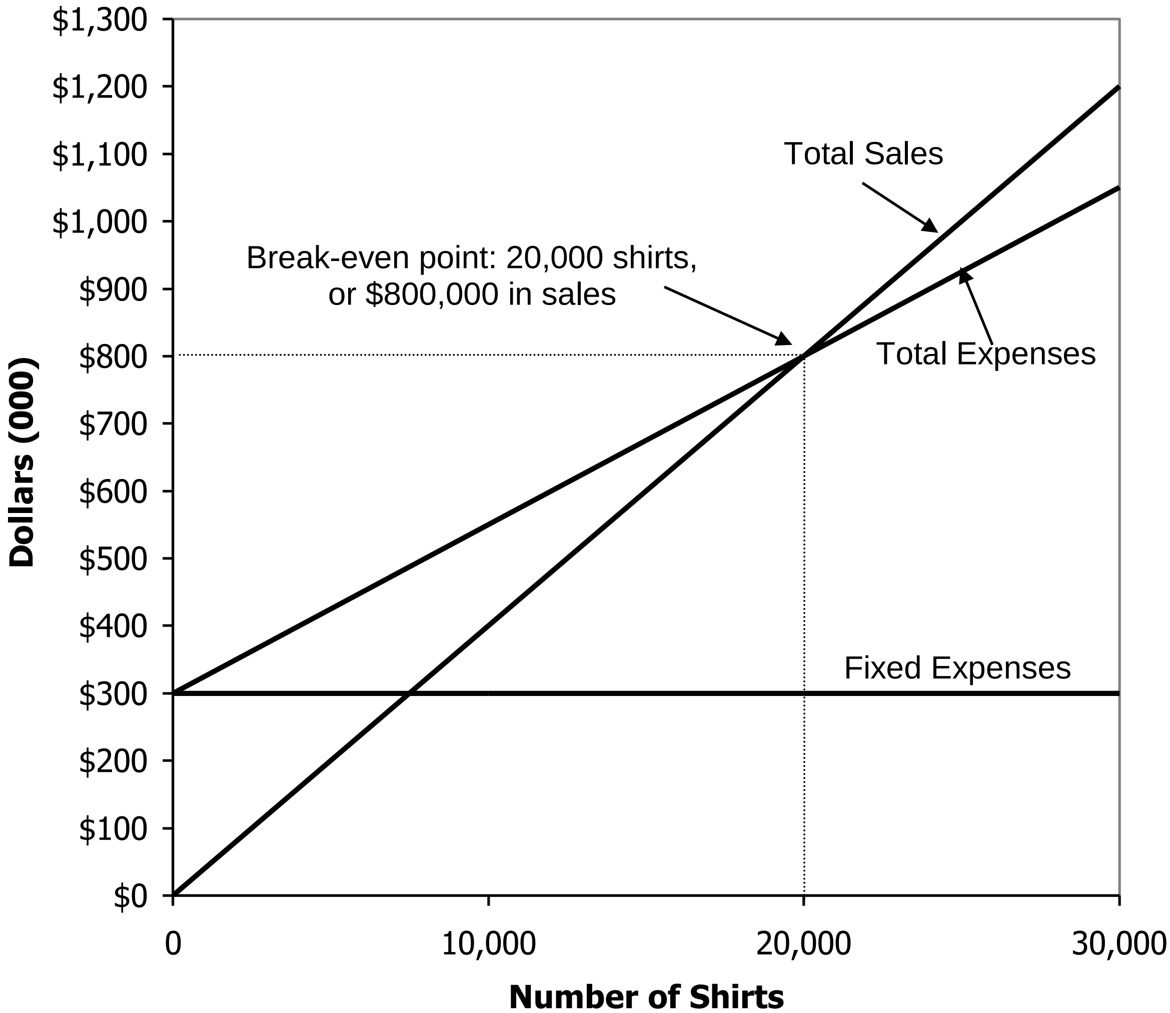
1,000 shirts × $15 contribution margin per shirt = $15,000 loss

Alternative solution:

Sales (19,000 shirts × $40 per shirt)	$760,000
Variable expenses (19,000 shirts × $25 per shirt).......	475,000
Contribution margin...	285,000
Fixed expenses..	300,000
Net operating loss	$(15,000)

Problem 6-21 (continued)

2. Cost-volume-profit graph:



Problem 6-21 (continued)

4. The variable expenses will now be \$28 (\$25 + \$3) per shirt, and the contribution margin will be \$12 (\$40 – \$28) per shirt.

$$
\begin{aligned}
\text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\
\$40Q &= \$28Q + \$300{,}000 + \$0 \\
\$12Q &= \$300{,}000 \\
Q &= \$300{,}000 \div \$12 \text{ per shirt} \\
Q &= 25{,}000 \text{ shirts}
\end{aligned}
$$

25,000 shirts × \$40 per shirt = \$1,000,000 in sales

Alternative solution:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \frac{\$300{,}000}{\$12 \text{ per shirt}} = 25{,}000 \text{ shirts}$$

$$\text{Break-even point in sales dollars} = \frac{\text{Fixed expenses}}{\text{CM ratio}}$$

$$= \frac{\$300{,}000}{0.30} = \$1{,}000{,}000 \text{ in sales}$$

5. The simplest approach is:

Actual sales	23,500 shirts
Break-even sales	20,000 shirts
Excess over break-even sales	3,500 shirts

3,500 shirts × \$12 per shirt* = \$42,000 profit

*\$15 present contribution margin – \$3 commission = \$12 per shirt

Problem 6-21 (continued)

Alternative solution:

Sales (23,500 shirts × \$40 per shirt)	\$940,000
Variable expenses [(20,000 shirts × \$25 per shirt) + (3,500 shirts × \$28 per shirt)]........................	598,000
Contribution margin..	342,000
Fixed expenses..	300,000
Net operating income	\$ 42,000

6. a. The new variable expense will be \$18 per shirt (the invoice price).

$$
\begin{aligned}
\text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits}\\
\$40Q &= \$18Q + \$407{,}000 + \$0\\
\$22Q &= \$407{,}000\\
Q &= \$407{,}000 \div \$22 \text{ per shirt}\\
Q &= 18{,}500 \text{ shirts}
\end{aligned}
$$

18,500 shirts × \$40 shirt = \$740,000 in sales

b. Although the change will lower the break-even point from 20,000 shirts to 18,500 shirts, the company must consider whether this reduction in the break-even point is more than offset by the possible loss in sales arising from having the sales staff on a salaried basis. Under a salary arrangement, the sales staff may have far less incentive to sell than under the present commission arrangement, resulting in a loss of sales and a reduction in profits. Although it generally is desirable to lower the break-even point, management must consider the other effects of a change in the cost structure. The break-even point could be reduced dramatically by doubling the selling price per shirt, but it does not necessarily follow that this would increase the company's profit.

Problem 6-22 (45 minutes)

1.

Sales (25,000 units × SFr 90 per unit)	SFr 2,250,000
Variable expenses	
(25,000 units × SFr 60 per unit)	1,500,000
Contribution margin	750,000
Fixed expenses	840,000
Net operating loss	SFr (90,000)

2.

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \frac{\text{SFr } 840{,}000}{\text{SFr } 30 \text{ per unit}} = 28{,}000 \text{ units}$$

28,000 units × SFr 90 per unit = SFr 2,520,000 to break even.

3.

Unit Sales Price	*Unit Variable Expense*	*Unit Contribution Margin*	*Volume (Units)*	*Total Contribution Margin*	*Fixed Expenses*	*Net Operating Income*
SFr 90	SFr 60	SFr 30	25,000	SFr 750,000	SFr 840,000	SFr (90,000)
88	60	28	30,000	840,000	840,000	0
86	60	26	35,000	910,000	840,000	70,000
84	60	24	40,000	960,000	840,000	120,000
82	60	22	45,000	990,000	840,000	150,000
80	60	20	50,000	1,000,000	840,000	160,000
78	60	18	55,000	990,000	840,000	150,000

Problem 6-22 (continued)

Thus, the maximum profit is SFr 160,000. This level of profit can be earned by selling 50,000 units at a selling price of SFr 80 per unit.

4. At a selling price of SFr 80 per unit, the contribution margin is SFr 20 per unit. Therefore:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \frac{\text{SFr } 840{,}000}{\text{SFr } 20 \text{ per unit}}$$

$$= 42{,}000 \text{ units}$$

42,000 units × SFr 80 per unit = SFr 3,360,000 to break even.

This break-even point is different from the break-even point in (2) because of the change in selling price. With the change in selling price, the unit contribution margin drops from SFr 30 to SFr 20, thereby driving up the break-even point.

Problem 6-23 (60 minutes)

1.

$$\begin{aligned}
\text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\
\$2.00Q &= \$0.80Q + \$60{,}000 + \$0 \\
\$1.20Q &= \$60{,}000 \\
Q &= \$60{,}000 \div \$1.20 \text{ per pair} \\
Q &= 50{,}000 \text{ pairs}
\end{aligned}$$

50,000 pairs × $2 per pair = $100,000 in sales.

Alternative solution:

$$\begin{array}{c}\text{Break-even point} \\ \text{in unit sales}\end{array} = \frac{\text{Fixed expenses}}{\text{CM per unit}} = \frac{\$60{,}000}{\$1.20 \text{ per pair}} = 50{,}000 \text{ pairs}$$

$$\begin{array}{c}\text{Break-even point} \\ \text{in dollar sales}\end{array} = \frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$60{,}000}{0.60} = \$100{,}000 \text{ in sales}$$

2. See the graph on the following page.

3.

$$\begin{aligned}
\text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\
\$2.00Q &= \$0.80Q + \$60{,}000 + \$9{,}000 \\
\$1.20Q &= \$69{,}000 \\
Q &= \$69{,}000 \div \$1.20 \text{ per pair} \\
Q &= 57{,}500 \text{ pairs}
\end{aligned}$$

Alternative solution:

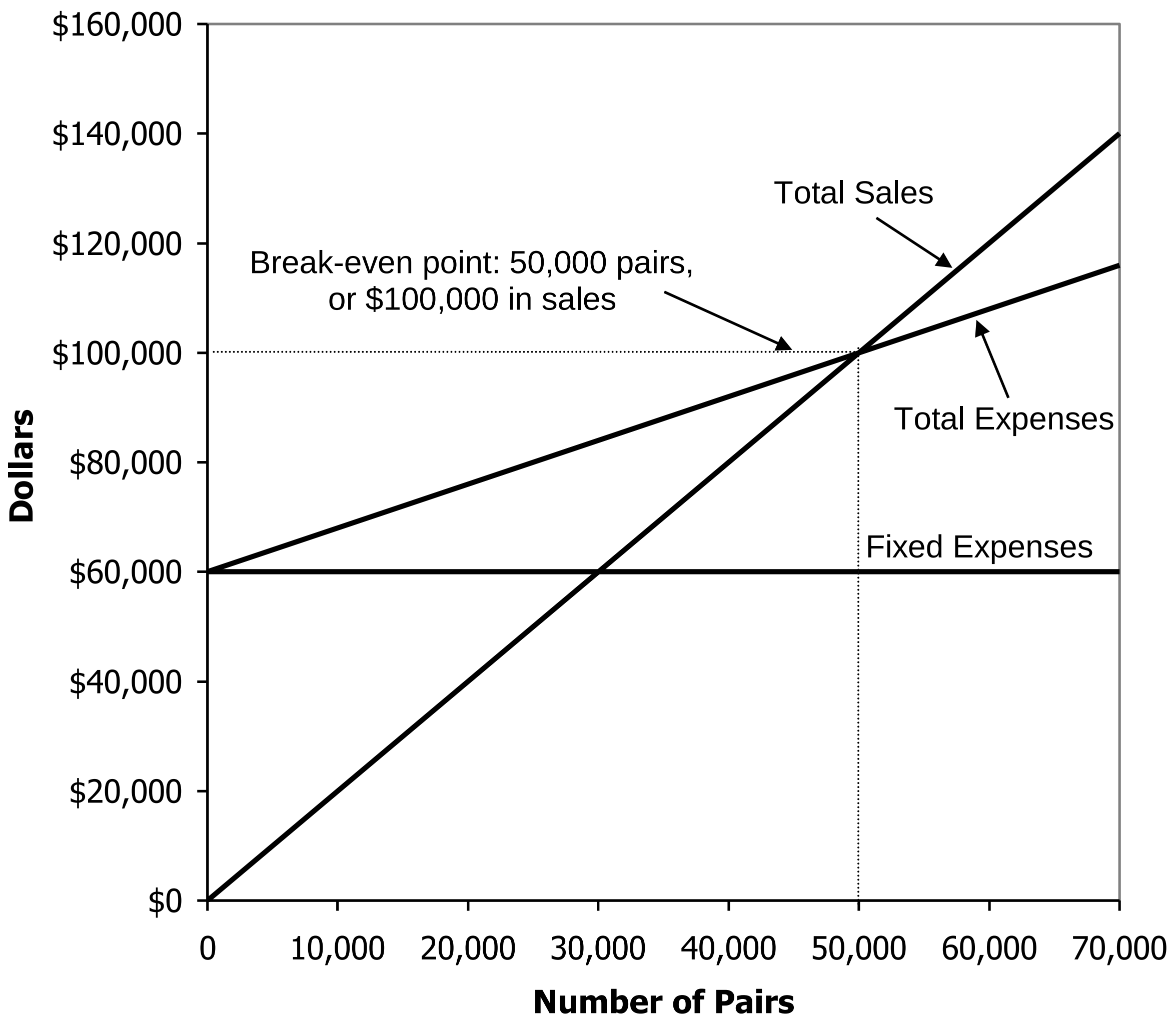
$$\begin{array}{c}\text{Unit sales to attain} \\ \text{target profit}\end{array} = \frac{\text{Fixed expenses} + \text{Target profit}}{\text{CM per unit}}$$

$$= \frac{\$60{,}000 + \$9{,}000}{\$1.20 \text{ per pair}}$$

$$= 57{,}500 \text{ pairs}$$

Problem 6-23 (continued)

2. Cost-volume-profit graph:



Problem 6-23 (continued)

4. Incremental contribution margin:

$20,000 increased sales × 60% CM ratio	$12,000
Less incremental fixed salary cost	8,000
Increased net operating income	$ 4,000

   Yes, the position should be converted to a full-time basis.

5. a. Degree of operating leverage:

$$\frac{\text{Contribution margin}}{\text{Net operating income}} = \frac{\$75,000}{\$15,000} = 5$$

   b. 5 × 20% sales increase = 100% increase in net operating income. Thus, net operating income would double next year, going from $15,000 to $30,000.

Problem 6-24 (30 minutes)

1. The contribution margin per stein would be:

Selling price		$30
Variable expenses:		
Purchase cost of the steins	$15	
Commissions to the student salespersons	6	21
Contribution margin		$ 9

Since there are no fixed costs, the number of unit sales needed to yield the desired $7,200 in profits can be obtained by dividing the target profit by the unit contribution margin:

$$\frac{\text{Target profit}}{\text{Unit contribution margin}} = \frac{\$7{,}200}{\$9 \text{ per stein}} = 800 \text{ steins}$$

800 steins × $30 per stein = $24,000 in total sales

2. Since an order has been placed, there is now a "fixed" cost associated with the purchase price of the steins (i.e., the steins can't be returned). For example, an order of 200 steins requires a "fixed" cost (investment) of $3,000 (200 steins × $15 per stein = $3,000). The variable costs drop to only $6 per stein, and the new contribution margin per stein becomes:

Selling price	$30
Variable expenses (commissions only)	6
Contribution margin	$24

Since the "fixed" cost of $3,000 must be recovered before Mr. Marbury shows any profit, the break-even computation would be:

$$\begin{array}{c}\text{Break-even point} \\ \text{in unit sales}\end{array} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}} = \frac{\$3{,}000}{\$24 \text{ per stein}} = 125 \text{ steins}$$

125 steins × $30 per stein =$3,750 in total sales

If a quantity other than 200 steins were ordered, the answer would change accordingly.

Problem 6-25 (45 minutes)

1. a.

	Alvaro		*Bazan*		*Total*	
	Euros	*%*	*Euros*	*%*	*Euros*	*%*
Sales	€800	100	€480	100	€1,280	100
Variable expenses	480	60	96	20	576	45
Contribution margin	€320	40	€384	80	704	55
Fixed expenses					660	
Net operating income					€ 44	

b. Break-even sales = Fixed expenses ÷ CM ratio
= €660 ÷ 0.55 = €1,200

Margin of safety in euros = Actual sales - Break-even sales
= €1,280 - €1,200
= €80

Margin of safety percentage = Margin of safety in euros ÷ Actual sales
= €80 ÷ €1,280
= 6.25%

Problem 6-25 (continued)

2. a.

	Alvaro		*Bazan*		*Cano*		*Total*	
	Euros	*%*	*Euros*	*%*	*Euros*	*%*	*Euros*	*%*
Sales	€800	100	€480	100	€320	100	€1,600	100
Variable expenses	480	60	96	20	240	75	816	51
Contribution margin	€320	40	€384	80	€ 80	25	784	49
Fixed expenses							660	
Net operating income							€ 124	

Problem 6-25 (continued)

b. Break-even sales = Fixed expenses ÷ CM ratio
= €660 ÷ 0.49
= €1,347 (rounded)

Margin of safety in euros = Actual sales - Break-even sales
= €1,600 - €1,347
= €253

Margin of safety percentage = Margin of safety in euros ÷ Actual sales
= €253 ÷ €1,600
= 15.81%

3. The reason for the increase in the break-even point can be traced to the decrease in the company's average contribution margin ratio when the third product is added. Note from the income statements above that this ratio drops from 55% to 49% with the addition of the third product. This product, called Cano, has a CM ratio of only 25%, which causes the average contribution margin ratio to fall.

   This problem shows the somewhat tenuous nature of break-even analysis when more than one product is involved. The manager must be very careful of his or her assumptions regarding sales mix when making decisions such as adding or deleting products.

   It should be pointed out to the president that even though the break-even point is higher with the addition of the third product, the company's margin of safety is also greater. Notice that the margin of safety increases from €80 to €253 or from 6.25% to 15.81%. Thus, the addition of the new product shifts the company much further from its break-even point, even though the break-even point is higher.

Problem 6-26 (60 minutes)

1. April's Income Statement:

	Standard		*Deluxe*		*Pro*		*Total*	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*	*Amount*	*%*
Sales	$80,000	100	$60,000	100	$450,000	100	$590,000	100
Variable expenses:								
Production	44,000	55	27,000	45	157,500	35	228,500	38.7
Selling	4,000	5	3,000	5	22,500	5	29,500	5.0
Total variable expenses	48,000	60	30,000	50	180,000	40	258,000	43.7
Contribution margin	$32,000	40	$30,000	50	$270,000	60	332,000	56.3
Fixed expenses:								
Production							120,000	
Advertising							100,000	
Administrative							50,000	
Total fixed expenses							270,000	
Net operating income							$ 62,000	

Problem 6-26 (continued)

May's Income Statement:

	Standard		Deluxe		Pro		Total	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*	*Amount*	*%*
Sales	$320,000	100	$60,000	100	$270,000	100	$650,000	100
Variable expenses:								
Production	176,000	55	27,000	45	94,500	35	297,500	45.8
Selling	16,000	5	3,000	5	13,500	5	32,500	5.0
Total variable expenses	192,000	60	30,000	50	108,000	40	330,000	50.8
Contribution margin	$128,000	40	$30,000	50	$162,000	60	320,000	49.2
Fixed expenses:								
Production							120,000	
Advertising							100,000	
Administrative							50,000	
Total fixed expenses							270,000	
Net operating income							$ 50,000	

Problem 6-26 (continued)

2. The sales mix has shifted over the last month from a greater concentration of Pro rackets to a greater concentration of Standard rackets. This shift has caused a decrease in the company's overall CM ratio from 56.3% in April to only 49.2% in May. For this reason, even though total sales (both in units and in dollars) is greater, net operating income is lower than last month in the division.

3. The break-even in dollar sales can be computed as follows:

$$\frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$270{,}000}{0.563} = \$479{,}574 \text{ (rounded)}$$

4. May's break-even point has gone up. The reason is that the division's overall CM ratio has declined for May as stated in (2) above. Unchanged fixed expenses divided by a lower overall CM ratio would yield a higher break-even point in sales dollars.

5.

	Standard	*Pro*
Increase in sales	$20,000	$20,000
Multiply by the CM ratio	× 40%	× 60%
Increase in net operating income*	$ 8,000	$12,000

*Assuming that fixed costs do not change.

Problem 6-27 (75 minutes)

1. a.

Selling price	$37.50	100%
Variable expenses	22.50	60%
Contribution margin	$15.00	40%

$$
\begin{aligned}
\text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\
\$37.50Q &= \$22.50Q + \$480{,}000 + \$0 \\
\$15.00Q &= \$480{,}000 \\
Q &= \$480{,}000 \div \$15.00 \text{ per skateboard} \\
Q &= 32{,}000 \text{ skateboards}
\end{aligned}
$$

Alternative solution:

$$
\begin{aligned}
\begin{array}{c}\text{Break-even point}\\ \text{in unit sales}\end{array} &= \frac{\text{Fixed expenses}}{\text{CM per unit}} \\
&= \frac{\$480{,}000}{\$15 \text{ per skateboard}} \\
&= 32{,}000 \text{ skateboards}
\end{aligned}
$$

b. The degree of operating leverage would be:

$$
\begin{aligned}
\text{Degree of operating leverage} &= \frac{\text{Contribution margin}}{\text{Net operating income}} \\
&= \frac{\$600{,}000}{\$120{,}000} = 5.0
\end{aligned}
$$

2. The new CM ratio will be:

Selling price	$37.50	100%
Variable expenses	25.50	68%
Contribution margin	$12.00	32%

Problem 6-27 (continued)

The new break-even point will be:

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$37.50Q &= \$25.50Q + \$480{,}000 + \$0 \\ \$12.00Q &= \$480{,}000 \\ Q &= \$480{,}000 \div \$12.00 \text{ per skateboard} \\ Q &= 40{,}000 \text{ skateboards} \end{aligned}$$

Alternative solution:

$$\begin{aligned} \text{Break-even point in unit sales} &= \frac{\text{Fixed expenses}}{\text{CM per unit}} \\ &= \frac{\$480{,}000}{\$12 \text{ per skateboard}} \\ &= 40{,}000 \text{ skateboards} \end{aligned}$$

3.
$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$37.50Q &= \$25.50Q + \$480{,}000 + \$120{,}000 \\ \$12.00Q &= \$600{,}000 \\ Q &= \$600{,}000 \div \$12.00 \text{ per skateboard} \\ Q &= 50{,}000 \text{ skateboards} \end{aligned}$$

Alternative solution:

$$\begin{aligned} \text{Unit sales to attain target profit} &= \frac{\text{Fixed expenses} + \text{Target profit}}{\text{CM per unit}} \\ &= \frac{\$480{,}000 + \$120{,}000}{\$12 \text{ per skateboard}} \\ &= 50{,}000 \text{ skateboards} \end{aligned}$$

Problem 6-27 (continued)

Thus, sales will have to increase by 10,000 skateboards (50,000 skateboards, less 40,000 skateboards currently being sold) to earn the same amount of net operating income as earned last year. The computations above and in part (2) show quite clearly the dramatic effect that increases in variable costs can have on an organization. These effects from a $3 per unit increase in labor costs for Tyrene Company are summarized below:

	Present	*Expected*
Break-even point (in skateboards)	32,000	40,000
Sales (in skateboards) needed to earn net operating income of $120,000	40,000	50,000

Note particularly that if variable costs do increase next year, then the company will just break even if it sells the same number of skateboards (40,000) as it did last year.

4. The contribution margin ratio last year was 40%. If we let P equal the new selling price, then:

$$P = \$25.50 + 0.40P$$
$$0.60P = \$25.50$$
$$P = \$25.50 \div 0.60$$
$$P = \$42.50$$

To verify:			
	Selling price	$42.50	100%
	Variable expenses	25.50	60%
	Contribution margin	$17.00	40%

Therefore, to maintain a 40% CM ratio, a $3 increase in variable costs would require a $5 increase in the selling price.

Problem 6-27 (continued)

5. The new CM ratio would be:

Selling price	$37.50	100%
Variable expenses	13.50 *	36%
Contribution margin	$24.00	64%

*$22.50 – ($22.50 × 40%) = $13.50

The new break-even point would be:

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$37.50Q &= \$13.50Q + \$912{,}000^{*} + \$0 \\ \$24.00Q &= \$912{,}000 \\ Q &= \$912{,}000 \div \$24.00 \text{ per skateboard} \\ Q &= 38{,}000 \text{ skateboards} \end{aligned}$$

*$480,000 × 1.9 = $912,000

Alternative solution:

$$\begin{aligned} \text{Break-even point in unit sales} &= \frac{\text{Fixed expenses}}{\text{CM per unit}} \\ &= \frac{\$912{,}000}{\$24 \text{ per skateboard}} \\ &= 38{,}000 \text{ skateboards} \end{aligned}$$

Although this break-even figure is greater than the company's present break-even figure of 32,000 skateboards [see part (1) above], it is less than the break-even point will be if the company does not automate and variable labor costs rise next year [see part (2) above].

Problem 6-27 (continued)

6. a.

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$37.50Q &= \$13.50Q + \$912{,}000^{*} + \$120{,}000 \\ \$24.00Q &= \$1{,}032{,}000 \\ Q &= \$1{,}032{,}000 \div \$24.00 \text{ per skateboard} \\ Q &= 43{,}000 \text{ skateboards} \end{aligned}$$

*480,000 × 1.9 = $912,000

Alternative solution:

$$\begin{aligned} \text{Unit sales to attain target profit} &= \frac{\text{Fixed expenses} + \text{Target profit}}{\text{CM per unit}} \\ &= \frac{\$912{,}000 + \$120{,}000}{\$24 \text{ per skateboard}} \\ &= 43{,}000 \text{ skateboards} \end{aligned}$$

Thus, the company will have to sell 3,000 more skateboards (43,000 – 40,000 = 3,000) than now being sold to earn a profit of $120,000 each year. However, this is still far less than the 50,000 skateboards that would have to be sold to earn a $120,000 profit if the plant is not automated and variable labor costs rise next year [see part (3) above].

Problem 6-27 (continued)

b. The contribution income statement would be:

Sales	
(40,000 skateboards × $37.50 per skateboard)..	$1,500,000
Variable expenses	
(40,000 skateboards × $13.50 per skateboard) .	540,000
Contribution margin..	960,000
Fixed expenses..	912,000
Net operating income...	$ 48,000

$$\text{Degree of operating leverage} = \frac{\text{Contribution margin}}{\text{Net operating income}}$$

$$= \frac{\$960{,}000}{\$48{,}000} = 20$$

c. This problem shows the difficulty faced by many firms today. Variable costs for labor are rising, yet because of competitive pressures it is often difficult to pass these cost increases along in the form of a higher price for products. Thus, firms are forced to automate (to some degree) resulting in higher operating leverage, often a higher break-even point, and greater risk for the company.

There is no clear answer as to whether one should have been in favor of constructing the new plant. However, this question provides an opportunity to bring out points such as in the preceding paragraph and it forces students to think about the issues.

Problem 6-28 (30 minutes)

1. The numbered components are as follows:
   - (1) Dollars of revenue and costs.
   - (2) Volume of output, expressed in units,% of capacity, sales, or some other measure of activity.
   - (3) Total expense line.
   - (4) Variable expense area.
   - (5) Fixed expense area.
   - (6) Break-even point.
   - (7) Loss area.
   - (8) Profit area.
   - (9) Revenue line.

Problem 6-28 (continued)

2. a. Line 3: Remain unchanged.
   Line 9: Have a flatter slope.
   Break-even point: Increase.

   b. Line 3: Have a steeper slope.
   Line 9: Remain unchanged.
   Break-even point: Increase.

   c. Line 3: Shift downward.
   Line 9: Remain unchanged.
   Break-even point: Decrease.

   d. Line 3: Remain unchanged.
   Line 9: Remain unchanged.
   Break-even point: Remain unchanged.

   e. Line 3: Shift upward and have a flatter slope.
   Line 9: Remain unchanged.
   Break-even point: Probably change, but the direction is uncertain.

   f. Line 3: Have a flatter slope.
   Line 9: Have a flatter slope.
   Break-even point: Remain unchanged in terms of units; decrease in terms of total dollars of sales.

   g. Line 3: Shift upward.
   Line 9: Remain unchanged.
   Break-even point: Increase.

   h. Line 3: Shift downward and have a steeper slope.
   Line 9: Remain unchanged.
   Break-even point: Probably change, but the direction is uncertain.

Problem 6-29 (30 minutes)

1. The contribution margin per unit on the first 30,000 units is:

	Per Unit
Selling price	$2.50
Variable expenses	1.60
Contribution margin	$0.90

The contribution margin per unit on anything over 30,000 units is:

	Per Unit
Selling price	$2.50
Variable expenses	1.75
Contribution margin	$0.75

Thus, for the first 30,000 units sold, the total amount of contribution margin generated would be:

30,000 units × $0.90 per unit = $27,000.

Since the fixed costs on the first 30,000 units total $40,000, the $27,000 contribution margin above is not enough to permit the company to break even. Therefore, in order to break even, more than 30,000 units will have to be sold. The fixed costs that will have to be covered by the additional sales are:

Fixed costs on the first 30,000 units	$40,000
Less contribution margin from the first 30,000 units	27,000
Remaining unrecovered fixed costs	13,000
Add monthly rental cost of the additional space needed to produce more than 30,000 units	2,000
Total fixed costs to be covered by remaining sales	$15,000

Problem 6-29 (continued)

The additional sales of units required to cover these fixed costs would be:

$$\frac{\text{Total remaining fixed costs}}{\text{Unit contribution margin on added units}} = \frac{\$15{,}000}{\$0.75 \text{ per unit}}$$

$$= 20{,}000 \text{ units}$$

Therefore, a total of 50,000 units (30,000 + 20,000) must be sold for the company to break even. This number of units would equal total sales of:

50,000 units × \$2.50 per unit = \$125,000 in total sales.

2 $$\frac{\text{Target profit}}{\text{Unit contribution margin}} = \frac{\$9{,}000}{\$0.75 \text{ per unit}} = 12{,}000 \text{ units}$$

Thus, the company must sell 12,000 units above the break-even point to earn a profit of \$9,000 each month. These units, added to the 50,000 units required to break even, would equal total sales of 62,000 units each month to reach the target profit figure.

3. If a bonus of \$0.15 per unit is paid for each unit sold in excess of the break-even point, then the contribution margin on these units would drop from \$0.75 to only \$0.60 per unit.

   The desired monthly profit would be:

   25% × (\$40,000 + \$2,000) = \$10,500

   Thus,

$$\frac{\text{Target profit}}{\text{Unit contribution margin}} = \frac{\$10{,}500}{\$0.60 \text{ per unit}} = 17{,}500 \text{ units}$$

   Therefore, the company must sell 17,500 units above the break-even point to earn a profit of \$10,500 each month. These units, added to the 50,000 units required to break even, would equal total sales of 67,500 units each month.

Problem 6-30 (60 minutes)

1. The income statements would be:

	Present			*Proposed*		
	Amount	*Per Unit*	*%*	*Amount*	*Per Unit*	*%*
Sales	$800,000	$20	100	$800,000	$20	100
Variable expenses	560,000	14	70	320,000	8 *	40
Contribution margin	240,000	$6	30	480,000	$12	60
Fixed expenses	192,000			432,000		
Net operating income	$ 48,000			$ 48,000		

*$14 – $6 = $8

2. a.

	Present	*Proposed*
Degree of operating leverage	$\frac{\$240,000}{\$48,000}=5$	$\frac{\$480,000}{\$48,000}=10$

b.

Break-even point in dollars	$\frac{\$192,000}{0.30}=\$640,000$	$\frac{\$432,000}{0.60}=\$720,000$

c.

Margin of safety = Total sales – Break-even sales:		
$800,000 – $640,000	$160,000	
$800,000 – $720,000		$80,000
Margin of safety percentage = Margin of safety ÷ Total sales:		
$160,000 ÷ $800,000	20%	
$80,000 ÷ $800,000		10%

Problem 6-30 (continued)

3. The major factor would be the sensitivity of the company's operations to cyclical movements in the economy. In years of strong economic activity, the company will be better off with the new equipment. The new equipment will increase the CM ratio and, as a consequence, profits would rise more rapidly in years with strong sales. However, the company will be worse off with the new equipment in years in which sales drop. The greater fixed costs of the new equipment will result in losses being incurred more quickly and they will be deeper. Thus, management must decide whether the potential greater profits in good years is worth the risk of deeper losses in bad years.

4. No information is given in the problem concerning the new variable expenses or the new contribution margin ratio. Both of these items must be determined before the new break-even point can be computed. The computations are:

   New variable expenses:

   Sales = Variable expenses + Fixed expenses + Profits
   $1,200,000* = Variable expenses + $240,000 + $60,000**
   $900,000 = Variable expenses

   * New level of sales: $800,000 × 1.5 = $1,200,000
   ** New level of net operating income: $48,000 × 1.25 = $60,000

   New CM ratio:

Sales	$1,200,000	100%
Variable expenses	900,000	75%
Contribution margin	$ 300,000	25%

   With the above data, the new break-even point can be computed:

$$\text{Break-even point in dollar sales} = \frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$240,000}{0.25} = \$960,000$$

Problem 6-30 (continued)

The greatest risk is that the marketing manager's estimates of increases in sales and net operating income will not materialize and that sales will remain at their present level. Note that the present level of sales is $800,000, which is well below the break-even level of sales under the new marketing method.

It would be a good idea to compare the new marketing strategy to the current situation more directly. What level of sales would be needed under the new method to generate at least the $48,000 in profits the company is currently earning each month? The computations are:

$$\text{Dollar sales to attain target profit} = \frac{\text{Fixed expenses + Target profit}}{\text{CM ratio}}$$

$$= \frac{\$240{,}000 + \$48{,}000}{0.25}$$

$$= \$1{,}152{,}000 \text{ in sales each month}$$

Thus, sales would have to increase by at least 44% ($1,152,000 is 44% higher than $800,000) in order to make the company better off with the new marketing strategy than with the current situation. This appears to be extremely risky.

CASE 6-31 (60 minutes)

1. The overall break-even sales can be determined using the CM ratio.

	Frog	*Minnow*	*Worm*	*Total*
Sales	$200,000	$280,000	$240,000	$720,000
Variable expenses	120,000	160,000	150,000	430,000
Contribution margin	$ 80,000	$120,000	$ 90,000	290,000
Fixed expenses				282,000
Net operating income				$ 8,000

$$\text{CM ratio} = \frac{\text{Contribution margin}}{\text{Sales}} = \frac{\$290{,}000}{\$720{,}000} = 0.4028$$

$$\begin{array}{c}\text{Break-even point in}\\ \text{total sales dollars}\end{array} = \frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$282{,}000}{0.4028} = \$700{,}100 \text{ (rounded)}$$

2. The issue is what to do with the common fixed cost when computing the break-evens for the individual products. The correct approach is to ignore the common fixed costs. If the common fixed costs are included in the computations, the break-even points will be overstated for individual products and managers may drop products that in fact are profitable.

   a. The break-even points for each product can be computed using the contribution margin approach as follows:

	Frog	*Minnow*	*Worm*
Unit selling price	$2.00	$1.40	$0.80
Variable cost per unit	1.20	0.80	0.50
Unit contribution margin (a)	$0.80	$0.60	$0.30
Product fixed expenses (b)	$18,000	$96,000	$60,000
Break-even point in units sold (b)÷(a)	22,500	160,000	200,000

   b. If the company were to sell exactly the break-even quantities computed above, the company would lose $108,000—the amount of the common fixed cost. This occurs because the common fixed costs have been ignored in the calculations of the break-evens.

Case 6-31 (continued)

The fact that the company loses $108,000 if it operates at the level of sales indicated by the break-evens for the individual products can be verified as follows:

	Frog	*Minnow*	*Worm*	*Total*
Unit sales	22,500	160,000	200,000	
Sales	$45,000	$224,000	$160,000	$ 429,000
Variable expenses	27,000	128,000	100,000	255,000
Contribution margin .	$18,000	$ 96,000	$ 60,000	174,000
Fixed expenses				282,000
Net operating loss				$(108,000)

At this point, many students conclude that something is wrong with their answer to part (a) since the company loses money operating at the break-evens for the individual products. They also worry that managers may be lulled into a false sense of security if they are given the break-evens computed in part (a). Total sales at the individual product break-evens is only $429,000 whereas the total sales at the overall break-even computed in part (1) is $700,100.

Many students (and managers, for that matter) attempt to resolve this apparent paradox by allocating the common fixed costs among the products prior to computing the break-evens for individual products. Any of a number of allocation bases could be used for this purpose—sales, variable expenses, product-specific fixed expenses, contribution margins, etc. (We usually take a tally of how many students allocated the common fixed costs using each possible allocation base before proceeding.) For example, the common fixed costs are allocated on the next page based on sales.

Case 6-31 (continued)

Allocation of common fixed expenses on the basis of sales revenue:

	Frog	*Minnow*	*Worm*	*Total*
Sales	$200,000	$280,000	$240,000	$720,000
Percentage of total sales	27.8%	38.9%	33.3%	100.0%
Allocated common fixed expense*	$30,000	$ 42,000	$36,000	$108,000
Product fixed expenses	18,000	96,000	60,000	174,000
Allocated common and product fixed expenses (a)	$48,000	$138,000	$96,000	$282,000
Unit contribution margin (b)	$0.80	$0.60	$0.30	
"Break-even" point in units sold (a)÷(b)	60,000	230,000	320,000	

*Total common fixed expense × Percentage of total sales

If the company sells 60,000 units of the Frog lure product, 230,000 units of the Minnow lure product, and 320,000 units of the Worm lure product, the company will indeed break even overall. However, the apparent break-evens for two of the products are above their normal annual sales.

	Frog	*Minnow*	*Worm*
Normal annual unit sales volume	100,000	200,000	300,000
"Break-even" unit annual sales (see above)	60,000	230,000	320,000
"Strategic" decision	retain	drop	drop

Case 6-31 (continued)

It would be natural to interpret a break-even for a product as the level of sales below which the company would be financially better off dropping the product. Therefore, we should not be surprised if managers, based on the erroneous break-even calculation on the previous page, would decide to drop the Minnow and Worm lures and concentrate on the company's "core competency", which appears to be the Frog lure. However, if they were to do that, the company would face a loss of $46,000:

	Frog	*Minnow*	*Worm*	*Total*
Sales	$200,000	dropped	dropped	$200,000
Variable expenses	120,000			120,000
Contribution margin	$ 80,000			80,000
Fixed expenses*				126,000
Net operating loss				$(46,000)

*By dropping the two products, the company reduces its fixed expenses by only $156,000 (=$96,000 + $60,000). Therefore, the total fixed expenses would be $126,000 (=$282,000 - $156,000).

By dropping the two products, the company would have a loss of $46,000 rather than a profit of $8,000. The reason is that the two dropped products were contributing $54,000 toward covering common fixed expenses and toward profits. This can be verified by looking at a segmented income statement like the one that will be introduced in a later chapter.

	Frog	*Minnow*	*Worm*	*Total*
Sales	$200,000	$280,000	$240,000	$720,000
Variable expenses	120,000	160,000	150,000	430,000
Contribution margin	80,000	120,000	90,000	290,000
Product fixed expenses	18,000	96,000	60,000	174,000
Product segment margin	$ 62,000	$ 24,000	$ 30,000	116,000
Common fixed expenses				108,000
Net operating income				$ 8,000

$54,000

Case 6-32 (75 minutes)

1. The contribution format income statements (in thousands of dollars) for the three alternatives are:

	18% Commission		*20% Commission*		*Own Sales Force*		
Sales	$30,000	100%	$30,000	100%	$30,000		100%
Variable expenses:							
Variable cost of goods sold	17,400		17,400		17,400		
Commissions	5,400		6,000		3,000		
Total variable expense	22,800	76%	23,400	78%	20,400		68%
Contribution margin	7,200	24%	6,600	22%	9,600		32%
Fixed expenses:							
Fixed cost of goods sold	2,800		2,800		2,800		
Fixed advertising expense	800		800		1,300	*	
Fixed marketing staff expense					1,300	**	
Fixed administrative expense	3,200		3,200		3,200		
Total fixed expenses	6,800		6,800		8,600		
Net operating income	$ 400		($ 200)		$ 1,000		

* $800,000 + $500,000 = $1,300,000

** $700,000 + $400,000 + $200,000 = $1,300,000

Case 6-32 (continued)

2. Given the data above, the break-even points can be determined using total fixed expenses and the CM ratios as follows:

   a. $$\frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$6{,}800{,}000}{0.24} = \$28{,}333{,}333$$

   b. $$\frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$6{,}800{,}000}{0.22} = \$30{,}909{,}091$$

   c. $$\frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$8{,}600{,}000}{0.32} = \$26{,}875{,}000$$

3 $$\text{Dollar sales to attain target profit} = \frac{\text{Fixed expenses + Target profit}}{\text{CM ratio}}$$

$$= \frac{\$8{,}600{,}000 - \$200{,}000}{0.32}$$

$$= \$26{,}250{,}000$$

4 X = Total sales revenue

Net operating income with company sales force = 0.32X - $8,600,000

Net operating income with the 20% commissions = 0.22X - $6,800,000

The two net operating incomes are equal when:

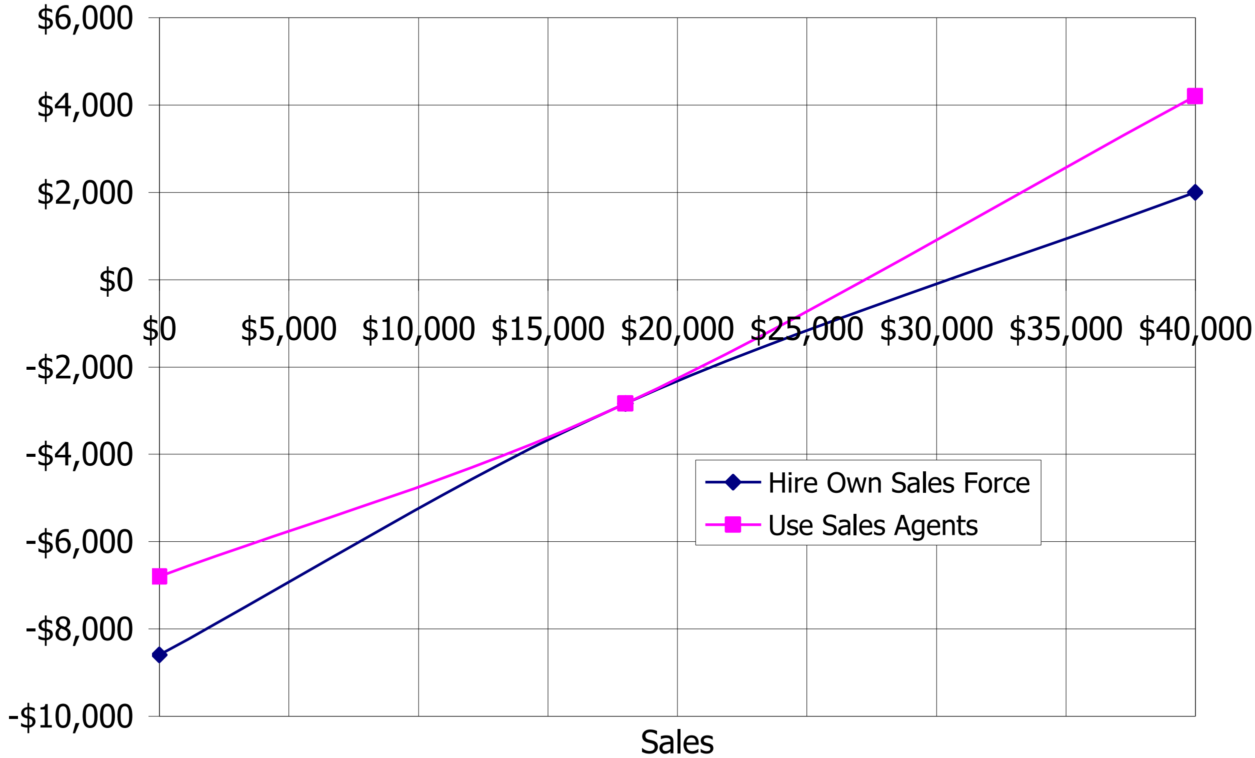
$$\begin{aligned} 0.32X - \$8{,}600{,}000 &= 0.22X - \$6{,}800{,}000 \\ 0.10X &= \$1{,}800{,}000 \\ X &= \$1{,}800{,}000 \div 0.10 \\ X &= \$18{,}000{,}000 \end{aligned}$$

Case 6-32 (continued)

Thus, at a sales level of $18,000,000 either plan will yield the same net operating income. This is verified below (in thousands of dollars):

	20% Commission		*Own Sales Force*	
Sales	$ 18,000	100%	$ 18,000	100%
Total variable expense	14,040	78%	12,240	68%
Contribution margin	3,960	22%	5,760	32%
Total fixed expenses	6,800		8,600	
Net operating income	$ (2,840)		$ (2,840)	

5. A graph showing both alternatives appears below:



6.

To: President of Marston Corporation
Fm: Student's name

Assuming that a competent sales force can be quickly hired and trained and the new sales force is as effective as the sales agents, this is the better alternative. Using the data provided by the controller, net operating income is higher when the company has its own sales force unless sales fall below $18,000,000. At that level of sales and below the company would be losing money so it is unlikely that this would be the normal situation.

The major concern I have with this recommendation is the assumption that the new sales force will be as effective as the sales agents. The sales agents have been selling our product for a number of years, so they are likely to have more field experience than any sales force we hire. And, our own sales force would be selling just our product instead of a variety of products. On the one hand, that will result in a more focused selling effort. On the other hand, that may make it more difficult for a salesperson to get the attention of a hospital's purchasing agent.

The purchasing agents may prefer to deal through a small number of salespersons each of whom sells many products rather than a large number of salespersons each of whom sells only a single product. Even so, we can afford some decrease in sales because of the lower cost of maintaining our own sales force. For example, assuming that the sales agents make the budgeted sales of $30,000,000, we would have a net operating loss of $200,000 for the year. We would do better than this with our own sales force as long as sales are greater than $26,250,000. In other words, we could afford a fall-off in sales of $3,750,000 or 12.5% and still be better off with our own sales force. If we are confident that our own sales force could do at least this well relative to the sales agents, then we should certainly switch to using our own sales force.

Case 6-33 (75 minutes)

1. The total annual fixed cost of the Cardiac Care Department can be computed as follows:

Annual Patient-Days	*Aides @ $36,000*	*Nurses @ $58,000*	*Supervising Nurses @ $76,000*	*Total Personnel*	*Other Fixed Cost*	*Total Fixed Cost*
10,000-12,000	$252,000	$870,000	$228,000	$1,350,000	$2,740,000	$4,090,000
12,001-13,750	$288,000	$870,000	$228,000	$1,386,000	$2,740,000	$4,126,000
13,751-16,500	$324,000	$928,000	$304,000	$1,556,000	$2,740,000	$4,296,000
16,501-18,250	$360,000	$928,000	$304,000	$1,592,000	$2,740,000	$4,332,000
18,251-20,750	$360,000	$986,000	$380,000	$1,726,000	$2,740,000	$4,466,000
20,751-23,000	$396,000	$1,044,000	$380,000	$1,820,000	$2,740,000	$4,560,000

2. The "break-even" can be computed for each range of activity by dividing the total fixed cost for that range of activity by the contribution margin per patient-day, which is $300 (=$480 revenue − $180 variable cost).

Annual Patient-Days	*(a) Total Fixed Cost*	*(b) Contribution Margin*	*"Break-Even" (a) ÷ (b)*	*Within Relevant Range?*
10,000-12,000	$4,090,000	$300	13,633	No
12,001-13,750	$4,126,000	$300	13,753	No
13,751-16,500	$4,296,000	$300	14,320	Yes
16,501-18,250	$4,332,000	$300	14,440	No
18,251-20,750	$4,466,000	$300	14,887	No
20,751-23,000	$4,560,000	$300	15,200	No

Case 6-33 (continued)

While a "break-even" can be computed for each range of activity (i.e., relevant range), all but one of these break-evens is bogus. For example, within the range of 10,000 to 12,000 patient-days, the computed break-even is 13,633 (rounded) patient-days. However, this level of activity is outside this relevant range. To serve 13,633 patient-days, the fixed costs would have to be increased from $4,090,000 to $4,126,000 by adding one more aide. The only "break-even" that occurs within its own relevant range is 14,320. This is the only legitimate break-even.

3. The level of activity required to earn a profit of $720,000 can be computed as follows:

Annual Patient-Days	*Total Fixed Cost*	*Target Profit*	*(a) Total Fixed Cost + Target Profit*	*(b) Contribution Margin*	*Activity to Attain Target Profit (a) ÷ (b)*	*Within Relevant Range?*
10,000-12,000	$4,090,000	$720,000	$4,810,000	$300	16,033	No
12,001-13,750	$4,126,000	$720,000	$4,846,000	$300	16,153	No
13,751-16,500	$4,296,000	$720,000	$5,016,000	$300	16,720	No
16,501-18,250	$4,332,000	$720,000	$5,052,000	$300	16,840	Yes
18,251-20,750	$4,466,000	$720,000	$5,186,000	$300	17,287	No
20,751-23,000	$4,560,000	$720,000	$5,280,000	$300	17,600	No

In this case, the only solution that is within the appropriate relevant range is 16,840 patient-days.

Research and Application 6-34 (120 minutes)

1. The income statement on page 50 is prepared using an absorption format. The income statement on page 33 is prepared using a contribution format. The annual report says that the contribution format income statement shown on page 33 is used for internal reporting purposes; nonetheless, Benetton has chosen to include it in the annual report. The contribution format income statement treats all cost of sales as variable costs. The selling, general and administrative expenses shown on the absorption income statement have been broken down into variable and fixed components in the contribution format income statement.

   It appears the Distribution and Transport expenses and the Sales Commissions have been reclassified as variable selling costs on the contribution format income statement. The sum of these two expenses according to the absorption income statement on page 50 is €103,561 and €114,309 in 2004 and 2003, respectively. If these numbers are rounded to the nearest thousand, they agree with the variable selling costs shown in the contribution format income statements on page 33.

2. The cost of sales is included in the computation of contribution margin because the Benetton Group primarily designs, markets, and sells apparel. The manufacturing of the products is outsourced to various suppliers. While Benetton's cost of sales may include some fixed costs, the overwhelming majority of the costs are variable, as one would expect for a merchandising company, thus the cost of sales is included in the calculation of contribution margin.

3. The break-even computations are as follows (see page 33 of annual report):

(in millions; figures are rounded)	*2003*	*2004*
Total fixed costs	€464	€436
Contribution margin ratio	÷ 0.374	÷ 0.387
Breakeven in euros	€1,241	€1,127

   The break-even point in 2004 is lower than in 2003 because Benetton's fixed costs in 2004 are lower than in 2003 and its contribution margin ratio in 2004 is higher than in 2003.

Research and Application 6-34 (continued)

4. The target profit calculation is as follows:

(in millions; figures are rounded)	*2004*
Total fixed costs + target profit..............	€736
Contribution margin ratio........................	÷ 0.387
Sales needed to achieve target profit.......	€1,902

5. The margin of safety calculations are as follows:

(in millions; figures are rounded)	*2003*	*2004*
Actual sales	€1,859	€1,686
Breakeven sales	1,241	1,127
Margin of safety	€618	€559

The margin of safety has declined because the drop in sales from 2003 to 2004 (€173) exceeds the decrease in breakeven sales from 2003 to 2004 (€114).

6. The degree of operating leverage is calculated as follows:

(in millions; figures are rounded)	*2004*
Contribution margin..................................	€653
Income from operations	÷ €217
Degree of operating leverage (rounded)	3

A 6% increase in sales would result in income from operations of:

(in millions; figures are rounded)	*2004*
Revised sales (€1,686 ×1.06)........................	€1,787
Contribution margin ratio.............................	0.387
Contribution margin....................................	692
Fixed general and administrative expenses	436
Income from operations	€256

The degree of operating leverage can be used to quickly determine that a 6% increase in sales translates into an 18% increase in income from operations (6% × 3 = 18%). Rather than preparing a revised contribution format income statement to ascertain the new income from operations, the computation could be performed as follows:

Research and Application 6-34 (continued)

(in millions; figures are rounded)	*2004*
Actual sales	€217
Percentage increase in income from operations	1.18
Projected income from operations	€256

7. The income from operations in the first scenario would be computed as follows:

(in millions; figures are rounded)	*2004*
Sales (1,686 × 1.03)	€1,737
Contribution margin ratio	0.387
Contribution margin	672
Fixed general and administrative expenses	446
Income from operations	€226

The second scenario is more complicated because students need to break the variable selling costs into its two components—Distribution and Transport and Sales Commissions. Using the absorption income statement on page 50, students can determine that Sales Commissions are about 4.4% of sales (€73,573 ÷ €1,686,351). If Sales Commissions are raised to 6%, this is a 1.6% increase in the rate. This 1.6% should be deducted from the contribution margin ratio as shown below:

(in millions; figures are rounded)	*2004*
Sales (1,686 × 1.05)	€1,770
Contribution margin ratio (0.387 − 0.016)	0.371

Contribution margin..	657
Fixed general and administrative expenses	446
Income from operations	€211

The first scenario is preferable because its increase income from operations by €9 million (€226−€217), whereas the second scenario decreases income from operations by €6 million (€217 − €211).

Research and Application 6-34 (continued)

8. The income from operations using the revised product mix is calculated as follows (the contribution margin ratios for each sector are given on pages 36 and 37 of the annual report):

(in millions)	*Casual*	*Sportswear & Equipment*	*Manufacturing & Other*	*Total*
Sales	€1,554	€45	€87	€1,686.0
CM ratio	0.418	0.208	0.089	*0.395
CM	€649.6	€9.4	€7.7	666.7
Fixed costs				436.0
Income from operations .				€230.7

*39.5% is the weighted average contribution margin ratio. Notice, it is higher than the 38.7% shown on page 33 of the annual report.

The income from operations is higher under this scenario because the product mix has shifted towards the sector with the highest contribution margin ratio—the Casual sector.

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Chapter 7
Variable Costing: A Tool for Management

Solutions to Questions

7-1 Absorption and variable costing differ in how they handle fixed manufacturing overhead. Under absorption costing, fixed manufacturing overhead is treated as a product cost and hence is an asset until products are sold. Under variable costing, fixed manufacturing overhead is treated as a period cost and is expensed on the current period's income statement.

7-2 Selling and administrative expenses are treated as period costs under both variable costing and absorption costing.

7-3 Under absorption costing, fixed manufacturing overhead costs are included in product costs, along with direct materials, direct labor, and variable manufacturing overhead. If some of the units are not sold by the end of the period, then they are carried into the next period as inventory. The fixed manufacturing overhead cost attached to the units in ending inventory follow the units into the next period. When the units are finally sold, the fixed manufacturing overhead cost that has been carried over with the units is included as part of that period's cost of goods sold.

7-4 Absorption costing advocates believe that absorption costing does a better job of matching costs with revenues than variable costing. They argue that all manufacturing costs must be assigned to products to properly match the costs of producing units of product with the revenues from the units when they are sold. They believe that no distinction should be made between variable and fixed manufacturing costs for the purposes of matching costs and revenues.

7-5 Advocates of variable costing argue that fixed manufacturing costs are not really the cost of any particular unit of product. If a unit is made or not, the total fixed manufacturing costs will be exactly the same. Therefore, how can one say that these costs are part of the costs of the products? These costs are incurred to have the capacity to make products during a particular period and should be charged against that period as period costs according to the matching principle.

7-6 If production and sales are equal, net operating income should be the same under absorption and variable costing. When production equals sales, inventories do not increase or decrease and therefore under absorption costing fixed manufacturing overhead cost cannot be deferred in inventory or released from inventory.

7-7 If production exceeds sales, absorption costing will usually show higher net operating income than variable costing. When production exceeds sales, inventories increase and under absorption costing part of the fixed manufacturing overhead cost of the current period is deferred in inventory to the next period. In contrast, all of the fixed manufacturing overhead cost of the current period is immediately expensed under variable costing.

7-8 If fixed manufacturing overhead cost is released from inventory, then inventory levels must have decreased and therefore production must have been less than sales.

7-9 Inventory decreased. The decrease resulted in fixed manufacturing overhead cost being released from inventory and expensed as part of cost of goods sold. This added fixed manufacturing overhead cost resulted in a loss even though the company operated at its breakeven.

7-10 Under absorption costing net operating income can be increased by simply increasing the level of production without any increase in sales. If production exceeds sales, units of product are added to inventory. These units carry a portion of the current period's fixed manufacturing overhead costs into the inventory account, thereby reducing the current period's reported expenses and causing net operating income to increase.

7-11 Generally speaking, variable costing cannot be used externally for financial reporting purposes nor can it be used for tax purposes. It can, however, be used in internal reports.

7-12 Differences in reported net operating income between absorption and variable costing arise because of changing levels of inventory. In lean production, goods are produced strictly to customers' orders. With production geared to sales, inventories are largely (or entirely) eliminated. If inventories are completely eliminated, they cannot change from one period to another and absorption costing and variable costing will report the same net operating income.

Exercise 7-1 (15 minutes)

1. Under absorption costing, all manufacturing costs (variable and fixed) are included in product costs.

Direct materials	R120
Direct labor	140
Variable manufacturing overhead	50
Fixed manufacturing overhead (R600,000 ÷ 10,000 units)	60
Unit product cost	R370

2. Under variable costing, only the variable manufacturing costs are included in product costs.

Direct materials	R120
Direct labor	140
Variable manufacturing overhead	50
Unit product cost	R310

Note that selling and administrative expenses are not treated as product costs under either absorption or variable costing; that is, they are not included in the costs that are inventoried. These expenses are always treated as period costs and are charged against the current period's revenue.

Exercise 7-2 (30 minutes)

1. 2,000 units × R60 per unit fixed manufacturing overhead = R120,000

2. The variable costing income statement appears below:

Sales		R4,000,000
Variable expenses:		
Variable cost of goods sold:		
Beginning inventory	R 0	
Add variable manufacturing costs (10,000 units· × R310 per unit)	3,100,000	
Goods available for sale	3,100,000	
Less ending inventory (2,000 units × R310 per unit)	620,000	
Variable cost of goods sold*	2,480,000	
Variable selling and administrative (8,000 units × R20 per unit)	160,000	2,640,000
Contribution margin		1,360,000
Fixed expenses:		
Fixed manufacturing overhead	600,000	
Fixed selling and administrative	400,000	1,000,000
Net operating income		R 360,000

* The variable cost of goods sold could be computed more simply as: 8,000 units sold × R310 per unit = R2,480,000.

The difference in net operating income between variable and absorption costing can be explained by the deferral of fixed manufacturing overhead cost in inventory that has taken place under the absorption costing approach. Note from part (1) that R120,000 of fixed manufacturing overhead cost has been deferred in inventory to the next period. Thus, net operating income under the absorption costing approach is R120,000 higher than it is under variable costing.

Exercise 7-3 (20 minutes)

1.

	Year 1	Year 2	Year 3
Beginning inventories (units)	180	150	160
Ending inventories (units)	150	160	200
Change in inventories (units)	(30)	10	40
Variable costing net operating income	$292,400	$269,200	$251,800
Add: Fixed manufacturing overhead cost deferred in inventory under absorption costing (10 units × $450 per unit; 40 units × $450 per unit)		4,500	18,000
Deduct: Fixed manufacturing overhead cost released from inventory under absorption costing (30 units × $450 per unit)	13,500		
Absorption costing net operating income	$278,900	$273,700	$269,800

2. Because absorption costing net operating income was greater than variable costing net operating income in Year 4, inventories must have increased during the year and hence fixed manufacturing overhead was deferred in inventories. The amount of the deferral is just the difference between the two net operating incomes or $27,000 = $267,200 – $240,200.

Exercise 7-4 (30 minutes)

1. a. By assumption, the unit selling price, unit variable costs, and total fixed costs are constant from year to year. Consequently, variable costing net operating income will vary with sales. If sales increase, variable costing net operating income will increase. If sales decrease, variable costing net operating income will decrease. If sales are constant, variable costing net operating income will be constant. Because variable costing net operating income was $16,847 each year, unit sales must have been the same in each year.

   The same is not true of absorption costing net operating income. Sales and absorption costing net operating income do not necessarily move in the same direction because changes in inventories also affect absorption costing net operating income.

   b. When variable costing net operating income exceeds absorption costing net operating income, sales exceeds production. Inventories shrink and fixed manufacturing overhead costs are released from inventories. In contrast, when variable costing net operating income is less than absorption costing net operating income, production exceeds sales. Inventories grow and fixed manufacturing overhead costs are deferred in inventories. The year-by-year effects are shown below.

Year 1	*Year 2*	*Year 3*
Variable costing NOI = Absorption costing NOI	Variable costing NOI < Absorption costing NOI	Variable costing NOI > Absorption costing NOI
Production = Sales	Production > Sales	Production < Sales
Inventories remain the same	Inventories grow	Inventories shrink

Exercise 7-4 (continued)

2. a. As discussed in part (1 a) above, unit sales and variable costing net operating income move in the same direction when unit selling prices and the cost structure are constant. Because variable costing net operating income declined, unit sales must have also declined. This is true even though the absorption costing net operating income increased. How can that be? By manipulating production (and inventories) it may be possible to maintain or increase the level of absorption costing net operating income even though unit sales decline. However, eventually inventories will grow to be so large that they cannot be ignored.

   b. As stated in part (1 b) above, when variable costing net operating income is less than absorption costing net operating income, production exceeds sales. Inventories grow and fixed manufacturing overhead costs are deferred in inventories. The year-by-year effects are shown below.

Year 1	*Year 2*	*Year 3*
Variable costing NOI = Absorption costing NOI	Variable costing NOI < Absorption costing NOI	Variable costing NOI < Absorption costing NOI
Production = Sales	Production > Sales	Production > Sales
Inventories remain the same	Inventories grow	Inventories grow

Exercise 7-4 (continued)

3. Variable costing appears to provide a much better picture of economic reality than absorption costing in the examples above. In the first case, absorption costing net operating income fluctuates wildly even though unit sales are the same each year and unit selling prices, unit variable costs, and total fixed costs remain the same. In the second case, absorption costing net operating income increases from year to year even though unit sales decline. Absorption costing is much more subject to manipulation than variable costing. Simply by changing production levels (and thereby deferring or releasing costs from inventory) absorption costing net operating income can be manipulated upward or downward.

Note: This exercise is based on the following data:

Common data:

Annual fixed manufacturing costs	$153,153
Contribution margin per unit	$35,000
Annual fixed SGA costs	$180,000

Part 1:

	Year 1	*Year 2*	*Year 3*
Beginning inventory	1	1	2
Production	10	11	9
Sales	10	10	10
Ending	1	2	1
Variable costing net operating income.	$16,847	$16,847	$16,847
Fixed manufacturing overhead in beginning inventory*	$15,315	$15,315	$27,846
Fixed manufacturing overhead in ending inventory	$15,315	$27,846	$17,017
Absorption costing net operating income	$16,847	$29,378	$6,018

* Fixed manufacturing overhead in beginning inventory is assumed in both parts 1 and 2 for Year 1. A FIFO inventory flow assumption is used.

Exercise 7-4 (continued)

Part 2:

	Year 1	*Year 2*	*Year 3*
Beginning inventory....................	1	1	4
Production	10	12	20
Sales	10	9	8
Ending	1	4	16
Variable costing net operating income (loss).........................	$16,847	($18,153)	($53,153)
Fixed manufacturing overhead in beginning inventory*.............	$15,315	$15,315	$51,051
Fixed manufacturing overhead in ending inventory....................	$15,315	$51,051	$122,522
Absorption costing net operating income	$16,847	$17,583	$18,318

* Fixed manufacturing overhead in beginning inventory is assumed in both parts 1 and 2 for Year 1. A FIFO inventory flow assumption is used.

Exercise 7-5 (30 minutes)

1. Under variable costing, only the variable manufacturing costs are included in product costs.

Direct materials	$ 60
Direct labor	30
Variable manufacturing overhead	10
Unit product cost	$100

Note that selling and administrative expenses are not treated as product costs; that is, they are not included in the costs that are inventoried. These expenses are always treated as period costs and are charged against the current period's revenue.

2. The variable costing income statement appears below:

Sales		$1,800,000
Variable expenses:		
Variable cost of goods sold:		
Beginning inventory	$ 0	
Add variable manufacturing costs (10,000 units × $100 per unit)	1,000,000	
Goods available for sale	1,000,000	
Less ending inventory (1,000 units × $100 per unit)	100,000	
Variable cost of goods sold*	900,000	
Variable selling and administrative (9,000 units × $20 per unit)	180,000	1,080,000
Contribution margin		720,000
Fixed expenses:		
Fixed manufacturing overhead	300,000	
Fixed selling and administrative	450,000	750,000
Net operating loss		$ (30,000)

* The variable cost of goods sold could be computed more simply as: 9,000 units sold × $100 per unit = $900,000.

Exercise 7-5 (continued)

3. The break-even point in units sold can be computed using the contribution margin per unit as follows:

Selling price per unit	$200
Variable cost per unit	120
Contribution margin per unit	$ 80

$$\text{Break-even unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \frac{\$750{,}000}{\$80 \text{ per unit}}$$

$$= 9{,}375 \text{ units}$$

Exercise 7-6 (20 minutes)

1. Under absorption costing, all manufacturing costs (variable and fixed) are included in product costs.

Direct materials	$ 60
Direct labor	30
Variable manufacturing overhead	10
Fixed manufacturing overhead ($300,000 ÷ 10,000 units)	30
Unit product cost	$130

2. The absorption costing income statement appears below:

Sales (9,000 units × $200 per unit)		$1,800,000
Cost of goods sold:		
Beginning inventory	$ 0	
Add cost of goods manufactured (10,000 units × $130 per unit)	1,300,000	
Goods available for sale	1,300,000	
Less ending inventory (1,000 units × $130 per unit)	130,000	1,170,000
Gross margin		630,000
Selling and administrative expenses:		
Variable selling and administrative (9,000 units × $20 per unit)	180,000	
Fixed selling and administrative	450,000	630,000
Net operating income		$ 0

Note: The company apparently has exactly zero net operating income even though its sales are below the break-even point computed in Exercise 7-5. This occurs because $30,000 of fixed manufacturing overhead has been deferred in inventory and does not appear on the income statement prepared using absorption costing.

Exercise 7-7 (30 minutes)

1. a. The unit product cost under absorption costing would be:

Direct materials	$18
Direct labor	7
Variable manufacturing overhead	2
Total variable manufacturing costs	27
Fixed manufacturing overhead ($160,000 ÷ 20,000 units)	8
Unit product cost	$35

b. The absorption costing income statement:

Sales (16,000 units × $50 per unit)		$800,000
Cost of goods sold:		
Beginning inventory	$ 0	
Add cost of goods manufactured (20,000 units × $35 per unit)	700,000	
Goods available for sale	700,000	
Less ending inventory (4,000 units × $35 per unit)	140,000	560,000
Gross margin		240,000
Selling and administrative expenses		190,000 *
Net operating income		$ 50,000

*(16,000 units × $5 per unit) + $110,000 = $190,000.

Exercise 7-7 (continued)

2. a. The unit product cost under variable costing would be:

Direct materials	$18
Direct labor	7
Variable manufacturing overhead	2
Unit product cost	$27

b. The variable costing income statement:

Sales (16,000 units × $50 per unit)		$800,000
Less variable expenses:		
Variable cost of goods sold:		
Beginning inventory	$ 0	
Add variable manufacturing costs (20,000 units × $27 per unit)	540,000	
Goods available for sale	540,000	
Less ending inventory (4,000 units × $27 per unit)	108,000	
Variable cost of goods sold	432,000 *	
Variable selling expense (16,000 units × $5 per unit)	80,000	512,000
Contribution margin		288,000
Less fixed expenses:		
Fixed manufacturing overhead	160,000	
Fixed selling and administrative	110,000	270,000
Net operating income		$ 18,000

* The variable cost of goods sold could be computed more simply as: 16,000 units × $27 per unit = $432,000.

Exercise 7-8 (20 minutes)

1. The company is using variable costing. The computations are:

	Variable Costing	*Absorption Costing*
Direct materials	$10	$10
Direct labor	5	5
Variable manufacturing overhead	2	2
Fixed manufacturing overhead ($90,000 ÷ 30,000 units)	—	3
Unit product cost	$17	$20
Total cost, 5,000 units	$85,000	$100,000

2. a. No, $85,000 is not the correct figure to use, because variable costing is not generally accepted for external reporting purposes or for tax purposes.

   b. The finished goods inventory account should be stated at $100,000, which represents the absorption cost of the 5,000 unsold units. Thus, the account should be increased by $15,000 for external reporting purposes. This $15,000 consists of the amount of fixed manufacturing overhead cost that is allocated to the 5,000 unsold units under absorption costing:

   5,000 units × $3 per unit fixed manufacturing overhead cost = $15,000

Exercise 7-9 (20 minutes)

1. Sales (40,000 units × $33.75 per unit)

Sales (40,000 units × $33.75 per unit)		$1,350,000
Variable expenses:		
Variable cost of goods sold (40,000 units × $16 per unit*)	$640,000	
Variable selling and administrative expenses (40,000 units × $3 per unit)	120,000	760,000
Contribution margin		590,000
Fixed expenses:		
Fixed manufacturing overhead	250,000	
Fixed selling and administrative expenses	300,000	550,000
Net operating income		$ 40,000

* Direct materials	$10
Direct labor	4
Variable manufacturing overhead	2
Total variable manufacturing cost	$16

2. The difference in net operating income can be explained by the $50,000 in fixed manufacturing overhead deferred in inventory under the absorption costing method:

Variable costing net operating income	$40,000
Add: Fixed manufacturing overhead cost deferred in inventory under absorption costing: 10,000 units × $5 per unit in fixed manufacturing overhead cost	50,000
Absorption costing net operating income	$90,000

Problem 7-10 (30 minutes)

1. The unit product cost under the variable costing approach would be computed as follows:

Direct materials	$ 8
Direct labor	10
Variable manufacturing overhead	2
Unit product cost	$20

With this figure, the variable costing income statements can be prepared:

	Year 1	*Year 2*
Sales	$1,000,000	$1,500,000
Variable expenses:		
Variable cost of goods sold @ $20 per unit	400,000	600,000
Variable selling and administrative @ $3 per unit	60,000	90,000
Total variable expenses	460,000	690,000
Contribution margin	540,000	810,000
Fixed expenses:		
Fixed manufacturing overhead	350,000	350,000
Fixed selling and administrative	250,000	250,000
Total fixed expenses	600,000	600,000
Net operating income (loss)	$ (60,000)	$ 210,000

2.

Variable costing net operating income (loss)	$ (60,000)	$ 210,000
Add: Fixed manufacturing overhead cost deferred in inventory under absorption costing (5,000 units × $14 per unit)	70,000	
Deduct: Fixed manufacturing overhead cost released from inventory under absorption costing (5,000 units × $14 per unit)		(70,000)
Absorption costing net operating income	$ 10,000	$ 140,000

Problem 7-11 (45 minutes)

1. a. The unit product cost under absorption costing:

Direct materials	$15
Direct labor	7
Variable manufacturing overhead	2
Fixed manufacturing overhead (640,000 ÷ 40,000 units)	16
Unit product cost	$40

b. The absorption costing income statement follows:

Sales (35,000 units × $60 per unit)		$2,100,000
Cost of goods sold:		
Beginning inventory	$ 0	
Add cost of goods manufactured (40,000 units × $40 per unit)	1,600,000	
Goods available for sale	1,600,000	
Less ending inventory (5,000 units × $40 per unit)	200,000	1,400,000
Gross margin		700,000
Selling and administrative expenses*		630,000
Net operating income		$ 70,000

*(35,000 units × $2 per unit) + $560,000 = $630,000.

2. a. The unit product cost under variable costing:

Direct materials	$15
Direct labor	7
Variable manufacturing overhead	2
Unit product cost	$24

Problem 7-11 (continued)

b. The variable costing income statement follows:

Sales (35,000 units × \$60 per unit)		\$2,100,000
Variable expenses:		
Variable cost of goods sold:		
Beginning inventory	\$ 0	
Add variable manufacturing costs (40,000 units × \$24 per unit)	960,000	
Goods available for sale	960,000	
Less ending inventory (5,000 units × \$24 per unit)	120,000	
Variable cost of goods sold	840,000	
Variable selling expense (35,000 units × \$2 per unit)	70,000	910,000
Contribution margin		1,190,000
Fixed expenses:		
Fixed manufacturing overhead	640,000	
Fixed selling and administrative expense	560,000	1,200,000
Net operating loss		\$ (10,000)

3. The difference in the ending inventory relates to a difference in the handling of fixed manufacturing overhead costs. Under variable costing, these costs have been expensed in full as period costs. Under absorption costing, these costs have been added to units of product at the rate of \$16 per unit (\$640,000 ÷ 40,000 units produced = \$16 per unit). Thus, under absorption costing a portion of the \$640,000 fixed manufacturing overhead cost of the month has been added to the inventory account rather than expensed on the income statement:

Added to the ending inventory (5,000 units × \$16 per unit)	\$ 80,000
Expensed as part of cost of goods sold (35,000 units × \$16 per unit)	560,000
Total fixed manufacturing overhead cost for the month	\$640,000

Problem 7-11 (continued)

Because $80,000 of fixed manufacturing overhead cost has been deferred in inventory under absorption costing, the net operating income reported under that costing method is $80,000 higher than the net operating income under variable costing, as shown in parts (1) and (2) above.

Problem 7-12 (45 minutes)

1. a. and b.

	Absorption Costing	*Variable Costing*
Direct materials	$ 86	$86
Variable manufacturing overhead	4	4
Fixed manufacturing overhead ($240,000 ÷ 4,000 units)	60	—
Unit product cost	$150	$90

2. Absorption costing income statement:

Sales (3,200 units × $250 per unit)		$800,000
Cost of goods sold:		
Beginning inventory	$ 0	
Add cost of goods manufactured (4,000 units × $150 per unit)	600,000	
Goods available for sale	600,000	
Less ending inventory (800 units × $150 per unit)	120,000	480,000
Gross margin		320,000
Selling and administrative expenses (15% × $800,000 + $160,000)		280,000
Net operating income		$ 40,000

Problem 7-12 (continued)

3. Variable costing income statement:

Sales (3,200 units × $250 per unit)		$800,000
Variable expenses:		
Variable cost of goods sold:		
Beginning inventory	$ 0	
Add variable manufacturing costs (4,000 units × $90 per unit)	360,000	
Goods available for sale	360,000	
Less ending inventory (800 units × $90 per unit)	72,000	
Variable cost of goods sold*	288,000	
Variable selling and administrative expense ($800,000 × 15%)	120,000	408,000
Contribution margin		392,000
Fixed expenses:		
Fixed manufacturing overhead	240,000	
Fixed selling and administrative	160,000	400,000
Net operating loss		$ (8,000)

* This figure could be computed more simply as: 3,200 units × $90 per unit = $288,000.

4. A manager may prefer to take the statement prepared under the absorption approach in part (2), because it shows a profit for the month. As long as inventory levels are rising, absorption costing will report higher profits than variable costing. Notice in the situation above that the company is operating below its theoretical break-even point [$816,327 = $400,000 ÷ ($392,000/$800,000)], but yet reports a profit under the absorption approach. The ethics of this approach are debatable.

5.

Variable costing net operating income (loss)	$ (8,000)
Add: Fixed manufacturing overhead cost deferred in inventory under absorption costing (800 units × $60 per unit)	48,000
Absorption costing net operating income	$40,000

Problem 7-13 (60 minutes)

1\. a.

Direct materials	$1.00
Direct labor	0.80
Variable manufacturing overhead	0.20
Fixed manufacturing overhead ($75,000 ÷ 50,000 units)	1.50
Unit product cost	$3.50

b.

Sales (40,000 units)		$200,000
Cost of goods sold:		
Beginning inventory	$ 0	
Add cost of goods manufactured (50,000 units × $3.50 per unit)	175,000	
Goods available for sale	175,000	
Less ending inventory (10,000 units × $3.50 per unit)	35,000	140,000
Gross margin		60,000
Selling and administrative expenses*		50,000
Net operating income		$ 10,000

*$30,000 variable plus $20,000 fixed = $50,000.

c.

Variable costing net operating loss	$ (5,000)
Add: Fixed manufacturing overhead cost deferred in inventory under absorption costing (10,000 units × $1.50 per unit)	15,000
Absorption costing net operating income	$ 10,000

Problem 7-13 (continued)

2. Under absorption costing, the company did earn a profit for the month. However, before the question can really be answered, one must first define what is meant by a "profit." The central issue here relates to *timing* of release of fixed manufacturing overhead costs to expense. Advocates of variable costing would argue that all such costs should be expensed immediately, and that no profit is earned unless the revenues of a period are sufficient to cover the fixed manufacturing overhead costs in full. From this point of view, then, no profit was earned during the month, because the fixed costs were not fully covered.

   Advocates of absorption costing would argue, however, that fixed manufacturing overhead costs attach to units of product as they are produced, and that such costs do not become expense until the units are sold. Therefore, if the selling price of a unit is greater than the unit cost (including a proportionate amount of fixed manufacturing overhead), then a profit is earned even if some units produced are unsold and carry some fixed manufacturing overhead with them to the following period. A difficulty with this argument is that "profits" will vary under absorption costing depending on how many units are added to or taken out of inventory. That is, profits will depend not only on sales, but on what happens to inventories. In particular, profits can be consciously manipulated by increasing or decreasing a company's inventories.

Problem 7-13 (continued)

3. a.

Sales (60,000 units × $5 per unit)		$300,000
Variable expenses:		
Variable cost of goods sold (60,000 units × $2 per unit)	$120,000	
Variable selling and administrative expenses (60,000 units × $0.75 per unit)	45,000	165,000
Contribution margin		135,000
Fixed expense:		
Fixed manufacturing overhead	75,000	
Fixed selling and administrative expense	20,000	95,000
Net operating income		$ 40,000

b. The absorption costing unit product cost will remain at $3.50, the same as in part (1).

Sales (60,000 units × $5 per unit)		$300,000
Cost of goods sold:		
Beginning inventory (10,000 units × $3.50 per unit)	$ 35,000	
Add cost of goods manufactured (50,000 units × $3.50 per unit)	175,000	
Goods available for sale	210,000	
Less ending inventory	0	210,000
Gross margin		90,000
Selling and administrative expenses (60,000 units × $0.75 per unit + $20,000)		65,000
Net operating income		$ 25,000

c.

Variable costing net operating income	$ 40,000
Deduct: Fixed manufacturing overhead cost released from inventory under absorption costing (10,000 units × $1.50 per unit)	15,000
Absorption costing net operating income	$ 25,000

Problem 7-14 (45 minutes)

1. a. and b.

	Absorption Costing	*Variable Costing*
Direct materials	$ 6	$ 6
Direct labor	12	12
Variable manufacturing overhead	4	4
Fixed manufacturing overhead ($240,000 ÷ 30,000 units)	8	—
Unit product cost	$30	$22

2.

	May	*June*
Sales	$1,040,000	$1,360,000
Variable expenses:		
Variable production costs @ $22 per unit	572,000	748,000
Variable selling and administrative @ $3 per unit	78,000	102,000
Total variable expenses	650,000	850,000
Contribution margin	390,000	510,000
Fixed expenses:		
Fixed manufacturing overhead	240,000	240,000
Fixed selling and administrative	180,000	180,000
Total fixed expenses	420,000	420,000
Net operating income (loss)	$ (30,000)	$ 90,000

3.

	May	*June*
Variable costing net operating income (loss)	$ (30,000)	$ 90,000
Add: Fixed manufacturing overhead cost deferred in inventory under absorption costing (4,000 units × $8 per unit)	32,000	
Deduct: Fixed manufacturing overhead cost released from inventory under absorption costing (4,000 units × $8 per unit)		(32,000)
Absorption costing net operating income	$ 2,000	$ 58,000

Problem 7-14 (continued)

4. As shown in the reconciliation in part (3) above, \$32,000 of fixed manufacturing overhead cost was deferred in inventory under absorption costing at the end of May, because \$8 of fixed manufacturing overhead cost "attached" to each of the 4,000 unsold units that went into inventory at the end of that month. This \$32,000 was part of the \$420,000 total fixed cost that has to be covered each month in order for the company to break even. Because the \$32,000 was added to the inventory account, and thus did not appear on the income statement for May as an expense, the company was able to report a small profit for the month even though it sold less than the break-even volume of sales. In short, only \$388,000 of fixed cost (\$420,000 – \$32,000) was expensed for May, rather than the full \$420,000 as contemplated in the break-even analysis. As stated in the text, this is a major problem with the use of absorption costing internally for management purposes. The method does not harmonize well with the principles of cost-volume-profit analysis, and can result in data that are unclear or confusing to management.

Problem 7-15 (30 minutes)

1. Because of soft demand for the Australian Division's product, the inventory should be drawn down to the minimum level of 1,500 units. Drawing inventory down to the minimum level would require production as follows during the last quarter:

Desired inventory, December 31	1,500 units
Expected sales, last quarter	18,000 units
Total needs	19,500 units
Less inventory, September 30................	12,000 units
Required production	7,500 units

Drawing inventory down to the minimum level would save inventory carrying costs such as storage (rent, insurance), interest, and obsolescence.

The number of units scheduled for production will not affect the reported net operating income or loss for the year if variable costing is in use. All fixed manufacturing overhead cost will be treated as an expense of the period regardless of the number of units produced. Thus, no fixed manufacturing overhead cost will be shifted between periods through the inventory account and income will be a function of the number of units sold, rather than a function of the number of units produced.

2. To maximize the Australian Division's operating income, Mr. Constantinos could produce as many units as storage facilities will allow. By building inventory to the maximum level, Mr. Constantinos will be able to defer a portion of the year's fixed manufacturing overhead costs to future years through the inventory account, rather than having all of these costs appear as charges on the current year's income statement. Building inventory to the maximum level of 30,000 units would require production as follows during the last quarter:

Desired inventory, December 31	30,000 units
Expected sales, last quarter	18,000 units
Total needs	48,000 units
Less inventory, September 30................	12,000 units
Required production	36,000 units

Problem 7-15 (continued)

Thus, by producing enough units to build inventory to the maximum level that storage facilities will allow, Mr. Constantinos could relieve the current year of fixed manufacturing overhead cost and thereby maximize the current year's net operating income.

3. By setting a production schedule that will maximize his division's net operating income—and maximize his own bonus—Mr. Constantinos will be acting against the best interests of the company as a whole. The extra units aren't needed and will be expensive to carry in inventory. Moreover, there is no indication that demand will be any better next year than it has been in the current year, so the company may be required to carry the extra units in inventory a long time before they are ultimately sold.

   The company's bonus plan undoubtedly is intended to increase the company's profits by increasing sales and controlling expenses. If Mr. Constantinos sets a production schedule as shown in part (2) above, he will obtain his bonus as a result of *producing* rather than as a result of selling. Moreover, he will obtain it by creating *greater* expenses—rather than fewer expenses—for the company as a whole.

   In sum, producing as much as possible so as to maximize the division's net operating income and the manager's bonus would be unethical because it subverts the goals of the overall organization.

Problem 7-16 (45 minutes)

1. a. and b.

	Absorption Costing		*Variable Costing*	
	Year 1	*Year 2*	*Year 1*	*Year 2*
Variable manufacturing costs	$ 6	$ 6	$6	$6
Fixed manufacturing overhead costs:				
$600,000 ÷ 40,000 units	15		—	
$600,000 ÷ 50,000 units		12		—
Unit product cost	$21	$18	$6	$6

2.

	Year 1		*Year 2*	
Sales		$1,250,000		$1,250,000
Variable expenses:				
Variable cost of goods sold:				
Beginning inventory	$ 0		$ 0	
Add variable manufacturing costs	240,000		300,000	
Goods available for sale	240,000		300,000	
Less ending inventory	0		60,000	
Variable cost of goods sold	240,000		240,000	
Variable selling and administrative expenses (40,000 units × $2 per unit)	80,000	320,000	80,000	320,000
Contribution margin		930,000		930,000
Fixed expenses:				
Fixed manufacturing overhead	600,000		600,000	
Fixed selling and administrative expenses	270,000	870,000	270,000	870,000
Net operating income		$ 60,000		$ 60,000

Problem 7-16 (continued)

3.

	Year 1	*Year 2*
Variable costing net operating income	$ 60,000	$ 60,000
Add: Fixed manufacturing overhead cost deferred in inventory under absorption costing (10,000 units × $12 per unit)....	—	120,000
Absorption costing net operating income .	$ 60,000	$180,000

4. The increase in production in Year 2, in the face of level sales, caused a buildup of inventory and a deferral of a portion of Year 2's fixed manufacturing overhead costs to the next year. This deferral of cost relieved Year 2 of $120,000 (10,000 units × $12 per unit) of fixed manufacturing overhead cost that it otherwise would have borne. Thus, net operating income was $120,000 higher in Year 2 than in Year 1, even though the same number of units was sold each year. In sum, by increasing production and building up inventory, profits increased without any increase sales or reduction in costs. This is a major criticism of the absorption costing approach.

5. a. Under lean production, production would have been geared to sales. Hence inventories would not have been built up in Year 2.

   b. Under lean production, the net operating income for Year 2 using absorption costing would have been $60,000—the same as in Year 1. With production geared to sales and no ending inventory, no fixed manufacturing overhead costs would have been deferred in inventory. The entire $600,000 in fixed manufacturing overhead costs would have been charged against Year 2 operations, rather than having $120,000 of it deferred to future periods through the inventory account. Thus, net operating income would have been the same in each year under *both* variable and absorption costing.

Problem 7-17 (75 minutes)

1.

	Year 1	Year 2	Year 3
Sales	$1,000,000	$ 800,000	$1,000,000
Variable expenses:			
Variable cost of goods sold @ $4 per unit	200,000	160,000	200,000
Variable selling and administrative @ $2 per unit	100,000	80,000	100,000
Total variable expenses	300,000	240,000	300,000
Contribution margin	700,000	560,000	700,000
Fixed expenses:			
Fixed manufacturing overhead	600,000	600,000	600,000
Fixed selling and administrative	70,000	70,000	70,000
Total fixed expenses	670,000	670,000	670,000
Net operating income (loss)	$ 30,000	$(110,000)	$ 30,000

2. a.

	Year 1	Year 2	Year 3
Variable manufacturing cost	$ 4	$ 4	$ 4
Fixed manufacturing cost:			
$600,000 ÷ 50,000 units	12		
$600,000 ÷ 60,000 units		10	
$600,000 ÷ 40,000 units			15
Unit product cost	$16	$14	$19

b.

Variable costing net operating income (loss)	$30,000	$(110,000)	$ 30,000
Add (Deduct): Fixed manufacturing overhead cost deferred in inventory from Year 2 to Year 3 under absorption costing (20,000 units × $10 per unit)		200,000	(200,000)
Add: Fixed manufacturing overhead cost deferred in inventory from Year 3 to the future under absorption costing (10,000 units × $15 per unit)			150,000
Absorption costing net operating income (loss)	$30,000	$ 90,000	$(20,000)

Problem 7-17 (continued)

3. Production went up sharply in Year 2 thereby reducing the unit product cost, as shown in (2a). This reduction in cost, combined with the large amount of fixed manufacturing overhead cost deferred in inventory for the year, more than offset the loss of revenue. The net result is that the company's net operating income rose even though sales were down.

4. The fixed manufacturing overhead cost deferred in inventory from Year 2 was charged against Year 3 operations, as shown in the reconciliation in (2b). This added charge against Year 3 operations was offset somewhat by the fact that part of Year 3's fixed manufacturing overhead costs was deferred in inventory to future years [again see (2b)]. Overall, the added costs charged against Year 3 were greater than the costs deferred to future years, so the company reported less income for the year even though the same number of units was sold as in Year 1.

5. a. With lean production, production would have been geared to sales in each year so that little or no inventory of finished goods would have been built up in either Year 2 or Year 3.

   b. If lean production had been in use, the net operating income under absorption costing would have been the same as under variable costing in all three years. With production geared to sales, there would have been no ending inventory on hand, and therefore there would have been no fixed manufacturing overhead costs deferred in inventory to other years. Assuming that the company *expected* to sell 50,000 units in each year and that unit product costs were set on the basis of that level of expected activity, the income statements under absorption costing would have appeared as shown on the next page.

Problem 7-17 (continued)

	Year 1	*Year 2*		*Year 3*
Sales	$1,000,000	$ 800,000		$1,000,000
Cost of goods sold:				
Cost of goods manufactured				
@ $16 per unit	800,000	640,000	*	800,000
Add underapplied overhead		120,000	**	
Cost of goods sold	800,000	760,000		800,000
Gross margin	200,000	40,000		200,000
Selling and administrative expenses	170,000	150,000		170,000
Net operating income (loss)	$ 30,000	$(110,000)		$ 30,000

* 40,000 units × $16 per unit = $640,000.

** 10,000 units *not* produced × $12 per unit fixed manufacturing overhead cost = $120,000 fixed manufacturing overhead cost not applied to products.

Case 7-18 (120 minutes)

1. The CVP analysis developed in the previous chapter works with variable costing but generally not with absorption costing. However, when production equals sales, absorption costing net operating income equals variable costing net operating income and we can use CVP analysis without any modification.

Selling price ($40,000,000 ÷ 200,000 units)........	$200
Less variable costs per unit	120
Unit contribution margin	$ 80

$$\text{Unit sales to attain target profit} = \frac{\text{Fixed expenses + Target net profit}}{\text{Unit contribution margin}}$$

$$= \frac{\$12{,}000{,}000 + \$4{,}800{,}000}{\$80 \text{ per unit}}$$

$$= 210{,}000 \text{ units}$$

2. The unit product cost at a production level of 210,000 units would be calculated as follows:

Direct materials	$ 50
Direct labor	40
Variable manufacturing overhead	20
Fixed manufacturing overhead ($8,400,000 ÷ 210,000 units).................	40
Unit product cost	$150

Case 7-18 (continued)

Sales (210,000 units × $200 per unit)		$42,000,000
Cost of goods sold:		
Beginning inventory	$ 0	
Add cost of goods manufactured (210,000 units × $150 per unit)	31,500,000	
Goods available for sale	31,500,000	
Less ending inventory	0	31,500,000
Gross margin		10,500,000
Selling and administrative expenses:		
Variable selling and administrative (210,000 units × $10 per unit)	2,100,000	
Fixed selling and administrative	3,600,000	5,700,000
Net operating income		$ 4,800,000

3. By increasing production so that it exceeds sales, inventories will be built up. This will have the effect of deferring fixed manufacturing overhead in the ending inventory. How much fixed manufacturing overhead must be deferred in this manner? The managers are suggesting an artificial boost to earnings of $800,000 because at the current rate of sales, profit will only be $4,000,000 and they want to hit the target profit of $4,800,000.

   The amount of production, Q, required to defer $800,000 can be determined as follows:

Units in beginning inventory ...	0
Units produced	Q
Units available for sale	Q
Units sold	200,000
Units in ending inventory	Q – 200,000

$$\text{Fixed manufacturing overhead per unit} = \frac{\$8{,}400{,}000}{Q}$$

Case 7-18 (continued)

$$\text{Fixed manufacturing overhead deferred in inventory} = \text{Fixed manufacturing overhead per unit} \times \text{Number of units added to inventory}$$

$$\$800{,}000 = \frac{\$8{,}400{,}000}{Q}(Q\text{-}200{,}000)$$

$$\$800{,}000Q = \$8{,}400{,}000(Q\text{-}200{,}000)$$

$$\$7{,}600{,}000Q = \$8{,}400{,}000 \times 200{,}000$$

$$Q = 221{,}053 \text{ units (rounded up)}$$

4. The unit product cost at a production level of 221,053 units would be calculated as follows:

Direct materials	$ 50
Direct labor	40
Variable manufacturing overhead	20
Fixed manufacturing overhead ($8,400,000 ÷ 221,053 units)	38
Unit product cost	$148

The absorption costing income statement would be:

Sales (200,000 units × $200 per unit)		$40,000,000
Cost of goods sold:		
Beginning inventory	$ 0	
Add cost of goods manufactured (221,053 units × $148 per unit)	32,715,844	
Goods available for sale	32,715,844	
Less ending inventory (21,053 units × $148 per unit)	3,115,844	29,600,000
Gross margin		10,400,000
Selling and administrative expenses:		
Variable selling and administrative (200,000 units × $10 per unit)	2,000,000	
Fixed selling and administrative	3,600,000	5,600,000
Net operating income		$ 4,800,000

Case 7-18 (continued)

5. As a practical matter, the scheme of building inventories to increase profits would work. However, the $800,000 in fixed manufacturing overhead is only *deferred* in inventory. It is an axe hanging over the head of the managers. If the inventories are allowed to fall back to normal levels in the next year, all of that deferred cost will be released to the income statement. In order to keep using inventory buildups as a way of meeting target profits, inventories must keep *growing* year after year. Eventually, someone on the Board of Directors is likely to question the wisdom of such large inventories. Inventories tie up capital, take space, result in operating problems, and expose the company to the risk of obsolescence. When inventories are eventually cut due to these problems, all of the deferred costs will flow through to the income statement—with a potentially devastating effect on net operating income.

   Apart from this practical consideration, behavioral and ethical issues should be addressed. Taking the ethical issue first, it is unlikely that this is the kind of action the Board of Directors had in mind when they set the target profit. Chances are that the Board of Directors would object to this kind of manipulation if they were informed of the reason for the buildup of inventories. The company must incur additional costs to build inventories at the end of the year. Does this make any sense when there is no indication that the excess inventories will be needed to meet sales demand? Wouldn't it be better to wait and meet demand out of normal production as needed? Essentially, the managers who approached Michael are asking him to waste the owners' money so as to artificially inflate the reported net operating income so that they can get a bonus.

   Behaviorally, this is troubling because it suggests that the former CEO left behind an unfortunate legacy in the form of managers who encourage questionable business practices. Michael needs to set a new moral climate in the company or there will likely be even bigger problems down the road. Michael should firmly turn down the managers' request and let them know why.

Having said all of that, it would not be easy for Michael to turn down $50,000—which is precisely what Michael would be doing if he were to pass up the opportunity to inflate the company's earnings. And, his refusal to cooperate with the other managers may create a great deal of resentment and bitterness. This is a very difficult position for any manager to be in and many would probably succumb to the temptation.

6. The Board of Directors, with their bonus plan, has unintentionally created a situation that is very difficult for the new CEO. Whenever such a bonus plan is based on absorption costing net operating income, managers may be tempted to manipulate net operating income by changing the amount that is produced. This temptation is magnified when an all-or-nothing bonus is awarded based on meeting target profits. When actual profits appear to be within spitting distance of the target profits, the temptation to manipulate net operating income to get the all-or-nothing bonus becomes almost overpowering. Ideally, managers should resist such temptations, but this particular temptation can be easily avoided. Bonuses should be based on variable costing net operating income, which is less subject to manipulation. And, all-or-nothing bonuses should be replaced with bonuses that start out small and slowly grow with net operating income.

Case 7-19 (90 minutes)

1. Under absorption costing, the net operating income of a particular period is dependent on both production and sales. For this reason, the controller's explanation was accurate. He should have pointed out, however, that the reduction in production resulted in a large amount of underapplied overhead, which was added to cost of goods sold in the Second Quarter. By producing fewer units than planned, the company was not able to absorb all the fixed manufacturing overhead incurred during the quarter into units of product. The result was that this unabsorbed overhead ended up on the income statement as a charge against the period, thereby sharply slashing income.

2.

	First Quarter	*Second Quarter*
Sales	$1,600,000	$2,000,000
Variable expenses:		
Variable manufacturing @ $30 per unit	480,000	600,000
Variable selling and administrative @ $5 per unit	80,000	100,000
Total variable expenses	560,000	700,000
Contribution margin	1,040,000	1,300,000
Fixed expenses:		
Fixed manufacturing overhead	800,000	800,000
Fixed selling and administrative*	230,000	230,000
Total fixed expenses	1,030,000	1,030,000
Net operating income	$ 10,000	$ 270,000

* Selling and administrative expenses, First Quarter	$310,000
Less variable portion (16,000 units × $5 per unit)	80,000
Fixed selling and administrative expenses	$230,000

Case 7-19 (continued)

3. To answer this part, it is helpful to prepare a schedule of inventories, production, and sales in units:

	Beginning Inventory	*Units Produced*	*Units Sold*	*Ending Inventory*
First Quarter	3,000	20,000	16,000	7,000
Second Quarter	7,000	14,000	20,000	1,000

Using these inventory data, the reconciliation would be as follows:

	First Quarter	*Second Quarter*
Variable costing net operating income..........	$ 10,000	$270,000
Deduct: Fixed manufacturing overhead cost released from inventory during the First Quarter (3,000 units × $40 per unit).........	(120,000)	
Add (deduct): Fixed manufacturing overhead cost deferred in inventory from the First Quarter to the Second Quarter (7,000 units × $40 per unit)	280,000	(280,000)
Add: Fixed overhead manufacturing cost deferred in inventory from the Second Quarter to the future (1,000 units × $40 per unit)...		40,000
Absorption costing net operating income......	$170,000	$ 30,000

Alternative solution:

Variable costing net operating income..........	$ 10,000	$270,000
Add: Fixed manufacturing overhead cost deferred in inventory to the Second Quarter (4,000 unit increase × $40 per unit)..	160,000	
Deduct: Fixed manufacturing overhead cost released from inventory due to a decrease in inventory during the Second Quarter (6,000 unit decrease × $40 per unit)		(240,000)
Absorption costing net operating income......	$170,000	$ 30,000

4. The advantages of using the variable costing method for internal reporting purposes include the following:
   - Variable costing aids in forecasting and reporting income for decision-making purposes.
   - Fixed costs are reported in total amount, thereby increasing the opportunity for more effective control of these costs.
   - Profits vary directly with sales volume and are not affected by changes in inventory levels.
   - Analysis of cost-volume-profit relationships is facilitated and management is able to determine the break-even point and total profit for a given volume of production and sales.

   The disadvantages of using the variable costing method for internal reporting purposes include the following:
   - Variable costing lacks acceptability for external financial reporting and cannot be used for income taxes in the United States. As a result, additional record keeping costs may be required.
   - It may be difficult to determine what costs are fixed and what costs are variable.

5. a. Under lean production, production is geared strictly to sales. Therefore, the company would have produced only enough units during the quarter to meet sales needs. The computations are:

Units sold	20,000
Less units in inventory at the beginning of the quarter	7,000
Units produced during the quarter under lean production	13,000

Case 7-19 (continued)

Although not asked for in the problem, a move to lean production during the Second Quarter would have reduced the company's reported net operating income even further. The loss for the quarter would have been:

Sales		$2,000,000
Cost of goods sold:		
Beginning inventory	$ 490,000	
Add cost of goods manufactured (13,000 units × $70 per unit)	910,000	
Goods available for sale	1,400,000	
Ending inventory	0	
Cost of goods sold	1,400,000	
Add underapplied overhead*	280,000	1,680,000
Gross margin		320,000
Selling and administrative expenses		330,000
Net operating loss		$ (10,000)

* Overhead rates are based on 20,000 units produced each quarter. If only 13,000 units are produced, then the underapplied fixed manufacturing overhead will be: 7,000 units × $40 per unit = $280,000.

b. Starting with the Third Quarter, there will be little or no difference between the incomes reported under variable costing and under absorption costing. The reason is that there will be few inventories on hand and therefore no way to shift fixed manufacturing overhead cost between periods under absorption costing.

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Chapter 8
Activity-Based Costing: A Tool to Aid Decision Making

Solutions to Questions

8-1 Activity-based costing differs from traditional costing systems in a number of ways. In activity-based costing, nonmanufacturing as well as manufacturing costs may be assigned to products. And, some manufacturing costs—including the costs of idle capacity--may be excluded from product costs. An activity-based costing system typically includes a number of activity cost pools, each of which has its unique measure of activity. These measures of activity often differ from the allocation bases used in traditional costing systems.

8-2 When direct labor is used as an allocation base for overhead, it is implicitly assumed that overhead cost is directly proportional to direct labor. When cost systems were originally developed in the 1800s, this assumption may have been reasonably accurate. However, direct labor has declined in importance over the years while overhead has been increasing. This suggests that there is no longer a direct link between the level of direct labor and overhead. Indeed, when a company automates, direct labor is replaced by machines; a decrease in direct labor is accompanied by an increase in overhead. This violates the assumption that overhead cost is directly proportional to direct labor. Overhead cost appears to be driven by factors such as product diversity and complexity as well as by volume, for which direct labor has served as a convenient measure.

8-3 Employees may resist activity-based costing because it changes the "rules of the game." ABC changes some of the key measures, such as product costs, used in making decisions and may affect how individuals are evaluated. Without top management support, employees may have little interest in making these changes. In addition, if top managers continue to make decisions based on the numbers generated by the traditional costing system, subordinates will quickly conclude that the activity-based costing system can be ignored.

8-4 Unit-level activities are performed for each unit that is produced. Batch-level activities are performed for each batch regardless of how many units are in the batch. Product-level activities must be carried out to support a product regardless of how many batches are run or units produced. Customer-level activities must be carried out to support customers regardless of what products or services they buy. Organization-sustaining activities are carried out regardless of the company's precise product mix or mix of customers.

8-5 Organization-sustaining costs, customer-level costs, and the costs of idle capacity should not be assigned to products. These costs represent resources that are not consumed by the products.

8-6 In activity-based costing, costs must first be allocated to activity cost pools and then they are allocated from the activity cost pools to products, customers, and other cost objects.

8-7 Since people are often involved in more than one activity, some way must be found to estimate how much time they spend in each activity. The most practical approach is often to ask employees how they spend their time. It is also possible to ask people to keep records of how they spend their time or observe them as they perform their tasks, but both of these alternatives are costly and it is not obvious that the data would be any better. People who know they are being observed may change how they behave.

8-8 In traditional cost systems, product-level costs are indiscriminately spread across all products using direct labor-hours or some other allocation base related to volume. As a consequence, high-volume products are assigned the bulk of such costs. If a product is responsible for 40% of the direct labor in a factory, it will be assigned 40% of the manufacturing overhead cost in the factory—including 40% of the product-level costs of low-volume products. In an activity-based costing system, batch-level and product-level costs are assigned more appropriately. This results in shifting product-level costs back to the products that cause them and away from the high-volume products. (A similar effect will be observed with batch-level costs if high-volume products are produced in larger batches than low-volume products.)

8-9 Activity rates tell managers the average cost of resources consumed to carry out a particular activity such as processing purchase orders. An activity whose average cost is high may be a good candidate for process improvements. Benchmarking can be used to identify which activities have unusually large costs. If some other organization is able to carry out the activity at a significantly lower cost, it is reasonable to suppose that improvement may be possible.

8-10 The activity-based costing approach described in the chapter is probably unacceptable for external financial reports for two reasons. First, activity-based product costs, as described in this chapter, exclude some manufacturing costs and include some nonmanufacturing costs. Second, the first-stage allocations are based on interviews rather than verifiable, objective data.

8-11 While the reports in Exhibits 8-10 and 8-11 can yield insights, they should not be used for decision making. These reports give no indication of what costs can actually be adjusted nor is there any indication of who would be responsible for adjusting the costs after a decision has been made. It would be dangerous, for example, to drop a product based solely on a report like the one in Exhibit 8-10. Most of the costs in this report do not automatically disappear if a product is dropped; managers must take explicit actions to eliminate resources or to redeploy resources to other uses. Managers may be reluctant to take these actions—particularly if it involves firing or transferring people. The action analysis has the advantage of making it clearer where savings have to come from and hence which managers will have to take action.

Exercise 8-1 (10 minutes)

a.	Various individuals manage the parts inventories.	Product-level
b.	A clerk in the factory issues purchase orders for a job.	Batch-level
c.	The personnel department trains new production workers.	Organization-sustaining
d.	The factory's general manager meets with other department heads such as marketing to coordinate plans.	Organization-sustaining
e.	Direct labor workers assemble products.	Unit-level
f.	Engineers design new products.	Product-level
g.	The materials storekeeper issues raw materials to be used in jobs.	Batch-level
h.	The maintenance department performs periodic preventative maintenance on general-use equipment.	Organization-sustaining

Note: Some of these classifications are debatable and may depend on the specific circumstances found in particular companies.

Exercise 8-2 (15 minutes)

	Travel	*Pickup and Delivery*	*Customer Service*	*Other*	*Totals*
Driver and guard wages	$336,000	$378,000	$ 84,000	$ 42,000	$ 840,000
Vehicle operating expense	202,500	13,500	0	54,000	270,000
Vehicle depreciation	105,000	15,000	0	30,000	150,000
Customer representative salaries and expenses	0	0	153,000	27,000	180,000
Office expenses	0	10,000	14,000	16,000	40,000
Administrative expenses	0	17,000	187,000	136,000	340,000
Total cost	$643,500	$433,500	$438,000	$305,000	$1,820,000

Each entry in the table is derived by multiplying the total cost for the cost category by the percentage taken from the table below that shows the distribution of resource consumption:

	Travel	*Pickup and Delivery*	*Customer Service*	*Other*	*Totals*
Driver and guard wages	40%	45%	10%	5%	100%
Vehicle operating expense	75%	5%	0%	20%	100%
Vehicle depreciation	70%	10%	0%	20%	100%
Customer representative salaries and expenses	0%	0%	85%	15%	100%
Office expenses	0%	25%	35%	40%	100%
Administrative expenses	0%	5%	55%	40%	100%

Exercise 8-3 (10 minutes)

Activity Cost Pool	*Estimated Overhead Cost*	*Expected Activity*		*Activity Rate*	
Caring for lawn	$77,400	180,000	square feet of lawn	$0.43	per square foot of lawn
Caring for garden beds–low maintenance	$30,000	24,000	square feet of low maintenance beds	$1.25	per square foot of low maintenance beds
Caring for garden beds–high maintenance	$57,600	18,000	square feet of high maintenance beds	$3.20	per square foot of high maintenance beds
Travel to jobs	$4,200	15,000	miles	$0.28	per mile
Customer billing and service	$8,700	30	customers	$290	per customer

The activity rate for each activity cost pool is computed by dividing its estimated overhead cost by its expected activity.

Exercise 8-4 (10 minutes)

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Activity Cost Pool		*Activity Rate*		*Activity*	*ABC Cost*
Supporting direct labor	$7	per direct labor-hour	1,000	direct labor-hours	$ 7,000
Machine processing	$3	per machine-hour	3,200	machine-hours	9,600
Machine setups	$40	per setup	5	setups	200
Production orders	$160	per order	5	order	800
Shipments	$120	per shipment	10	shipment	1,200
Product sustaining	$800	per product	1	product	800
Total overhead cost					$19,600

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Activity Cost Pool		*Activity Rate*		*Activity*	*ABC Cost*
Supporting direct labor	$7	per direct labor-hour	40	direct labor-hours	$ 280
Machine processing	$3	per machine-hour	30	machine-hours	90
Machine setups	$40	per setup	1	setups	40
Production orders	$160	per order	1	orders	160
Shipments	$120	per shipment	1	shipments	120
Product sustaining	$800	per product	1	product	800
Total overhead cost					$1,490

Exercise 8-5 (15 minutes)

Sales ($1,650 per standard model glider × 10 standard model gliders + $2,300 per custom designed glider × 2 custom designed gliders)		$21,100
Costs:		
Direct materials ($462 per standard model glider × 10 standard model gliders + $576 per custom designed glider × 2 custom designed gliders)	$5,772	
Direct labor ($19 per direct labor-hour × 28.5 direct labor-hours per standard model glider × 10 standard model gliders + $19 per direct labor-hour × 32 direct labor-hours per custom designed glider × 2 custom designed gliders)....................	6,631	
Supporting manufacturing ($18 per direct labor-hour × 28.5 direct labor-hours per standard model glider × 10 standard model gliders + $18 per direct labor-hour × 32 direct labor-hours per custom designed glider × 2 custom designed gliders)	6,282	
Order processing ($192 per order × 3 orders)	576	
Custom designing ($261 per custom design × 2 custom designs)...	522	
Customer service ($426 per customer × 1 customer)	426	20,209
Customer margin..		$ 891

Exercise 8-6 (20 minutes)

Sales (80 clubs × $48 per club)		$3,840.00
Green costs:		
Direct materials (80 clubs × $25.40 per club)	$2,032.00	2,032.00
Green margin		1,808.00
Yellow costs:		
Direct labor (80 clubs × 0.3 hour per club × $21.50 per hour)	516.00	
Indirect labor	90.00	
Marketing expenses	540.20	1,146.20
Yellow margin		661.80
Red costs:		
Factory equipment depreciation	106.40	
Factory administration	262.40	
Selling and administrative wages and salaries	436.00	
Selling and administrative depreciation	30.00	834.80
Red margin		($ 173.00)

While not required in the problem, the conventional ABC analysis would be:

Sales (80 clubs × $48 per club)		$3,840.00
Costs:		
Direct materials	$2,032.00	
Direct labor	516.00	
Volume related overhead	283.20	
Batch processing overhead	53.00	
Order processing overhead	118.80	
Customer service overhead	1,010.00	4,013.00
Customer margin		($ 173.00)

Exercise 8-7 (45 minutes)

1. The predetermined overhead rate is computed as follows:

$$\text{Predetermined overhead rate} = \frac{\$290{,}000}{50{,}000 \text{ DLHs}} = \$5.80 \text{ per DLH}$$

The unit product costs under the company's traditional costing system are computed as follows:

	Deluxe	*Standard*
Direct materials	$60.00	$45.00
Direct labor	9.60	7.20
Manufacturing overhead (0.8 DLH × $5.80 per DLH; 0.6 DLH × $5.80 per DLH)	4.64	3.48
Unit product cost	$74.24	$55.68

2. The activity rates are computed as follows:

Activities	*(a) Estimated Overhead Cost*	*(b) Total Expected Activity*		*(a) ÷ (b) Activity Rate*	
Supporting direct labor	$150,000	50,000	DLHs	$3	per DLH
Batch setups	$60,000	250	setups	$240	per setup
Safety testing	$80,000	100	tests	$800	per test

Exercise 8-7 (continued)

Manufacturing overhead is assigned to the two products as follows:

Deluxe Product:

Activity Cost Pool	*(a)* *Activity Rate*	*(b)* *Activity*	*(a) × (b)* *ABC Cost*
Supporting direct labor	$3 per DLH	8,000 DLHs	$24,000
Batch setups	$240 per setup	200 setups	48,000
Safety testing	$800 per test	80 tests	64,000
Total....................................			$136,000

Standard Product:

Activity Cost Pool	*(a)* *Activity Rate*	*(b)* *Activity*	*(a) × (b)* *ABC Cost*
Supporting direct labor	$3 per DLH	42,000 DLHs	$126,000
Batch setups	$240 per setup	50 setups	12,000
Safety testing	$800 per test	20 tests	16,000
Total....................................			$154,000

Activity-based costing unit product costs are computed as follows:

	Deluxe	*Standard*
Direct materials..	$60.00	$45.00
Direct labor	9.60	7.20
Manufacturing overhead ($136,000 ÷ 10,000 units; $154,000 ÷ 70,000 units)........................	13.60	2.20
Unit product cost..	$83.20	$54.40

Exercise 8-8 (10 minutes)

	Activity	*Activity Classification*	*Examples of Activity Measures*
a.	Materials are moved from the receiving dock to the assembly area by a material-handling crew	Batch-level	Number of materials moves; time spent moving materials
b.	Direct labor workers assemble various products	Unit-level	Time spent assembling products
c.	Diversity training is provided to all employees in the company	Organization-sustaining	Number of employees taking diversity training; Time spent in training
d.	A product is designed by a cross-functional team	Product-level	Number of new products designed; time spent developing new products
e.	Equipment is set up to process a batch	Batch-level	Number of batches run; time spent setting up
f.	A customer is billed for all products delivered during the month	Customer-level	Number of customer bills prepared; time spent preparing bills

Notes:

1. In all cases except for direct labor in part (b), two activity measures are listed. The first is a "transaction driver" and the second is a "duration driver." Transaction drivers are simple counts of the number of times an activity occurs such as the number of times materials are moved. Duration drivers are measures of the amount of time required to perform an activity such as the time spent moving materials. In general, duration drivers are more accurate measures of the consumption of resources than transaction drivers, but they take more effort to record.
2. Activity measures should be assigned to organization-sustaining activities and costs only when they will be allocated. In this case, the costs of diversity training may be allocated to departments and for that purpose the number of employees taking the training or the amount of time they spend in the training may be recorded. However, these costs should not be allocated beyond departments to products or customers.

Exercise 8-9 (30 minutes)

1. Activity rates are computed as follows:

Activity Cost Pool	(a) Estimated Overhead Cost	(b) Expected Activity	(a) ÷ (b) Activity Rate
Machine setups	$21,600	180 setups	$120 per setup
Special processing ...	$180,000	4,000 MHs	$45 per MH
General factory	$288,000	24,000 DLHs	$12 per DLH

2. Overhead is assigned to the two products as follows:

Rims:

Activity Cost Pool	(a) Activity Rate	(b) Activity	(a) × (b) ABC Cost
Machine setups	$120 per setup	100 setups	$ 12,000
Special processing	$45 per MH	4,000 MHs	180,000
General factory	$12 per DLH	8,000 DLHs	96,000
Total....................................			$288,000

Posts:

Activity Cost Pool	(a) Activity Rate	(b) Activity	(a) × (b) ABC Cost
Machine setups	$120 per setup	80 setups	$ 9,600
Special processing	$45 per MH	0 MHs	0
General factory	$12 per DLH	16,000 DLHs	192,000
Total....................................			$201,600

Exercise 8-9 (continued)

	Rims	*Posts*
Direct materials	$17.00	$10.00
Direct labor:		
$16 per DLH × 0.40 DLHs per unit	6.40	
$16 per DLH × 0.20 DLHs per unit		3.20
Overhead:		
$288,000 ÷ 20,000 units	14.40	
$201,600 ÷ 80,000 units		2.52
Unit cost	$37.80	$15.72

Exercise 8-10 (10 minutes)

Teller wages	$150,000
Assistant branch manager salary ..	$70,000
Branch manager salary	$85,000

	Distribution of Resource Consumption Across Activities				
	Opening Accounts	*Processing Deposits and Withdrawals*	*Processing Other Customer Transactions*	*Other Activities*	*Totals*
Teller wages	0%	75%	15%	10%	100%
Assistant branch manager salary ..	10%	15%	25%	50%	100%
Branch manager salary	0%	0%	20%	80%	100%

	Opening Accounts	*Processing Deposits and Withdrawals*	*Processing Other Customer Transactions*	*Other Activities*	*Totals*
Teller wages	$ 0	$112,500	$22,500	$ 15,000	$150,000
Assistant branch manager salary...	7,000	10,500	17,500	35,000	70,000
Branch manager salary.................	0	0	17,000	68,000	85,000
Total cost	$7,000	$123,000	$57,000	$118,000	$305,000

Teller wages are $150,000 and 75% of the tellers' time is spent processing deposits and withdrawals:

$150,000 × 75% = $112,500

Other entries in the table are similarly determined.

Exercise 8-11 (20 minutes)

1. Computation of activity rates:

Activity Cost Pools	(a) Total Cost	(b) Total Activity	(a) ÷ (b) Activity Rate
Opening accounts	$7,000	200 accounts opened	$35.00 per account opened
Processing deposits and withdrawals	$123,000	50,000 deposits and withdrawals	$2.46 per deposit or withdrawal
Processing other customer transactions	$57,000	1,000 other customer transactions	$57.00 per other customer transaction

2. The cost of opening an account at the Avon branch is much higher than at the lowest cost branch ($35.00 versus $24.35). On the other hand, the cost of processing deposits and withdrawals is lower than at the lowest cost branch ($2.46 versus $2.72). And the cost of processing other customer transactions is somewhat higher at the Avon branch ($57.00 versus $48.90). The other branches may have something to learn from Avon concerning processing deposits and withdrawals and Avon may benefit from learning about how some of the other branches open accounts and process other transactions. It may be particularly instructive to compare the details of the activity rates. For example, is the cost of opening accounts at Avon apparently high because of the involvement of the assistant branch manager in this activity? Perhaps tellers open new accounts at other branches.

   The apparent differences in the costs of the activities at the various branches could be due to inaccuracies in employees' reports of the amount of time they devote to the activities. The differences in costs may also reflect different strategies. For example, the Avon branch may purposely spend more time with new customers to win their loyalty. The higher cost of opening new accounts at the Avon branch may be justified by future benefits of having more satisfied customers. Nevertheless, comparative studies of the costs of activities may provide a useful starting point for identifying best practices within a company and where improvements can be made.

Exercise 8-12 (10 minutes)

Activity Cost Pool	*(a)* *Activity Rate*	*(b)* *Activity*	*(a) × (b)* *ABC Cost*
Order size	R 17.60 per direct labor-hour	150 direct labor-hours	R 2,640
Customer orders ..	R 360.00 per customer order	1 customer order	360
Product testing	R 79.00 per product testing hour	18 product testing hours	1,422
Selling.................	R 1,494.00 per sales call	3 sales calls	4,482
Total...................			R 8,904

According to these calculations, the total overhead cost of the order is R 8,904.

Exercise 8-13 (30 minutes)

1.

	Order Size	Customer Orders	Product Testing	Selling	Total
Total activity for the order........	150 direct labor-hours	1 customer order	18 product testing hours	3 sales calls	
Manufacturing overhead:					
Indirect labor	R 1,440	R 231	R 648	R 0	R 2,319
Factory depreciation	1,050	0	324	0	1,374
Factory utilities.....................	30	0	18	0	48
Factory administration	0	46	432	36	514
Selling and administrative:					
Wages and salaries	120	72	0	2,895	3,087
Depreciation	0	11	0	108	119
Taxes and insurance.............	0	0	0	147	147
Selling expenses...................	0	0	0	1,296	1,296
Total overhead cost	R 2,640	R 360	R 1,422	R 4,482	R 8,904

Example: R 9.60 per direct labor-hour × 150 direct labor-hours = R 1,440

According to these calculations, the overhead cost of the order was R 8,904. This agrees with the computations in Exercise 8-12.

Exercise 8-13 (continued)

2. The table prepared in part (1) above allows two different perspectives on the overhead cost of the order. The column totals that appear in the last row of the table tell us the cost of the order in terms of the activities it required. The row totals that appear in the last column of the table tell us how much the order cost in terms of the overhead accounts in the underlying accounting system. Another way of saying this is that the column totals tell us what the costs were incurred *for*. The row totals tell us what the costs were incurred *on*. For example, you may spend money *on* a chocolate bar to satisfy your craving *for* chocolate. Both perspectives are important. To control costs, it is necessary both to know what the costs were incurred for and what actual costs would have to be adjusted (i.e., what the costs were incurred on).

   The two different perspectives can be explicitly shown as follows:

   What the overhead costs were spent *on*:

Manufacturing overhead:	
Indirect labor	R 2,319
Factory depreciation	1,374
Factory utilities.............................	48
Factory administration	514
Selling and administrative:	
Wages and salaries........................	3,087
Depreciation.................................	119
Taxes and insurance......................	147
Selling expenses............................	1,296
Total overhead cost.........................	R 8,904

   What the overhead costs were incurred *for*:

Order size.......................................	R 2,640
Customer orders	360
Product testing	1,422
Selling	4,482
Total overhead cost.........................	R 8,904

Exercise 8-14 (10 minutes)

	Activity	*Level*
a.	The purchasing department orders the specific color of paint specified by the customer from the company's supplier	Batch-level
b.	A steering wheel is installed in a golf cart ..	Unit-level
c.	An outside attorney draws up a new generic sales contract for the company limiting Green Glider's liability in the case of accidents that involve its golf carts	Organization-sustaining
d.	The company's paint shop makes a stencil for a customer's logo	Batch-level
e.	A sales representative visits an old customer to check on how the company's golf carts are working out and to try to make a new sale	Customer-level
f.	The accounts receivable department prepares the bill for a completed order ...	Batch-level
g.	Electricity is used to heat and light the factory and the administrative offices......	Organization-sustaining
h.	A golf cart is painted	Unit-level
i.	The company's engineer modifies the design of a model to eliminate a potential safety problem........................	Product-level
j.	The marketing department has a catalogue printed and then mails them to golf course managers........................	Customer-level
k.	Completed golf carts are each tested on the company's test track	Unit-level
l.	A new model golf cart is shipped to the leading golfing trade magazine to be evaluated for the magazine's annual rating of golf carts	Product-level

Exercise 8-15 (15 minutes)

Customer Margin—ABC Analysis

Sales (2,400 seats × $137.95 per seat)............		$331,080
Costs:		
Direct materials ($112 per seat × 2,400 seats)..	$268,800	
Direct labor ($14.40 per seat × 2,400 seats).....	34,560	
Supporting direct labor ($12 per DLH × 0.8 DLH per seat × 2,400 seats)..........................	23,040	
Batch processing ($96 per batch × 4 batches)...	384	
Order processing ($284 per order × 1 order).....	284	
Customer service overhead ($2,620 per customer × 1 customer)................................	2,620	329,688
Customer margin		$ 1,392

Exercise 8-16 (30 minutes)

	Supporting Direct Labor	*Batch Processing*	*Order Processing*	*Customer Service*	*Total*
Total activity for the order	1,920 direct labor-hours*	4 batches	1 order	1 customer	
Manufacturing overhead:					
Indirect labor	$ 3,456	$288	$ 18	$ 0	$ 3,762
Factory equipment depreciation	14,112	13	0	0	14,125
Factory administration	4,032	28	28	268	4,356
Selling and administrative:					
Wages and salaries	960	52	153	1,864	3,029
Depreciation	0	3	6	26	35
Marketing expenses	480	0	79	462	1,021
Total overhead cost	$23,040	$384	$284	$2,620	$26,328

Example: $1.80 per direct labor-hour × 1,920 direct labor-hours = $3,456

*1,920 direct labor-hours = 0.8 direct labor-hour per seat × 2,400 seats

Exercise 8-16 (continued)

The action analysis report for the customer can be constructed using the row totals from the activity rate table, organized according to the ease of adjustment codes.

Sales ($137.95 per seat × 2,400 seats)		$331,080
Green costs:		
Direct materials ($112 per seat × 2,400 seats)	$268,800	268,800
Green margin		62,280
Yellow costs:		
Direct labor ($14.40 per seat × 2,400 seats)	34,560	
Indirect labor	3,762	
Marketing expenses	1,021	39,343
Yellow margin		22,937
Red costs:		
Factory equipment depreciation	14,125	
Factory administration	4,356	
Selling and administrative wages and salaries	3,029	
Selling and administrative depreciation	35	21,545
Red margin		$ 1,392

Exercise 8-17 (15 minutes)

1. & 2.

	Activity	*Activity Classification*	*Examples of Activity Measures*
a.	Preventive maintenance is performed on general-purpose production equipment.	Organization-sustaining	Not applicable; these costs probably should not be assigned to products or customers.
b.	Products are assembled by hand.	Unit-level	Time spent assembling products.
c.	Reminder notices are sent to customers who are late in making payments.	Customer-level	Number of reminders; time spent preparing reminders.
d.	Purchase orders are issued for materials to be used in production.	Batch-level	Number of purchase orders; time spent preparing purchase orders
e.	Modifications are made to product designs.	Product-level	Number of modifications made; time spent making modifications
f.	New employees are hired by the personnel office.	Organization-sustaining	Not applicable; these costs probably should not be assigned to products or customers.
g.	Machine settings are changed between batches of different products.	Batch-level	Number of batch setups; time spent making setups
h.	Parts inventories are maintained in the storeroom. (Each product requires its own unique parts.)	Product-level	Number of products; number of parts; time spent maintaining inventories of parts
i.	Insurance costs are incurred on the company's facilities.	Organization-sustaining	Not applicable; these costs probably should not be assigned to products or customers.

Exercise 8-18 (30 minutes)

1. First-stage allocations of overhead costs to the activity cost pools:

	Direct Labor Support	Order Processing	Customer Support	Other	Totals
	Distribution of Resource Consumption Across Activity Cost Pools				
Wages and salaries..........	30%	35%	25%	10%	100%
Other overhead costs	25%	15%	20%	40%	100%

	Direct Labor Support	Order Processing	Customer Support	Other	Totals
Wages and salaries..........	$105,000	$122,500	$ 87,500	$ 35,000	$350,000
Other overhead costs	50,000	30,000	40,000	80,000	200,000
Total cost........................	$155,000	$152,500	$127,500	$115,000	$550,000

Example: 30% of $350,000 is $105,000.

2. Computation of activity rates:

Activity Cost Pools	(a) Total Cost	(b) Total Activity	(a) ÷ (b) Activity Rate
Direct labor support........	$155,000	10,000 DLHs	$15.50 per DLH
Order processing............	$152,500	500 orders	$305 per order
Customer support...........	$127,500	100 customers	$1,275 per customer

Exercise 8-18 (continued)

3. Computation of the overhead costs for the Indus Telecom order:

Activity Cost Pool	*(a)* *Activity Rate*	*(b)* *Activity*	*(a) × (b)* *ABC Cost*
Direct labor support	$15.50 per DLH	50 DLHs*	$ 775
Order processing	$305 per order	1 orders	305
Customer support	$1,275 per customer	1 customer	1,275
Total			$2,355

*0.5 DLH per unit × 100 units = 50 DLHs

4. The customer margin for Indus Telecom is computed as follows:

Customer Margin—ABC Analysis		
Sales (100 units × $295 per unit)		$29,500
Costs:		
Direct materials ($264 per unit × 100 units)	$26,400	
Direct labor ($25 per DLH × 0.5 DLH per unit × 100 units)	1,250	
Direct labor support overhead (see part 3 above)	775	
Order processing overhead (see part 3 above)	305	
Customer support overhead (see part 3 above)	1,275	30,005
Customer margin		$ (505)

Exercise 8-19 (60 minutes)

1. First-stage allocations of overhead costs to the activity cost pools:

	Distribution of Resource Consumption Across Activity Cost Pools				
	Direct Labor Support	*Order Processing*	*Customer Support*	*Other*	*Totals*
Wages and salaries.......	30%	35%	25%	10%	100%
Other overhead costs ...	25%	15%	20%	40%	100%

	Direct Labor Support	*Order Processing*	*Customer Support*	*Other*	*Totals*
Wages and salaries.......	$105,000	$122,500	$ 87,500	$ 35,000	$350,000
Other overhead costs ...	50,000	30,000	40,000	80,000	200,000
Total cost....................	$155,000	$152,500	$127,500	$115,000	$550,000

Example: 30% of $350,000 is $105,000.

Other entries in the table are determined in a similar manner.

Exercise 8-19 (continued)

2. The activity rates are computed by dividing the costs in the cells of the first-stage allocation above by the total activity from the top of the column.

	Direct Labor Support	*Order Processing*	*Customer Support*
Total activity	10,000 DLHs	500 orders	100 customers
Wages and salaries	$10.50	$245.00	$ 875.00
Other overhead costs .	5.00	60.00	400.00
Total cost	$15.50	$305.00	$1,275.00

Example: $105,000 ÷ 10,000 DLHs = $10.50 per DLH

Direct labor support wages and salaries from the first-stage allocation above.

3. The overhead cost for the order is computed as follows:

	Direct Labor Support	*Order Processing*	*Customer Support*	*Total*
Activity	50 DLHs	1 order	1 customer	
Wages and salaries	$525	$245	$ 875	$1,645
Other overhead costs	250	60	400	710
Total cost	$775	$305	$1,275	$2,355

Example: 50 DLHs × $10.50 per DLH = $525

Activity rate for direct labor support wages and salaries from part (2) above.

Exercise 8-19 (continued)

4. The report can be constructed using the column totals at the bottom of the overhead cost analysis in part (3) above.

Customer Margin—ABC Analysis

Sales (100 units × $295 per unit)		$29,500
Costs:		
Direct materials ($264 per unit × 100 units)	$26,400	
Direct labor ($25 per DLH × 0.5 DLH per unit × 100 units)	1,250	
Direct labor support overhead (see part 3 above)	775	
Order processing overhead (see part 3 above)	305	
Customer support overhead (see part 3 above)	1,275	30,005
Customer margin		$ (505)

5. The action analysis report can be constructed using the row totals from the activity rate table, organized according to the ease of adjustment codes:

Sales ($295 per unit × 100 units)		$29,500
Green costs:		
Direct materials ($264 per unit × 100 units)	$26,400	26,400
Green margin		3,100
Yellow costs:		
Direct labor ($25 per DLH × 0.5 DLH per unit × 100 units)	1,250	
Wages and salaries (see part 3 above)	1,645	2,895
Yellow margin		205
Red costs:		
Other overhead costs (see part 3 above)	710	710
Red margin		$ (505)

Exercise 8-19 (continued)

6. While the company appears to have incurred a loss on its business with Indus Telecom, caution must be exercised. The green margin on the business was $3,100. Silicon Optics really incurred a loss on this business only if at least $3,100 of the yellow and red costs would have been avoided if the Indus Telecom order had been rejected. For example, we don't know what specific costs are included in the "Other overhead" category. If these costs are committed fixed costs that cannot be avoided in the short run, then the company would been worse off if the Indus Telecom order had not been accepted.

   Suppose that Indus Telecom will be submitting a similar order every year. As a general policy, the company might consider turning down this business in the future. Costs that cannot be avoided in the short run, may be avoided in the long run through the budgeting process or in some other manner. However, if the Indus Telecom business is turned down, management must make sure that at least $3,100 of the yellow and red costs are really eliminated or the resources represented by those costs are really redeployed to the constraint. If these costs remain unchanged, then the company would be better off accepting than rejecting business from the Indus Telecom in the future.

Exercise 8-20 (45 minutes)

1. The unit product costs under the company's conventional costing system would be computed as follows:

	Mercon	*Wurcon*	*Total*
Number of units produced (a)	10,000	40,000	
Direct labor-hours per unit (b)	0.20	0.25	
Total direct labor-hours (a) × (b)	2,000	10,000	12,000

Total manufacturing overhead (a)	$336,000
Total direct labor-hours (b)	12,000 DLHs
Predetermined overhead rate (a) ÷ (b)	$28.00 per DLH

	Mercon	*Wurcon*
Direct materials	$10.00	$ 8.00
Direct labor	3.00	3.75
Manufacturing overhead applied:		
0.20 DLH per unit × $28.00 per DLH	5.60	
0.25 DLH per unit × $28.00 per DLH		7.00
Unit product cost	$18.60	$18.75

Exercise 8-20 (continued)

2. The unit product costs with the proposed ABC system can be computed as follows:

Activity Cost Pool	*Estimated Overhead Cost**	*(b) Expected Activity*	*(a) ÷ (b) Activity Rate*
Labor related	$168,000	12,000 direct labor-hours	$14 per direct labor-hour
Engineering design...	168,000	8,000 engineering-hours	$21 per engineering-hour
	$336,000		

*The total manufacturing overhead cost is split evenly between the two activity cost pools.

Manufacturing overhead is assigned to the two products as follows:

Mercon:

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Labor related	$14 per DLH	2,000 DLHs	$28,000
Engineering design .	$21 per engineering-hour	4,000 engineering-hours	84,000
Total.....................			$112,000

Wurcon:

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Labor related	$14 per DLH	10,000 DLHs	$140,000
Engineering design .	$21 per engineering-hour	4,000 engineering-hours	84,000
Total.....................			$224,000

Exercise 8-20 (continued)

The unit product costs combine direct materials, direct labor, and manufacturing overhead costs:

	Mercon	*Wurcon*
Direct materials	$10.00	$ 8.00
Direct labor	3.00	3.75
Manufacturing overhead ($112,000 ÷ 10,000 units; $224,000 ÷ 40,000 units)	11.20	5.60
Unit product cost	$24.20	$17.35

3. The unit product cost of the high-volume product, Wurcon, declines under the activity-based costing system, whereas the unit product cost of the low-volume product, Mercon, increases. This occurs because half of the overhead is applied on the basis of engineering design hours instead of direct labor-hours. When the overhead was applied on the basis of direct labor-hours, most of the overhead was applied to the high-volume product. However, when the overhead is applied on the basis of engineering-hours, more of the overhead cost is shifted over to the low-volume product. Engineering design is a product-level activity, so the higher the volume, the lower the unit cost and the lower the volume, the higher the unit cost.

Exercise 8-21 (30 minutes)

1. The first step is to determine the activity rates:

Activity Cost Pools	(a) Total Cost	(b) Total Activity	(a) ÷ (b) Activity Rate
Serving parties	$12,000	5,000 parties	$2.40 per party
Serving diners	$90,000	12,000 diners	$7.50 per diner
Serving drinks	$26,000	10,000 drinks	$2.60 per drink

According to the activity-based costing system, the cost of serving each of the parties can be computed as follows:

a. Party of 4 persons who order a total of 3 drinks:

Activity Cost Pool	(a) Activity Rate	(b) Activity	(a) × (b) ABC Cost
Serving parties	$2.40 per party	1 party	$ 2.40
Serving diners	$7.50 per diner	4 diners	30.00
Serving drinks	$2.60 per drink	3 drinks	7.80
Total			$40.20

b. Party of 2 persons who order no drinks:

Activity Cost Pool	(a) Activity Rate	(b) Activity	(a) × (b) ABC Cost
Serving parties	$2.40 per party	1 party	$ 2.40
Serving diners	$7.50 per diner	2 diners	15.00
Serving drinks	$2.60 per drink	0 drinks	0
Total			$17.40

c. Party of 1 person who orders 2 drinks:

Activity Cost Pool	(a) Activity Rate	(b) Activity	(a) × (b) ABC Cost
Serving parties	$2.40 per party	1 party	$ 2.40
Serving diners	$7.50 per diner	1 diner	7.50
Serving drinks	$2.60 per drink	2 drinks	5.20
Total			$15.10

Exercise 8-21 (continued)

2. The average cost per diner for each party can be computed by dividing the total cost of the party by the number of diners in the party as follows:
   a. $40.20 ÷ 4 diners = $10.05 per diner
   b. $17.40 ÷ 2 diners = $8.70 per diner
   c. $15.10 ÷ 1 diner = $15.10 per diner

3. The average cost per diner differs from party to party under the activity-based costing system for two reasons. First, the $2.40 cost of serving a party does not depend on the number of diners in the party. Therefore, the average cost per diner of this activity decreases as the number of diners in the party increases. With only one diner, the cost is $2.40. With two diners, the average cost per diner is cut in half to $1.20. With six diners, the average cost per diner would be only $0.40. And so on. Second, the average cost per diner differs also because of the differences in the number of drinks ordered by the diners. If a party does not order any drinks, as was the case with the party of two, no costs of serving drinks are assigned to the party.

   The average cost per diner under the ABC system differs from the overall average cost of $15 per diner for several reasons. First, the average cost of $15 per diner includes organization-sustaining costs that are excluded from the computations in the activity-based costing system. Second, the $15 per diner figure does not recognize differences in the diners' demands on resources. It does not recognize that some diners order more drinks than others nor does it recognize that there are some economies of scale in serving larger parties. (The batch-level costs of serving a party can be spread over more diners if the party is larger.)

   We should note that the activity-based costing system itself does not recognize all of the differences in diners' demands on resources. For example, the costs of preparing the various meals on the menu surely differ. It may or may not be worth the effort to build a more detailed activity-based costing system that would take into account such nuances.

Problem 8-22 (45 minutes)

1. The first-stage allocation of costs to activity cost pools appears below:

	Distribution of Resource Consumption Across Activity Cost Pools				
	Cleaning Carpets	*Travel to Jobs*	*Job Support*	*Other*	*Total*
Wages	75%	15%	0%	10%	100%
Cleaning supplies	100%	0%	0%	0%	100%
Cleaning equipment depreciation	70%	0%	0%	30%	100%
Vehicle expenses	0%	80%	0%	20%	100%
Office expenses	0%	0%	60%	40%	100%
President's compensation	0%	0%	30%	70%	100%

	Cleaning Carpets	*Travel to Jobs*	*Job Support*	*Other*	*Total*
Wages	$105,000	$21,000	$ 0	$14,000	$140,000
Cleaning supplies	25,000	0	0	0	25,000
Cleaning equipment depreciation	7,000	0	0	3,000	10,000
Vehicle expenses	0	24,000	0	6,000	30,000
Office expenses	0	0	36,000	24,000	60,000
President's compensation	0	0	22,500	52,500	75,000
Total cost	$137,000	$45,000	$58,500	$99,500	$340,000

75% of $140,000 = $105,000

Other entries in the table are determined in a similar manner.

Problem 8-22 (continued)

2. The activity rates are computed as follows:

Activity Cost Pool	*(a)* *Total Cost*	*(b)* *Total Activity*	*(a) ÷ (b)* *Activity Rate*
Cleaning carpets...	$137,000	10,000 hundred square feet	$13.70 per hundred square feet
Travel to jobs.......	$45,000	50,000 miles	$0.90 per mile
Job support..........	$58,500	1,800 jobs	$32.50 per job

3. The cost for the Lazy Bee Ranch job is computed as follows:

Activity Cost Pool	*(a)* *Activity Rate*	*(b)* *Activity*	*(a) × (b)* *ABC Cost*
Cleaning carpets...	$13.70 per hundred square feet	6 hundred square feet	$ 82.20
Travel to jobs.......	$0.90 per mile	52 miles	46.80
Job support..........	$32.50 per job	1 job	32.50
Total...................			$161.50

4. The product margin can be easily computed below by using the costs calculated in part (3) above.

Sales......................		$137.70
Costs:		
Cleaning carpets...	$82.20	
Travel to jobs.......	46.80	
Job support..........	32.50	161.50
Product margin.......		$(23.80)

Problem 8-22 (continued)

5. Gore Range Carpet Cleaning appears to be losing money on the Lazy Bee Ranch job. However, caution is advised. Some of the costs may not be avoidable and hence would have been incurred even if the Lazy Bee Ranch job had not been accepted. An action analysis (discussed in Appendix 8A) is a more appropriate starting point for analysis than the simple report in part (4) above.

   Nevertheless, there is a point at which travel costs eat up all of the profit from a job. With the company's current policy of charging a flat fee for carpet cleaning irrespective of how far away the client is from the office, there clearly is some point at which jobs should be turned down. (What if a potential customer is located in Florida?)

6. The company should consider charging a fee for travel to outlying customers based on the distance traveled and a flat fee per job. At present, close-in customers are in essence subsidizing service to outlying customers and large-volume customers are subsidizing service to low-volume customers. With fees for travel and for job support, the fee per hundred square feet can be dropped substantially. This may result in losing some low-volume jobs in outlying areas, but the lower fee per hundred square feet may result in substantially more business close to Eagle-Vail. (If the fee is low enough, the added business may not even have to come at the expense of competitors. Some customers may choose to clean their carpets more frequently if the price were more attractive.)

Problem 8-23 (75 minutes)

1. The first-stage allocation of costs to activity cost pools appears below:

	Distribution of Resource Consumption Across Activity Cost Pools				
	Cleaning Carpets	*Travel to Jobs*	*Job Support*	*Other*	*Total*
Wages	75%	15%	0%	10%	100%
Cleaning supplies	100%	0%	0%	0%	100%
Cleaning equipment depreciation	70%	0%	0%	30%	100%
Vehicle expenses	0%	80%	0%	20%	100%
Office expenses	0%	0%	60%	40%	100%
President's compensation	0%	0%	30%	70%	100%

	Cleaning Carpets	*Travel to Jobs*	*Job Support*	*Other*	*Total*
Wages	$105,000	$21,000	$ 0	$14,000	$140,000
Cleaning supplies	25,000	0	0	0	25,000
Cleaning equipment depreciation	7,000	0	0	3,000	10,000
Vehicle expenses	0	24,000	0	6,000	30,000
Office expenses	0	0	36,000	24,000	60,000
President's compensation	0	0	22,500	52,500	75,000
Total cost	$137,000	$45,000	$58,500	$99,500	$340,000

75% of $140,000 = $105,000

Other entries in the table are determined in a similar manner.

Problem 8-23 (continued)

2. The activity rates are computed as follows:

	Cleaning Carpets	*Travel to Jobs*	*Job Support*
Total activity	10,000 hundred square feet	50,000 miles driven	1,800 jobs
Wages	$10.50	$0.42	$ 0.00
Cleaning supplies	2.50	0.00	0.00
Cleaning equipment depreciation	0.70	0.00	0.00
Vehicle expenses	0.00	0.48	0.00
Office expenses	0.00	0.00	20.00
President's compensation	0.00	0.00	12.50
Total cost	$13.70	$0.90	$32.50

Example: $105,000 ÷ 10,000 hundred square feet = $10.50 per hundred square feet

Wages attributable to cleaning carpets from the first-stage allocation above.

Problem 8-23 (continued)

3. The cost for the Lazy Bee Ranch job is computed as follows:

	Cleaning Carpets	*Travel to Jobs*	*Job Support*	*Total*
Activity for the Lazy Bee job.........	6 hundred square feet	52 miles driven	1 job	
Wages	$63.00	$21.84	$ 0.00	$ 84.84
Cleaning supplies	15.00	0.00	0.00	15.00
Cleaning equipment depreciation..	4.20	0.00	0.00	4.20
Vehicle expenses........................	0.00	24.96	0.00	24.96
Office expenses..........................	0.00	0.00	20.00	20.00
President's compensation............	0.00	0.00	12.50	12.50
Total cost	$82.20	$46.80	$32.50	$161.50

Example: $10.50 per hundred square feet × 6 hundred square feet = $63.00

Activity rate for wages and cleaning carpets.

Problem 8-23 (continued)

4. The product margin can be easily computed using the costs along the right-most column of the cost table prepared in part (3) above.

Sales		$137.70
Green costs:		
Wages	$84.84	
Cleaning supplies	15.00	
Cleaning equipment depreciation	4.20	
Vehicle expenses	24.96	129.00
Green margin		8.70
Yellow costs:		
Office expenses	20.00	20.00
Yellow margin		(11.30)
Red costs:		
President's compensation	12.50	12.50
Red margin		($ 23.80)

5. At most, Gore Range Carpet Cleaning is making only $8.70 on the Lazy Bee Ranch job. If more than $8.70 of the $20.00 in Office Expenses are actually avoidable if the job were not accepted, then the job is actually losing money.

   There is a point at which travel costs eat up all of the profit from a job. With the company's current policy of charging a flat fee for carpet cleaning irrespective of how far away the client is from the office, there clearly is some point at which jobs should be turned down. (What if a potential customer is located in Florida?)

Problem 8-23 (continued)

6. The company should consider charging a fee for travel to outlying customers based on the distance traveled and a flat fee per job. At present, close-in customers are in essence subsidizing service to outlying customers and large-volume customers are subsidizing service to low-volume customers. With fees for travel and for job support, the fee per hundred square feet can be dropped substantially. This may result in losing some low-volume jobs in outlying areas, but the lower fee per hundred square feet may result in substantially more business close to Eagle-Vail. (If the fee is low enough, the added business may not even have to come at the expense of competitors. Some customers may choose to clean their carpets more frequently if the price were more attractive.)

   Before making such a radical change, the data should be carefully reviewed. For example, the wage cost of $21.84 for a 52-mile trip seems rather high. Are two people sent out on jobs? Can the remote jobs be done with one person?

Problem 8-24 (60 minutes)

1. The company's estimated direct labor-hours (DLHs) can be computed as follows:

Deluxe model: 15,000 units × 1.6 DLH per unit....	24,000
Regular model: 120,000 units × 0.8 DLH per unit.	96,000
Total direct labor-hours......................................	120,000

Using direct labor-hours as the base, the predetermined overhead rate would be:

$$\frac{\text{Estimated overhead cost}}{\text{Estimated direct labor-hours}} = \frac{\$6{,}000{,}000}{120{,}000\text{ DLHs}} = \$50\text{ per DLH}$$

The unit product cost of each model using the company's traditional costing system would be:

	Deluxe	*Regular*
Direct materials.................	$154	$112
Direct labor.......................	16	8
Manufacturing overhead:		
$50 per DLH × 1.6 DLHs.	80	
$50 per DLH × 0.8 DLHs.		40
Total unit product cost.......	$250	$160

2. Predetermined overhead rates are computed below:

Activity Cost Pool	*(a) Estimated Overhead Cost*	*(b) Expected Activity*	*(a) ÷ (b) Predetermined Overhead Rate*
Purchase orders........	$252,000	1,200 purchase orders	$210 per purchase order
Scrap/rework orders..	$648,000	900 scrap/rework orders	$720 per scrap/ rework order
Product testing..........	$1,350,000	15,000 tests	$90 per test
Machine related	$3,750,000	50,000 MHs	$75 per MH

Problem 8-24 (continued)

3. a. The overhead applied to each product can be determined as follows:

The Deluxe Model

Activity Cost Pool	*(a) Predetermined Overhead Rate*	*(b) Activity*	*(a) × (b) Overhead Applied*
Purchase orders	$210 per PO	400 POs	$ 84,000
Scrap/rework orders	$720 per order	500 orders	360,000
Product testing	$90 per test	6,000 tests	540,000
Machine related	$75 per MH	20,000 MHs	1,500,000
Total overhead cost (a)			$2,484,000
Number of units produced (b)			15,000
Overhead cost per unit (a) ÷ (b)			$165.60

The Regular Model

Activity Cost Pool	*(a) Predetermined Overhead Rate*	*(b) Activity*	*(a) × (b) Overhead Applied*
Purchase orders	$210 per PO	800 POs	$ 168,000
Scrap/rework orders	$720 per order	400 orders	288,000
Product testing	$90 per test	9,000 tests	810,000
Machine related	$75 per MH	30,000 MHs	2,250,000
Total overhead cost (a)			$3,516,000
Number of units produced (b)			120,000
Overhead cost per unit (a) ÷ (b)			$29.30

Problem 8-24 (continued)

b. Using activity-based costing, the unit product cost of each model would be:

	Deluxe	*Regular*
Direct materials	$154.00	$112.00
Direct labor	16.00	8.00
Manufacturing overhead (above)	165.60	29.30
Total unit product cost	$335.60	$149.30

4. It is risky to draw any definite conclusions based on the above analysis. The activity-based costing system used in this company is not completely suitable for making decisions. Product costs probably include the costs of idle capacity and organization-sustaining costs. They also exclude nonmanufacturing costs that may be caused by the products. Nevertheless, the above analysis is suggestive. Unit costs appear to be distorted as a result of using direct labor-hours as the base for assigning overhead cost to products. Although the deluxe model requires twice as much labor time as the regular model, it still is not being assigned enough overhead cost, as shown in the analysis in part 3(a).

   When the company's overhead costs are analyzed on an activities basis, it appears that the deluxe model is more expensive to manufacture than the company realizes. Note that the deluxe model accounts for 40% of the machine-hours, although it represents a small part of the company's total production. Also, it consumes a disproportionately large amount of the activities.

   When activity-based costing is used in place of direct labor as the basis for assigning overhead cost to products, the unit product cost of the deluxe model jumps from $250 to $335.60. If the $250 cost figure is being used as the basis for pricing, then the selling price for the deluxe model may be too low. This may be one reason why profits have been declining over the last several years. It may also be the reason why sales of the deluxe model have been increasing rapidly.

Problem 8-25 (45 minutes)

1. The results of the first-stage allocation appear below:

	Removing Asbestos	*Estimating and Job Setup*	*Working on Nonroutine Jobs*	*Other*	*Totals*
Wages and salaries	$ 80,000	$ 20,000	$ 70,000	$ 30,000	$ 200,000
Disposal fees..................	420,000	0	180,000	0	600,000
Equipment depreciation ...	40,000	0	32,000	8,000	80,000
On-site supplies	33,000	9,000	12,000	6,000	60,000
Office expenses..............	19,000	76,000	57,000	38,000	190,000
Licensing and insurance...	185,000	0	148,000	37,000	370,000
Total cost	$777,000	$105,000	$499,000	$119,000	$1,500,000

According to the data in the problem, 40% of the wages and salaries cost of $200,000 is attributable to activities related to job size.

$200,000 × 40% = $80,000
Other entries in the table are determined in a similar manner.

2.

Activity Cost Pool	*(a) Total Cost*	*(b) Total Activity*	*(a) ÷ (b) Activity Rate*
Removing asbestos	$777,000	500 thousand square feet	$1,554 per thousand square feet
Estimating and job setup	$105,000	200 jobs	$525 per job
Working on nonroutine jobs.	$499,000	25 nonroutine jobs	$19,960 per nonroutine job

Problem 8-25 (continued)

3. The costs of each of the jobs can be computed as follows using the activity rates computed above:

   a. *Routine two-thousand-square-foot job:*

Removing asbestos	
($1,554 per thousand square feet × 2 thousand square feet)	$3,108
Estimating and job setup ($525 per job × 1 job)	525
Nonroutine job (not applicable)	0
Total cost of the job	$3,633
Average cost per thousand square feet ($3,633 ÷ 2 thousand square feet)	$1,816.50

   b. *Routine four-thousand-square-foot job:*

Removing asbestos	
($1,554 per thousand square feet × 4 thousand square feet)	$6,216
Estimating and job setup ($525 per job × 1 job)	525
Nonroutine job (not applicable)	0
Total cost of the job	$6,741
Cost per thousand square feet ($6,741 ÷ 4 thousand square feet)	$1,685.25

   c. *Nonroutine two-thousand-square-foot job:*

Removing asbestos	
($1,554 per thousand square feet × 2 thousand square feet)	$ 3,108
Estimating and job setup ($525 per job × 1 job)	525
Nonroutine job ($19,960 per nonroutine job × 1 nonroutine job)	19,960
Total cost of the job	$23,593
Cost per thousand square feet ($23,593 ÷ 2 thousand square feet)	$11,796.50

4. The objectivity of the interview data can be questioned since the on-site work supervisors were undoubtedly trying to prove their case about the cost of nonroutine jobs. Nevertheless, the activity-based costing data certainly suggest that dramatic differences exist in the costs of jobs. While some of the costs may be difficult to adjust in response to changes in activity, it does appear that the standard bid of $4,000 per thousand square feet may be substantially under the company's cost for nonroutine jobs. Even though it may be difficult to detect nonroutine situations before work begins, the average additional cost of $19,960 for nonroutine work suggests that the estimator should try. And if a nonroutine situation is spotted, this should be reflected in the bid price.

   Savvy competitors are likely to bid less than $4,000 per thousand square feet on routine work and substantially more than $4,000 per thousand square feet on nonroutine work. Consequently, Denny Asbestos Removal may find that its product mix shifts toward nonroutine work and away from routine work as customers accept bids on nonroutine work from the company and go to competitors for routine work. This may have a disastrous effect on the company's profits.

Problem 8-26 (20 minutes)

1. The cost of serving the local commercial market according to the ABC model can be determined as follows:

Activity Cost Pool	(a) Activity Rate	(b) Activity	(a) × (b) ABC Cost
Animation concept........	$6,000 per proposal	20 proposals	$120,000
Animation production....	$7,700 per minute of animation	12 minutes	92,400
Contract administration.	$6,600 per contract	8 contracts	52,800
			$265,200

2. The product margin of the local commercial market is negative, as shown below:

Sales		$240,000
Costs:		
Animation concept.............................	$120,000	
Animation production..........................	92,400	
Contract administration......................	52,800	265,200
Product margin....................................		($25,200)

3. It appears that the local commercial market is losing money and the company would be better off dropping this market segment. However, as discussed in Problem 8-27, not all of the costs included above may be avoidable. If more than $25,200 of the total costs of $265,200 is not avoidable, then the company really isn't losing money on the local commercial market and the segment should not be dropped. These issues will be discussed in more depth in Chapters 12 and 13.

Problem 8-27 (30 minutes)

1. The detailed cost analysis of local commercials appears below:

	Activity Rates		
	Animation Concept	*Animation Production*	*Contract Administration*
Technical staff salaries	$3,500	$5,000	$1,800
Animation equipment depreciation	600	1,500	0
Administrative wages and salaries	1,400	200	4,600
Supplies costs	300	600	100
Facility costs	200	400	100
Total	$6,000	$7,700	$6,600

	Animation Concept	*Animation Production*	*Contract Administration*	*Total*
Activity level	20 proposals	12 minutes	8 contracts	
Technical staff salaries	$ 70,000	$60,000	$14,400	$144,400
Animation equipment depreciation	12,000	18,000	0	30,000
Administrative wages and salaries	28,000	2,400	36,800	67,200
Supplies costs	6,000	7,200	800	14,000
Facility costs	4,000	4,800	800	9,600
Total cost	$120,000	$92,400	$52,800	$265,200

Example: $3,500 per proposal × 20 proposals = $70,000

Problem 8-27 (continued)

2. The action analysis report is constructed by using the row totals from the cost report in part (1) above:

Sales		$240,000
Green costs:		
Supplies costs	$ 14,000	14,000
Green margin		226,000
Yellow costs:		
Administrative wages and salaries	67,200	67,200
Yellow margin		158,800
Red costs:		
Technical staff salaries	144,400	
Animation equipment depreciation	30,000	
Facility costs	9,600	184,000
Red margin		($ 25,200)

3. At first glance, it appears that the company is losing money on local commercials. However, the action analysis report indicates that if this market segment were dropped, most of the costs would probably continue to be incurred. The nature of the technical staff salaries is clearly critical since it makes up the bulk of the costs. Management has suggested that the company's most valuable asset is the technical staff and that they would be the last to go in case of financial difficulties. Nevertheless, there are at least two situations in which these costs would be relevant. First, dropping the local commercial market segment may reduce future hiring of new technical staff. This would have the effect of reducing future spending and therefore would reduce the company's costs. Second, if technical staff time is a constraint, dropping the local commercial market segment would allow managers to shift technical staff time to other, presumably more profitable, work. However, if this is the case, there are better ways to determine which projects should get technical staff attention. This subject will be covered in Chapter 13 in the section on utilization of scarce resources.

Finally, the cost of the animation concept at the proposal stage is a major drag on the profitability of the local commercial market. The activity-based costing system, as currently designed, assumes that all project proposals require the same effort. This may not be the case. Proposals for local commercials may be far less elaborate than proposals for major special effects animation sequences for motion pictures. If management *has* been putting about the same amount of effort into every proposal, the above activity-based costing analysis suggests that this may be a mistake. Management may want to consider cutting back on the effort going into animation concepts for local commercials at the project proposal stage. Of course, this may lead to an even lower success rate on bids for local commercials.

Problem 8-28 (60 minutes)

1. The company expects to work 60,000 direct labor-hours during the year, computed as follows:

Mono-circuit: 40,000 units × 1 DLH per unit........	40,000
Bi-circuit: 10,000 units × 2 DLH per unit............	20,000
Total direct labor-hours....................................	60,000

Using direct labor-hours as the base, the predetermined manufacturing overhead rate would be:

$$\frac{\text{Estimated overhead cost}}{\text{Estimated direct labor-hours}} = \frac{\$3{,}000{,}000}{60{,}000\text{ DLHs}} = \$50\text{ per DLH}$$

The unit product cost of each product would be:

	Mono-circuit	*Bi-circuit*
Direct materials (given)	$ 40	$ 80
Direct labor (given)	18	36
Manufacturing overhead:		
$50 per DLH × 1 DLH and 2 DLHs ..	50	100
Total unit product cost.....................	$108	$216

2. The predetermined overhead rates would be computed as follows:

Activity Center	*(a) Estimated Overhead Costs*	*(b) Expected Activity*	*(a) ÷ (b) Predetermined Overhead Rate*
Maintaining parts inventory............	$360,000	900 part types	$400 per part type
Processing purchase orders..	$540,000	3,000 orders	$180 per order
Quality control	$600,000	8,000 tests	$75 per test
Machine-related	$1,500,000	50,000 MHs	$30 per MH

Problem 8-28 (continued)

3. a. The overhead applied to each product can be determined as follows:

Mono-Circuit

Activity Cost Pool	*(a) Predetermined Overhead Rate*	*(b) Activity*	*(a) × (b) Overhead Applied*
Maintaining parts inventory	$400 per part type	300 part types	$ 120,000
Processing purchase orders	$180 per order	2,000 orders	360,000
Quality control	$75 per test	2,000 tests	150,000
Machine-related	$30 per MH	20,000 MHs	600,000
Total manufacturing overhead cost (a)			$1,230,000
Number of units produced (b)			40,000
Overhead cost per unit (a) ÷ (b)			$30.75

Bi-Circuit

Activity Cost Pool	*(a) Predetermined Overhead Rate*	*(b) Activity*	*(a) × (b) Overhead Applied*
Maintaining parts inventory	$400 per part type	600 part types	$ 240,000
Processing purchase orders	$180 per order	1,000 orders	180,000
Quality control	$75 per test	6,000 tests	450,000
Machine-related	$30 per MH	30,000 MHs	900,000
Total manufacturing overhead cost (a)			$1,770,000
Number of units produced (b)			10,000
Overhead cost per unit (a) ÷ (b)			$177.00

Problem 8-28 (continued)

b. Using activity-based costing, the unit product cost of each product would be:

	Mono-circuit	*Bi-circuit*
Direct materials	$40.00	$ 80.00
Direct labor	18.00	36.00
Manufacturing overhead (above)	30.75	177.00
Total unit product cost	$88.75	$293.00

4. Although the bi-circuit accounts for only 20% of the company's total production, it is responsible for two-thirds of the part types carried in inventory and 60% of the machine-hours. It is also responsible for one-third of the purchase orders and three-fourths of the quality control tests. These factors have been concealed as a result of using direct labor-hours as the base for assigning overhead cost to products. Since the bi-circuit is responsible for a majority of the activity in the company, under activity-based costing it is assigned most of the overhead cost.

   Managers should be cautious about drawing firm conclusions about the profitability of products from the above activity-based cost analysis. The ABC system used in this company is not completely suitable for making decisions. Product costs probably include costs of idle capacity and organization-sustaining costs. They also exclude nonmanufacturing costs that may be caused by the products. Nevertheless, the above analysis is suggestive. The bi-circuit may not be as profitable as management believes, and this may be the reason for the company's declining profits. Note that from part (1), the unit product cost of the bi-circuit is $216. In part (3), however, the activity-based costing system sets the unit product cost of the bi-circuit at $293. This is a difference of $77 per unit. If the unit product cost of $216 is being used to set the selling price for the bi-circuit, the selling price may not be high enough to cover the company's costs.

Problem 8-29 (60 minutes)

1. a. When direct labor-hours are used to apply overhead cost to products, the company's predetermined overhead rate would be:

$$\text{Predetermined overhead rate} = \frac{\text{Manufacturing overhead cost}}{\text{Direct labor hours}}$$

$$= \frac{\$1{,}480{,}000}{20{,}000 \text{ DLHs}} = \$74 \text{ per DLH}$$

b.

	Model	
	XR7	*ZD5*
Direct materials	$35.00	$25.00
Direct labor:		
$20 per hour × 0.2 DLH, 0.4 DLH	4.00	8.00
Manufacturing overhead:		
$74 per hour × 0.2 DLH, 0.4 DLH	14.80	29.60
Total unit product cost	$53.80	$62.60

2. a. Predetermined overhead rates for the activity cost pools:

Activity Cost Pool	*(a) Estimated Total Cost*	*(b) Estimated Total Activity*	*(a) ÷ (b) Activity Rate*
Machine setups	$180,000	250 setups	$720 per setup
Special milling	$300,000	1,000 MHs	$300 per MH
General factory	$1,000,000	20,000 DLHs	$50 per DLH

Problem 8-29 (continued)

The overhead applied to each product can be determined as follows:

Model XR7

Activity Cost Pool	*(a) Predetermined Overhead Rate*	*(b) Activity*	*(a) × (b) Overhead Applied*
Machine setups	$720 per setup	150 setups	$108,000
Special milling	$300 per MH	1,000 MHs	300,000
General factory	$50 per DLH	4,000 DLHs	200,000
Total manufacturing overhead cost (a)			$608,000
Number of units produced (b)			20,000
Overhead cost per unit (a) ÷ (b)			$30.40

Model ZD5

Activity Cost Pool	*(a) Predetermined Overhead Rate*	*(b) Activity*	*(a) × (b) Overhead Applied*
Machine setups	$720 per setup	100 setups	$ 72,000
Special milling	$300 per MH	0 MHs	0
General factory	$50 per DLH	16,000 DLHs	800,000
Total manufacturing overhead cost (a)			$872,000
Number of units produced (b)			40,000
Overhead cost per unit (a) ÷ (b)			$21.80

Problem 8-29 (continued)

b. The unit product cost of each model under activity-based costing would be computed as follows:

	Model	
	XR7	*ZD5*
Direct materials	$35.00	$25.00
Direct labor ($20 per DLH × 0.2 DLH; $20 per DLH × 04.DLH)	4.00	8.00
Manufacturing overhead (above)	30.40	21.80
Total unit product cost	$69.40	$54.80

Comparing these unit cost figures with the unit costs in Part 1(b), we find that the unit product cost for Model XR7 has increased from $53.80 to $69.40, and the unit product cost for Model ZD5 has decreased from $62.60 to $54.80.

3. It is especially important to note that, even under activity-based costing, 68% of the company's overhead costs continue to be applied to products on the basis of direct labor-hours:

Machine setups (number of setups)	$ 180,000	12%
Special milling (machine-hours)	300,000	20
General factory (direct labor-hours)	1,000,000	68
Total overhead cost	$1,480,000	100%

Thus, the shift in overhead cost from the high-volume product (Model ZD5) to the low-volume product (Model XR7) occurred as a result of reassigning only 32% of the company's overhead costs.

The increase in unit product cost for Model XR7 can be explained as follows: First, where possible, overhead costs have been traced to the products rather than being lumped together and spread uniformly over production. Therefore, the special milling costs, which are traceable to Model XR7, have all been assigned to Model XR7 and none assigned to Model ZD5 under the activity-based costing approach. It is common in industry to have some products that require special handling or special milling of some type. This is especially true in modern factories that produce a variety of products. Activity-based costing provides a vehicle for assigning these costs to the appropriate products.

Problem 8-29 (continued)

Second, the costs associated with the batch-level activity (machine setups) have also been assigned to the specific products to which they relate. These costs have been assigned according to the number of setups completed for each product. However, since a batch-level activity is involved, another factor affecting unit costs comes into play. That factor is batch size. Some products are produced in large batches and some are produced in small batches. *The smaller the batch, the higher the cost per unit of the batch activity.* In the case at hand, the data can be analyzed as shown below.

Model XR7:		
Cost to complete one setup [see 2(a)]	$720	(a)
Number of units processed per setup		
(20,000 units ÷ 150 setups)	133.33	(b)
Setup cost per unit (a) ÷ (b)	$5.40	
Model ZD5:		
Cost to complete one setup (above)	$720	(a)
Number of units processed per setup		
(40,000 units ÷ 100 setups)	400	(b)
Setup cost per unit (a) ÷ (b)	$1.80	

Thus, the cost per unit for setups is three times as great for Model XR7, the low-volume product, as it is for Model ZD5, the high-volume product. Such differences in cost are obscured when direct labor-hours (or any other volume measure) is used as the basis for applying overhead cost to products.

In sum, overhead cost has shifted from the high-volume product to the low-volume product as a result of more appropriately assigning some costs to the products on the basis of the activities involved, rather than on the basis of direct labor-hours.

Case 8-30 (120 minutes)

1. a. The predetermined overhead rate is computed as follows:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated manufacturing overhead cost}}{\text{Estimated direct labor-hours}}$$

$$= \frac{\$600,000}{80,000\text{DLHs}} = \$7.50 \text{ per DLH}$$

b. The margins for the windows ordered by the two customers are computed as follows under the traditional costing system:

	Avon Construction		*Lynx Builders*	
Sales		$9,995		$54,995
Costs:				
Direct materials	$3,400		$17,200	
Direct labor	4,500		27,000	
Manufacturing overhead (@ $7.50 per DLH)	1,875	9,775	11,250	55,450
Margin		$ 220		$(455)

Case 8-30 (continued)

2. a. The first-stage allocation of costs to activity cost pools appears below:

	Making Windows	*Processing Orders*	*Customer Relations*	*Other*	*Totals*
Indirect factory wages	$ 60,000	$120,000	$ 24,000	$ 36,000	$ 240,000
Production equipment depreciation	200,000	0	0	50,000	250,000
Other factory costs	44,000	0	0	66,000	110,000
Administrative wages and salaries	0	60,000	84,000	96,000	240,000
Office expenses	0	12,000	18,000	30,000	60,000
Marketing expenses	0	0	210,000	70,000	280,000
Total cost	$304,000	$192,000	$336,000	$348,000	$1,180,000

According to the data in the problem, 25% of the indirect factory wages are attributable to the activity of making windows.

25% of $240,000 = $60,000

The other entries in the table are determined in a similar manner.

Case 8-30 (continued)

2. b. The activity rates are computed as follows:

	Making Windows	*Processing Orders*	*Customer Relations*
Total activity	80,000 DLHs	1,000 orders	200 customers
Indirect factory wages	$0.75	$120	$ 120
Production equipment depreciation	2.50	0	0
Other factory costs	0.55	0	0
Administrative wages and salaries	0.00	60	420
Office expenses	0.00	12	90
Marketing expenses	0.00	0	1,050
Total cost	$3.80	$192	$1,680

Example: $60,000 ÷ 80,000 DLHs = $0.75 per DLH

Indirect factory wages attributable to the activity of making windows from the first-stage allocation above.

Case 8-30 (continued)

2. c. The overhead cost of serving Avon Construction is computed as follows:

	Making Windows	*Processing Orders*	*Customer Relations*	*Total*
Activity for Avon Construction	250 DLHs	2 orders	1 customer	
Indirect factory wages	$187.50	$240.00	$ 120.00	$ 547.50
Production equipment depreciation ...	625.00	0.00	0.00	625.00
Other factory costs	137.50	0.00	0.00	137.50
Administrative wages and salaries	0.00	120.00	420.00	540.00
Office expenses	0.00	24.00	90.00	114.00
Marketing expenses	0.00	0.00	1,050.00	1,050.00
Total cost	$950.00	$384.00	$1,680.00	$3,014.00

Example: $0.75 per DLH × 250 DLHs = $187.50

Activity rate for indirect wages for the activity making windows.

Case 8-30 (continued)

The overhead cost of serving Lynx Builders is computed as follows:

	Making Windows	*Processing Orders*	*Customer Relations*	*Total*
Activity for Lynx Builders	1,500 DLHs	3 orders	1 customer	
Indirect factory wages....................	$1,125.00	$360.00	$ 120.00	$1,605.00
Production equipment depreciation ..	3,750.00	0.00	0.00	3,750.00
Other factory costs........................	825.00	0.00	0.00	825.00
Administrative wages and salaries	0.00	180.00	420.00	600.00
Office expenses............................	0.00	36.00	90.00	126.00
Marketing expenses.......................	0.00	0.00	1,050.00	1,050.00
Total cost	$5,700.00	$576.00	$1,680.00	$7,956.00

Example: $0.75 per DLH × 1,500 DLHs = $1,125.00

Activity rate for indirect wages for the activity of making windows.

Case 8-30 (continued)

2. d. The action analyses can be constructed using the row totals from the overhead cost analysis in part (2c) above.

Avon Construction

Sales		$9,995.00
Green costs:		
Direct materials	$3,400.00	3,400.00
Green margin		6,595.00
Yellow costs:		
Direct labor	4,500.00	
Indirect factory wages	547.50	
Production equipment depreciation	625.00	
Other factory costs	137.50	
Office expenses	114.00	
Marketing expenses	1,050.00	6,974.00
Yellow margin		(379.00)
Red costs:		
Administrative wages and salaries	540.00	540.00
Red margin		$(919.00)

Case 8-30 (continued)

Lynx Builders		
Sales		$54,995
Green costs:		
Direct materials	$17,200	17,200
Green margin		37,795
Yellow costs:		
Direct labor	27,000	
Indirect factory wages	1,605	
Production equipment depreciation	3,750	
Other factory costs	825	
Office expenses	126	
Marketing expenses	1,050	34,356
Yellow margin		3,439
Red costs:		
Administrative wages and salaries	600	600
Red margin		$ 2,839

Case 8-30 (continued)

3. According to the activity-based costing analysis, Victorian Windows may be losing money dealing with Avon Construction. Both the red and yellow margins are negative. This means that if Victorian Windows could actually avoid the yellow costs (or redeploy those resources to more profitable uses) by dropping Avon Construction as a customer, the company would be better off without this customer.

   The activity-based costing and traditional costing systems do not agree concerning the profitability of these two customers. The traditional costing system regards Avon Construction as a profitable customer and Lynx Builders as a money-losing customer. The activity-based costing system comes to exactly the opposite conclusion. The activity-based costing system provides more useful data for decision making for several reasons. First, the traditional costing system assigns all manufacturing costs to products—even costs that are not actually caused by the products such as costs of idle capacity and organization-sustaining costs. Second, the traditional costing system excludes all nonmanufacturing costs from product costs—even those that are caused by the product such as some office expenses. Third, the traditional costing system spreads manufacturing overhead uniformly among products based on direct labor-hours. This penalizes high-volume products with large amounts of direct labor-hours. Low-volume products with relatively small amounts of direct labor-hours benefit since the costs of batch-level activities like processing orders are pushed onto the high-volume products.

Case 8-31 (90 minutes)

1. a. The predetermined overhead rate would be computed as follows:

$$\frac{\text{Expected manufacturing overhead cost}}{\text{Estimated direct labor-hours}} = \frac{\$3{,}000{,}000}{50{,}000 \text{ DLHs}}$$

$$= \$60 \text{ per DLH}$$

   b. The unit product cost per pound, using the company's present costing system, would be:

	Mona Loa	*Malaysian*
Direct materials (given)	$4.20	$3.20
Direct labor (given)	0.30	0.30
Manufacturing overhead:		
0.025 DLH × $60 per DLH.....	1.50	1.50
Total unit product cost.............	$6.00	$5.00

2. a. Overhead rates by activity center:

Activity Center	*(a) Estimated Overhead Costs*	*(b) Expected Activity*	*(a) ÷ (b) Predetermined Overhead Rate*
Purchasing	$513,000	1,710 orders	$300 per order
Material handling ..	$720,000	1,800 setups	$400 per setup
Quality control	$144,000	600 batches	$240 per batch
Roasting...............	$961,000	96,100 hours	$10 per hour
Blending...............	$402,000	33,500 hours	$12 per hour
Packaging.............	$260,000	26,000 hours	$10 per hour

Case 8-31 (continued)

Before we can determine the amount of overhead cost to assign to the products we must first determine the activity for each of the products in the six activity centers. The necessary computations follow:

Number of purchase orders:
Mona Loa: 100,000 pounds ÷ 20,000 pounds per order = 5 orders
Malaysian: 2,000 pounds ÷ 500 pounds per order = 4 orders
Number of batches:
Mona Loa: 100,000 pounds ÷ 10,000 pounds per batch = 10 batches
Malaysian: 2,000 pounds ÷ 500 pounds per batch = 4 batches
Number of setups:
Mona Loa: 10 batches × 3 setups per batch = 30 setups
Malaysian: 4 batches × 3 setups per batch = 12 setups
Roasting hours:
Mona Loa: 1 hour × (100,000 pounds ÷ 100 pounds) = 1,000 hours
Malaysian: 1 hour × (2,000 pounds ÷ 100 pounds) = 20 hours
Blending hours:
Mona Loa: 0.5 hour × (100,000 pounds ÷ 100 pounds) = 500 hours
Malaysian: 0.5 hour × (2,000 pounds ÷ 100 pounds) = 10 hours
Packaging hours:
Mona Loa: 0.1 hour × (100,000 pounds ÷ 100 pounds) = 100 hours
Malaysian: 0.1 hour × (2,000 pounds ÷ 100 pounds) = 2 hours

Case 8-31 (continued)

The overhead applied to each product can be determined as follows:

Mona Loa

Activity Cost Pool	*(a) Predetermined Overhead Rate*	*(b) Activity*	*(a) × (b) Overhead Applied*
Purchasing............	$300 per order	5 orders	$ 1,500
Material handling ...	$400 per setup	30 setups	12,000
Quality control	$240 per batch	10 batches	2,400
Roasting	$10 per roasting hour	1,000 roasting hours	10,000
Blending	$12 per blending hour	500 blending hours	6,000
Packaging	$10 per packaging hour	100 packaging hours	1,000
Total			$32,900

Malaysian

Activity Cost Pool	*(a) Predetermined Overhead Rate*	*(b) Activity*	*(a) × (b) Overhead Applied*
Purchasing............	$300 per order	4 orders	$1,200
Material handling ...	$400 per setup	12 setups	4,800
Quality control	$240 per batch	4 batches	960
Roasting	$10 per roasting hour	20 roasting hours	200
Blending	$12 per blending hour	10 blending hours	120
Packaging	$10 per packaging hour	2 packaging hours	20
Total			$7,300

Case 8-31 (continued)

b. According to the activity-based costing system, the manufacturing overhead cost per pound is:

	Mona Loa	*Malaysian*
Total overhead cost assigned (above) (a) ...	$32,900	$7,300
Number of pounds manufactured (b)..........	100,000	2,000
Cost per pound (a) ÷ (b)	$0.33	$3.65

c. The unit product costs according to the activity-based costing system are:

	Mona Loa	*Malaysian*
Direct materials (given)	$4.20	$3.20
Direct labor (given)	0.30	0.30
Manufacturing overhead	0.33	3.65
Total unit product cost...........	$4.83	$7.15

3. MEMO TO THE PRESIDENT: Analysis of CBI's data shows that several activities other than direct labor drive the company's manufacturing overhead costs. These activities include purchase orders issued, number of setups for material processing, and number of batches processed. The company's present costing system, which relies on direct labor time as the sole basis for assigning overhead cost to products, significantly undercosts low-volume products, such as the Malaysian coffee, and significantly overcosts high-volume products, such as our Mona Loa coffee.

   An implication of the activity-based costing analysis is that our low-volume products may not be covering the costs of the manufacturing resources they use. For example, Malaysian coffee is currently priced at $6.50 per pound, but this price is significantly below its activity-based cost of $7.15 per pound. Under our present costing and pricing system, our high-volume products, such as our Mona Loa coffee, may be subsidizing our low-volume products. Some adjustments in prices may be required. However, before taking such an action, an action analysis report (discussed in Appendix 8A) should be prepared.

Case 8-31 (continued)

ALTERNATIVE SOLUTION:

Many students will compute the manufacturing overhead cost per pound of the two coffees as shown above. However, the cost per pound can also be computed as shown below. *This alternative approach provides additional insight into the data and facilitates emphasis of some points made in the chapter.*

	Mona Loa		*Malaysian*	
	Total	*Per Pound (÷ 100,000)*	*Total*	*Per Pound (÷ 2,000)*
Purchasing	$ 1,500	$0.015	$1,200	$0.600
Material handling	12,000	0.120	4,800	2.400
Quality control	2,400	0.024	960	0.480
Roasting	10,000	0.100	200	0.100
Blending	6,000	0.060	120	0.060
Packaging	1,000	0.010	20	0.010
Total	$32,900	$0.329	$7,300	$3.650

Note particularly how batch size impacts unit cost data. For example, the cost to the company to process a purchase order is $300, regardless of how many pounds of coffee are contained in the order. Twenty thousand pounds of the Mona Loa coffee are purchased per order (with five orders per year), and just 500 pounds of the Malaysian coffee are purchased per order (with four orders per year). Thus, the purchase order cost *per pound* for the Mona Loa coffee is just 1.5 cents, whereas the purchase order cost *per pound* for the Malaysian coffee is 40 times as much, or 60 cents. As stated in the text, this is one reason why unit costs of low-volume products, such as the Malaysian coffee, increase so dramatically when activity-based costing is used.

Research and Application 8-32 (240 minutes)

1. JetBlue succeeds first and foremost because of its operational excellence customer value proposition. Pages 1-3 of the 10-K/A make numerous references to JetBlue's goal of being a "leading low-fare, low-cost passenger airline." For example, page 2 discusses three major aspects of the company's strategy—to stimulate demand with low fares, to continuously decrease operating costs, and to offer point-to-point flights to underserved and/or overpriced markets. Page 3 describes how the company lowers its operating costs by efficiently utilizing its aircraft, maintaining a productive workforce, operating only one type of aircraft, and streamlining the reservation booking process.

2. JetBlue faces numerous business risks as described in pages 17-23 of the 10-K/A. Students may mention other risks beyond those specifically mentioned in the 10-K/A. Here are four risks faced by JetBlue with suggested control activities:

- Risk: Rising fuel prices may lower profits. Control activities: Page 23 of the 10-K/A mentions that JetBlue uses a fuel hedging program to help control this risk.
- Risk: JetBlue's reputation could be severely harmed by a major airplane crash. Control activities: Implement a rigorously monitored preventive maintenance program. Provide pilots with state-of-the-art flight training.
- Risk: Page 20 of the 10-K/A mentions that approximately 75% of JetBlue's daily flights have JFK or LaGuardia airport as their destination or point of origin. This exposes JetBlue to the risk of a downturn in the local New York City economy or to a downturn in local tourism due to a terrorist act or some other factor. Control activities: Increase the number of cities served so that a smaller portion of total revenues is tied to New York City.
- Risk: JetBlue's workforce could seek to unionize. This process could result in work slowdowns or stoppages and it could increase operating expenses. Control activities: Establish a Human Resource Management Department that proactively works with employees to ensure that their morale remains high and that they feel fairly treated.

3. In a manufacturing context, a unit refers to an individual unit of product. In an airline context, a "unit" refers to a passenger on a particular flight. Two examples of unit-level activities include baggage handling and ticket processing. Both activities are directly influenced by the number of passengers served. JetBlue's point-to-point flights simplify the baggage handling process because there is no need to transfer luggage from one flight to numerous other connecting flights. Point-to-point flights also lower the incidence of mishandled bags. JetBlue reports that it mishandled only 2.99 bags per 1,000 customers (see page 10 of the 10-K/A).

   JetBlue uses technology to streamline ticket processing. Page 3 of the 10-K/A mentions that 75.4% of the company's sales were booked at www.jetblue.com. This is the company's least expensive form of ticket processing. It also mentions that JetBlue further simplified ticket processing by enabling on-line check-ins, allowing customers to change reservations through the website, and installing 76 kiosks in 19 cities.

4. In a manufacturing context, a batch refers to a number of units of product that are processed together. A batch-level cost is the same regardless of how many units of the product are included in the batch. In an airline context, a "batch" refers to a flight departure. Examples of batch-level activities include refueling the airplane, performing pre-flight maintenance, and cleaning the interior of the cabin. The costs to refuel an airplane, maintain it, and clean it are essentially the same regardless of how many passengers are on board.

   Through 2004, JetBlue operated 70 Airbus A320 airplanes (see page 1 of the 10-K/A). Using only one type of aircraft simplifies the gate turnaround process, which includes all of the batch-level activities mentioned in the prior paragraph. Page 3 of the 10-K/A says that JetBlue operated each airplane an average of 13.4 hours per day, which the company believes was higher than any other major U. S. airline. Efficient gate turnarounds are one of the keys to JetBlue's high rate of aircraft utilization.

Research and Application 8-32 (continued)

5. An example of a customer-level activity for JetBlue is maintaining its customer loyalty program called TrueBlue Flight Gratitude (see page 4 of the 10-K/A). Currently, more than two million customers are enrolled in this program. The work involved in maintaining the customer accounts for this program is driven primarily by the number of customers served rather than the number of tickets sold. An example of an organization-sustaining activity is complying with government regulations that are established by the Department of Transportation, the Federal Aviation Administration, and the Transportation Security Administration (see page 14 of the 10-K/A). JetBlue must comply with these regulations in order for the business to operate.

6. Fuel costs could be assigned using the number of departures, a transaction driver, or the number of miles flown, a duration driver. The number of miles flown would be more accurate because it recognizes that fuel is consumed by miles flown and that each departure flies a different number of miles.

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Chapter 9
Profit Planning

Solutions to Questions

9-1 A budget is a detailed quantitative plan for the acquisition and use of financial and other resources over a given time period. Budgetary control involves the use of budgets to control the *actual* activities of a firm.

9-2

1. Budgets communicate management's plans throughout the organization.
2. Budgets force managers to think about and plan for the future.
3. The budgeting process provides a means of allocating resources to those parts of the organization where they can be used most effectively.
4. The budgeting process can uncover potential bottlenecks before they occur.
5. Budgets coordinate the activities of the entire organization by integrating the plans of its various parts. Budgeting helps to ensure that everyone in the organization is pulling in the same direction.
6. Budgets define goals and objectives that can serve as benchmarks for evaluating subsequent performance.

9-3 Responsibility accounting is a system in which a manager is held responsible for those items of revenues and costs—and only those items—that the manager can control to a significant extent. Each line item in the budget is made the responsibility of a manager who is then held responsible for differences between budgeted and actual results.

9-4 A master budget represents a summary of all of management's plans and goals for the future, and outlines the way in which these plans are to be accomplished. The master budget is composed of a number of smaller, specific budgets encompassing sales, production, raw materials, direct labor, manufacturing overhead, selling and administrative expenses, and inventories. The master budget generally also contains a budgeted income statement, budgeted balance sheet, and cash budget.

9-5 The level of sales impacts virtually every other aspect of the firm's activities. It determines the production budget, cash collections, cash disbursements, and selling and administrative budget that in turn determine the cash budget and budgeted income statement and balance sheet.

9-6 No. Planning and control are different, although related, concepts. Planning involves developing goals and developing budgets to achieve those goals. Control, by contrast, involves the means by which management attempts to ensure that the goals set down at the planning stage are attained.

9-7 The flow of budgeting information moves in two directions—upward and downward. The initial flow should be from the bottom of the organization upward. Each person having responsibility over revenues or costs should prepare the budget data against which his or her subsequent performance will be measured. As the budget data are communicated upward, higher-level managers should review the budgets for consistency with the overall goals of the organization and the plans of other units in the organization. Any issues should be resolved in discussions between the individuals who prepared the budgets and their managers.

All levels of an organization should participate in the budgeting process—not just top management or the accounting department. Generally, the lower levels will be more familiar with detailed, day-to-day operating data, and for this reason will have primary responsibility for developing the specifics in the budget. Top levels of management should have a better perspective concerning the company's strategy.

9-8 A self-imposed budget is one in which persons with responsibility over cost control prepare their own budgets. This is in contrast to a budget that is imposed from above. The major advantages of a self-imposed budget are: (1) Individuals at all levels of the organization are recognized as members of the team whose views and judgments are valued. (2) Budget estimates prepared by front-line managers are often more accurate and reliable than estimates prepared by top managers who have less intimate knowledge of markets and day-to-day operations. (3) Motivation is generally higher when individuals participate in setting their own goals than when the goals are imposed from above. Self-imposed budgets create commitment. (4) A manager who is not able to meet a budget that has been imposed from above can always say that the budget was unrealistic and impossible to meet. With a self-imposed budget, this excuse is not available.

Self-imposed budgets do carry with them the risk of budgetary slack. The budgets prepared by lower-level managers should be carefully reviewed to prevent too much slack.

9-9 Budgeting can assist a company forecast its workforce staffing needs through direct labor and other budgets. By careful planning through the budget process, a company can often smooth out its activities and avoid erratic hiring and laying off employees.

9-10 No, although this is clearly one of the purposes of the cash budget. The principal purpose is to provide information on probable cash needs *during* the budget period, so that bank loans and other sources of financing can be anticipated and arranged well in advance.

Exercise 9-1 (20 minutes)

1.

	July	*August*	*September*	*Total*
May sales:				
$430,000 × 10%	$ 43,000			$ 43,000
June sales:				
$540,000 × 70%, 10%	378,000	$ 54,000		432,000
July sales:				
$600,000 × 20%, 70%, 10%	120,000	420,000	$ 60,000	600,000
August sales:				
$900,000 × 20%, 70%		180,000	630,000	810,000
September sales:				
$500,000 × 20%			100,000	100,000
Total cash collections	$541,000	$654,000	$790,000	$1,985,000

Notice that even though sales peak in August, cash collections peak in September. This occurs because the bulk of the company's customers pay in the month following sale. The lag in collections that this creates is even more pronounced in some companies. Indeed, it is not unusual for a company to have the least cash available in the months when sales are greatest.

2. Accounts receivable at September 30:

From August sales: $900,000 × 10%	$ 90,000
From September sales:	
$500,000 × (70% + 10%)	400,000
Total accounts receivable	$490,000

Exercise 9-2 (10 minutes)

	July	*August*	*September*	*Quarter*
Budgeted sales in units	30,000	45,000	60,000	135,000
Add desired ending inventory* .	4,500	6,000	5,000	5,000
Total needs	34,500	51,000	65,000	140,000
Less beginning inventory..........	3,000	4,500	6,000	3,000
Required production	31,500	46,500	59,000	137,000

*10% of the following month's sales

Exercise 9-3 (15 minutes)

	Quarter—Year 2				Year 3
	First	Second	Third	Fourth	First
Required production of calculators	60,000	90,000	150,000	100,000	80,000
Number of chips per calculator	× 3	× 3	× 3	× 3	× 3
Total production needs—chips	180,000	270,000	450,000	300,000	240,000

	Year 2				
	First	Second	Third	Fourth	Year
Production needs—chips	180,000	270,000	450,000	300,000	1,200,000
Add desired ending inventory—chips	54,000	90,000	60,000	48,000	48,000
Total needs—chips	234,000	360,000	510,000	348,000	1,248,000
Less beginning inventory—chips	36,000	54,000	90,000	60,000	36,000
Required purchases—chips	198,000	306,000	420,000	288,000	1,212,000
Cost of purchases at $2 per chip	$396,000	$612,000	$840,000	$576,000	$2,424,000

Exercise 9-4 (20 minutes)

1. Assuming that the direct labor workforce is adjusted each quarter, the direct labor budget would be:

	1st Quarter	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Year*
Units to be produced	5,000	4,400	4,500	4,900	18,800
Direct labor time per unit (hours)	×0.40	×0.40	×0.40	×0.40	×0.40
Total direct labor hours needed	2,000	1,760	1,800	1,960	7,520
Direct labor cost per hour	×$11.00	×$11.00	×$11.00	×$11.00	×$11.00
Total direct labor cost	$22,000	$19,360	$19,800	$21,560	$82,720

2. Assuming that the direct labor workforce is not adjusted each quarter and that overtime wages are paid, the direct labor budget would be:

	1st Quarter	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Year*
Units to be produced	5,000	4,400	4,500	4,900	18,800
Direct labor time per unit (hours)	×0.40	×0.40	×0.40	×0.40	×0.40
Total direct labor hours needed	2,000	1,760	1,800	1,960	7,520
Regular hours paid	1,800	1,800	1,800	1,800	7,200
Overtime hours paid	200	0	0	160	360
Wages for regular hours (@ $11.00 per hour)	$19,800	$19,800	$19,800	$19,800	$79,200
Overtime wages (@ $11.00 per hour × 1.5 hours)	3,300	0	0	2,640	5,940
Total direct labor cost	$23,100	$19,800	$19,800	$22,440	$85,140

Exercise 9-5 (15 minutes)

1.

Krispin Corporation
Manufacturing Overhead Budget

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year
Budgeted direct labor-hours	5,000	4,800	5,200	5,400	20,400
Variable overhead rate	× $1.75	× $1.75	× $1.75	× $1.75	× $1.75
Variable manufacturing overhead	$ 8,750	$ 8,400	$ 9,100	$ 9,450	$ 35,700
Fixed manufacturing overhead	35,000	35,000	35,000	35,000	140,000
Total manufacturing overhead	43,750	43,400	44,100	44,450	175,700
Less depreciation	15,000	15,000	15,000	15,000	60,000
Cash disbursements for manufacturing overhead	$28,750	$28,400	$29,100	$29,450	$115,700

2.

Total budgeted manufacturing overhead for the year (a)	$175,700
Total budgeted direct labor-hours for the year (b)	20,400
Predetermined overhead rate for the year (a) ÷ (b)	$8.61

Exercise 9-6 (15 minutes)

Haerve Company
Selling and Administrative Expense Budget

	1st Quarter	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Year*
Budgeted unit sales	12,000	14,000	11,000	10,000	47,000
Variable selling and administrative expense per unit	× $2.75	× $2.75	× $2.75	× $2.75	× $2.75
Variable expense	$ 33,000	$ 38,500	$ 30,250	$ 27,500	$129,250
Fixed selling and administrative expenses:					
Advertising	12,000	12,000	12,000	12,000	48,000
Executive salaries	40,000	40,000	40,000	40,000	160,000
Insurance		6,000		6,000	12,000
Property taxes			6,000		6,000
Depreciation	16,000	16,000	16,000	16,000	64,000
Total fixed selling and administrative expenses	68,000	74,000	74,000	74,000	290,000
Total selling and administrative expenses	101,000	112,500	104,250	101,500	419,250
Less depreciation	16,000	16,000	16,000	16,000	64,000
Cash disbursements for selling and administrative expenses	$ 85,000	$ 96,500	$ 88,250	$ 85,500	$355,250

Exercise 9-7 (20 minutes)

	Quarter (000 omitted)				
	1	*2*	*3*	*4*	*Year*
Cash balance, beginning	$ 9 *	$ 5	$ 5	$ 5	$ 9
Add collections from customers	76	90	125 *	100	391 *
Total cash available	85 *	95	130	105	400
Less disbursements:					
Purchase of inventory	40 *	58 *	36	32 *	166
Operating expenses	36	42 *	54 *	48	180 *
Equipment purchases	10 *	8 *	8 *	10	36 *
Dividends	2 *	2 *	2 *	2 *	8
Total disbursements	88	110 *	100	92	390
Excess (deficiency) of cash available over disbursements	(3)*	(15)	30 *	13	10
Financing:					
Borrowings	8	20 *	0	0	28
Repayments (including interest)	0	0	(25)	(7)*	(32)
Total financing	8	20	(25)	(7)	(4)
Cash balance, ending	$ 5	$ 5	$ 5	$ 6	$ 6

*Given.

Problem 9-8 (30 minutes)

1. Cadence and Cross used a top-down approach to prepare the budget. That is, they prepared the budget with little or no input from the individuals who would have to implement the budget. In contrast, the recommended approach is a participative budget in which the individuals who have cost control responsibility initiate and fully participate in the budgeting process. Participatory budgets have a number of advantages including: 1) those who are closest to the action are likely to have better information; 2) managers are likely to be more committed to and understand a budget they participated in preparing than a budget that is imposed from above; and 3) participative budgets help to foster a sense that everyone's input is valued.

2. While Cadence and Cross are undoubtedly pleased with their work, the dissatisfaction expressed by some employees with the budget process is a sign that there may be storm clouds ahead. If employees feel that the budget is unrealistic, the fact that it was imposed can lead to resentment, anger, and a sense of helplessness. Employees may, as a consequence, spend their time and energy complaining about the budget rather than creatively solving problems. And if the budget is indeed unrealistic and managers are held responsible for meeting the budget, unproductive finger-pointing is likely to result as reality fails to live up to expectations.

Problem 9-9 (30 minutes)

1.

September cash sales	$ 7,400
September collections on account:	
July sales: $20,000 × 18%	3,600
August sales: $30,000 × 70%	21,000
September sales: $40,000 × 10%	4,000
Total cash collections	$36,000

2.

Payments to suppliers:	
August purchases (accounts payable)	$16,000
September purchases: $25,000 × 20%	5,000
Total cash payments	$21,000

3.

Calgon Products
Cash Budget
For the Month of September

Cash balance, September 1		$ 9,000
Add cash receipts:		
Collections from customers		36,000
Total cash available before current financing		45,000
Less disbursements:		
Payments to suppliers for inventory	$21,000	
Selling and administrative expenses	9,000 *	
Equipment purchases	18,000	
Dividends paid	3,000	
Total disbursements		51,000
Excess (deficiency) of cash available over disbursements		(6,000)
Financing:		
Borrowings		11,000
Repayments		0
Interest		0
Total financing		11,000
Cash balance, September 30		$ 5,000

*$13,000 – $4,000 = $9,000.

Problem 9-10 (45 minutes)

1. Stokes is using the budget as a club to pressure employees and as a way to find someone to blame rather than as a legitimate planning and control tool. His planning seems to consist of telling everyone to increase sales volume by 40%. This kind of "planning" requires no analysis, no intelligence, no business insight, and is very likely viewed with contempt by the employees of the company.

2. The way in which the budget is being used is likely to breed hostility, tension, mistrust, lack of respect, and actions designed to meet targets using any means available. Unreasonable targets imposed from the top, coupled with a "no excuses" policy and the threat of being fired, create an ideal breeding ground for questionable business practices. Managers who would not, under ordinary circumstances, cheat or cut corners may do so if put under this kind of pressure.

3. As the old saying goes, Keri Kalani is "between a rock and a hard place." The Standards of Ethical Conduct for Management Accountants states that management accountants have a responsibility to "disclose fully all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, comments, and recommendations presented." Assuming that Keri helps prepare the Production Department's reports to top management, collaborating with her boss in hiding losses due to defective disk drives would clearly violate this standard. Apart from the misrepresentation on the accounting reports, the policy of shipping defective returned units to customers is bound to have a negative effect on the company's reputation. If this policy were to become widely known, it would very likely have a devastating effect on the company's future sales. Moreover, this practice may be illegal under statutes designed to protect consumers.

   Having confronted her boss with no satisfactory resolution of the problem, Keri must now decide what to do. The Standards of Ethical Conduct for Management Accountants suggests that Keri go to the next higher level in management to present her case. Unfortunately, in the prevailing moral climate at PrimeDrive, she is unlikely to win any blue ribbons for blowing the whistle on her boss. All of the managers below Stokes are likely to be in fear of losing their own jobs and many of them may have taken actions to meet Stokes' targets that they are not proud

Problem 9-10 (continued)

of either. It would take tremendous courage for Keri to take the problem all the way up to Stokes himself—particularly in view of his less-than-humane treatment of subordinates. And going to the Board of Directors is unlikely to work either since Stokes and his venture capital firm apparently control the Board. Resigning, with a letter of memorandum to the individual who is most likely to be concerned and to be able to take action, may be the only ethical course of action that is left open to Keri in this situation. Of course, she must pay her rent, so hopefully she has good alternative employment opportunities.

Note: This problem is very loosely based on the MiniScribe scandal reported in the December, 1992 issue of *Management Accounting* as well as in other business publications. After going bankrupt, it was discovered that managers at MiniScribe had perpetrated massive fraud as a result of the unrelenting pressure to meet unrealistic targets. Q. T. Wiles, the real chairman of MiniScribe, was reported to have behaved much as described in this problem. Keri Kalani is, alas, a fabrication. Hopefully, there were people like Keri at MiniScribe who tried to do something to stop the fraud.

Problem 9-11 (45 minutes)

1. Production budget:

	July	*August*	*September*	*October*
Budgeted sales (units)	40,000	50,000	70,000	35,000
Add desired ending inventory	20,000	26,000	15,500	11,000
Total needs	60,000	76,000	85,500	46,000
Less beginning inventory	17,000	20,000	26,000	15,500
Required production	43,000	56,000	59,500	30,500

2. During July and August the company is building inventories in anticipation of peak sales in September. Therefore, production exceeds sales during these months. In September and October inventories are being reduced in anticipation of a decrease in sales during the last months of the year. Therefore, production is less than sales during these months to cut back on inventory levels.

3. Direct materials budget:

	July	*August*	*September*	*Third Quarter*
Required production (units)	43,000	56,000	59,500	158,500
Material A135 needed per unit	× 3 lbs.	× 3 lbs.	× 3 lbs.	× 3 lbs.
Production needs (lbs.)	129,000	168,000	178,500	475,500
Add desired ending inventory (lbs.)	84,000	89,250	45,750 *	45,750
Total Material A135 needs	213,000	257,250	224,250	521,250
Less beginning inventory (lbs.)	64,500	84,000	89,250	64,500
Material A135 purchases (lbs.)	148,500	173,250	135,000	456,750

*30,500 units (October production) × 3 lbs. per unit= 91,500 lbs.; 91,500 lbs. × 0.5 = 45,750 lbs.

As shown in part (1), production is greatest in September. However, as shown in the raw material purchases budget, the purchases of materials is greatest a month earlier because materials must be on hand to support the heavy production scheduled for September.

Problem 9-12 (30 minutes)

1.

Priston Company
Direct Materials Budget

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year
Required production	6,000	7,000	8,000	5,000	26,000
Raw materials per unit	× 3	× 3	× 3	× 3	× 3
Production needs	18,000	21,000	24,000	15,000	78,000
Add desired ending inventory	4,200	4,800	3,000	3,700	3,700
Total needs	22,200	25,800	27,000	18,700	81,700
Less beginning inventory	3,600	4,200	4,800	3,000	3,600
Raw materials to be purchased	18,600	21,600	22,200	15,700	78,100
Cost of raw materials to be purchased at $2.50 per pound	$46,500	$54,000	$55,500	$39,250	$195,250

Schedule of Expected Cash Disbursements for Materials

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year
Accounts payable, beginning balance	$11,775				$ 11,775
1st Quarter purchases	32,550	$13,950			46,500
2nd Quarter purchases		37,800	$16,200		54,000
3rd Quarter purchases			38,850	$16,650	55,500
4th Quarter purchases				27,475	27,475
Total cash disbursements for materials	$44,325	$51,750	$55,050	$44,125	$195,250

Problem 9-12 (continued)

2.

Priston Company
Direct Labor Budget

	1st Quarter	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Year*
Units to be produced	6,000	7,000	8,000	5,000	26,000
Direct labor time per unit (hours)	× 0.50	× 0.50	× 0.50	× 0.50	× 0.50
Total direct labor-hours needed	3,000	3,500	4,000	2,500	13,000
Direct labor cost per hour	× $12.00	× $12.00	× $12.00	× $12.00	× $12.00
Total direct labor cost	$ 36,000	$ 42,000	$ 48,000	$ 30,000	$156,000

Problem 9-13 (30 minutes)

1.

Harveton Corporation
Direct Labor Budget

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year
Units to be produced	16,000	15,000	14,000	15,000	60,000
Direct labor time per unit (hours)	0.80	0.80	0.80	0.80	0.80
Total direct labor-hours needed	12,800	12,000	11,200	12,000	48,000
Direct labor cost per hour	$11.50	$11.50	$11.50	$11.50	$11.50
Total direct labor cost	$147,200	$138,000	$128,800	$138,000	$552,000

2.

Harveton Corporation
Manufacturing Overhead Budget

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year
Budgeted direct labor-hours	12,800	12,000	11,200	12,000	48,000
Variable overhead rate	$2.50	$2.50	$2.50	$2.50	$2.50
Variable manufacturing overhead	$ 32,000	$ 30,000	$ 28,000	$ 30,000	$120,000
Fixed manufacturing overhead	90,000	90,000	90,000	90,000	360,000
Total manufacturing overhead	122,000	120,000	118,000	120,000	480,000
Less depreciation	34,000	34,000	34,000	34,000	136,000
Cash disbursements for manufacturing overhead	$ 88,000	$ 86,000	$ 84,000	$ 86,000	$344,000

Problem 9-14 (45 minutes)

1. Schedule of expected cash collections:

	Month			
	April	*May*	*June*	*Quarter*
From accounts receivable.	$141,000	$ 7,200		$148,200
From April sales:				
20% × 200,000	40,000			40,000
75% × 200,000		150,000		150,000
4% × 200,000			$ 8,000	8,000
From May sales:				
20% × 300,000		60,000		60,000
75% × 300,000			225,000	225,000
From June sales:				
20% × 250,000			50,000	50,000
Total cash collections	$181,000	$217,200	$283,000	$681,200

Problem 9-14 (continued)

2. Cash budget:

	Month April	May	June	Quarter
Cash balance, beginning	$ 26,000	$ 27,000	$ 20,200	$ 26,000
Add receipts:				
Collections from customers	181,000	217,200	283,000	681,200
Total available	207,000	244,200	303,200	707,200
Less disbursements:				
Merchandise purchases	108,000	120,000	180,000	408,000
Payroll	9,000	9,000	8,000	26,000
Lease payments	15,000	15,000	15,000	45,000
Advertising	70,000	80,000	60,000	210,000
Equipment purchases	8,000	—	—	8,000
Total disbursements	210,000	224,000	263,000	697,000
Excess (deficiency) of receipts over disbursements	(3,000)	20,200	40,200	10,200
Financing:				
Borrowings	30,000	—	—	30,000
Repayments	—	—	(30,000)	(30,000)
Interest	—	—	(1,200)	(1,200)
Total financing	30,000	—	(31,200)	(1,200)
Cash balance, ending	$ 27,000	$ 20,200	$ 9,000	$ 9,000

3. If the company needs a minimum cash balance of $20,000 to start each month, the loan cannot be repaid in full by June 30. If the loan is repaid in full, the cash balance will drop to only $9,000 on June 30, as shown above. Some portion of the loan balance will have to be carried over to July, at which time the cash inflow should be sufficient to complete repayment.

Problem 9-15 (60 minutes)

1. Schedule of cash receipts:

Cash sales—June	$ 60,000
Collections on accounts receivable:	
May 31 balance	72,000
June (50% × 190,000)	95,000
Total cash receipts	$227,000

Schedule of cash payments for purchases:

May 31 accounts payable balance	$ 90,000
June purchases (40% × 200,000)	80,000
Total cash payments	$170,000

Phototec, Inc.
Cash Budget
For the Month of June

Cash balance, beginning	$ 8,000
Add receipts from customers (above)	227,000
Total cash available	235,000
Less disbursements:	
Purchase of inventory (above)	170,000
Selling and administrative expenses	51,000
Purchases of equipment	9,000
Total cash disbursements	230,000
Excess of receipts over disbursements	5,000
Financing:	
Borrowings—note	18,000
Repayments—note	(15,000)
Interest	(500)
Total financing	2,500
Cash balance, ending	$ 7,500

Problem 9-15 (continued)

2. Phototec, Inc.
Budgeted Income Statement
For the Month of June

Sales		$250,000
Cost of goods sold:		
Beginning inventory	$ 30,000	
Add purchases	200,000	
Goods available for sale	230,000	
Ending inventory	40,000	
Cost of goods sold		190,000
Gross margin		60,000
Selling and administrative expenses ($51,000 + $2,000)		53,000
Net operating income		7,000
Interest expense		500
Net income		$ 6,500

3. Phototec, Inc.
Budgeted Balance Sheet
June 30

Assets

Cash	$ 7,500
Accounts receivable (50% × 190,000)	95,000
Inventory	40,000
Buildings and equipment, net of depreciation ($500,000 + $9,000 – $2,000)	507,000
Total assets	$649,500

Liabilities and Equity

Accounts payable (60% × 200,000)	$120,000
Note payable	18,000
Capital stock	420,000
Retained earnings ($85,000 + $6,500)	91,500
Total liabilities and equity	$649,500

Problem 9-16 (60 minutes)

1. The sales budget for the third quarter:

	July	*Aug.*	*Sept.*	*Quarter*
Budgeted sales (pairs)	6,000	7,000	5,000	18,000
Selling price per pair	× $50	× $50	× $50	× $50
Total budgeted sales	$300,000	$350,000	$250,000	$900,000

The schedule of expected cash collections from sales:

	July	*Aug.*	*Sept.*	*Quarter*
Accounts receivable,				
beginning balance	$130,000			$130,000
July sales:				
$300,000 × 40%, 50% .	120,000	$150,000		270,000
August sales:				
$350,000 × 40%, 50% .		140,000	$175,000	315,000
September sales:				
$250,000 × 40%			100,000	100,000
Total cash collections	$250,000	$290,000	$275,000	$815,000

2. The production budget for July through October:

	July	*Aug.*	*Sept.*	*Oct.*
Budgeted sales (pairs)	6,000	7,000	5,000	4,000
Add desired ending inventory	700	500	400	300
Total needs	6,700	7,500	5,400	4,300
Less beginning inventory...................	600	700	500	400
Required production (pairs)...............	6,100	6,800	4,900	3,900

Problem 9-16 (continued)

3. The direct materials budget for the third quarter:

	July	*Aug.*	*Sept.*	*Quarter*
Required production—pairs (above)	6,100	6,800	4,900	17,800
Raw materials needs per pair	× 2lbs.	× 2lbs.	× 2lbs.	× 2lbs.
Production needs (lbs.)	12,200	13,600	9,800	35,600
Add desired ending inventory	2,720	1,960	1,560 *	1,560
Total needs	14,920	15,560	11,360	37,160
Less beginning inventory	2,440	2,720	1,960	2,440
Raw materials to be purchased	12,480	12,840	9,400	34,720
Cost of raw materials to be purchased at $2.50 per lb.	$31,200	$32,100	$23,500	$86,800

*3,900 pairs (October) × 2 lbs. per pair= 7,800 lbs.;
7,800 lbs. × 20% = 1,560 lbs.

The schedule of expected cash disbursements:

	July	*Aug.*	*Sept.*	*Quarter*
Accounts payable, beginning balance	$11,400			$11,400
July purchases: $31,200 × 60%, 40%	18,720	$12,480		31,200
August purchases: $32,100 × 60%, 40%		19,260	$12,840	32,100
September purchases: $23,500 × 60%			14,100	14,100
Total cash disbursements	$30,120	$31,740	$26,940	$88,800

Problem 9-17 (120 minutes)

1. Schedule of expected cash collections:

	April	*May*	*June*	*Total*
Cash sales	$14,000	$17,000	$18,000	$ 49,000
Credit sales	48,000	56,000	68,000	172,000
Total collections	$62,000	$73,000	$86,000	$221,000

2. a. Merchandise purchases budget:

	April	*May*	*June*	*Total*
Budgeted cost of goods sold	$42,000	$51,000	$54,000	$147,000
Add desired ending inventory*	15,300	16,200	9,000	9,000
Total needs	57,300	67,200	63,000	156,000
Less beginning inventory	12,600	15,300	16,200	12,600
Required purchases	$44,700	$51,900	$46,800	$143,400

*At April 30: $51,000 × 30% = $15,300.
At June 30: $50,000 July sales × 60% × 30% = $9,000.

b. Schedule of cash disbursements for purchases:

	April	*May*	*June*	*Total*
For March purchases	$18,300			$18,300
For April purchases	22,350	$22,350		44,700
For May purchases		25,950	$25,950	51,900
For June purchases			23,400	23,400
Total cash disbursements	$40,650	$48,300	$49,350	$138,300

Problem 9-17 (continued)

3. Schedule of cash disbursements for selling and administrative expenses:

	April	*May*	*June*	*Total*
Salaries and wages	$ 7,500	$ 7,500	$ 7,500	$22,500
Shipping	4,200	5,100	5,400	14,700
Advertising	6,000	6,000	6,000	18,000
Other expenses	2,800	3,400	3,600	9,800
Total cash disbursements for operating expenses	$20,500	$22,000	$22,500	$65,000

4. Cash budget:

	April	*May*	*June*	*Total*
Cash balance, beginning	$ 9,000	$ 8,350	$ 8,050	$ 9,000
Add cash collections	62,000	73,000	86,000	221,000
Total cash available	71,000	81,350	94,050	230,000
Less disbursements:				
For inventory purchases	40,650	48,300	49,350	138,300
For selling and administrative expenses	20,500	22,000	22,500	65,000
For equipment purchases	11,500	3,000	0	14,500
For dividends	0	0	3,500	3,500
Total disbursements	72,650	73,300	75,350	221,300
Excess (deficiency) of cash	(1,650)	8,050	18,700	8,700
Financing:				
Borrowings	10,000	0	0	10,000
Repayments	0	0	(10,000)	(10,000)
Interest ($10,000 × 1% × 3)	0	0	(300)	(300)
Total financing	10,000	0	(10,300)	(300)
Cash balance, ending	$ 8,350	$ 8,050	$ 8,400	$ 8,400

Problem 9-17 (continued)

5. Income Statement:

Nordic Company
Income Statement
For the Quarter Ended June 30

Sales		$245,000
Cost of goods sold:		
Beginning inventory (given)	$ 12,600	
Add purchases (Part 2)	143,400	
Goods available for sale	156,000	
Ending inventory (Part 2)	9,000	147,000
Gross margin		98,000
Selling and administrative expenses:		
Salaries and wages (Part 3)	22,500	
Shipping (Part 3)	14,700	
Advertising (Part 3)	18,000	
Depreciation	6,000	
Other expenses (Part 3)	9,800	71,000
Net operating income		27,000
Less interest expense (Part 4)		300
Net income		$ 26,700

Problem 9-17 (continued)

6. Balance sheet:

Nordic Company
Balance Sheet
June 30

Assets

Current assets:		
Cash (Part 4)		$ 8,400
Accounts receivable (80% × $90,000)		72,000
Inventory (Part 2)		9,000
Total current assets		89,400
Buildings and equipment, net ($214,100 + $14,500 – $6,000)		222,600
Total assets		$312,000

Liabilities and Equity

Current liabilities:		
Accounts payable (Part 2: 50% × $46,800)		$ 23,400
Stockholders' equity:		
Capital stock	$190,000	
Retained earnings*	98,600	288,600
Total liabilities and equity		$312,000

* Retained earnings, beginning	$ 75,400
Add net income	26,700
Total	102,100
Less dividends	3,500
Retained earnings, ending	$ 98,600

Problem 9-18 (60 minutes)

1. a. Schedule of expected cash collections:

	Year 2 Quarter				
	First	*Second*	*Third*	*Fourth*	*Total*
Year 1—Fourth quarter sales:					
$300,000 × 65%	$195,000				$ 195,000
Year 2—First quarter sales:					
$400,000 × 33%	132,000				132,000
$400,000 × 65%		$260,000			260,000
Year 2—Second quarter sales:					
$500,000 × 33%		165,000			165,000
$500,000 × 65%			$325,000		325,000
Year 2—Third quarter sales:					
$600,000 × 33%			198,000		198,000
$600,000 × 65%				$390,000	390,000
Year 2—Fourth quarter sales:					
$480,000 × 33%				158,400	158,400
Total cash collections	$327,000	$425,000	$523,000	$548,400	$1,823,400

Problem 9-18 (continued)

b. Schedule of budgeted cash disbursements for merchandise purchases:

	Year 2 Quarter				
	First	*Second*	*Third*	*Fourth*	*Total*
Year 1—Fourth quarter purchases:					
$180,000 × 80%	$144,000				$ 144,000
Year 2—First quarter purchases:					
$260,000 × 20%	52,000				52,000
$260,000 × 80%		$208,000			208,000
Year 2—Second quarter purchases:					
$310,000 × 20%		62,000			62,000
$310,000 × 80%			$248,000		248,000
Year 2—Third quarter purchases:					
$370,000 × 20%			74,000		74,000
$370,000 × 80%				$296,000	296,000
Year 2—Fourth quarter purchases:					
$240,000 × 20%				48,000	48,000
Total cash disbursements	$196,000	$270,000	$322,000	$344,000	$1,132,000

Problem 9-18 (continued)

2.

	Year 2 Quarter				
	First	*Second*	*Third*	*Fourth*	*Year*
Budgeted sales.................	$400,000	$500,000	$600,000	$480,000	$1,980,000
Variable expense rate	× 12%	× 12%	× 12%	× 12%	× 12%
Variable expenses.............	48,000	60,000	72,000	57,600	237,600
Fixed expenses	90,000	90,000	90,000	90,000	360,000
Total expenses	138,000	150,000	162,000	147,600	597,600
Less depreciation	20,000	20,000	20,000	20,000	80,000
Cash disbursements	$118,000	$130,000	$142,000	$127,600	$ 517,600

Problem 9-18 (continued)

3. Cash budget for Year 2:

	Year 2 Quarter				
	First	*Second*	*Third*	*Fourth*	*Year*
Cash balance, beginning	$ 20,000	$ 23,000	$ 18,000	$ 18,500	$ 20,000
Add collections from sales	327,000	425,000	523,000	548,400	1,823,400
Total cash available	347,000	448,000	541,000	566,900	1,843,400
Less disbursements:					
Merchandise purchases	196,000	270,000	322,000	344,000	1,132,000
Operating expenses	118,000	130,000	142,000	127,600	517,600
Dividends	10,000	10,000	10,000	10,000	40,000
Land	0	80,000	48,500	0	128,500
Total disbursements	324,000	490,000	522,500	481,600	1,818,100
Excess (deficiency) of receipts over disbursements	23,000	(42,000)	18,500	85,300	25,300
Financing:					
Borrowings	0	60,000	0	0	60,000
Repayments	0	0	0	(60,000)	(60,000)
Interest ($60,000 × 1% × 9)	0	0	0	(5,400)	(5,400)
Total financing	0	60,000	0	(65,400)	(5,400)
Cash balance, ending	$ 23,000	$ 18,000	$ 18,500	$ 19,900	$ 19,900

Problem 9-19 (60 minutes)

1. Collections on sales:

	July	*August*	*Sept.*	*Quarter*
Cash sales	$ 8,000	$14,000	$10,000	$ 32,000
Credit sales:				
May: $30,000 × 80% × 20%	4,800			4,800
June: $36,000 × 80% × 70%, 20%	20,160	5,760		25,920
July: $40,000 × 80% × 10%, 70%, 20%	3,200	22,400	6,400	32,000
Aug.: $70,000 × 80% × 10%, 70%		5,600	39,200	44,800
Sept.: $50,000 × 80% × 10%			4,000	4,000
Total cash collections	$36,160	$47,760	$59,600	$143,520

2. a. Merchandise purchases budget:

	July	*August*	*Sept.*	*Oct.*
Budgeted cost of goods sold	$24,000	$42,000	$30,000	$27,000
Add desired ending inventory*	31,500	22,500	20,250	
Total needs	55,500	64,500	50,250	
Less beginning inventory	18,000	31,500	22,500	
Required inventory purchases	$37,500	$33,000	$27,750	

*75% of the next month's budgeted cost of goods sold.

b. Schedule of expected cash disbursements for merchandise purchases:

	July	*August*	*Sept.*	*Quarter*
Accounts payable, June 30	$11,700			$11,700
July purchases	18,750	$18,750		37,500
August purchases		16,500	$16,500	33,000
September purchases			13,875	13,875
Total cash disbursements	$30,450	$35,250	$30,375	$96,075

Problem 9-19 (continued)

3.

Janus Products, Inc.
Cash Budget
For the Quarter Ended September 30

	July	*August*	*Sept.*	*Quarter*
Cash balance, beginning	$ 8,000	$ 8,410	$ 8,020	$ 8,000
Add collections from sales	36,160	47,760	59,600	143,520
Total cash available	44,160	56,170	67,620	151,520
Less disbursements:				
For inventory purchases	30,450	35,250	30,375	96,075
For selling expenses	7,200	11,700	8,500	27,400
For administrative expenses	3,600	5,200	4,100	12,900
For land	4,500	0	0	4,500
For dividends	0	0	1,000	1,000
Total disbursements	45,750	52,150	43,975	141,875
Excess (deficiency) of cash available over disbursements	(1,590)	4,020	23,645	9,645
Financing:				
Borrowings	10,000	4,000		14,000
Repayment	0	0	(14,000)	(14,000)
Interest	0	0	(380)	(380)
Total financing	10,000	4,000	(14,380)	(380)
Cash balance, ending	$ 8,410	$ 8,020	$ 9,265	$ 9,265

* $10,000 × 1% × 3 =	$300
$4,000 × 1% × 2 =	80
	$380

Problem 9-20 (90 minutes)

1.

	April	*May*	*June*	*Quarter*
Budgeted sales....................	20,000	35,000	50,000	105,000
Add desired ending inventory*........................	7,000	10,000	9,000	9,000
Total needs.........................	27,000	45,000	59,000	114,000
Less beginning inventory	4,000	7,000	10,000	4,000
Required production............	23,000	38,000	49,000	110,000

*20% of the next month's sales.

2.

Material #208:	*April*	*May*	*June*	*Quarter*
Required production—units	23,000	38,000	49,000	110,000
Material #208 per unit.....	× 4 lbs.	× 4 lbs.	× 4 lbs.	× 4 lbs.
Production needs—pounds.........................	92,000	152,000	196,000	440,000
Add desired ending inventory*...................	76,000	98,000	84,000	84,000
Total needs—pounds	168,000	250,000	280,000	524,000
Less beginning inventory .	46,000	76,000	98,000	46,000
Required purchases—pounds.........................	122,000	174,000	182,000	478,000
Required purchases at $5.00 per pound...........	$610,000	$870,000	$910,000	$2,390,000

* 50% of the following month's production needs. For June: July production 45,000 + 6,000 – 9,000 = 42,000 units; 42,000 units × 4 lbs. per unit = 168,000 lbs.; 168,000 lbs. × 50% = 84,000 lbs.

Problem 9-20 (continued)

Material #311:	*April*	*May*	*June*	*Quarter*
Required production—units	23,000	38,000	49,000	110,000
Material #311 per unit	× 9 ft.	× 9 ft	× 9 ft	× 9 ft
Production needs—feet	207,000	342,000	441,000	990,000
Add desired ending inventory*	114,000	147,000	126,000	126,000
Total needs—feet	321,000	489,000	567,000	1,116,000
Less beginning inventory	69,000	114,000	147,000	69,000
Required purchases—feet	252,000	375,000	420,000	1,047,000
Required purchases at $2.00 per foot	$504,000	$750,000	$840,000	$2,094,000

* 1/3 of the following month's production needs. For June:
July production 45,000 + 6,000 – 9,000 = 42,000 units;
42,000 units × 9 ft. per unit = 378,000 ft.;
378,000 ft. × 1/3 = 126,000 ft.

3. Direct labor budget:

		Direct Labor Hours			
	Units Produced	*Per Unit*	*Total*	*Cost per DLH*	*Total Cost*
Shaping	110,000	0.25	27,500	$18.00	$ 495,000
Assembly	110,000	0.70	77,000	$16.00	1,232,000
Finishing	110,000	0.10	11,000	$20.00	220,000
			115,500		$1,947,000

Problem 9-20 (continued)

4. Manufacturing overhead budget:

Expected production for the year	250,000
Actual production through March 31	32,000
Expected production, April through December	218,000
Variable manufacturing overhead rate per unit ($112,000 ÷ 32,000 units)	× $3.50
Variable manufacturing overhead	$ 763,000
Fixed manufacturing overhead ($4,628,000 × ¾)	3,471,000
Total manufacturing overhead	4,234,000
Less depreciation ($2,910,000 × ¾)	2,182,500
Cash disbursement for manufacturing overhead	$2,051,500

Problem 9-21 (120 minutes)

1. Schedule of expected cash collections:

	January	February	March	Quarter
Cash sales	$28,000	$32,000	$34,000	$ 94,000
Credit sales*	36,000	42,000	48,000	126,000
Total collections	$64,000	$74,000	$82,000	$220,000

*60% of the preceding month's sales.

2. Merchandise purchases budget:

	January	February	March	Quarter
Budgeted cost of goods sold (70% of sales)	$49,000	$56,000	$59,500	$164,500
Add desired ending inventory*	11,200	11,900	7,700	7,700
Total needs	60,200	67,900	67,200	172,200
Less beginning inventory	9,800	11,200	11,900	9,800
Required purchases	$50,400	$56,700	$55,300	$162,400

*At March 30: April sales $55,000 × 70% × 20% = $7,700.

Schedule of expected cash disbursements—merchandise purchases

	January	February	March	Quarter
December purchases	$32,550			$ 32,550
January purchases	12,600	$37,800		50,400
February purchases		14,175	$42,525	56,700
March purchases			13,825	13,825
Total disbursements	$45,150	$51,975	$56,350	$153,475

Problem 9-21 (continued)

3. Schedule of expected cash disbursements—selling and administrative expenses

	January	*February*	*March*	*Quarter*
Commissions	$12,000	$12,000	$12,000	$36,000
Rent	1,800	1,800	1,800	5,400
Other expenses	5,600	6,400	6,800	18,800
Total disbursements	$19,400	$20,200	$20,600	$60,200

4. Cash budget:

	January	*February*	*March*	*Quarter*
Cash balance, beginning	$ 6,000	$ 5,450	$ 5,275	$ 6,000
Add cash collections	64,000	74,000	82,000	220,000
Total cash available	70,000	79,450	87,275	226,000
Less cash disbursements:				
For inventory	45,150	51,975	56,350	153,475
For operating expenses	19,400	20,200	20,600	60,200
For equipment	3,000	8,000	0	11,000
Total disbursements	67,550	80,175	76,950	224,675
Excess (deficiency) of cash	2,450	(725)	10,325	1,325
Financing:				
Borrowings	3,000	6,000	0	9,000
Repayments	0	0	(5,000)	(5,000)
Interest*	0	0	(210)	(210)
Total financing	3,000	6,000	(5,210)	3,790
Cash balance, ending	$ 5,450	$ 5,275	$ 5,115	$ 5,115

*	$3,000 × 1% × 3 =	$ 90
	$6,000 × 1% × 2 =	120
	Total interest	$210

Problem 9-21 (continued)

5.

Picanuy Corporation
Income Statement
For the Quarter Ended March 31

Sales ($70,000 + $80,000 + $85,000)		$235,000
Cost of goods sold:		
Beginning inventory (Given)	$ 9,800	
Add purchases (Part 2)	162,400	
Goods available for sale	172,200	
Less ending inventory (Part 2)	7,700	164,500
Gross margin		70,500
Selling and administrative expenses:		
Commissions (Part 3)	36,000	
Rent (Part 3)	5,400	
Depreciation (Given)	2,400	
Other expenses (Part 3)	18,800	62,600
Net operating income		7,900
Less interest expense		210
Net income		$ 7,690

Problem 9-21 (continued)

6.

Picanuy Corporation
Balance Sheet
March 31

Assets

Current assets:		
Cash (Part 4)		$ 5,115
Accounts receivable ($85,000 × 60%)		51,000
Inventory (Part 2)		7,700
Total current assets		63,815
Fixed assets—net		
($110,885 + $3,000 + $8,000 – $2,400)		119,485
Total assets		$183,300

Liabilities and Equity

Accounts payable (Part 2: $55,300 × 75%)		$ 41,475
Bank loan payable		4,000
Stockholders' equity:		
Capital stock (Given)	$100,000	
Retained earnings*	37,825	137,825
Total liabilities and equity		$183,300

* Retained earnings, beginning	$30,135
Add net income	7,690
Retained earnings, ending	$37,825

Case 9-22 (45 minutes)

1. The budgetary control system has several important shortcomings that reduce its effectiveness and may cause it to interfere with good performance. Some of the shortcomings are explained below.
   a. *Lack of Coordinated Goals.* Emory had been led to believe high-quality output is the goal; it now appears low cost is the goal. Employees do not know what the goals are and thus cannot make decisions that further the goals.
   b. *Influence of Uncontrollable Factors.* Actual performance relative to budget is greatly influenced by uncontrollable factors (i.e., rush orders, lack of prompt maintenance). Thus, the variance reports serve little purpose for performance evaluation or for locating controllable factors to improve performance. As a result, the system does not encourage coordination among departments.
   c. *The Short-Run Perspectives.* Monthly evaluations and budget tightening on a monthly basis results in a very short-run perspective. This results in inappropriate decisions (i.e., inspect forklift trucks rather than repair inoperative equipment, fail to report supplies usage).
   d. *System Does Not Motivate.* The budgetary system appears to focus on performance evaluation even though most of the essential factors for that purpose are missing. The focus on evaluation and the weaknesses take away an important benefit of the budgetary system—employee motivation.

2. The improvements in the budgetary control system should correct the deficiencies described above. The system should:
   a. more clearly define the company's objectives.
   b. develop an accounting reporting system that better matches controllable factors with supervisor responsibility and authority.
   c. establish budgets for appropriate time periods that do not change monthly simply as a result of a change in the prior month's performance.

   The entire company from top management down should be educated in sound budgetary procedures.

(Unofficial CMA Solution, adapted)

Case 9-23 (120+ minutes)

1\. a. Sales budget:

	April	*May*	*June*	*Quarter*
Budgeted sales in units	35,000	45,000	60,000	140,000
Selling price per unit ...	× $8	× $8	× $8	× $8
Total sales	$280,000	$360,000	$480,000	$1,120,000

b. Schedule of expected cash collections:

February sales	$ 48,000			$ 48,000
March sales	112,000	$ 56,000		168,000
April sales..................	70,000	140,000	$ 70,000	280,000
May sales		90,000	180,000	270,000
June sales...................			120,000	120,000
Total cash collections...	$230,000	$286,000	$370,000	$ 886,000

c. Merchandise purchases budget:

Budgeted sales in units	35,000	45,000	60,000	140,000
Add budgeted ending inventory*................	40,500	54,000	36,000	36,000
Total needs.................	75,500	99,000	96,000	176,000
Less beginning inventory	31,500	40,500	54,000	31,500
Required unit purchases	44,000	58,500	42,000	144,500
Unit cost.....................	× $5	× $5	× $5	× $5
Required dollar purchases	$220,000	$292,500	$210,000	$ 722,500

*90% of the next month's sales in units.

Case 9-23 (continued)

d. Budgeted cash disbursements for merchandise purchases:

	April	*May*	*June*	*Quarter*
March purchases....	$ 85,750			$ 85,750
April purchases	110,000	$110,000		220,000
May purchases.......		146,250	$146,250	292,500
June purchases......			105,000	105,000
Total cash disbursements.....	$195,750	$256,250	$251,250	$ 703,250

Case 9-23 (continued)

2. Cravat Sales Company
Cash Budget
For the Three Months Ending June 30

	April	*May*	*June*	*Quarter*
Cash balance, beginning..	$ 14,000	$ 10,250	$ 10,000	$ 14,000
Add receipts from customers (Part 1 b.)....	230,000	286,000	370,000	886,000
Total cash available.........	244,000	296,250	380,000	900,000
Less disbursements:				
Purchase of inventory (Part 1 d.)	195,750	256,250	251,250	703,250
Sales commissions........	35,000	45,000	60,000	140,000
Salaries and wages.......	22,000	22,000	22,000	66,000
Utilities	14,000	14,000	14,000	42,000
Miscellaneous..............	3,000	3,000	3,000	9,000
Dividends paid	12,000	0	0	12,000
Land purchases...........	0	25,000	0	25,000
Total disbursements	281,750	365,250	350,250	997,250
Excess (deficiency) of receipts over disbursements.............	(37,750)	(69,000)	29,750	(97,250)
Financing:				
Borrowings	48,000	79,000	0	127,000
Repayments*	0	0	(16,000)	(16,000)
Interest*	0	0	(3,020)	(3,020)
Total financing...............	48,000	79,000	(19,020)	107,980
Cash balance, ending	$ 10,250	$ 10,000	$ 10,730	$ 10,730

* This is the maximum amount (in increments of $1,000) that the company could repay to the bank and still have at least a $10,000 ending balance.

** $48,000 × 1% × 3 = $1,440
$79,000 × 1% × 2 = 1,580
Total interest = $3,020

Case 9-23 (continued)

3. Cravat Sales Company
Budgeted Income Statement
For the Three Months Ended June 30

Sales revenue (Part 1 a.)		$1,120,000
Variable expenses:		
Cost of goods sold		
(140,000 ties @ $5 per tie)	$700,000	
Commissions		
(140,000 ties @ $1 per tie)	140,000	840,000
Contribution margin		280,000
Fixed expenses:		
Wages and salaries	66,000	
Utilities	42,000	
Insurance expired	3,600	
Depreciation	4,500	
Miscellaneous	9,000	125,100
Net operating income		154,900
Less interest expense		3,020
Net income		$ 151,880

Case 9-23 (continued)

4.

Cravat Sales Company
Budgeted Balance Sheet
June 30

Assets

Cash (Part 2)	$ 10,730
Accounts receivable (see below)	450,000
Inventory (36,000 ties @ $5 per tie)	180,000
Unexpired insurance ($14,400 – $3,600)	10,800
Fixed assets, net of depreciation ($172,700 + $25,000 – $4,500)	193,200
Total assets	$844,730

Liabilities and Equity

Accounts payable, purchases (50% × $210,000 from Part 1 c.)	$105,000
Dividends payable	12,000
Loans payable, bank (Part 2; $127,000 – $16,000)	111,000
Capital stock, no par	300,000
Retained earnings (see below)	316,730
Total liabilities and equity	$844,730

Accounts receivable at June 30:

25% × May sales of $360,000	$ 90,000
75% × June sales of $480,000	360,000
Total	$450,000

Retained earnings at June 30:

Balance, March 31	$176,850
Add net income (Part 3)	151,880
Total	328,730
Less dividends declared	12,000
Balance, June 30	$316,730

Research and Application 9-24 (240 minutes)

1. Procter & Gamble (P&G) succeeds first and foremost because of its product leadership customer value proposition. Page 26 of the annual report says that P&G succeeds by winning two "moments of truth." First, P&G must win the moment of truth "when a consumer stands in front of the shelf and chooses a product from among many competitive offerings." This moment of truth alludes to a dimension of product leadership called perceived quality, or brand recognition. P&G must also win the second moment of truth "when the consumer uses the product and evaluates how well the product meets his or her expectations." This moment of truth alludes to the actual functionality of the product. If P&G cannot win these two "moments of truth" all other dimensions of competitiveness are moot.

   Students can make defensible arguments in favor of customer intimacy and operational excellence. For example, the Market Development Organization (MDO) operates in over 80 countries in an effort to tailor P&G's brands to local consumer preferences. However, these customer intimacy efforts are targeted at fairly large customer segments. Companies that succeed primarily because of customer intimacy tailor their offerings to individual customers, not large customer segments. P&G also cites economies of scale as being important to its success. While this is certainly true, scale does not differentiate P&G from its major competitors. What differentiates P&G from its competitors is the leadership position of its 17 "billion dollar brands."

2. P&G faces numerous business risks, some of which are described on page 28 and throughout the annual report. Students may mention other risks beyond those specifically mentioned in the annual report. Here are four risks faced by P&G with suggested control activities:

   - Risk: Patents granted to competitors may introduce product innovations that threaten P&G's product leadership position. Control activity: Create a competitive intelligence department that legally gathers information about the plans and actions of competitors.
   - Risk: One customer, Wal-Mart, accounted for 16% of P&G's sales in 2005 (see page 60 of the annual report). Control activity: Seek to diversify sources of sales revenue. P&G appears to be doing this because Wal-Mart was responsible for 17% and 18% of P&G's sales in 2004 and 2003, respectively.

Research and Application 9-24 (continued)

- Risk: P&G's pipeline of product innovations will dissipate, thereby threatening the company's product leadership position. Control activities: Invest generously in research & development and create performance measures that monitor the number of patents generated per dollar of investment.
- Risk: Globalization efforts may fail to grow sales. Page 7 of the annual report mentions that P&G currently generates only 23% of its sales from countries that comprise 86% of the world's population. Control activities: Continue to invest in the Market Development Organization and ask it to survey customers in target markets to ensure a good fit between P&G products and local consumer tastes.

3. P&G's quarterly sales (in millions) for 2005 were as follows: September 30th, $13,744; December 31st, $14,452; March 31st, $14,287; and June 30th, $14,258. Federated Department Stores had quarterly sales (in millions) in 2004 of: March 31st, $3,517; June 30th, $3,548; September 30th, $3,491; and December 31st, $5,074. P&G's quarterly sales trend is relatively smooth, whereas Federated's sales spiked upward in the fourth quarter.

   Federated has strong sales during the year-end holiday season, whereas P&G sells products that are daily essentials—Crest, Bounty, Charmin, Downy, and Folgers are used by consumers 365 days a year. Generally speaking, companies with seasonal customer demand will have greater cash budgeting concerns. These companies need to have enough cash available to buy large amounts of inventory even though the related cash inflows may not be received for months.

4. The "Item 2: Properties" section of P&G's 10-K states that the company operates 33 manufacturing plants in 21 different states in the United States. P&G also operates 91 manufacturing facilities in 42 other countries.

   P&G's three Global Business Units (GBUs) include P&G Beauty, P&G Family Health, and P&G Household Care. P&G Beauty includes five of the company's billion dollar brands—Pantene, Olay, Head & Shoulders, Wella, and Always. P&G Family Health includes six of the company's billion dollar brands—Pampers, Charmin, Bounty, Crest, Actonel, and

Iams. P&G Household Care includes the remaining six billion dollar brands—Folgers, Downy, Tide, Pringles, Dawn, and Ariel. Page 25 of the annual report mentions that P&G markets a total of over 300 branded products in more than 160 countries. The company's Market Development Organization operates in 80 countries.

5. Numerous uncertainties discussed on page 28 of the annual report complicate P&G's forecasting process. These include: (1) raw material cost fluctuations, (2) competitor advertising, pricing and promotion decisions, (3) global economic and political conditions, (4) changes in the regulatory environment, and (5) unforeseen difficulties integrating acquisitions such as Wella and Gillette.

6. The potential for data redundancy and data inconsistencies in a company the size of P&G is enormous. For example, disintegrated computer systems may allow each P&G plant to create its own unique terminology for identifying particular types of raw material. This kind of data inconsistency creates problems when P&G attempts to roll-up the underlying budgets from all of its manufacturing plants into one cohesive whole. The amount of time required to enable disintegrated software programs used at more than 120 manufacturing facilities across more than 40 countries to dovetail with one another would be overwhelming.

   Enterprise systems would enable each data element to have only one unique identifier across the entire company. All plants would have a common language for categorizing raw material costs as well as other types of expenses. Furthermore, the process of rolling-up the budget would be greatly simplified because all parts of the organization could easily share financial information rather than having to rely on extraordinary amounts of computer code to forge linkages between disconnected legacy systems.

Research and Application 9-24 (continued)

7. Differences in budgeting practices could definitely create cultural differences in terms of accountability and internal communication. For example, if one company uses inflexible and non-negotiable budget targets to blame and punish its employees it would create a counter-productive culture of accountability. This would stand in stark contrast to a company that uses budgets to plan, coordinate, and improve its operations, rather than to assign blame.

   Furthermore, a "top-down" approach to budgeting would create a different cultural environment in terms of internal communication than a "bottom-up" participative approach to budgeting. The "top-down" approach would create a sub-optimal environment of one-way communication where the knowledge of those closest to the customer is disregarded. The "bottom-up" approach would empower subordinates to improve the quality of the budget by sharing their knowledge while at the same time recognizing the need for strategic oversight from senior managers.

Case B-8 (continued)

Note that this profitability index takes into account the salespersons' natural inclinations to focus their efforts on the products with the highest sales commissions. Of course, it would be an even better idea to change the salespersons' compensation scheme, but this alternative was ruled out in the case.

Chapter 10
Standard Costs and the Balanced Scorecard

Solutions to Questions

10-1 A quantity standard indicates how much of an input should be used to make a unit of output. A price standard indicates how much the input should cost.

10-2 Ideal standards assume perfection and do not allow for any inefficiency. Thus, ideal standards are rarely, if ever, attained. Practical standards can be attained by employees working at a reasonable, though efficient pace and allow for normal breaks and work interruptions.

10-3 Chronic inability to meet a standard is likely to be demoralizing and may result in decreased productivity.

10-4 A budget is usually expressed in terms of total dollars, whereas a standard is expressed on a per unit basis. A standard might be viewed as the budgeted cost for one unit.

10-5 A variance is the difference between what was planned or expected and what was actually accomplished. A standard cost system has at least two types of variances. A price variance focuses on the difference between the standard price and the actual price of an input. A quantity variance is concerned with the difference between the standard quantity of the input allowed for the actual output and the actual amount of the input used.

10-6 Under management by exception, managers focus their attention on results that deviate from expectations. It is assumed that results that meet expectations do not require investigation.

10-7 Separating an overall variance into a price variance and a quantity variance provides more information. Moreover, price and quantity variances are usually the responsibilities of different managers.

10-8 The materials price variance is usually the responsibility of the purchasing manager. The materials quantity and labor efficiency variances are usually the responsibility of production managers and supervisors.

10-9 The materials price variance can be computed either when materials are purchased or when they are placed into production. It is usually better to compute the variance when materials are purchased since that is when the purchasing manager, who has responsibility for this variance, has completed his or her work. In addition, recognizing the price variance when materials are purchased allows the company to carry its raw materials in the inventory accounts at standard cost, which greatly simplifies bookkeeping.

10-10 This combination of variances may indicate that inferior quality materials were purchased at a discounted price, but the low-quality materials created production problems.

10-11 If standards are used to find who to blame for problems, they can breed resentment and undermine morale. Standards should not be used to find someone to blame for problems.

10-12 Several factors other than the contractual rate paid to workers can cause a labor rate variance. For example, skilled workers with high hourly rates of pay can be given duties that require little skill and that call for low hourly rates of pay, resulting in an unfavorable rate variance. Or unskilled or untrained workers can be assigned to tasks that should be filled by more skilled workers with higher rates of pay, resulting in a favorable rate variance. Unfavorable rate variances can also arise from overtime work at premium rates.

10-13 If poor quality materials create production problems, a result could be excessive labor time and therefore an unfavorable labor efficiency variance. Poor quality materials would not ordinarily affect the labor rate variance.

10-14 If overhead is applied on the basis of direct labor-hours, then the variable overhead efficiency variance and the direct labor efficiency variance will always be favorable or unfavorable together. Both variances are computed by comparing the number of direct labor-hours actually worked to the standard hours allowed. That is, in each case the formula is:

Efficiency Variance = SR(AH – SH)

Only the "SR" part of the formula, the standard rate, differs between the two variances.

10-15 A statistical control chart is a graphical aid that helps workers identify variances that should be investigated. Upper and lower limits are set on the control chart. Any variances falling between those limits are considered to be normal. Any variances falling outside of those limits are considered abnormal and are investigated.

10-16 If labor is a fixed cost and standards are tight, then the only way to generate favorable labor efficiency variances is for every workstation to produce at capacity. However, the output of the entire system is limited by the capacity of the bottleneck. If workstations before the bottleneck in the production process produce at capacity, the bottleneck will be unable to process all of the work in process. In general, if every workstation is attempting to produce at capacity, then work in process inventory will build up in front of the workstations with the least capacity.

10-17 A company's balanced scorecard should be derived from and support its strategy. Since different companies have different strategies, their balanced scorecards should be different.

10-18 The balanced scorecard is constructed to support the company's strategy, which is a theory about what actions will further the company's goals. Assuming that the company has financial goals, measures of financial performance must be included in the balanced scorecard as a check on the reality of the theory. If the internal business processes improve, but the financial outcomes do not improve, the theory may be flawed and the strategy should be changed.

10-19 The difference between delivery cycle time and throughput time is the waiting period between when an order is received and when production on the order is started. Throughput time is made up of process time, inspection time, move time, and queue time. These four elements can be classified into value-added time (process time) and non-value-added time (inspection time, move time, and queue time).

10-20 An MCE of less than 1 means that the production process includes non-value-added time. An MCE of 0.40, for example, means that 40% of throughput time consists of actual processing, and that the other 60% consists of moving, inspection, and other non-value-added activities.

10-21 Formal entry tends to give variances more emphasis than off-the-record computations. And, the use of standard costs in the journals simplifies the bookkeeping process by allowing all inventories to be carried at standard, rather than actual, cost.

Exercise 10-1 (20 minutes)

1.

Cost per 2 kilogram container	6,000.00	Kr
Less: 2% cash discount	120.00	
Net cost	5,880.00	
Add freight cost per 2 kilogram container (1,000 Kr ÷ 10 containers)	100.00	
Total cost per 2 kilogram container (a)	5,980.00	Kr
Number of grams per container (2 kilograms × 1000 grams per kilogram) (b)	2,000	
Standard cost per gram purchased (a) ÷ (b)	2.99	Kr

2.

Alpha SR40 required per capsule as per bill of materials	6.00	grams
Add allowance for material rejected as unsuitable (6 grams ÷ 0.96 = 6.25 grams; 6.25 grams – 6.00 grams = 0.25 grams)	0.25	grams
Total	6.25	grams
Add allowance for rejected capsules (6.25 grams ÷ 25 capsules)	0.25	grams
Standard quantity of Alpha SR40 per salable capsule	6.50	grams

3.

Item	*Standard Quantity per Capsule*	*Standard Price per Gram*	*Standard Cost per Capsule*
Alpha SR40	6.50 grams	2.99 Kr	19.435 Kr

Exercise 10-2 (20 minutes)

1.

Number of chopping blocks	4,000
Number of board feet per chopping block	× 2.5
Standard board feet allowed	10,000
Standard cost per board foot	× $1.80
Total standard cost	$18,000
Actual cost incurred	$18,700
Standard cost above	18,000
Total variance—unfavorable	$ 700

2.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
$18,700	11,000 board feet × $1.80 per board foot = $19,800	10,000 board feet × $1.80 per board foot = $18,000

Price Variance, $1,100 F

Quantity Variance, $1,800 U

Total Variance, $700 U

Alternatively:

Materials Price Variance = AQ (AP – SP)
11,000 board feet ($1.70 per board foot* – $1.80 per board foot) = $1,100 F

*$18,700 ÷ 11,000 board feet = $1.70 per board foot.

Materials Quantity Variance = SP (AQ – SQ)
$1.80 per board foot (11,000 board feet – 10,000 board feet) = $1,800 U

Exercise 10-3 (20 minutes)

1.

Number of meals prepared	6,000
Standard direct labor-hours per meal	× 0.20
Total direct labor-hours allowed	1,200
Standard direct labor cost per hour	× $9.50
Total standard direct labor cost	$11,400
Actual cost incurred	$11,500
Total standard direct labor cost (above)	11,400
Total direct labor variance	$ 100 Unfavorable

2.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
1,150 hours × $10.00 per hour = $11,500	1,150 hours × $9.50 per hour = $10,925	1,200 hours × $9.50 per hour = $11,400

↑ Rate Variance, $575 U ↑ Efficiency Variance, $475 F ↑

Total Variance, $100 U

Alternatively, the variances can be computed using the formulas:

Labor rate variance = AH(AR – SR)
= 1,150 hours ($10.00 per hour – $9.50 per hour)
= $575 U

Labor efficiency variance = SR(AH – SH)
= $9.50 per hour (1,150 hours – 1,200 hours)
= $475 F

Exercise 10-4 (20 minutes)

1.

Number of items shipped	140,000
Standard direct labor-hours per item	× 0.04
Total direct labor-hours allowed	5,600
Standard variable overhead cost per hour	× $2.80
Total standard variable overhead cost	$15,680
Actual variable overhead cost incurred	$15,950
Total standard variable overhead cost (above)	15,680
Total variable overhead variance	$ 270 Unfavorable

2.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
5,800 hours × $2.75 per hour* = $15,950	5,800 hours × $2.80 per hour = $16,240	5,600 hours × $2.80 per hour = $15,680

Variable overhead spending variance, $290 F

Variable overhead efficiency variance, $560 U

Total variance, $270 U

*$15,950÷ 5,800 hours =$2.75 per hour

Alternatively, the variances can be computed using the formulas:

Variable overhead spending variance:

AH(AR – SR) = 5,800 hours ($2.75 per hour – $2.80 per hour)
= $290 F

Variable overhead efficiency variance:

SR(AH – SH) = $2.80 per hour (5,800 hours – 5,600 hours)
= $560 U

Exercise 10-5 (45 minutes)

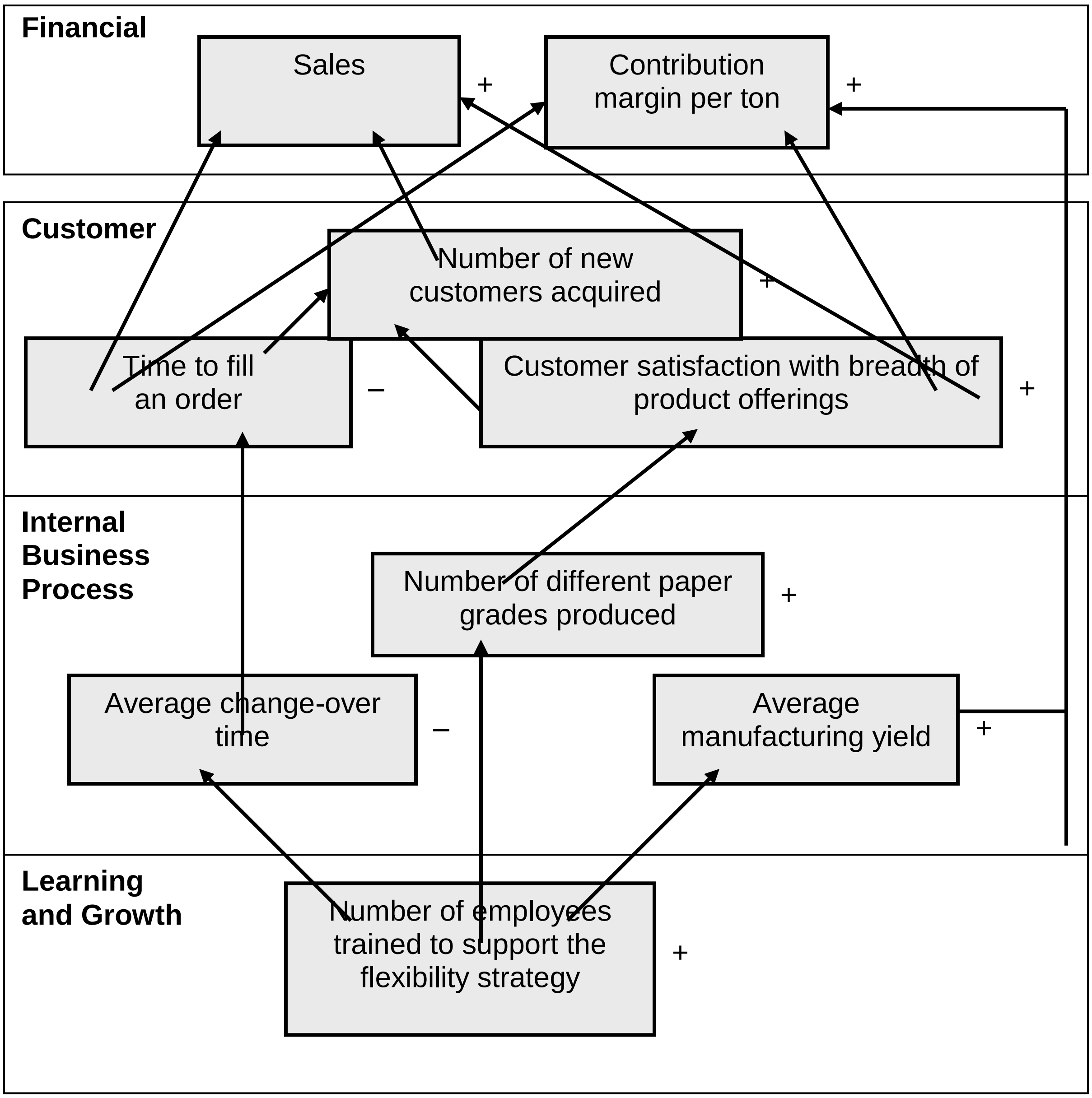
1. MPC's previous manufacturing strategy was focused on high-volume production of a limited range of paper grades. The goal of this strategy was to keep the machines running constantly to maximize the number of tons produced. Changeovers were avoided because they lowered equipment utilization. Maximizing tons produced and minimizing changeovers helped spread the high fixed costs of paper manufacturing across more units of output. The new manufacturing strategy is focused on low-volume production of a wide range of products. The goals of this strategy are to increase the number of paper grades manufactured, decrease changeover times, and increase yields across non-standard grades. While MPC realizes that its new strategy will decrease its equipment utilization, it will still strive to optimize the utilization of its high fixed cost resources within the confines of flexible production. In an economist's terms the old strategy focused on economies of scale while the new strategy focuses on economies of scope.

2. Employees focus on improving those measures that are used to evaluate their performance. Therefore, strategically-aligned performance measures will channel employee effort towards improving those aspects of performance that are most important to obtaining strategic objectives. If a company changes its strategy but continues to evaluate employee performance using measures that do not support the new strategy, it will be motivating its employees to make decisions that promote the old strategy, not the new strategy. And if employees make decisions that promote the new strategy, their performance measures will suffer.

   Some performance measures that would be appropriate for MPC's old strategy include: equipment utilization percentage, number of tons of paper produced, and cost per ton produced. These performance measures would not support MPC's new strategy because they would discourage increasing the range of paper grades produced, increasing the number of changeovers performed, and decreasing the batch size produced per run.

Exercise 10-5 (continued)

3. Students' answers may differ in some details from this solution.



Exercise 10-5 (continued)

4. The hypotheses underlying the balanced scorecard are indicated by the arrows in the diagram. Reading from the bottom of the balanced scorecard, the hypotheses are:
   - If the number of employees trained to support the flexibility strategy increases, then the average changeover time will decrease and the number of different paper grades produced and the average manufacturing yield will increase.
   - If the average changeover time decreases, then the time to fill an order will decrease.
   - If the number of different paper grades produced increases, then the customer satisfaction with breadth of product offerings will increase.
   - If the average manufacturing yield increases, then the contribution margin per ton will increase.
   - If the time to fill an order decreases, then the number of new customers acquired, sales, and the contribution margin per ton will increase.
   - If the customer satisfaction with breadth of product offerings increases, then the number of new customers acquired, sales, and the contribution margin per ton will increase.
   - If the number of new customers acquired increases, then sales will increase.

   Each of these hypotheses can be questioned. For example, the time to fill an order is a function of additional factors above and beyond changeover times. Thus, MPC's average changeover time could decrease while its time to fill an order increases if, for example, the shipping department proves to be incapable of efficiently handling greater product diversity, smaller batch sizes, and more frequent shipments. The fact that each of the hypotheses mentioned above can be questioned does not invalidate the balanced scorecard. If the scorecard is used correctly, management will be able to identify which, if any, of the hypotheses are invalid and modify the balanced scorecard accordingly.

Exercise 10-6 (20 minutes)

1. Throughput time = Process time + Inspection time + Move time + Queue time
   = 2.8 days + 0.5 days + 0.7 days + 4.0 days
   = 8.0 days

2. Only process time is value-added time; therefore the manufacturing cycle efficiency (MCE) is:

$$\text{MCE}=\frac{\text{Value-added time}}{\text{Throughput time}}=\frac{2.8\text{ days}}{8.0\text{ days}}=0.35$$

3. If the MCE is 35%, then the complement of this figure, or 65% of the time, was spent in non-value-added activities.

4. Delivery cycle time = Wait time + Throughput time
   = 16.0 days + 8.0 days
   = 24.0 days

5. If all queue time in production is eliminated, then the throughput time drops to only 4 days (0.5 + 2.8 + 0.7). The MCE becomes:

$$\text{MCE}=\frac{\text{Value-added time}}{\text{Throughput time}}=\frac{2.8\text{ days}}{4.0\text{ days}}=0.70$$

   Thus, the MCE increases to 70%. This exercise shows quite dramatically how the lean production approach can improve operations and reduce throughput time.

Exercise 10-7 (20 minutes)

1. The general ledger entry to record the purchase of materials for the month is:

Raw Materials		
(15,000 meters at $5.40 per meter)	81,000	
Materials Price Variance		
(15,000 meters at $0.20 per meter U)	3,000	
Accounts Payable		
(15,000 meters at $5.60 per meter)		84,000

2. The general ledger entry to record the use of materials for the month is:

Work in Process		
(12,000 meters at $5.40 per meter)	64,800	
Materials Quantity Variance		
(100 meters at $5.40 per meter F)		540
Raw Materials		
(11,900 meters at $5.40 per meter)		64,260

3. The general ledger entry to record the incurrence of direct labor cost for the month is:

Work in Process (2,000 hours at $14.00 per hour)	28,000	
Labor Rate Variance		
(1,950 hours at $0.20 per hour U)	390	
Labor Efficiency Variance		
(50 hours at $14.00 per hour F)		700
Wages Payable		
(1,950 hours at $14.20 per hour)		27,690

Exercise 10-8 (20 minutes)

1. The standard price of a kilogram of white chocolate is determined as follows:

Purchase price, finest grade white chocolate	£9.00
Less purchase discount, 5% of the purchase price of £9.00 ..	(0.45)
Shipping cost from the supplier in Belgium...........................	0.20
Receiving and handling cost...	0.05
Standard price per kilogram of white chocolate	£8.80

2. The standard quantity, in kilograms, of white chocolate in a dozen truffles is computed as follows:

Material requirements............................	0.80
Allowance for waste	0.02
Allowance for rejects	0.03
Standard quantity of white chocolate.......	0.85

3. The standard cost of the white chocolate in a dozen truffles is determined as follows:

Standard quantity of white chocolate (a)	0.85 kilogram
Standard price of white chocolate (b)..........	£8.80 per kilogram
Standard cost of white chocolate (a) × (b) ..	£7.48

Exercise 10-9 (30 minutes)

1. a. Notice in the solution below that the materials price variance is computed on the entire amount of materials purchased, whereas the materials quantity variance is computed only on the amount of materials used in production.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
70,000 diodes × $0.28 per diode = $19,600	70,000 diodes × $0.30 per diode = $21,000	40,000 diodes* × $0.30 per diode = $12,000

Price Variance, $1,400 F

50,000 diodes × $0.30 per diode = $15,000

Quantity Variance, $3,000 U

*5,000 toys × 8 diodes per toy = 40,000 diodes

Alternative Solution:

Materials Price Variance = AQ (AP – SP)
70,000 diodes ($0.28 per diode – $0.30 per diode) = $1,400 F

Materials Quantity Variance = SP (AQ – SQ)
$0.30 per diode (50,000 diodes – 40,000 diodes) = $3,000 U

Exercise 10-9 (continued)

b. Direct labor variances:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$48,000	6,400 hours × $7 per hour = $44,800	6,000 hours* × $7 per hour = $42,000

Rate Variance, $3,200 U

Efficiency Variance, $2,800 U

Total Variance, $6,000 U

*5,000 toys × 1.2 hours per toy = 6,000 hours

Alternative Solution:

Labor Rate Variance = AH (AR – SR)
6,400 hours ($7.50* per hour – $7.00 per hour) = $3,200 U
*$48,000 ÷ 6,400 hours = $7.50 per hour

Labor Efficiency Variance = SR (AH – SH)
$7 per hour (6,400 hours – 6,000 hours) = $2,800 U

Exercise 10-9 (continued)

2. A variance usually has many possible explanations. In particular, we should always keep in mind that the standards themselves may be incorrect. Some of the other possible explanations for the variances observed at Topper Toys appear below:

   Materials Price Variance Since this variance is favorable, the actual price paid per unit for the material was less than the standard price. This could occur for a variety of reasons including the purchase of a lower grade material at a discount, buying in an unusually large quantity to take advantage of quantity discounts, a change in the market price of the material, and particularly sharp bargaining by the purchasing department.

   Materials Quantity Variance Since this variance is unfavorable, more materials were used to produce the actual output than were called for by the standard. This could also occur for a variety of reasons. Some of the possibilities include poorly trained or supervised workers, improperly adjusted machines, and defective materials.

   Labor Rate Variance Since this variance is unfavorable, the actual average wage rate was higher than the standard wage rate. Some of the possible explanations include an increase in wages that has not been reflected in the standards, unanticipated overtime, and a shift toward more highly paid workers.

   Labor Efficiency Variance Since this variance is unfavorable, the actual number of labor hours was greater than the standard labor hours allowed for the actual output. As with the other variances, this variance could have been caused by any of a number of factors. Some of the possible explanations include poor supervision, poorly trained workers, low-quality materials requiring more labor time to process, and machine breakdowns. In addition, if the direct labor force is essentially fixed, an unfavorable labor efficiency variance could be caused by a reduction in output due to decreased demand for the company's products.

Exercise 10-10 (20 minutes)

1.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
20,000 ounces × $2.40 per ounce = $48,000	20,000 ounces × $2.50 per ounce = $50,000	18,000 ounces* × $2.50 per ounce = $45,000

Price Variance, $2,000 F	Quantity Variance, $5,000 U
Total Variance, $3,000 U	

*2,500 units × 7.2 ounces per unit = 18,000 ounces

Alternatively:

Materials Price Variance = AQ (AP – SP)
20,000 ounces ($2.40 per ounce – $2.50 per ounce) = $2,000 F

Materials Quantity Variance = SP (AQ – SQ)
$2.50 per ounce (20,000 ounces – 18,000 ounces) = $5,000 U

Exercise 10-10 (continued)

2.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$10,800	900 hours × $10 per hour = $9,000	1,000 hours* × $10 per hour = $10,000

Rate Variance, $1,800 U

Efficiency Variance, $1,000 F

Total Variance, $800 U

*2,500 units × 0.4 hour per unit = 1,000 hours

Alternatively:

Labor Rate Variance = AH (AR – SR)
900 hours ($12 per hour* – $10 per hour) = $1,800 U
*10,800 ÷ 900 hours = $12 per hour

Labor Efficiency Variance = SR (AH – SH)
$10 per hour (900 hours – 1,000 hours) = 1,000 F

Exercise 10-11 (15 minutes)

Notice in the solution below that the materials price variance is computed on the entire amount of materials purchased, whereas the materials quantity variance is computed only on the amount of materials used in production.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
20,000 ounces × $2.40 per ounce = $48,000	20,000 ounces × $2.50 per ounce = $50,000	14,400 ounces* × $2.50 per ounce = $36,000

Price Variance,
$2,000 F

16,000 ounces × $2.50 per ounce
= $40,000

Quantity Variance,
$4,000 U

*2,000 bottles × 7.2 ounces per bottle = 14,400 ounces

Alternatively:

Materials Price Variance = AQ (AP – SP)
20,000 ounces ($2.40 per ounce – $2.50 per ounce) = $2,000 F

Materials Quantity Variance = SP (AQ – SQ)
$2.50 per ounce (16,000 ounces – 14,400 ounces) = $4,000 U

Exercise 10-12 (30 minutes)

1.

Number of units manufactured	20,000
Standard labor time per unit (24 minutes ÷ 60 minutes per hour)	× 0.4
Total standard hours of labor time allowed	8,000
Standard direct labor rate per hour	× $6
Total standard direct labor cost	$48,000
Actual direct labor cost	$49,300
Standard direct labor cost	48,000
Total variance—unfavorable	$ 1,300

2.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$49,300	8,500 hours × $6 per hour = $51,000	8,000 hours* × $6 per hour = $48,000

Rate Variance, $1,700 F	Efficiency Variance, $3,000 U
Total Variance, $1,300 U	

*20,000 units × 0.4 hour per unit = 8,000 hours

Alternative Solution:

Labor Rate Variance = AH (AR – SR)
8,500 hours ($5.80 per hour* – $6.00 per hour) = $1,700 F
*$49,300 ÷ 8,500 hours = $5.80 per hour

Labor Efficiency Variance = SR (AH – SH)
$6 per hour (8,500 hours – 8,000 hours) = $3,000 U

Exercise 10-12 (continued)

3.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$39,100	8,500 hours × $4 per hour = $34,000	8,000 hours × $4 per hour = $32,000

Spending Variance, $5,100 U	Efficiency Variance, $2,000 U
Total Variance, $7,100 U	

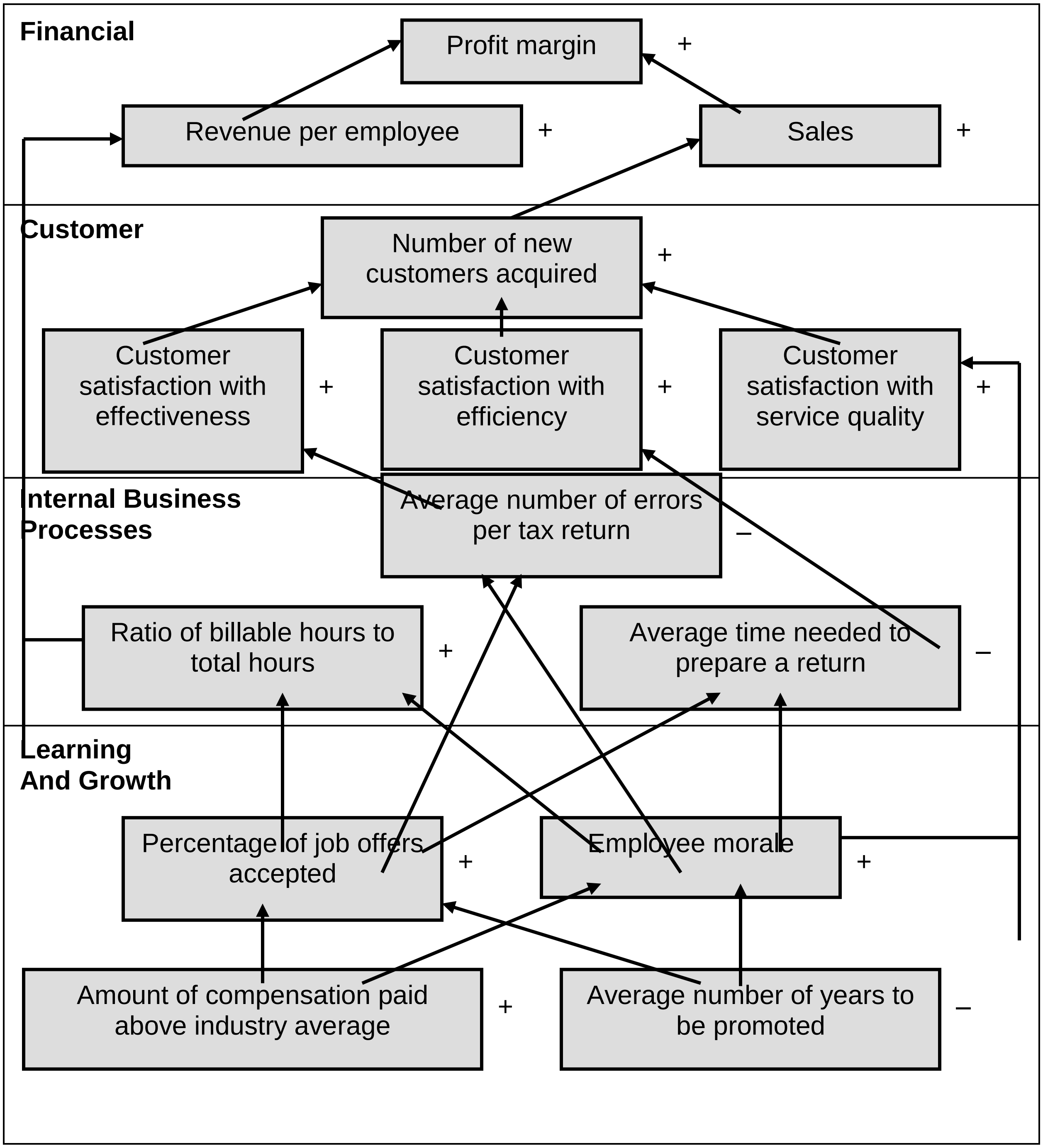
Alternative Solution:

Variable Overhead Spending Variance = AH (AR – SR)
8,500 hours ($4.60 per hour* – $4.00 per hour) = $5,100 U
*$39,100 ÷ 8,500 hours = $4.60 per hour

Variable Overhead Efficiency Variance = SR (AH – SH)
$4 per hour (8,500 hours – 8,000 hours) = $2,000 U

Exercise 10-13 (45 minutes)

1. Students' answers may differ in some details from this solution.



Exercise 10-13 (continued)

2. The hypotheses underlying the balanced scorecard are indicated by the arrows in the diagram. Reading from the bottom of the balanced scorecard, the hypotheses are:
   - If the amount of compensation paid above the industry average increases, then the percentage of job offers accepted and the level of employee morale will increase.
   - If the average number of years to be promoted decreases, then the percentage of job offers accepted and the level of employee morale will increase.
   - If the percentage of job offers accepted increases, then the ratio of billable hours to total hours should increase while the average number of errors per tax return and the average time needed to prepare a return should decrease.
   - If employee morale increases, then the ratio of billable hours to total hours should increase while the average number of errors per tax return and the average time needed to prepare a return should decrease.
   - If employee morale increases, then the customer satisfaction with service quality should increase.
   - If the ratio of billable hours to total hours increases, then the revenue per employee should increase.
   - If the average number of errors per tax return decreases, then the customer satisfaction with effectiveness should increase.
   - If the average time needed to prepare a return decreases, then the customer satisfaction with efficiency should increase.
   - If the customer satisfaction with effectiveness, efficiency and service quality increases, then the number of new customers acquired should increase.
   - If the number of new customers acquired increases, then sales should increase.
   - If revenue per employee and sales increase, then the profit margin should increase.

Exercise 10-13 (continued)

Each of these hypotheses can be questioned. For example, Ariel's customers may define effectiveness as minimizing their tax liability which is not necessarily the same as minimizing the number of errors in a tax return. If some of Ariel's customers became aware that Ariel overlooked legal tax minimizing opportunities, it is likely that the "customer satisfaction with effectiveness" measure would decline. This decline would probably puzzle Ariel because, although the firm prepared what it believed to be error-free returns, it overlooked opportunities to minimize customers' taxes. In this example, Ariel's internal business process measure of the average number of errors per tax return does not fully capture the factors that drive the customer satisfaction. The fact that each of the hypotheses mentioned above can be questioned does not invalidate the balanced scorecard. If the scorecard is used correctly, management will be able to identify which, if any, of the hypotheses are invalid and then modify the balanced scorecard accordingly.

3. The performance measure "total dollar amount of tax refunds generated" would motivate Ariel's employees to aggressively search for tax minimization opportunities for its clients. However, employees may be too aggressive and recommend questionable or illegal tax practices to clients. This undesirable behavior could generate unfavorable publicity and lead to major problems for the company as well as its customers. Overall, it would probably be unwise to use this performance measure in Ariel's scorecard.

   However, if Ariel wanted to create a scorecard measure to capture this aspect of its client service responsibilities, it may make sense to focus the performance measure on its training process. Properly trained employees are more likely to recognize viable tax minimization opportunities.

Exercise 10-13 (continued)

4. Each office's individual performance should be based on the scorecard measures only if the measures are controllable by those employed at the branch offices. In other words, it would not make sense to attempt to hold branch office managers responsible for measures such as the percent of job offers accepted or the amount of compensation paid above industry average. Recruiting and compensation decisions are not typically made at the branch offices. On the other hand, it would make sense to measure the branch offices with respect to internal business process, customer, and financial performance. Gathering this type of data would be useful for evaluating the performance of employees at each office.

Exercise 10-14 (20 minutes)

1. If the total variance is \$330 unfavorable, and if the rate variance is \$150 favorable, then the efficiency variance must be \$480 unfavorable, since the rate and efficiency variances taken together always equal the total variance.

   Knowing that the efficiency variance is \$480 unfavorable, one approach to the solution would be:

   Efficiency Variance = SR (AH – SH)
   \$6 per hour (AH – 420 hours*) = \$480 U
   \$6 per hour × AH – \$2,520 = \$480**
   \$6 per hour × AH = \$3,000
   AH = 500 hours

   * 168 batches × 2.5 hours per batch = 420 hours
   ** When used with the formula, unfavorable variances are positive and favorable variances are negative.

2. Knowing that 500 hours of labor time were used during the week, the actual rate of pay per hour can be computed as follows:

   Rate Variance = AH (AR – SR)
   500 hours (AR – \$6 per hour) = \$150 F
   500 hours × AR – \$3,000 = -\$150*
   500 hours × AR = \$2,850
   AR = \$5.70 per hour

   * When used with the formula, unfavorable variances are positive and favorable variances are negative.

Exercise 10-14 (continued)

An alternative approach to each solution would be to work from known to unknown data in the columnar model for variance analysis:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
500 hours × $5.70 per hour = $2,850	500 hours × $6 per hour* = $3,000	420 hours[§] × $6 per hour* = $2,520

Rate Variance, $150 F*

Efficiency Variance, $480 U

Total Variance, $330 U*

[§]168 batches × 2.5 hours per batch = 420 hours

*Given

Exercise 10-15 (45 minutes)

1. a.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
7,000 feet × $5.75 per foot = $40,250	7,000 feet × $6.00 per foot = $42,000	5,250 feet* × $6.00 per foot = $31,500

Price Variance,
$1,750 F

6,000 feet × $6.00 per foot
= $36,000

Quantity Variance,
$4,500 U

*1,500 units × 3.5 feet per unit = 5,250 feet

Alternatively:

Materials Price Variance = AQ (AP – SP)
7,000 feet ($5.75 per foot – $6.00 per foot) = $1,750 F

Materials Quantity Variance = SP (AQ – SQ)
$6.00 per foot (6,000 feet – 5,250 feet) = $4,500 U

Exercise 10-15 (continued)

b. The journal entries would be:

Raw Materials (7,000 feet × \$6 per foot)............	42,000	
Materials Price Variance (7,000 feet × \$0.25 F per foot)		1,750
Accounts Payable (7,000 feet × \$5.75 per foot)		40,250
Work in Process (5,250 feet × \$6 per foot)..........	31,500	
Materials Quantity Variance (750 feet U × \$6 per foot)	4,500	
Raw Materials (6,000 feet × \$6 per foot)		36,000

2. a.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
\$8,120	725 hours × \$10 per hour = \$7,250	600 hours* × \$10 per hour = \$6,000

Rate Variance, \$870 U

Efficiency Variance, \$1,250 U

Total Variance, \$2,120 U

*1,500 units × 0.4 hour per unit = 600 hours

Alternatively:

Labor Rate Variance = AH (AR – SR)
725 hours (\$11.20 per hour* – \$10.00 per hour) = \$870 U
*\$8,120 ÷ 725 hours = \$11.20 per hour

Labor Efficiency Variance = SR (AH – SH)
\$10 per hour (725 hours – 600 hours) = \$1,250 U

Exercise 10-15 (continued)

b. The journal entry would be:

	Debit	Credit
Work in Process (600 hours × $10 per hour)	6,000	
Labor Rate Variance (725 hours × $1.20 U per hour)	870	
Labor Efficiency Variance (125 U hours × $10 per hour)	1,250	
Wages Payable (725 hours × $11.20 per hour)		8,120

3. The entries are: (a) purchase of materials; (b) issue of materials to production; and (c) incurrence of direct labor cost.

Raw Materials

(a)	42,000	(b)	36,000
Bal.	6,000[1]		

Accounts Payable

		(a)	40,250

Materials Price Variance

		(a)	1,750

Wages Payable

		(c)	8,120

Materials Quantity Variance

(b)	4,500		

Labor Rate Variance

(c)	870		

Work in Process

(b)	31,500[2]		
(c)	6,000[3]		

Labor Efficiency Variance

(c)	1,250		

[1]1,000 feet of material at a standard cost of $6.00 per foot
[2]Materials used
[3]Labor cost

Problem 10-16 (45 minutes)

1. a.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
25,000 pounds × $2.95 per pound = $73,750	25,000 pounds × $2.50 per pound = $62,500	20,000 pounds* × $2.50 per pound = $50,000

Price Variance,
$11,250 U

19,800 pounds × $2.50 per pound
= $49,500

Quantity Variance,
$500 F

*5,000 ingots × 4.0 pounds per ingot = 20,000 pounds

Alternatively:

Materials Price Variance = AQ (AP – SP)
25,000 pounds ($2.95 per pound – $2.50 per pound) = $11,250 U

Materials Quantity Variance = SP (AQ – SQ)
$2.50 per pound (19,800 pounds – 20,000 pounds) = $500 F

Problem 10-16 (continued)

b.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
3,600 hours × $8.70 per hour = $31,320	3,600 hours × $9.00 per hour = $32,400	3,000 hours* × $9.00 per hour = $27,000

Rate Variance, $1,080 F | Efficiency Variance, $5,400 U

Total Variance, $4,320 U

*5,000 ingots × 0.6 hour per ingot = 3,000 hours

Alternatively:

Labor Rate Variance = AH (AR – SR)
3,600 hours ($8.70 per hour – $9.00 per hour) = $1,080 F

Labor Efficiency Variance = SR (AH – SH)
$9.00 per hour (3,600 hours – 3,000 hours) = $5,400 U

Problem 10-16 (continued)

c.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$4,320	1,800 hours × $2.00 per hour = $3,600	1,500 hours* × $2.00 per hour = $3,000

Spending Variance, $720 U	Efficiency Variance, $600 U

Total Variance, $1,320 U

*5,000 ingots × 0.3 hours per ingot = 1,500 hours

Alternatively:

Variable Overhead Spending Variance = AH (AR – SR)
1,800 hours ($2.40 per hour* – $2.00 per hour) = $720 U
*$4,320 ÷ 1,800 hours = $2.40 per hour

Variable Overhead Efficiency Variance = SR (AH – SH)
$2.00 per hour (1,800 hours – 1,500 hours) = $600 U

Problem 10-16 (continued)

2. Summary of variances:

Material price variance	$11,250	U
Material quantity variance	500	F
Labor rate variance	1,080	F
Labor efficiency variance	5,400	U
Variable overhead spending variance	720	U
Variable overhead efficiency variance	600	U
Net variance	$16,390	U

The net unfavorable variance of $16,390 for the month caused the plant's variable cost of goods sold to increase from the budgeted level of $80,000 to $96,390:

Budgeted cost of goods sold at $16 per ingot	$80,000
Add the net unfavorable variance (as above)	16,390
Actual cost of goods sold	$96,390

This $16,390 net unfavorable variance also accounts for the difference between the budgeted net operating income and the actual net loss for the month.

Budgeted net operating income	$15,000
Deduct the net unfavorable variance added to cost of goods sold for the month	16,390
Net operating loss	$(1,390)

3. The two most significant variances are the materials price variance and the labor efficiency variance. Possible causes of the variances include:

Materials Price Variance:	Outdated standards, uneconomical quantity purchased, higher quality materials, high-cost method of transport.
Labor Efficiency Variance:	Poorly trained workers, poor quality materials, faulty equipment, work interruptions, inaccurate standards, insufficient demand.

Problem 10-17 (45 minutes)

1. The standard quantity of plates allowed for tests performed during the month would be:

Smears	2,700
Blood tests	900
Total	3,600
Plates per test	× 3
Standard quantity allowed	10,800

The variance analysis for plates would be:

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
$38,400	16,000 plates × $2.50 per plate = $40,000	10,800 plates × $2.50 per plate = $27,000

Price Variance,
$1,600 F

14,000 plates × $2.50 per plate
= $35,000

Quantity Variance,
$8,000 U

Alternative Solution:

Materials Price Variance = AQ (AP – SP)
16,000 plates ($2.40 per plate* – $2.50 per plate) = $1,600 F
*$38,400 ÷ 16,000 plates = $2.40 per plate.

Materials Quantity Variance = SP (AQ – SQ)
$2.50 per plate (14,000 plates – 10,800 plates) = $8,000 U

Problem 10-17 (continued)

Note that all of the price variance is due to the hospital's 4% quantity discount. Also note that the $8,000 quantity variance for the month is equal to nearly 30% of the standard cost allowed for plates. This variance may be the result of using too many assistants in the lab.

2. a. The standard hours allowed for tests performed during the month would be:

Smears: 0.3 hour per test × 2,700 tests	810
Blood tests: 0.6 hour per test × 900 tests...	540
Total standard hours allowed......................	1,350

The variance analysis of labor would be:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$18,450	1,800 hours × $12 per hour = $21,600	1,350 hours × $12 per hour = $16,200

Rate Variance, $3,150 F

Efficiency Variance, $5,400 U

Total Variance, $2,250 U

Alternative Solution:

Labor Rate Variance = AH (AR – SR)
1,800 hours ($10.25 per hour* – $12.00 per hour) = $3,150 F
*$18,450 ÷ 1,800 hours = $10.25 per hour

Labor Efficiency Variance = SR (AH – SH)
$12 per hour (1,800 hours – 1,350 hours) = $5,400 U

Problem 10-17 (continued)

b. The policy probably should not be continued. Although the hospital is saving $1.75 per hour by employing more assistants relative to the number of senior technicians than other hospitals, this savings is more than offset by other factors. Too much time is being taken in performing lab tests, as indicated by the large unfavorable labor efficiency variance. And, it seems likely that most (or all) of the hospital's unfavorable quantity variance for plates is traceable to inadequate supervision of assistants in the lab.

3. The variable overhead variances follow:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$11,700	1,800 hours × $6 per hour = $10,800	1,350 hours × $6 per hour = $8,100

Spending Variance, $900 U

Efficiency Variance, $2,700 U

Total Variance, $3,600 U

Alternative Solution:

Variable Overhead Spending Variance = AH (AR – SR)
1,800 hours ($6.50 per hour* – $6.00 per hour) = $900 U
*$11,700 ÷ 1,800 hours = $6.50 per hour

Variable Overhead Efficiency Variance = SR (AH – SH)
$6 per hour (1,800 hours – 1,350 hours) = $2,700 U

Yes, the two variances are related. Both are computed by comparing actual labor time to the standard hours allowed for the output of the period. Thus, if there is an unfavorable labor efficiency variance, there will also be an unfavorable variable overhead efficiency variance.

Problem 10-18 (60 minutes)

1. a.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
21,120 yards × $3.35 per yard = $70,752	21,120 yards × $3.60 per yard = $76,032	19,200 yards* × $3.60 per yard = $69,120

Price Variance, $5,280 F	Quantity Variance, $6,912 U
Total Variance, $1,632 U	

*4,800 units × 4.0 yards per unit = 19,200 yards

Alternatively:

Materials Price Variance = AQ (AP – SP)
21,120 yards ($3.35 per yard – $3.60 per yard) = $5,280 F

Materials Quantity Variance = SP (AQ – SQ)
$3.60 per yard (21,120 yards – 19,200 yards) = $6,912 U

b.

Raw Materials (21,120 yards @ $3.60 per yard)	76,032	
Materials Price Variance (21,120 yards @ $0.25 per yard F)		5,280
Accounts Payable (21,120 yards @ $3.35 per yard)		70,752
Work in Process (19,200 yards @ $3.60 per yard) ...	69,120	
Materials Quantity Variance (1,920 yards U @ $3.60 per yard)......................	6,912	
Raw Materials (21,120 yards @ $3.60 per yard) .		76,032

Problem 10-18 (continued)

2. a.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
6,720 hours* × $4.85 per hour = $32,592	6,720 hours × $4.50 per hour = $30,240	7,680 hours** × $4.50 per hour = $34,560

Rate Variance, $2,352 U	Efficiency Variance, $4,320 F
Total Variance, $1,968 F	

*4,800 units × 1.4 hours per unit = 6,720 hours
**4,800 units × 1.6 hours per unit = 7,680 hours

Alternatively:

Labor Rate Variance = AH (AR – SR)
6,720 hours ($4.85 per hour – $4.50 per hour) = $2,352 U

Labor Efficiency Variance = SR (AH – SH)
$4.50 per hour (6,720 hours – 7,680 hours) = $4,320 F

b.

Work in Process (7,680 hours @ $4.50 per hour).....	34,560	
Labor Rate Variance (6,720 hours @ $0.35 per hour U)	2,352	
Labor Efficiency Variance (960 hours F @ $4.50 per hour)		4,320
Wages Payable (6,720 hours @ $4.85 per hour).		32,592

Problem 10-18 (continued)

3\.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
6,720 hours × $2.15 per hour = $14,448	6,720 hours × $1.80 per hour = $12,096	7,680 hours × $1.80 per hour = $13,824

Spending Variance, $2,352 U

Efficiency Variance, $1,728 F

Total Variance, $624 U

Alternatively:

Variable Overhead Spending Variance = AH (AR – SR)
6,720 hours ($2.15 per hour – $1.80 per hour) = $2,352 U

Variable Overhead Efficiency Variance = SR (AH – SH)
$1.80 per hour (6,720 hours – 7,680 hours) = $1,728 F

4\. No. This total variance is made up of several quite large individual variances, some of which may warrant investigation. A summary of variances is given below:

Materials:		
Price variance	$5,280 F	
Quantity variance	6,912 U	$1,632 U
Labor:		
Rate variance	2,352 U	
Efficiency variance	4,320 F	1,968 F
Variable overhead:		
Spending variance	2,352 U	
Efficiency variance	1,728 F	624 U
Net unfavorable variance		$ 288 U

Problem 10-18 (continued)

5. The variances have many possible causes. Some of the more likely causes include:

   Materials variances:

   Favorable price variance: Good price, inaccurate standards, inferior quality materials, unusual discount due to quantity purchased, drop in market price.

   Unfavorable quantity variance: Carelessness, poorly adjusted machines, unskilled workers, inferior quality materials, inaccurate standards.

   Labor variances:

   Unfavorable rate variance: Use of highly skilled workers, change in wage rates, inaccurate standards, overtime.

   Favorable efficiency variance: Use of highly skilled workers, high-quality materials, new equipment, inaccurate standards.

   Variable overhead variances:

   Unfavorable spending variance: Increase in costs, inaccurate standards, waste, theft, spillage, purchases in uneconomical lots.

   Favorable efficiency variance: Same as for labor efficiency variance.

Problem 10-19 (45 minutes)

1. a. In the solution below, the materials price variance is computed on the entire amount of materials purchased, whereas the materials quantity variance is computed only on the amount of materials used in production:

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
$46,000	8,000 pounds × $6.00 per pound = $48,000	4,500 pounds* × $6.00 per pound = $27,000

Price Variance,
$2,000 F

6,000 pounds × $6.00 per pound
= $36,000

Quantity Variance,
$9,000 U

*3,000 units × 1.5 pounds per unit = 4,500 pounds

Alternatively:

Materials Price Variance = AQ (AP – SP)
8,000 pounds ($5.75 per pound* – $6.00 per pound) = $2,000 F
*$46,000 ÷ 8,000 pounds = $5.75 per pound

Materials Quantity Variance = SP (AQ – SQ)
$6 per pound (6,000 pounds – 4,500 pounds) = $9,000 U

b. No, the contract should probably not be signed. Although the new supplier is offering the material at only $5.75 per pound, it does not seem to hold up well in production as shown by the large materials quantity variance. Moreover, the company still has 2,000 pounds of unused material in the warehouse; if these materials do as poorly in production as the 6,000 pounds already used, the total quantity variance on the 8,000 pounds of materials purchased will be very large.

Problem 10-19 (continued)

2. a.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
1,600 hours* × $12.50 per hour = $20,000	1,600 hours × $12.00 per hour = $19,200	1,800 hours** × $12.00 per hour = $21,600

Rate Variance, $800 U

Efficiency Variance, $2,400 F

Total Variance, $1,600 F

* 10 workers × 160 hours per worker = 1,600 hours

** 3,000 units × 0.6 hours per unit = 1,800 hours

Alternatively:

Labor Rate Variance = AH (AR – SR)

1,600 hours ($12.50 per hour – $12.00 per hour) = $800 U

Labor Efficiency Variance = SR (AH – SH)

$12.00 per hour (1,600 hours – 1,800 hours) = $2,400 F

b. Yes, the new labor mix should probably be continued. Although it increases the average hourly labor cost from $12.00 to $12.50, thereby causing an $800 unfavorable labor rate variance, this is more than offset by greater efficiency of labor time. Notice that the labor efficiency variance is $2,400 favorable. Thus, the new labor mix reduces overall labor costs.

Problem 10-19 (continued)

3.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$3,600	1,600 hours × $2.50 per hour = $4,000	1,800 hours × $2.50 per hour = $4,500

Spending Variance, $400 F	Efficiency Variance, $500 F
Total Variance, $900 F	

Alternatively:

Variable Overhead Spending Variance = AH (AR – SR)
1,600 hours ($2.25 per hour* – $2.50 per hour) = $400 F
*$3,600 ÷ 1,600 hours = $2.25 per hour

Variable Overhead Efficiency Variance = SR (AH – SH)
$2.50 per hour (1,600 hours – 1,800 hours) = $500 F

Both the labor efficiency variance and the variable overhead efficiency variance are computed by comparing actual labor-hours to standard labor-hours. Thus, if the labor efficiency variance is favorable, then the variable overhead efficiency variance will be favorable as well.

Problem 10-20 (30 minutes)

1. a., b., and c.

	Month 1	2	3	4
Throughput time in days:				
Process time	0.6	0.5	0.5	0.4
Inspection time	0.7	0.7	0.4	0.3
Move time	0.5	0.5	0.4	0.5
Queue time	3.6	3.6	2.6	1.7
Total throughput time	5.4	5.3	3.9	2.9
Manufacturing cycle efficiency (MCE):				
Process time ÷ Throughput time	11.1%	9.4%	12.8%	13.8%
Delivery cycle time in days:				
Wait time	9.6	8.7	5.3	4.7
Total throughput time	5.4	5.3	3.9	2.9
Total delivery cycle time	15.0	14.0	9.2	7.6

2. The general trend is favorable in all of the performance measures except for total sales. On-time delivery is up, process time is down, inspection time is down, move time is basically unchanged, queue time is down, manufacturing cycle efficiency is up, and the delivery cycle time is down. Even though the company has improved its operations, it has not yet increased its sales. This may have happened because management attention has been focused on the factory—working to improve operations. However, it may be time now to exploit these improvements to go after more sales—perhaps by increased product promotion and better marketing strategies. It will ultimately be necessary to increase sales so as to translate the operational improvements into more profits.

Problem 10-20 (continued)

3. a. and b.

	Month 5	Month 6
Throughput time in days:		
Process time	0.4	0.4
Inspection time	0.3	
Move time	0.5	0.5
Queue time	—	—
Total throughput time	1.2	0.9
Manufacturing cycle efficiency (MCE):		
Process time ÷ Throughput time	33.3%	44.4%

As a company pares away non-value-added activities, the manufacturing cycle efficiency improves. The goal, of course, is to have an efficiency of 100%. This will be achieved when all non-value-added activities have been eliminated and process time equals throughput time.

Problem 10-21 (45 minutes)

The answers below are not the only possible answers. Ingenious people can figure out many different ways of making performance look better even though it really isn't. This is one of the reasons for a *balanced scorecard*. By having a number of different measures that ultimately are linked to overall financial goals, "gaming" the system is more difficult.

1. Speed-to-market can be improved by taking on less ambitious projects. Instead of working on major product innovations that require a great deal of time and effort, R&D may choose to work on small, incremental improvements in existing products. There is also a danger that in the rush to push products out the door, the products will be inadequately tested and developed.

2. Performance measures that are ratios or percentages present special dangers. A ratio can be increased either by increasing the numerator or by decreasing the denominator. Usually, the intention is to increase the numerator in the ratio, but a manager may react by decreasing the denominator instead. In this case (which actually happened), the managers pulled telephones out of the high-crime areas. This eliminated the problem for the managers, but was not what the CEO or the city officials had intended. They wanted the phones fixed, not eliminated.

3. In real life, the production manager simply added several weeks to the delivery cycle time. In other words, instead of promising to deliver an order in four weeks, the manager promised to deliver in six weeks. This increase in delivery cycle time did not, of course, please customers and drove some business away, but it dramatically improved the percentage of orders delivered on time.

Problem 10-21 (continued)

4. As stated above, ratios can be improved by changing either the numerator or the denominator. Managers who are under pressure to increase the revenue per employee may find it easier to eliminate employees than to increase revenues. Of course, eliminating employees may reduce total revenues and total profits, but the revenue per employee will increase as long as the percentage decline in revenues is less than the percentage cut in number of employees. Suppose, for example, that a manager is responsible for business units with a total of 1,000 employees, $120 million in revenues, and profits of $2 million. Further suppose that a manager can eliminate one of these business units that has 200 employees, revenues of $10 million, and profits of $1.2 million.

	Before eliminating the business unit	*After eliminating the business unit*
Total revenue	$120,000,000	$110,000,000
Total employees	1,000	800
Revenue per employee	$120,000	$137,500
Total profits	$2,000,000	$800,000

As these examples illustrate, performance measures should be selected with a great deal of care and managers should avoid placing too much emphasis on any one performance measure.

Problem 10-22 (30 minutes)

1. Lanolin quantity standard:

Required per 100-liter batch	100 liters
Loss from rejected batches (100 liters × 1/20)	5 liters
Total quantity per good batch	105 liters

Alcohol quantity standard:

Required per 100-liter batch	8.0 liters
Loss from rejected batches (8 liters × 1/20)	0.4 liters
Total quantity per good batch	8.4 liters

Lilac powder quantity standard:

Required per 100-liter batch	200 grams
Loss from rejected batches (200 grams × 1/20)	10 grams
Total quantity per good batch	210 grams

2. Direct labor quantity standard:

Total hours per day	8 hours
Less lunch, rest breaks, and cleanup	2 hours
Productive time each day	6 hours

$$\frac{\text{Productive time each day}}{\text{Time required per batch}} = \frac{\text{6 hours per day}}{\text{2 hours per batch}} = \text{3 batches per day}$$

Time required per batch	120 minutes
Lunch, rest breaks, and cleanup (120 minutes ÷ 3 batches)	40 minutes
Total	160 minutes
Loss from rejected batches (160 minutes × 1/20)	8 minutes
Total time per good batch	168 minutes

Problem 10-22 (continued)

3. Standard cost card:

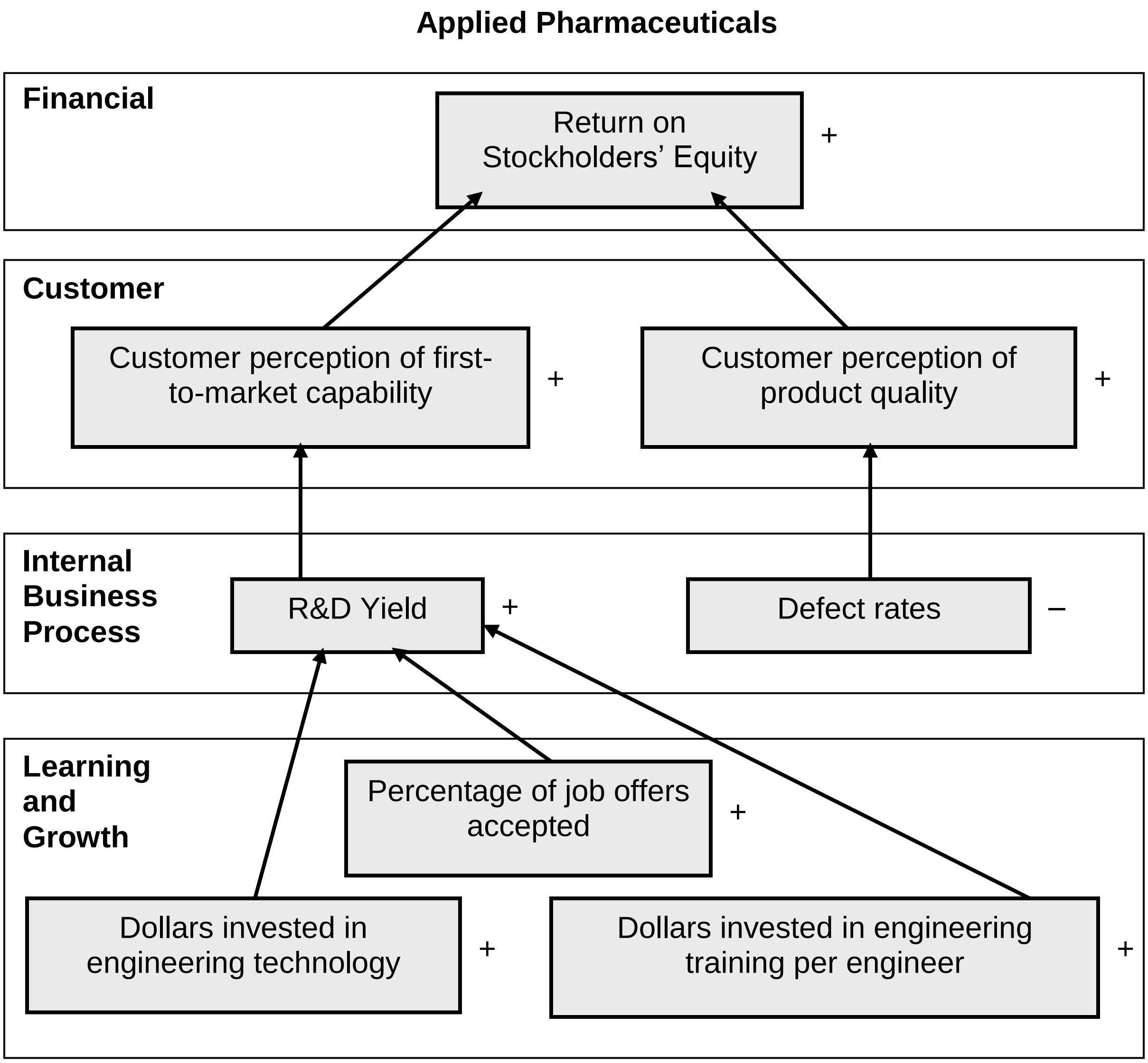
	Standard Quantity or Time per Batch	*Standard Price or Rate*	*Standard Cost per Batch*
Lanolin	105 liters	€16 per liter	€1,680.00
Alcohol	8.4 liters	€2 per liter	16.80
Lilac powder	210 grams	€1 per gram	210.00
Direct labor	168 minutes	€0.20 per minute	33.60
Total standard cost per good batch.....			€1,940.40

Problem 10-23 (60 minutes)

1. Both companies view training as important; both companies need to leverage technology to succeed in the marketplace; and both companies are concerned with minimizing defects. There are numerous differences between the two companies. For example, Applied Pharmaceuticals is a product-focused company and Destination Resorts International (DRI) is a service-focused company. Applied Pharmaceuticals' training resources are focused on their engineers because they hold the key to the success of the organization. DRI's training resources are focused on their front-line employees because they hold the key to the success of their organization. Applied Pharmaceuticals' technology investments are focused on supporting the innovation that is inherent in the product development side of the business. DRI's technology investments are focused on supporting the day-to-day execution that is inherent in the customer interface side of the business. Applied Pharmaceuticals defines a defect from an internal manufacturing standpoint, while DRI defines a defect from an external customer interaction standpoint.

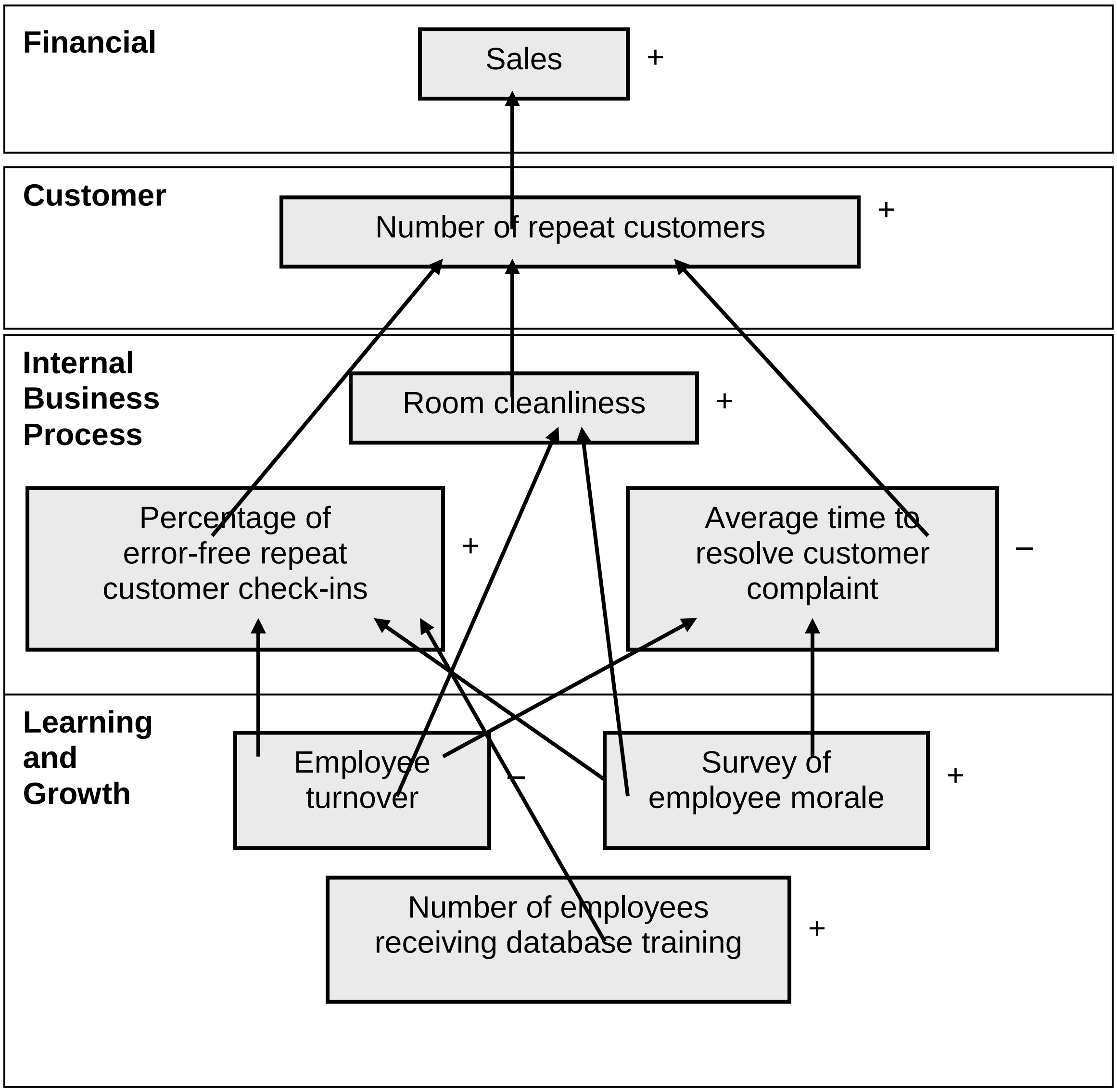
Problem 10-23 (continued)

2. Students' answers may differ in some details from this solution.



Problem 10-23 (continued)

Destination Resorts International



Problem 10-23 (continued)

3. The hypotheses underlying the balanced scorecards are indicated by the arrows in each diagram. Reading from the bottom of each balanced scorecard, the hypotheses are:

Applied Pharmaceuticals

- If the dollars invested in engineering technology increase, then the R&D yield will increase.
- If the percentage of job offers accepted increases, then the R&D yield will increase.
- If the dollars invested in engineering training per engineer increase, then the R&D yield will increase.
- If the R&D yield increases, then customer perception of first-to-market capability will increase.
- If the defects per million opportunities decrease, then the customer perception of product quality will increase.
- If the customer perception of first-to-market capability increases, then the return on stockholders' equity will increase.
- If the customer perception of product quality increases, then the return on stockholders' equity will increase.

Destination Resort International

- If the employee turnover decreases, then the percentage of error-free repeat customer check-ins and room cleanliness will increase and the average time to resolve customer complaints will decrease.
- If the number of employees receiving database training increases, then the percentage of error-free repeat customer check-ins will increase.
- If employee morale increases, then the percentage of error-free repeat customer check-ins and room cleanliness will increase and the average time to resolve customer complaints will decrease.
- If the percentage of error-free repeat customer check-ins increases, then the number of repeat customers will increase.
- If the room cleanliness increases, then the number of repeat customers will increase.
- If the average time to resolve customer complaints decreases, then the number of repeat customers will increase.
- If the number of repeat customers increases, then sales will increase.

Problem 10-23 (continued)

Each of these hypotheses is questionable to some degree. For example, in the case of Applied Pharmaceuticals, R&D yield is not the sole driver of the customers' perception of first-to-market capability. More specifically, if Applied Pharmaceuticals experimented with nine possible drug compounds in year one and three of those compounds proved to be successful in the marketplace it would result in an R&D yield of 33%. If in year two, it experimented with four possible drug compounds and two of those compounds proved to be successful in the marketplace it would result in an R&D yield of 50%. While the R&D yield has increased from year one to year two, it is quite possible that the customer's perception of first-to-market capability would decrease. The fact that each of the hypotheses mentioned above can be questioned does not invalidate the balanced scorecard. If the scorecard is used correctly, management will be able to identify which, if any, of the hypotheses are invalid and the balanced scorecard can then be appropriately modified.

Problem 10-24 (30 minutes)

1. a., b., and c.

	Month 1	Month 2	Month 3	Month 4
Throughput time in days:				
Process time	0.6	0.6	0.6	0.6
Inspection time	0.1	0.3	0.6	0.8
Move time	1.4	1.3	1.3	1.4
Queue time	5.6	5.7	5.6	5.7
Total throughput time	7.7	7.9	8.1	8.5
Manufacturing cycle efficiency (MCE):				
Process time ÷ Throughput time	7.8%	7.6%	7.4%	7.1%
Delivery cycle time in days:				
Wait time	16.7	15.2	12.3	9.6
Total throughput time	7.7	7.9	8.1	8.5
Total delivery cycle time	24.4	23.1	20.4	18.1

2. a. The company seems to be improving mainly in the areas of quality control, material control, on-time delivery, and total delivery cycle time. Customer complaints, warranty claims, defects, and scrap are all down somewhat, which suggests that the company has been paying attention to quality in its improvement campaign. The fact that on-time delivery and delivery cycle time have both improved also suggests that the company is seeking to please the customer with improved service.

   b. Inspection time has increased dramatically. Use as percentage of availability has deteriorated, and throughput time as well as MCE show negative trends.

Problem 10-24 (continued)

c. While it is difficult to draw any definitive conclusions, it appears that the company has concentrated first on those areas of performance that are of most immediate concern to the customer—quality and delivery performance. The lower scrap and defect statistics suggest that the company has been able to improve its processes to reduce the rate of defects; although, some of the improvement in quality apparently was due simply to increased inspections of the products before they were shipped to customers.

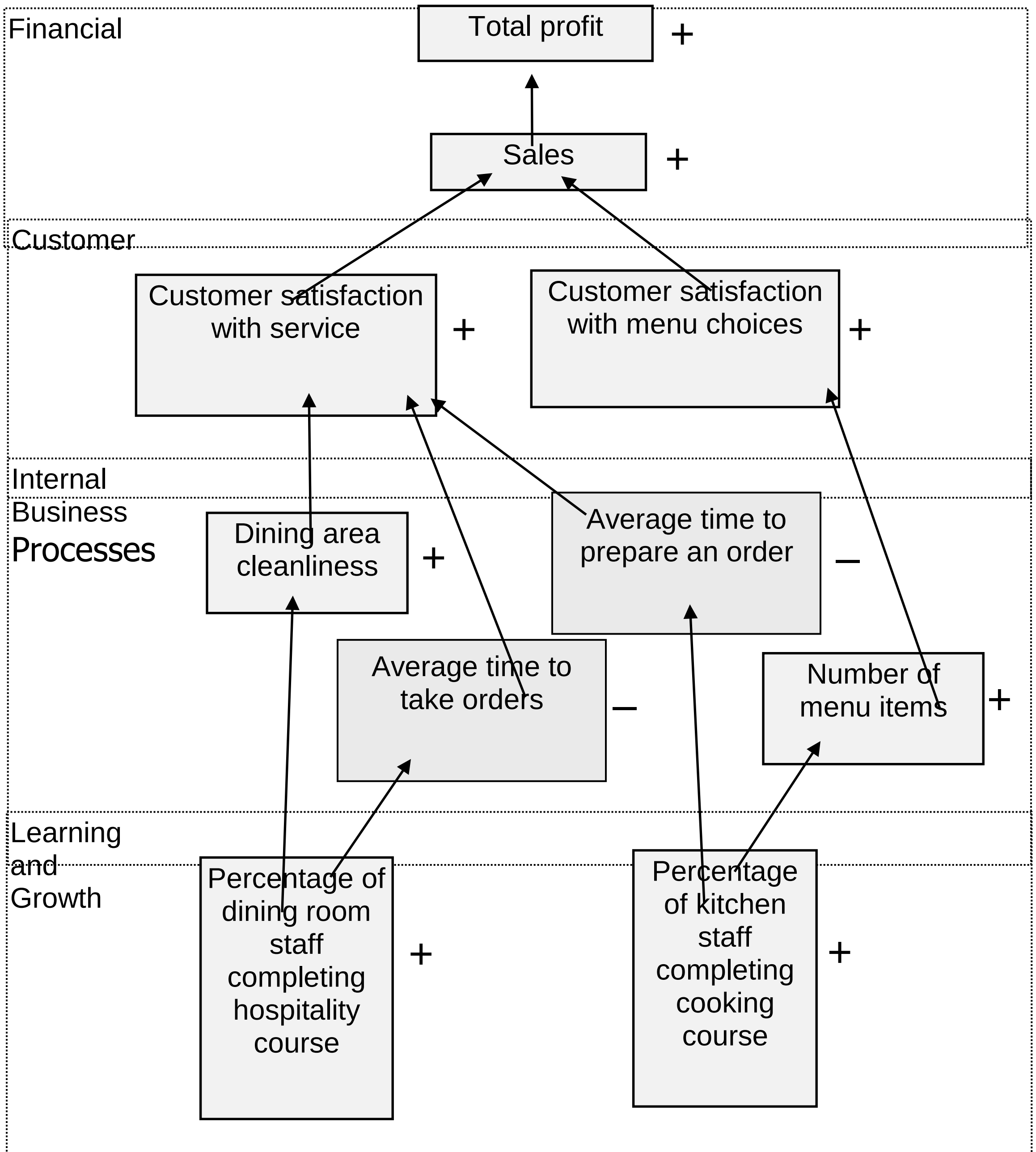
3. a. and b.

	Month	
	5	*6*
Throughput time in days:		
Process time	0.6	0.6
Inspection time	0.8	0.0
Move time	1.4	1.4
Queue time	0.0	0.0
Total throughput time	2.8	2.0
Manufacturing cycle efficiency (MCE):		
Process time ÷ Throughput time	21.4%	30.0%

As non-value-added activities are eliminated, the manufacturing cycle efficiency improves. The goal, of course, is to have an efficiency of 100%. This is achieved when all non-value-added activities have been eliminated and process time equals throughput time.

Problem 10-25 (45 minutes)

1. Students' answers may differ in some details from this solution.



Problem 10-25 (continued)

2. The hypotheses underlying the balanced scorecard are indicated by the arrows in the diagram. Reading from the bottom of the balanced scorecard, the hypotheses are:
   - o If the percentage of dining room staff who complete the hospitality course increases, the average time to take an order will decrease.
   - o If the percentage of dining room staff who complete the hospitality course increases, then dining room cleanliness will improve.
   - o If the percentage of kitchen staff who complete the cooking course increases, then the average time to prepare an order will decrease.
   - o If the percentage of kitchen staff who complete the cooking course increases, then the number of menu items will increase.
   - o If the dining room cleanliness improves, then customer satisfaction with service will increase.
   - o If the average time to take an order decreases, then customer satisfaction with service will increase.
   - o If the average time to prepare an order decreases, then customer satisfaction with service will increase.
   - o If the number of menu items increases, then customer satisfaction with menu choices will increase.
   - o If customer satisfaction with service increases, sales will increase.
   - o If customer satisfaction with menu choices increases, sales will increase.
   - o If sales increase, total profits for the Lodge will increase.

   Each of these hypotheses can be questioned. For example, even if the number of menu items increases, customer satisfaction with the menu choices may not increase. The items added to the menu may not appeal to customers. The fact that each of the hypotheses can be questioned does not, however, invalidate the balanced scorecard. If the scorecard is used correctly, management will be able to identify which, if any, of the hypotheses is incorrect. [See below.]

3. Management will be able to tell if a hypothesis is false if an improvement in a performance measure at the bottom of an arrow does not, in fact, lead to improvement in the performance measure at the tip of the arrow. For example, if the number of menu items is increased, but customer satisfaction with the menu choices does not increase, management will immediately know that something was wrong with their assumptions.

Problem 10-26 (45 minutes)

1. Each kilogram of fresh mushrooms yields 150 grams of dried mushrooms suitable for packing:

One kilogram of fresh mushrooms	1,000 grams
Less: unacceptable mushrooms (¼ of total)	250
Acceptable mushrooms	750
Less 80% shrinkage during drying	600
Acceptable dried mushrooms	150 grams

   Since 1,000 grams of fresh mushrooms yield 150 grams of dried mushrooms, 100 grams (or, 0.1 kilogram) of fresh mushrooms should yield the 15 grams of acceptable dried mushrooms that are packed in each jar.

   The direct labor standards are determined as follows:

	Sorting and Inspecting
Direct labor time per kilogram of fresh mushrooms	15 minutes
Grams of dried mushrooms per kilogram of fresh mushrooms	÷ 150 grams
Direct labor time per gram of dried mushrooms	0.10 minute per gram
Grams of dried mushrooms per jar	× 15 grams
Direct labor time per jar	1.5 minutes

	Drying
Direct labor time per kilogram of acceptable sorted fresh mushrooms	10 minutes
Grams of dried mushrooms per kilogram of acceptable sorted fresh mushrooms	÷ 200 grams
Direct labor time per gram of dried mushrooms	0.05 minute per gram
Grams of dried mushrooms per jar	× 15 grams
Direct labor time per jar	0.75 minute

Problem 10-26 (continued)

Standard cost per jar of dried chanterelle mushrooms:

Direct material:		
Fresh mushrooms		
(0.1 kilogram per jar × €60.00 per kilogram)	€6.00	
Jars, lids, and labels (€10.00 ÷ 100 jars).................	0.10	€6.10
Direct labor:		
Sorting and inspecting		
(1.5 minutes per jar × €0.20 per minute*)	0.30	
Drying (0.75 minute per jar × €0.20 per minute*)	0.15	
Packing		
(0.10 minute per jar** × €0.20 per minute*)	0.02	0.47
Standard cost per jar		€6.57

*€12.00 per hour is €0.20 per minute.

**10 minutes per 100 jars is 0.10 minute per jar.

Problem 10-26 (continued)

2. a. Ordinarily, the purchasing manager has more influence over the prices of purchased materials than anyone else in the organization. Therefore, the purchasing manager is usually held responsible for material price variances.

   b. The production manager is usually held responsible for materials quantity variances. However, this situation is a bit unusual. The quantity variance will be heavily influenced by the quality of the mushrooms acquired from gatherers by the purchasing manager. If the mushrooms have an unusually large proportion of unacceptable mushrooms, the quantity variance will be unfavorable. The production process itself is likely to have less effect on the amount of wastage and spoilage. On the other hand, if the production manager is not held responsible for the quantity variance, the production workers may not take sufficient care in their handling of the mushrooms. A partial solution to this problem would be to make the sorting and inspection process part of the purchasing manager's responsibility. The purchasing manager would then be held responsible for any wastage in excess of the 100 grams expected for each 300 grams of acceptable fresh mushrooms. The production manager would be held responsible for any wastage after that point. This is only a partial solution, however, because the purchasing manager may pass on at least 300 grams of every 400 grams of fresh mushrooms, whether they are acceptable or not.

Problem 10-27 (45 minutes)

1. a. Materials Price Variance = AQ (AP – SP)
   6,000 pounds ($2.75 per pound* – SP) = $1,500 F**
   $16,500 – 6,000 pounds × SP = $1,500***
   6,000 pounds × SP = $18,000
   SP = $3 per pound

   *$16,500 ÷ 6,000 pounds = $2.75 per pound
   **$1,200 U + ? = $300 F; $1,200 U – $1,500 F = $300 F.
   ***When used with the formula, unfavorable variances are positive and favorable variances are negative.

   b. Materials Quantity Variance = SP (AQ – SQ)
   $3 per pound (6,000 pounds – SQ) = $1,200 U
   $18,000 – $3 per pound × SQ = $1,200*
   $3 per pound × SQ = $16,800
   SQ = 5,600 pounds

   *When used with the formula, unfavorable variances are positive and favorable variances are negative.

   Alternative approach to parts (a) and (b):

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
$16,500*	6,000 pounds* × $3 per pound = $18,000	5,600 pounds × $3 per pound = $16,800

Price Variance, $1,500 F | Quantity Variance, $1,200 U*

Total Variance, $300 F*

*Given.

   c. 5,600 pounds ÷ 1,400 units = 4 pounds per unit.

Problem 10-27 (continued)

2. a. Labor Efficiency Variance = SR (AH – SH)
   $9 per hour (AH – 3,500 hours*) = $4,500 F
   $9 per hour × AH – $31,500 = –$4,500**
   $9 per hour × AH = $27,000
   AH = 3,000 hours

   *1,400 units × 2.5 hours per unit = 3,500 hours
   **When used with the formula, unfavorable variances are positive and favorable variances are negative.

   b. Labor Rate Variance = AH (AR – SR)
   3,000 hours ($9.50 per hour* – $9.00 per hour) = $1,500 U

   Alternative approach to parts (a) and (b):

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
3,000 hours × $9.50 per hour* = $28,500*	3,000 hours × $9.00 per hour** = $27,000	3,500 hours*** × $9.00 per hour** = $31,500

Rate Variance, $1,500 U	Efficiency Variance, $4,500 F*
Total Variance, $3,000 F	

* $28,500 total labor cost ÷ 3,000 hours = $9.50 per hour
** Given
*** 1,400 units × 2.5 hours per unit = 3,500 hours

Problem 10-28 (75 minutes)

1. a.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
60,000 feet × $0.95 per foot = $57,000	60,000 feet × $1.00 per foot = $60,000	36,000 feet* × $1.00 per foot = $36,000

Price Variance,
$3,000 F

38,000 feet × $1.00 per foot
= $38,000

Quantity Variance,
$2,000 U

*6,000 units × 6.0 feet per unit = 36,000 feet

Alternative approach:

Materials Price Variance = AQ (AP – SP)
60,000 feet ($0.95 per foot – $1.00 per foot) = $3,000 F

Materials Quantity Variance = SP (AQ – SQ)
$1.00 per foot (38,000 feet – 36,000 feet) = $2,000 U

b.

Raw Materials (60,000 feet @ $1.00 per foot).......	60,000	
Materials Price Variance (60,000 feet @ $0.05 per foot F)..................		3,000
Accounts Payable (60,000 feet @ $0.95 per foot).....................		57,000
Work in Process (36,000 feet @ $1.00 per foot)....	36,000	
Materials Quantity Variance (2,000 feet U @ $1.00 per foot)	2,000	
Raw Materials (38,000 feet @ $1.00 per foot)..		38,000

Problem 10-28 (continued)

2. a.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$27,950	6,500 hours* × $4.50 per hour = $29,250	6,000 hours** × $4.50 per hour = $27,000

Rate Variance, $1,300 F	Efficiency Variance, $2,250 U

Total Variance, $950 U

*The actual hours worked during the period can be computed through the variable overhead efficiency variance, as follows:

SR (AH – SH) = Efficiency Variance
$3 per hour (AH – 6,000 hours**) = $1,500 U
$3 per hour × AH – $18,000 = $1,500***
$3 per hour × AH = $19,500
AH = 6,500 hours

**6,000 units × 1.0 hour per unit = 6,000 hours
***When used with the formula, unfavorable variances are positive and favorable variances are negative.

Alternative approach:

Labor Rate Variance = AH × (AR – SR)
6,500 hours ($4.30 per hour* – $4.50 per hour) = $1,300 F

*$27,950 ÷ 6,500 hours = $4.30 per hour

Labor Efficiency Variance = SR (AH – SH)
$4.50 per hour (6,500 hours – 6,000 hours) = $2,250 U

Problem 10-28 (continued)

b. Work in Process

Work in Process (6,000 hours @ $4.50 per hour)	27,000	
Labor Efficiency Variance (500 hours U @ $4.50 per hour)	2,250	
Labor Rate Variance (6,500 hours @ $0.20 per hour F)		1,300
Wages Payable (6,500 hours @ $4.30 per hour)		27,950

3. a.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$20,475	6,500 hours × $3.00 per hour = $19,500	6,000 hours × $3.00 per hour = $18,000

Spending Variance, $975 U

Efficiency Variance, $1,500 U

Total Variance, $2,475 U

Alternative approach:

Variable Overhead Spending Variance = AH × (AR – SR)
6,500 hours ($3.15 per hour* – $3.00 per hour) = $975 U

*$20,475 ÷ 6,500 hours = $3.15 per hour

Variable Overhead Efficiency Variance = SR (AH – SH)
$3.00 per hour (6,500 hours – 6,000 hours) = $1,500 U

Problem 10-28 (continued)

b. No. When variable manufacturing overhead is applied on the basis of direct labor-hours, it is impossible to have an unfavorable variable manufacturing overhead efficiency variance when the direct labor efficiency variance is favorable. The variable manufacturing overhead efficiency variance is the same as the direct labor efficiency variance except that the difference between actual hours and the standard hours allowed for the output is multiplied by a different rate. If the direct labor efficiency variance is favorable, the variable manufacturing overhead efficiency variance must also be favorable.

4. *For materials:*

Favorable price variance: Decrease in outside purchase prices, fortunate buy, inferior quality materials, unusual discounts due to quantity purchased, inaccurate standards.

Unfavorable quantity variance: Inferior quality materials, carelessness, poorly adjusted machines, unskilled workers, inaccurate standards.

For labor:

Favorable rate variance: Unskilled workers (paid lower rates), piecework, inaccurate standards.

Unfavorable efficiency variance: Poorly trained workers, poor quality materials, faulty equipment, work interruptions, fixed labor with insufficient demand to keep them all busy, inaccurate standards.

For variable overhead:

Unfavorable spending variance: Increase in supplier prices, inaccurate standards, waste, theft of supplies.

Unfavorable efficiency variance: See comments under direct labor efficiency variance.

Problem 10-29 (45 minutes)

This is a very difficult problem that is harder than it looks. Be sure your students have been thoroughly "checked out" in the variance formulas before assigning it.

1.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
\$36,000	6,000 yards × \$6.50 per yard* = \$39,000	5,600 yards** × \$6.50 per yard* = \$36,400

Price Variance, \$3,000 F	Quantity Variance, \$2,600 U
Total Variance, \$400 F	

*\$18.20 ÷ 2.8 yards = \$6.50 per yard.
**2,000 units × 2.8 yards per unit = 5,600 yards

Alternative Solution:

Materials Price Variance = AQ (AP – SP)
6,000 yards (\$6.00 per yard* – \$6.50 per yard) = \$3,000 F
*\$36,000 ÷ 6,000 yards = \$6.00 per yard

Materials Quantity Variance = SP (AQ – SQ)
\$6.50 per yard (6,000 yards – 5,600 yards) = \$2,600 U

Problem 10-29 (continued)

2. Many students will miss parts 2 and 3 because they will try to use *product* costs as if they were *hourly* costs. Pay particular attention to the computation of the standard direct labor time per unit and the standard direct labor rate per hour.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
\$7,600	760 hours × \$9 per hour* = \$6,840	800 hours** × \$9 per hour* = \$7,200

Rate Variance, \$760 U | Efficiency Variance, \$360 F

Total Variance, \$400 U

* 780 standard hours ÷ 1,950 robes = 0.4 standard hour per robe.
\$3.60 standard cost per robe ÷ 0.4 standard hours = \$9 standard rate per hour.

** 2,000 robes × 0.4 standard hour per robe = 800 standard hours.

Alternative Solution:

Labor Rate Variance = AH (AR – SR)
760 hours (\$10 per hour* – \$9 per hour) = \$760 U
*\$7,600 ÷ 760 hours = \$10 per hour

Labor Efficiency Variance = SR (AH – SH)
\$9 per hour (760 hours – 800 hours) = \$360 F

Problem 10-29 (continued)

3.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
\$3,800	760 hours × \$3 per hour* = \$2,280	800 hours × \$3 per hour* = \$2,400

Spending Variance, \$1,520 U | Efficiency Variance, \$120 F

Total Variance, \$1,400 U

*\$1.20 standard cost per robe ÷ 0.4 standard hours = \$3 standard rate per hour.

Alternative Solution:

Variable Overhead Spending Variance = AH (AR – SR)
760 hours (\$5 per hour* – \$3 per hour) = \$1,520 U
*\$3,800 ÷ 760 hours = \$5 per hour

Variable Overhead Efficiency Variance = SR (AH – SH)
\$3 per hour (760 hours – 800 hours) = \$120 F

Problem 10-30 (60 minutes)

1. Total standard cost for units produced during August:

500 kits × $42 per kit	$21,000
Less standard cost of labor and overhead:	
Direct labor	(8,000)
Variable manufacturing overhead	(1,600)
Standard cost of materials used during August	$11,400

2.

Standard cost of materials used during August (a)	$11,400
Number of units produced (b)	500
Standard materials cost per kit (a) ÷ (b)	$ 22.80

$$\frac{\text{Standard materials cost per kit}}{\text{Standard materials cost per yard}} = \frac{\$22.80 \text{ per kit}}{\$6 \text{ per yard}} = 3.8 \text{ yards per kit}$$

3.

Actual cost of material used	$10,000
Standard cost of material used	11,400
Total variance	$ 1,400 F

The price and quantity variances together equal the total variance. If the quantity variance is $600 U, then the price variance must be $2,000F:

Price variance	$ 2,000 F
Quantity variance	600 U
Total variance	$ 1,400 F

Problem 10-30 (continued)

Alternative Solution:

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
2,000 yards × $5 per yard = $10,000*	2,000 yards × $6 per yard* = $12,000	1,900 yards** × $6 per yard* = $11,400

Price Variance, $2,000 F	Quantity Variance, $600 U*
Total Variance, $1,400 F	

*Given.

**500 kits × 3.8 yards per kit = 1,900 yards

4. The first step in computing the standard direct labor rate is to determine the standard direct labor-hours allowed for the month's production. The standard direct labor-hours can be computed by working with the variable manufacturing overhead cost figures, since they are based on direct labor-hours worked:

Standard manufacturing variable overhead cost for August (a)	$1,600
Standard manufacturing variable overhead rate per direct labor-hour (b)	$2
Standard direct labor-hours for the month (a) ÷ (b)	800

$$\frac{\text{Total standard labor cost for the month}}{\text{Total standard direct labor-hours for the month}} = \frac{\$8{,}000}{800\text{ DLHs}}$$

$$= \$10 \text{ per DLH}$$

Problem 10-30 (continued)

5. Before the labor variances can be computed, it is necessary to compute the actual direct labor cost for the month:

Actual cost per kit produced ($42.00 + $0.14)		$ 42.14
Number of kits produced		× 500
Total actual cost of production		$21,070
Less: Actual cost of materials..............................	$10,000	
Actual cost of manufacturing variable overhead	1,620	11,620
Actual cost of direct labor		$ 9,450

With this information, the variances can be computed:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$9,450	900 hours* × $10 per hour = $9,000	$8,000*

Rate Variance, $450 U	Efficiency Variance, $1,000 U
Total Variance, $1,450 U	

*Given.

Problem 10-30 (continued)

6.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$1,620*	900 hours* × $2 per hour* = $1,800	$1,600*

Spending Variance, $180 F	Efficiency Variance, $200 U
Total Variance, $20 U	

*Given.

7.

	Standard Quantity or Hours per Kit	*Standard Price or Rate*	*Standard Cost per Kit*
Direct materials.................	3.8 yards[1]	$ 6 per yard	$22.80
Direct labor.......................	1.6 hours[2]	$10 per hour[3]	16.00
Variable manufacturing overhead........................	1.6 hours	$ 2 per hour	3.20
Total standard cost per kit..			$42.00

[1]From part 2.
[2]800 hours (from part 4) ÷ 500 kits = 1.6 hours per kit.
[3]From part 4.

Case 10-31 (30 minutes)

This case may be difficult for some students to grasp since it requires looking at standard costs from an entirely different perspective. In this case, standard costs have been inappropriately used as a means to manipulate reported earnings rather than as a way to control costs.

1. Lansing has evidently set very loose standards in which the standard prices and standard quantities are far too high. This guarantees that favorable variances will ordinarily result from operations. If the standard costs are set artificially high, the standard cost of goods sold will be artificially high and thus the division's net operating income will be depressed until the favorable variances are recognized. If Lansing saves the favorable variances, he can release just enough in the second and third quarters to show some improvement and then he can release all of the rest in the last quarter, creating the annual "Christmas present."

2. Lansing should not be permitted to continue this practice for several reasons. First, it distorts the quarterly earnings for both the division and the company. The distortions of the division's quarterly earnings are troubling because the manipulations may mask real signs of trouble. The distortions of the company's quarterly earnings are troubling because they may mislead external users of the financial statements. Second, Lansing should not be rewarded for manipulating earnings. This sets a moral tone in the company that is likely to lead to even deeper trouble. Indeed, the permissive attitude of top management toward the manipulation of earnings may indicate the existence of other, even more serious, ethical problems in the company. Third, a clear message should be sent to division managers like Lansing that their job is to manage their operations, not their earnings. If they keep on top of operations and manage well, the earnings should take care of themselves.

Case 10-31 (continued)

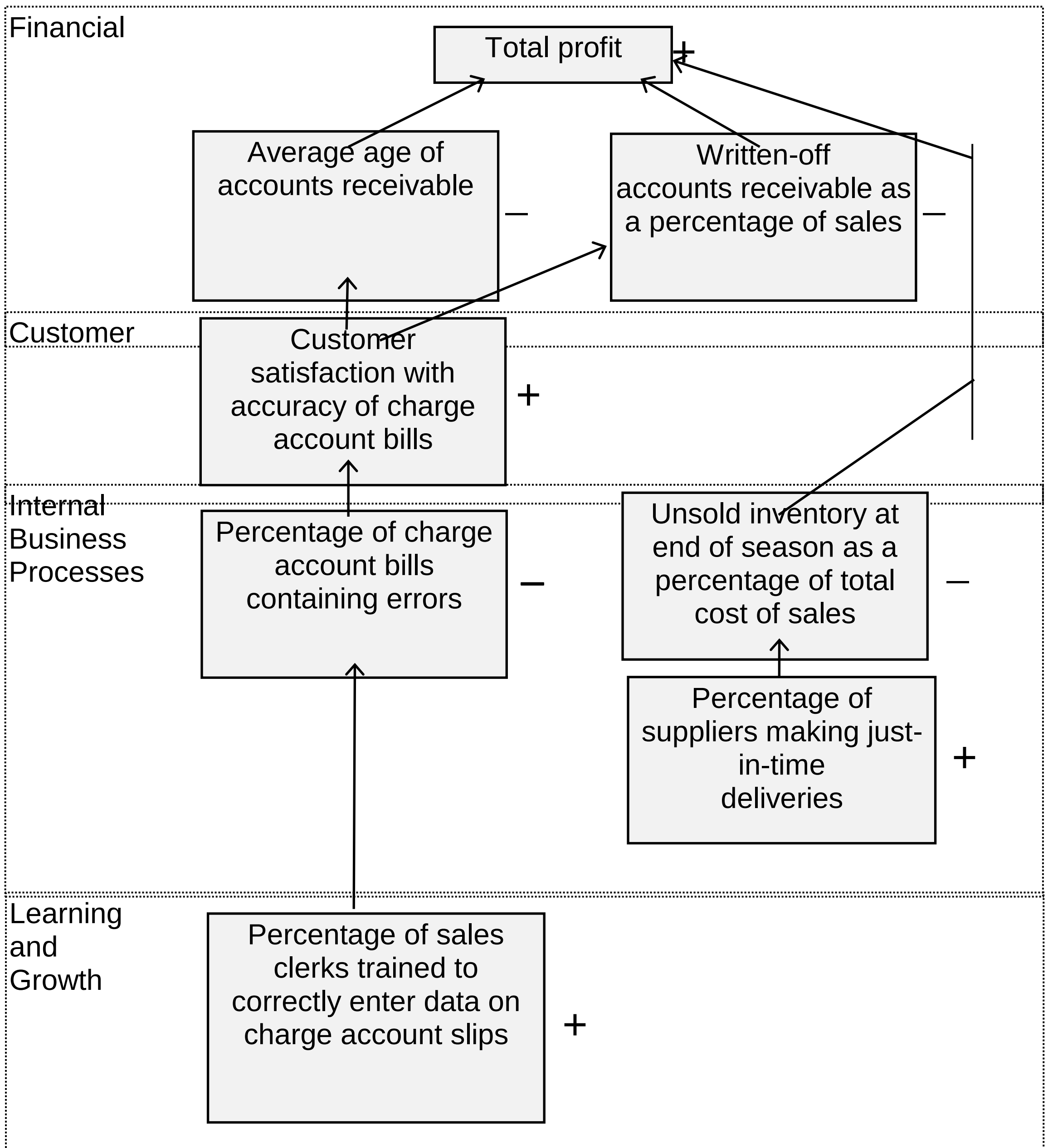
3. Stacy Cummins does not have any easy alternatives available. She has already taken the problem to the President, who was not interested. If she goes around the President to the Board of Directors, she will be putting herself in a politically difficult position with little likelihood that it will do much good if, in fact, the Board of Directors already knows what is going on.

   On the other hand, if she simply goes along, she will be violating the "Objectivity" standard of ethical conduct for management accountants. The Home Security Division's manipulation of quarterly earnings does distort the entire company's quarterly reports. And the Objectivity standard clearly stipulates that "management accountants have a responsibility to disclose fully all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, comments, and recommendations presented." Apart from the ethical issue, there is also a very practical consideration. If Merced Home Products becomes embroiled in controversy concerning questionable accounting practices, Stacy Cummins will be viewed as a responsible party by outsiders and her career is likely to suffer dramatically and she may even face legal problems.

   We would suggest that Ms. Cummins quietly bring the manipulation of earnings to the attention of the audit committee of the Board of Directors, carefully laying out in a non-confrontational manner the problems created by Lansing's practice of manipulating earnings. If the President and the Board of Directors are still not interested in dealing with the problem, she may reasonably conclude that the best alternative is to start looking for another job.

Case 10-32 (60 minutes)

1. Answers may differ concerning which category—learning and growth, internal business processes, customers, or financial—a particular performance measure belongs to.



Case 10-32 (continued)

A number of the performance measures suggested by managers have not been included in the above balanced scorecard. The excluded performance measures may have an impact on total profit, but they are not linked in any obvious way with the two key problems that have been identified by management—accounts receivables and unsold inventory. If every performance measure that potentially impacts profit is included in a company's balanced scorecard, it would become unwieldy and focus would be lost.

2. The results of operations can be exploited for information about the company's strategy. Each link in the balanced scorecard should be regarded as a hypothesis of the form "If ..., then ...". For example, the balanced scorecard on the previous page contains the hypothesis "If customers express greater satisfaction with the accuracy of their charge account bills, then the average age of accounts receivable will improve." If customers in fact do express greater satisfaction with the accuracy of their charge account bills, but the average age of accounts receivable does not improve, this would have to be considered evidence that is inconsistent with the hypothesis. Management should try to figure out why the average age of receivables has not improved. (See the answer below for possible explanations.) The answer may suggest a shift in strategy.

   In general, the most important results are those that provide evidence inconsistent with the hypotheses embedded in the balanced scorecard. Such evidence suggests that the company's strategy needs to be reexamined.

Case 10-32 (continued)

3. a. This evidence is inconsistent with two of the hypotheses underlying the balanced scorecard. The first of these hypotheses is "If customers express greater satisfaction with the accuracy of their charge account bills, then there will be improvement in the average age of accounts receivable." The second of these hypotheses is "If customers express greater satisfaction with the accuracy of their charge account bills, then there will be improvement in bad debts." There are a number of possible explanations. Two possibilities are that the company's collection efforts are ineffective and that the company's credit reviews are not working properly. In other words, the problem may not be incorrect charge account bills at all. The problem may be that the procedures for collecting overdue accounts are not working properly. Or, the problem may be that the procedures for reviewing credit card applications let through too many poor credit risks. If so, this would suggest that efforts should be shifted from reducing charge account billing errors to improving the internal business processes dealing with collections and credit screening. And in that case, the balanced scorecard should be modified.

   b. This evidence is inconsistent with three hypotheses. The first of these is "If the average age of receivables declines, then profits will increase." The second hypothesis is "If the written-off accounts receivable decrease as a percentage of sales, then profits will increase." The third hypothesis is "If unsold inventory at the end of the season as a percentage of cost of sales declines, then profits will increase."

   Again, there are a number of possible explanations for the lack of results consistent with the hypotheses. Managers may have decreased the average age of receivables by simply writing off old accounts earlier than was done previously. This would actually decrease reported profits in the short term. Bad debts as a percentage of sales could be decreased by drastically cutting back on extensions of credit to customers—perhaps even canceling some charge accounts. (There would be no bad debts at all if there were no credit sales.) This would have the effect of reducing bad debts, but might irritate otherwise loyal credit customers and reduce sales and profits.

Case 10-32 (continued)

The reduction in unsold inventories at the end of the season as a percentage of cost of sales could have occurred for a number of reasons that are not necessarily good for profits. For example, managers may have been too cautious about ordering goods to restock low inventories—creating stockouts and lost sales. Or, managers may have cut prices drastically on excess inventories in order to eliminate them before the end of the season. This may have reduced the willingness of customers to pay the store's normal prices. Or, managers may have gotten rid of excess inventories by selling them to discounters *before* the end of the season.

Research and Application 10-33 (240 minutes)

1. Nordstrom succeeds first and foremost because of its customer intimacy customer value proposition. The company's Personal Book system is the clearest indication of its customer intimacy value proposition. Page 17 of the annual report says "With Personal Book, our salespeople are able to set and manage their customer follow-ups, organize and track customer preferences and easily reference customer purchases and contact information. The result is that our salespeople are able to tailor our service to the needs of each customer. We are able to stay connected with our customers and invite them back in for the new trends, merchandise, sales and events that interest them." The Personal Book system is the latest innovation from a company that has prospered because of its attentiveness to individual customer needs.

   Offering fashionable, high-quality merchandise is also important to Nordstrom. However, the company has historically differentiated itself from competitors such as Dillard's, Federated, and Neiman Marcus by hiring top-notch salespeople and motivating them to provide superior individualized customer service. Page 14 of the annual report says "On the selling floor, our goal has been to create an environment that's fair and positive, while at the same time, providing our people with the tools they need to run their own businesses within our four walls. By giving each individual the ability and freedom to excel, we enhance our company's ability to do the same." Providing this extraordinary level of employee autonomy is another major driving force behind Nordstrom's customer intimacy value proposition.

2. These measures do not comprise a balanced scorecard because all of the measures, except one (inventory turns) are financial measures. The measures shown in the annual report may be satisfactory for external investors who are primarily interested in financial results; however, they would not constitute a balanced scorecard for internal management purposes. First, the scorecard does not include enough measures related to the non-financial leading indicators that drive financial results. In other words, the customer, internal business process, and learning and growth perspectives are largely non-existent in the scorecard included in the annual report. Second, there are no linkages between the measures shown in the scorecard. This is understandable because all of the measures except one are financial measures. Nonetheless, to quality as a genuine balanced scorecard, the scorecard shown in the annual

report would need to include measures from various non-financial perspectives (such as the customer, internal business process, and learning and growth perspectives) and those measures would need to be related to one another on a cause-and-effect basis.

3. Students will probably choose their measures from among those shown in the scorecard included in Nordstrom's annual report: (1) sales per square foot; (2) same-store sales percentage change; (3) gross profit as a percentage of sales; (4) SG&A expense as a percentage of sales; (5) earnings before income taxes as a percentage of sales; and (6) cash flow from operations. All of these measures, except SG&A expense as a percentage of sales, should increase over time.

   The most important part of this question is for students to see that these six measures provide feedback on different facets of financial performance. The "same-store sales percentage change" focuses on revenue management. The "gross profit as a percentage of sales," "SG&A expense as a percentage of sales," and "earnings before income taxes as a percentage of sales" are all margin-oriented measures that incorporate expense management into the evaluative scheme. The "sales per square foot" incorporates constraint management into the scorecard. Finally, "cash flow from operations" looks at cash flow management.

4. The annual report does not explicitly mention customer-focused performance measures. However, it contains numerous statements that refer to performance attributes that would be important to customers. For example, page 14 says "our merchants are doing a better job of reacting quickly to feedback from the sales floor by leveraging our new perpetual inventory system. As a result, we're selling more of the right merchandise in the right store at the right time. This improved merchandise flow brings more fresh and compelling goods to the floor, resulting in fewer markdowns." This quote alludes to two important aspects of the customers' shopping experience. First, the survey-based measure "customer perception of merchandise fashion appeal" assesses if customers perceive Nordstrom's product offerings as fresh and compelling. Second, the survey-based measure "customer perception of merchandise availability" assesses if customers perceive that Nordstrom has the right kind of merchandise available at the right time. Poor

performance on this measure could be caused by excessive markdowns, which would indicate that Nordstrom does not have enough fresh and compelling merchandise available for sale, or excessive stockouts, which would indicate that Nordstrom is running out of items that customers would like to have purchased.

As already mentioned, the annual report also discusses the company's Personal Book system. The purpose of this technology is to enable superior individualized customer service. The survey-based measure "customer perception of tailored service quality" assesses if customers believe that their individual preferences are understood and being met. Finally, page 15 of the annual report says "we've been taking a look at the different ways our customers choose to shop with us, whether by phone, online, or in our stores. We want to create a seamless shopping experience, sending our customers a clear and consistent message with the merchandise we offer, across all channels." The survey-based measure "customer perception of channel integration" assesses if customers perceive a seamless shopping experience. All four of these measures should increase over time.

5. The annual report explicitly mentions one internal business process measure, inventory turns. If Nordstrom is selling "more of the right merchandise in the right store at the right time," then inventory turnover should increase. The annual report does not explicitly mention any other internal process measures; however, it contains statements that point to various internal business process measures. For example, as previously mentioned, the Personal Book is a new tool that Nordstrom implemented to better serve and retain individual customers. For the Personal Book to work optimally, each Nordstrom salesperson should use the technology to help develop long-term relationships with their customers, to generate more follow-up visits from them, and to sell more merchandise to them. The measure "number of follow-up visits from customers" would provide feedback regarding the effectiveness of this technology. This measure should go up over time.

   The annual report also mentions that Nordstrom is always striving to improve its ability to respond to fashion trends. The measure "order cycle time" could be used to measure the amount of time that elapses from when Nordstrom spots a new trend and places an order with a supplier for a new SKU (Stock Keeping Unit) to when the merchandise becomes available for sale to end consumers. The same type of time-based measure could be used to assess how efficiently Nordstrom replenishes its existing SKUs. These time-based measures should go down over time.

The annual report emphasizes the importance of providing superior customer service. The measure "number of customer complaints" could be used to provide feedback regarding customer dissatisfaction with Nordstrom's sales process. This measure should go down over time.

The annual report says that Nordstrom strives to provide its customers with compelling merchandise. If customers return merchandise for a refund, it provides clear evidence that they did not find the merchandise to be very compelling or satisfying. Accordingly, the "dollar value of merchandise returns" is an internal business process measure that should decline over time.

6. The annual report does not explicitly mention any learning and growth measures; however, students can suggest some measures based on an elementary understanding of the business. The salespersons are critically important to Nordstrom because they manage the face-to-face customer interactions. Therefore, it would make sense for students to propose numerous measures related to the salesforce. For example, the measure "percentage of excellent job candidates hired" would assess Nordstrom's ability to hire highly qualified job candidates. The measure "hours of training per employee" would assess Nordstrom's investment in enabling its salesforce to succeed. The qualitative measure "employee morale" would measure how satisfied employees are with their jobs. In a highly autonomous environment such as Nordstrom, intrinsic motivation and high employee morale are critical drivers of success. Finally, the measure "employee retention" would assess how effective Nordstrom is at retaining its employees.

Research and Application 10-33 (continued)

7. Here are eight "if-then" hypothesis statements based on the measures mentioned above:
    - If the level of employee morale increases, then the rate of employee retention should increase.
    - If the rate of employee retention increases, then the number of follow-up visits from customers should increase.
    - If the number of follow-up visits from customers increases, then the customer perception of tailored service quality should increase.
    - If the customer perception of tailored service quality increases, then the same store sales percentage change should increase.
    - If the order cycle time for new SKUs decreases, then the customer perception of merchandise fashion appeal should increase.
    - If the customer perception of merchandise fashion appeal increases, then the gross margin as a percentage of sales should increase.
    - If the inventory turnover increases, then the sales per square foot should increase.
    - If the customer perception of channel integration increases, then the earnings before income taxes as a percentage of sales should increase.

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Chapter 11
Flexible Budgets and Overhead Analysis

Solutions to Questions

11-1 A static budget is a budget prepared for a single level of activity. The static budget is not adjusted even if the activity level subsequently changes.

11-2 A flexible budget can be adjusted to reflect any level of activity. By contrast, a static budget is prepared for a single level of activity and is not subsequently adjusted.

11-3 Criteria for choosing an activity base:

1. The activity base and overhead cost should be causally related.
2. The activity base should not be expressed in dollars.
3. The activity base should be simple and easy to understand.

11-4 If the flexible budget is based on actual hours worked, only a spending variance will be produced on the performance report. Both a spending and an efficiency variance will be produced if the flexible budget is based on both actual hours and standard hours.

11-5 Standard hours allowed means the time that should have been taken to complete the actual output of the period.

11-6 The materials price variance is entirely caused by any difference between the standard price of a material and the price actually paid. The variable overhead spending variance consists of two elements. One element is like a price variance and results from differences between actual and standard prices for variable overhead inputs. The other element is like a quantity variance and results from differences between the amount of variable overhead inputs that should have been used and the amounts that were actually used. Ordinarily these two elements are not separated.

11-7 The overhead efficiency variance does not really measure efficiency in the use of overhead. It actually measures efficiency in the use of the base underlying the flexible budget. This base could be direct labor-hours, machine-hours, or some other measure of activity.

11-8 The denominator level of activity is the denominator in the predetermined overhead rate.

11-9 A normal costing system was used in Chapter 3, whereas in Chapter 11 a standard cost system is used. Standard costing ensures that the same amount of overhead is applied to a product regardless of the actual amount of the application base (such as machine-hours or direct labor-hours) that is used during a period.

11-10 In a standard cost system both a budget variance and a volume variance are computed for fixed manufacturing overhead cost.

11-11 The fixed overhead budget variance is the difference between total budgeted fixed overhead cost and the total amount of fixed overhead cost incurred. If actual costs exceed budgeted costs, the variance is labeled unfavorable.

11-12 The volume variance is favorable when the activity level for a period, at standard, is greater than the denominator activity level. Conversely, if the activity level, at standard, is less than the denominator level of activity, the volume variance is unfavorable. The variance does not measure deviations in spending. It measures deviations in actual activity from the denominator level of activity.

11-13 If fixed costs are expressed on a per unit basis, managers may be misled into thinking that they are really variable. This can lead to faulty predictions concerning cost behavior and to bad decisions and erroneous performance evaluations.

11-14 Underapplied or overapplied overhead can be factored into variable overhead spending and efficiency variances and the fixed overhead budget and volume variances.

11-15 The total of the overhead variances is favorable when overhead is overapplied.

Exercise 11-1 (15 minutes)

Swan Company
Flexible Budget

Overhead Costs	*Cost Formula per MH*	*Machine-Hours 8,000*	*9,000*	*10,000*
Variable:				
Supplies	$0.20	$ 1,600	$ 1,800	$ 2,000
Indirect labor	0.25	2,000	2,250	2,500
Utilities	0.15	1,200	1,350	1,500
Maintenance	0.10	800	900	1,000
Total variable overhead cost	$0.70	5,600	6,300	7,000
Fixed:				
Indirect labor		10,000	10,000	10,000
Maintenance		7,000	7,000	7,000
Depreciation		8,000	8,000	8,000
Total fixed overhead cost		25,000	25,000	25,000
Total overhead cost		$30,600	$31,300	$32,000

Exercise 11-2 (15 minutes)

1.

Canyonland Boat Charter Service
Flexible Budget Performance Report
For the Month Ended August 31

	Cost Formula (per charter)	Actual Costs Incurred for 140 Charters	Flexible Budget Based on 140 Charters	Variance	
Variable overhead costs:					
Cleaning	$ 72.50	$10,360	$10,150	$ 210	U
Maintenance	56.25	7,630	7,875	245	F
Park usage fees....................	15.75	2,210	2,205	5	U
Total variable overhead cost......	$144.50	20,200	20,230	30	F
Fixed overhead costs:					
Salaries and wages..............		7,855	7,860	5	F
Depreciation		14,450	13,400	1,050	U
Utilities		735	720	15	U
Moorage		3,950	3,670	280	U
Total fixed overhead cost..........		26,990	25,650	1,340	U
Total overhead cost		$47,190	$45,880	$1,310	U

2. The addition of a new boat to the charter fleet apparently increased depreciation and moorage charges for the month above what had been anticipated. (A new boat adds to depreciation charges and a new boat needs to be moored, hence the higher moorage charges.) These two items are responsible for most of the $1,310 unfavorable total variance for the month.

Exercise 11-3 (15 minutes)

Jessel Corporation
Variable Overhead Performance Report
For the Year Ended December 31

Budgeted direct labor-hours	42,000
Actual direct labor-hours	44,000
Standard direct labor-hours allowed	45,000

Overhead Costs	*Cost Formula (per DLH)*	*Actual Costs Incurred 44,000 DLHs (AH × AR)*	*Flexible Budget Based on 44,000 DLHs (AH × SR)*	*Spending Variance*
Indirect labor	\$0.90	\$42,000	\$39,600	\$2,400 U
Supplies	0.15	6,900	6,600	300 U
Electricity	0.05	1,800	2,200	400 F
Total variable overhead cost	\$1.10	\$50,700	\$48,400	\$2,300 U

Exercise 11-4 (20 minutes)

Jessel Corporation
Variable Overhead Performance Report
For the Year Ended December 31

Budgeted direct labor-hours	42,000
Actual direct labor-hours	44,000
Standard direct labor-hours allowed	45,000

Overhead Costs	*Cost Formula (per DLH)*	*(1) Actual Costs Incurred 44,000 DLHs (AH × AR)*	*(2) Flexible Budget Based on 44,000 DLHs (AH × SR)*	*(3) Flexible Budget Based on 45,000 DLHs (SH × SR)*	*(4) Total Variance (1)-(3)*	*Spending Variance (1)-(2)*	*Efficiency Variance (2)-(3)*
Indirect labor	$0.90	$42,000	$39,600	$40,500	$1,500 U	$2,400 U	$ 900 F
Supplies	0.15	6,900	6,600	6,750	150 U	300 U	150 F
Electricity	0.05	1,800	2,200	2,250	450 F	400 F	50 F
Total variable overhead cost	$1.10	$50,700	$48,400	$49,500	$1,200 U	$2,300 U	$1,100 F

Exercise 11-5 (15 minutes)

1. The flexible budget amount for overhead at the denominator level of activity must be determined before the predetermined overhead rate can be computed.

Total fixed overhead cost per year	$600,000
Total variable overhead cost at the denominator level of activity ($3.50 per DLH × 80,000 DLHs)	280,000
Total overhead cost at the denominator level of activity ..	$880,000

$$\text{Predetermined overhead rate} = \frac{\text{Overhead at the denominator level of activity}}{\text{Denominator level of activity}}$$

$$= \frac{\$880,000}{80,000 \text{ DLHs}} = \$11.00 \text{ per DLH}$$

2.

Standard direct labor-hours allowed for the actual output (a)...........................	82,000 DLHs
Predetermined overhead rate (b)	$11.00 per DLH
Overhead applied (a) × (b)....................	$902,000

Exercise 11-6 (15 minutes)

1.

$$\text{Fixed portion of the predetermined overhead rate} = \frac{\text{Fixed overhead}}{\text{Denominator level of activity}}$$

$$= \frac{\$400{,}000}{50{,}000 \text{ DLHs}}$$

$$= \$8.00 \text{ per DLH}$$

2.

$$\text{Budget variance} = \text{Actual fixed overhead cost} - \text{Budgeted fixed overhead cost}$$

$$= \$394{,}000 - \$400{,}000$$

$$= \$6{,}000 \text{ F}$$

$$\text{Volume variance} = \text{Fixed portion of the predetermined overhead rate} \times \left(\text{Denominator hours} - \text{Standard hours allowed}\right)$$

$$= \$8.00 \text{ per DLH } (50{,}000 \text{ DLHs} - 48{,}000 \text{ DLHs})$$

$$= \$16{,}000 \text{ U}$$

Exercise 11-7 (15 minutes)

AutoPutz, Gmbh
Flexible Budget

Overhead Costs	*Cost Formula (per car)*	*Activity (cars)* 7,000	8,000	9,000
Variable overhead costs:				
Cleaning supplies	€ 0.75	€ 5,250	€ 6,000	€ 6,750
Electricity	0.60	4,200	4,800	5,400
Maintenance	0.15	1,050	1,200	1,350
Total variable overhead cost	€ 1.50	10,500	12,000	13,500
Fixed overhead costs:				
Operator wages		10,000	10,000	10,000
Depreciation		20,000	20,000	20,000
Rent		8,000	8,000	8,000
Total fixed overhead cost		38,000	38,000	38,000
Total overhead cost		€ 48,500	€ 50,000	€ 51,500

Exercise 11-8 (10 minutes)

AutoPutz, Gmbh
Static Budget
For the Month Ended August 31

Budgeted number of cars	8,200
Budgeted variable overhead costs:	
Cleaning supplies (@ € 0.75 per car)	€ 6,150
Electricity (@ € 0.60 per car)	4,920
Maintenance (@ € 0.15 per car)	1,230
Total variable overhead cost	12,300
Budgeted fixed overhead costs:	
Operator wages	10,000
Depreciation	20,000
Rent	8,000
Total fixed overhead cost	38,000
Total budgeted overhead cost	€ 50,300

Exercise 11-9 (15 minutes)

AutoPutz, Gmbh
Flexible Budget Performance Report
For the Month Ended August 31

Budgeted number of cars	8,200
Actual number of cars	8,300

Overhead Costs	*Cost Formula (per car)*	*Actual Costs Incurred for 8,300 Cars*	*Flexible Budget Based on 8,300 Cars*	*Variance*
Variable overhead costs:				
Cleaning supplies	€ 0.75	€ 6,350	€ 6,225	€ 125 U
Electricity............................	0.60	4,865	4,980	115 F
Maintenance	0.15	1,600	1,245	355 U
Total variable overhead cost...	€ 1.50	12,815	12,450	365 U
Fixed overhead costs:				
Operator wages		10,050	10,000	50 U
Depreciation		20,200	20,000	200 U
Rent....................................		8,000	8,000	-
Total fixed overhead cost		38,250	38,000	250 U
Total overhead cost		€ 51,065	€ 50,450	€ 615 U

Students may question the variances for fixed costs. Operator wages can differ from what was budgeted for a variety of reasons including an unanticipated increase in the wage rate; changes in the mix of workers between those earning lower and higher wages; changes in the number of operators on duty; and overtime. Depreciation may have increased because of the acquisition of new equipment or because of a loss on equipment that must be scrapped—perhaps due to poor maintenance. (This assumes that the loss flows through the depreciation account on the performance report.)

Exercise 11-10 (20 minutes)

1. Whaley Company
Variable Manufacturing Overhead Performance Report

Budgeted machine-hours	18,000
Actual machine-hours worked	16,000

	Actual 16,000 hours	*Flexible Budget 16,000 hours*	*Spending Variance*
Variable overhead costs:			
Utilities	$20,000	$19,200	$ 800 U
Supplies	4,700	4,800	100 F
Maintenance	35,100	38,400	3,300 F
Rework time	12,300	9,600	2,700 U
Total variable overhead cost	$72,100	$72,000	$ 100 U

2. Favorable variances can be as much a matter of managerial concern as unfavorable variances. In this case, the favorable maintenance variance undoubtedly would require investigation. Efforts should be made to determine if maintenance is not being carried out. In terms of percentage deviation from budgeted allowances, the rework time variance is even more significant (equal to 28% of the budget allowance). It may be that this unfavorable variance in rework time is a result of poor maintenance of machines. Some may say that if the two variances are related, then the trade-off is a good one, since the savings in maintenance cost is greater than the added cost of rework time. But this is shortsighted reasoning. Poor maintenance can reduce the life of equipment, as well as decrease overall output. These long-run costs may swamp any short-run savings.

Exercise 11-11 (20 minutes)

1.

Overall rate: $\dfrac{\$33{,}200}{8{,}000\text{ MHs}} = \$4.15$ per MH

Variable rate: $\dfrac{\$8{,}400}{8{,}000\text{ MHs}} = \$1.05$ per MH

Fixed rate: $\dfrac{\$24{,}800}{8{,}000\text{ MHs}} = \$3.10$ per MH

2. The standard hours per unit of product are:

   8,000 MHs ÷ 3,200 units = 2.5 MHs per unit

   The standard hours allowed for the actual production would be:

   3,500 units × 2.5 MHs per unit = 8,750 MHs

3. Variable overhead spending variance = (AH × AR) – (AH × SR)
   = ($9,860) – (8,500 MHs × $1.05 per MH)
   = ($9,860) – ($8,925)
   = $935 U

   Variable overhead efficiency variance = SR (AH – SH)
   = $1.05 per MH (8,500 MHs – 8,750 MHs)
   = $262.50 F

Exercise 11-11 (continued)

Fixed overhead budget and volume variances:

Actual Fixed Overhead Cost	Budgeted Fixed Overhead Cost	Fixed Overhead Cost Applied to Work in Process
$25,100	$24,800*	8,750 standard MHs × $3.10 per MH = $27,125

Budget Variance, $300 U

Volume Variance, $2,325 F

Total Variance, $2,025 F

*8,000 denominator MHs × $3.10 per MH = $24,800.

Alternative approach to the budget variance:

$$\text{Budget Variance} = \text{Actual Fixed Overhead Cost} - \text{Budgeted Fixed Overhead Cost}$$

$$= \$25{,}100 - \$24{,}800 = \$300\text{ U}$$

Alternative approach to the volume variance:

$$\text{Volume Variance} = \text{Fixed Portion of the Predetermined Overhead Rate}\left(\text{Denominator Hours} - \text{Standard Hours Allowed}\right)$$

$$= \$3.10\text{ per MH }(8{,}000\text{ MHs} - 8{,}750\text{ MHs}) = \$2{,}325\text{ F}$$

Exercise 11-12 (15 minutes)

1. 10,000 units × 0.8 DLH per unit = 8,000 DLHs.

2. and 3.

Actual Fixed Overhead Cost	Budgeted Fixed Overhead Cost	Fixed Overhead Cost Applied to Work in Process
$45,600*	$45,000	8,000 standard DLHs × $6 per DLH* = $48,000

Budget Variance, $600 U

Volume Variance, $3,000 F*

*Given.

4. $$\frac{\text{Fixed cost element of the}}{\text{predetermined overhead rate}} = \frac{\text{Budgeted fixed overhead cost}}{\text{Denominator activity}}$$

$$= \frac{\$45{,}000}{\text{Denominator activity}} = \$6 \text{ per DLH}$$

Therefore, the denominator activity was 7,500 direct labor-hours.

Exercise 11-13 (15 minutes)

San Juan Bank
Check-Clearing Office
Variable Overhead Performance Report
For the Month Ended October 31

Budgeted labor-hours	865
Actual labor-hours	860
Standard labor-hours allowed for the actual number of checks processed	880

Overhead costs	*Cost Formula (per labor-hour)*	*(1) Actual Costs Incurred for 860 Labor-Hours (AH × AR)*	*(2) Flexible Budget Based on 860 Labor-Hours (AH × SR)*	*(3) Flexible Budget Based on 880 Labor-Hours (SH × SR)*	*Total Variance (1) – (3)*	*Breakdown of the Total Variance* Spending Variance (1) – (2)	Efficiency Variance (2) – (3)
Variable overhead costs:							
Office supplies	$0.15	$ 146	$ 129	$ 132	$14 U	$17 U	$ 3 F
Staff coffee lounge	0.05	124	43	44	80 U	81 U	1 F
Indirect labor	3.25	2,790	2,795	2,860	70 F	5 F	65 F
Total variable overhead cost	$3.45	$3,060	$2,967	$3,036	$24 U	$93 U	$69 F

Exercise 11-14 (15 minutes)

1.

Actual fixed overhead costs incurred	$79,000
Add favorable budget variance	1,000
Budgeted fixed overhead cost	$80,000

$$\frac{\text{Budgeted fixed overhead cost}}{\text{Denominator hours}} = \frac{\$80,000}{20,000\text{ MHs}} = \$4\text{ per MH}$$

2. 9,500 units × 2 MHs per unit = 19,000 MHs

3.

$$\text{Volume Variance} = \text{Fixed Portion of the Predetermined Overhead Rate}\left(\text{Denominator Hours} - \text{Standard Hours Allowed}\right)$$

$$= \$4\text{ per MH }(20,000\text{ MHs} - 19,000\text{ MHs}) = 4,000\text{ U}$$

Alternative solutions to parts 1-3:

Actual Fixed Overhead Cost	Budgeted Fixed Overhead Cost	Fixed Overhead Cost Applied to Work in Process
$79,000*	$80,000[a]	19,000 MHs[b] × $4 per MH[c] = $76,000

Budget Variance	Volume Variance
$1,000 F*	$4,000 U

*Given.

[a]$79,000 + $1,000 = $80,000.

[b]9,500 units × 2 MHs per unit = 19,000 MHs

[c]$80,000 ÷ 20,000 denominator MHs = $4 per MH.

Exercise 11-15 (15 minutes)

1. Predetermined overhead rate:

$$\frac{\text{Total overhead from the flexible budget at the denominator activity level}}{\text{Denominator activity}} = \frac{\$122{,}400}{24{,}000\ \text{DLHs}} = \$5.10\ \text{per DLH}$$

   Variable element: \$38,400 ÷ 24,000 DLHs = \$1.60 per DLH

   Fixed element: \$84,000 ÷ 24,000 DLHs = \$3.50 per DLH

2.

Direct materials, 2 pounds × \$4.20 per pound	\$ 8.40
Direct labor, 3 DLHs* × \$12.60 per DLH	37.80
Variable overhead, 3 DLHs × \$1.60 per DLH	4.80
Fixed overhead, 3 DLHs × \$3.50 per DLH	10.50
Total standard cost per unit	\$61.50

*24,000 DLHs ÷ 8,000 units = 3 DLHs per unit.

Exercise 11-16 (10 minutes)

Company X:	This company has an unfavorable volume variance since the standard direct labor-hours allowed for the actual output are less than the denominator activity.
Company Y:	This company has an unfavorable volume variance since the standard direct labor-hours allowed for the actual output are less than the denominator activity.
Company Z:	This company has a favorable volume variance since the standard direct labor-hours allowed for the actual output are greater than the denominator activity.

Problem 11-17 (30 minutes)

1. The reports as presently prepared are of little use to the company. The problem is that the company is using a static budget approach, and is comparing budgeted performance at one level of activity to actual performance at another level of activity. Although the reports do a good job of showing whether or not the budgeted level of activity was attained, they do not tell whether costs were controlled for the period.

2. The company should use a flexible budget approach to evaluate control over costs. Under the flexible budget approach, the actual costs incurred during the quarter in working 25,000 hours should be compared to budgeted costs at that activity level.

3. Shipley Company
Overhead Performance Report—Milling Department
For the Quarter Ended June 30

Budgeted machine-hours	30,000 MHs
Actual machine-hours	25,000 MHs

Overhead Costs	*Cost Formula (per MH)*	*Actual 25,000 hours*	*Flexible Budget 25,000 hours*	*Spending or Budget Variance*
Variable overhead costs:				
Indirect labor	$0.75	$ 20,000	$ 18,750	$1,250 U
Supplies.....................	0.20	5,400	5,000	400 U
Utilities	1.00	27,000	25,000	2,000 U
Rework......................	0.50	14,000	12,500	1,500 U
Total variable overhead cost...........................	$2.45	66,400	61,250	5,150 U
Fixed overhead costs:				
Maintenance		61,900	60,000	1,900 U
Inspection		90,000	90,000	0
Total fixed overhead cost...........................		151,900	150,000	1,900 U
Total overhead cost.......		$218,300	$211,250	$7,050 U

Problem 11-18 (45 minutes)

1. Direct materials price and quantity variances:

   Direct Materials Price Variance = AQ (AP – SP)
   78,000 yards ($3.75 per yard – $3.50 per yard) = $19,500 U

   Direct Materials Quantity Variance = SP (AQ – SQ)
   $3.50 per yard (78,000 yards – 80,000 yards*) = $7,000 F

   *20,000 units × 4 yards per unit = 80,000 yards

2. Direct labor rate and efficiency variances:

   Direct Labor Rate Variance = AH (AR – SR)
   32,500 DLHs ($11.80 per DLH – $12.00 per DLH) = $6,500 F

   Direct Labor Efficiency Variance = SR (AH – SH)
   $12.00 per DLH (32,500 DLHs – 30,000 DLHs*) = $30,000 U

   *20,000 units × 1.5 DLHs per unit = 30,000 DLHs

3. a. Variable manufacturing overhead spending and efficiency variances:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$68,250	32,500 DLHs × $2 per DLH = $65,000	30,000 DLHs × $2 per DLH = $60,000

Spending Variance, $3,250 U | Efficiency Variance, $5,000 U

Alternative solution:

Variable Overhead Spending Variance = (AH × AR) – (AH × SR)
($68,250) – (32,500 DLHs × $2.00 per DLH) = $3,250 U

Variable Overhead Efficiency Variance = SR (AH – SH)
$2.00 per DLH (32,500 DLHs – 30,000 DLHs) = $5,000 U

b. Fixed overhead budget and volume variances:

Actual Fixed Overhead Cost	Budgeted Fixed Overhead Cost	Fixed Overhead Cost Applied to Work in Process
$148,000	$150,000	30,000 DLHs × $6 per DLH = $180,000

Budget Variance, $2,000 F (between Actual Fixed Overhead Cost and Budgeted Fixed Overhead Cost)

Volume Variance, $30,000 F (between Budgeted Fixed Overhead Cost and Fixed Overhead Cost Applied to Work in Process)

Alternative approach to the budget variance:

$$\text{Budget Variance} = \text{Actual Fixed Overhead Cost} - \text{Flexible Budget Fixed Overhead Cost}$$

$148,000 – $150,000 = $2,000 F

Alternative approach to the volume variance:

$$\text{Volume Variance} = \text{Fixed Portion of the Predetermined Overhead Rate} \left(\text{Denominator Hours} - \text{Standard Hours Allowed}\right)$$

$6.00 per DLH (25,000 DLHs – 30,000 DLHs) = $30,000 F

Problem 11-18 (continued)

4. The total of the variances would be:

Direct materials variances:		
Price variance	$19,500	U
Quantity variance	7,000	F
Direct labor variances:		
Rate variance	6,500	F
Efficiency variance	30,000	U
Variable manufacturing overhead variances:		
Spending variance	3,250	U
Efficiency variance	5,000	U
Fixed manufacturing overhead variances:		
Budget variance	2,000	F
Volume variance	30,000	F
Total of variance	$12,250	U

Notice that the total of the variances agrees with the $12,250 unfavorable variance mentioned by the vice president.

It appears that not everyone should be given a bonus for good cost control. The materials price variance and the labor efficiency variance are 7.1% and 8.3%, respectively, of the standard cost allowed and thus would warrant investigation. In addition, the variable overhead spending variance is 5.0% of the standard cost allowed.

The reason the company's large unfavorable variances (for materials price and labor efficiency) do not show up more clearly is that they are offset for the most part by the company's favorable volume variance for the year. This favorable volume variance is the result of the company operating at an activity level that is well above the denominator activity level used to set predetermined overhead rates. (The company operated at an activity level of 30,000 standard DLHs; the denominator activity level set at the beginning of the year was 25,000 DLHs.) As a result of the large favorable volume variance, the unfavorable price and efficiency variances have been concealed in a small "net" figure. Finally, the large favorable volume variance may have been achieved by building up inventories.

Problem 11-19 (45 minutes)

1.

$$\text{Total rate: } \frac{£31{,}500 + £72{,}000}{18{,}000 \text{ MHs}} = £5.75 \text{ per MH}$$

$$\text{Variable element: } \frac{£31{,}500}{18{,}000 \text{ MHs}} = £1.75 \text{ per MH}$$

$$\text{Fixed element: } \frac{£72{,}000}{18{,}000 \text{ MHs}} = £4 \text{ per MH}$$

2. 16,000 standard MHs × £5.75 per MH = £92,000

3. Variable manufacturing overhead variances:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
£26,500	15,000 MHs × £1.75 per MH = £26,250	16,000 MHs × £1.75 per MH = £28,000

Spending Variance, £250 U

Efficiency Variance, £1,750 F

Alternative solution:

Variable Overhead Spending Variance = (AH × AR) – (AH × SR)
(£26,500) – (15,000 MHs × £1.75 per MH) = £250 U

Variable Overhead Efficiency Variance = SR (AH – SH)
£1.75 per MH (15,000 MHs – 16,000 MHs) = £1,750 F

Problem 11-19 (continued)

Fixed overhead variances:

Actual Fixed Overhead Cost	Budgeted Fixed Overhead Cost	Fixed Overhead Cost Applied to Work in Process
£70,000	£72,000	16,000 MHs × £4 per MH = £64,000

Budget Variance, £2,000 F	Volume Variance, £8,000 U

Alternative solution:

$$\text{Budget Variance} = \text{Actual Fixed Overhead Cost} - \text{Flexible Budget Fixed Overhead Cost}$$

£70,000 – £72,000 = £2,000 F

$$\text{Volume Variance} = \text{Fixed Portion of the Predetermined Overhead Rate}\left(\text{Denominator Hours} - \text{Standard Hours Allowed}\right)$$

£4 per MH (18,000 MHs – 16,000 MHs) = £8,000 U

Verification of variances:

Variable overhead spending variance................	£ 250	U
Variable overhead efficiency variance...............	1,750	F
Fixed overhead budget variance.......................	2,000	F
Fixed overhead volume variance	8,000	U
Underapplied overhead	£4,500	

Problem 11-19 (continued)

4. Variable overhead

   Spending variance: This variance includes both price and quantity elements. The overhead spending variance reflects differences between actual and standard prices for variable overhead items. It also reflects differences between the amounts of variable overhead inputs that were actually used and the amounts that should have been used for the actual output of the period. Since the variable overhead spending variance is unfavorable, either too much was paid for variable overhead items or too many of them were used.

   Efficiency variance: The term "variable overhead efficiency variance" is a misnomer, since the variance does not measure efficiency in the use of overhead items. It measures the indirect effect on variable overhead of the efficiency or inefficiency with which the activity base is utilized. In this company, machine-hours is the activity base. If variable overhead is really proportional to machine-hours, then more effective use of machine-hours has the indirect effect of reducing variable overhead. Since 1,000 fewer machine-hours were required than indicated by the standards, the indirect effect was presumably to reduce variable overhead spending by about £1,750 (£1.75 per machine-hour × 1,000 machine-hours).

   Fixed overhead

   Budget variance: This variance is simply the difference between the budgeted fixed cost and the actual fixed cost. In this case, the variance is favorable, which indicates that actual fixed costs were lower than anticipated in the budget.

   Volume variance: This variance occurs as a result of actual activity being different from the denominator activity that was used in the predetermined overhead rate. In this case, the variance is unfavorable, so actual activity was less than the denominator activity. It is difficult to place much of a meaningful economic interpretation on this variance. It tends to be large, so it often swamps the other, more meaningful variances if they are simply netted against each other.

Problem 11-20 (30 minutes)

1. The cost formulas in the flexible budget performance report below were obtained by dividing the costs on the static budget in the problem statement by the budgeted level of activity (600 liters). The fixed costs are carried over from the static budget.

KGV Blood Bank
Flexible Budget Performance Report
For the Month Ended September 30

Budgeted activity (in liters)	600
Actual activity (in liters)	780

Costs	*Cost Formula (per liter)*	*Actual Costs Incurred for 780 Liters*	*Flexible Budget Based on 780 Liters*	*Variance*	
Variable costs:					
Medical supplies	$11.85	$ 9,252	$ 9,243	$ 9	U
Lab tests	14.35	10,782	11,193	411	F
Refreshments for donors	1.60	1,186	1,248	62	F
Administrative supplies	0.25	189	195	6	F
Total variable cost	$28.05	21,409	21,879	470	F
Fixed costs:					
Staff salaries		13,200	13,200	0	
Equipment depreciation		2,100	1,900	200	U
Rent		1,500	1,500	0	
Utilities		324	300	24	U
Total fixed cost		17,124	16,900	224	U
Total cost		$38,533	$38,779	$246	F

Problem 11-20 (continued)

2. The overall variance is favorable and none of the unfavorable variances is particularly large. Nevertheless, the large favorable variance for lab tests is worrisome. Perhaps the blood bank has not been doing all of the lab tests for HIV, hepatitis, and other blood-transmittable diseases that it should be doing. This is well worth investigating and points out that favorable variances may warrant attention as much as unfavorable variances.

   Some may wonder why there is a variance for depreciation. Fixed costs can change; they just don't vary with the level of activity. Depreciation may have increased because of the acquisition of new equipment or because of a loss on equipment that must be scrapped. (This assumes that the loss flows through the depreciation account on the performance report.)

Problem 11-21 (30 minutes)

1.

Direct materials, 4 pounds × \$2.60 per pound	\$10.40
Direct labor, 2 DLHs × \$9.00 per DLH	18.00
Variable manufacturing overhead, 2 DLHs × \$3.80 per DLH*	7.60
Fixed manufacturing overhead, 2 DLHs × \$7.00 per DLH**	14.00
Standard cost per unit	\$50.00

* \$34,200 ÷ 9,000 DLHs = \$3.80 per DLH
** \$63,000 ÷ 9,000 DLHs = \$7.00 per DLH

2. Materials variances:

Materials Price Variance = AQ (AP – SP)
30,000 pounds (\$2.50 per pound – \$2.60 per pound) = \$3,000 F

Materials Quantity Variance = SP (AQ – SQ)
\$2.60 per pound (20,000 pounds – 19,200 pounds*) = \$2,080 U
*4,800 units × 4 pounds per unit = 19,200 pounds

Labor variances:

Labor Rate Variance = AH (AR – SR)
10,000 DLHs (\$8.60 per DLH – \$9.00 per DLH) = \$4,000 F

Labor Efficiency Variance = SR (AH – SH)
\$9 per DLH (10,000 DLHs – 9,600 DLHs*) = \$3,600 U
*4,800 units × 2 DLHs per unit = 9,600 DLHs

Problem 11-21 (continued)

3. Variable manufacturing overhead variances:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$35,900	10,000 DLHs × $3.80 per DLH = $38,000	9,600 DLHs × $3.80 per DLH = $36,480

Spending Variance, $2,100 F	Efficiency Variance, $1,520 U
Total Variance, $580 F	

Alternative solution for the variable overhead variances:

Variable Overhead Spending Variance = (AH × AR) – (AH × SR)
($35,900) – (10,000 DLHs × $3.80 per DLH) = $2,100 F

Variable Overhead Efficiency Variance = SR (AH – SH)
$3.80 per DLH (10,000 DLHs – 9,600 DLHs) = $1,520 U

Fixed manufacturing overhead variances:

Actual Fixed Overhead Cost	Budgeted Fixed Overhead Cost	Fixed Overhead Cost Applied to Work in Process
$64,800	$63,000	9,600 DLHs × $7 per DLH = $67,200

Budget Variance, $1,800 U	Volume Variance, $4,200 F

Problem 11-21 (continued)

Alternative approach to the budget variance:

$$\text{Budget Variance} = \text{Actual Fixed Overhead Cost} - \text{Budgeted Fixed Overhead Cost}$$

$$= \$64,800 - \$63,000 = \$1,800\text{ U}$$

Alternative approach to the volume variance:

$$\text{Volume Variance} = \text{Fixed Portion of the Predetermined Overhead Rate} \left(\text{Denominator Hours} - \text{Standard Hours Allowed} \right)$$

$$= \$7\text{ per DLH }(9,000\text{ DLHs} - 9,600\text{ DLHs}) = \$4,200\text{ F}$$

4. The choice of a denominator activity level affects standard unit costs in that the higher the denominator activity level chosen, the lower standard unit costs will be. The reason is that the fixed portion of overhead costs is spread more thinly as the denominator activity figure rises.

   The volume variance cannot be controlled by controlling spending. Rather, the volume variance simply reflects whether actual activity was greater or less than the denominator activity. Thus, the volume variance is controllable only through activity.

Problem 11-22 (45 minutes)

1.

The Rowe Company
Flexible Budget—Finishing Department

Budgeted direct labor-hours 50,000

Item	*Cost Formula per DLH*	*Direct Labor-Hours* 40,000	50,000	60,000
Variable overhead costs:				
Indirect labor	$0.60	$ 24,000	$ 30,000	$ 36,000
Utilities	1.00	40,000	50,000	60,000
Maintenance	0.40	16,000	20,000	24,000
Total variable overhead cost	$2.00	80,000	100,000	120,000
Fixed overhead costs:				
Supervisory salaries ...		60,000	60,000	60,000
Insurance		5,000	5,000	5,000
Depreciation		190,000	190,000	190,000
Equipment rental		45,000	45,000	45,000
Total fixed overhead cost		300,000	300,000	300,000
Total overhead cost		$380,000	$400,000	$420,000

2.

Total: $\dfrac{\$400,000}{50,000\text{ DLHs}} = \$8$ per DLH

Variable: $\dfrac{\$100,000}{50,000\text{ DLHs}} = \$2$ per DLH

Fixed: $\dfrac{\$300,000}{50,000\text{ DLHs}} = \$6$ per DLH

3. a.

Manufacturing Overhead			
Actual costs	385,700	Applied costs	360,000*
Underapplied overhead	25,700		

*45,000 standard DLHs × $8 per DLH = $360,000.

Problem 11-22 (continued)

b. Variable overhead variances:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$89,700	46,000 DLHs × $2 per DLH = $92,000	45,000 DLHs × $2 per DLH =$90,000

Spending Variance, $2,300 F	Efficiency Variance, $2,000 U

Alternative solution:

Variable Overhead Spending Variance = (AH × AR) – (AH × SR)
($89,700) – (46,000 DLHs × $2 per DLH) = $2,300 F

Variable Overhead Efficiency Variance = SR (AH – SH)
$2 per DLH (46,000 DLHs – 45,000 DLHs) = $2,000 U

Fixed overhead variances:

Actual Fixed Overhead Cost	Budgeted Fixed Overhead Cost	Fixed Overhead Cost Applied to Work in Process
$296,000	$300,000	45,000 DLHs × $6 per DLH = $270,000

Budget Variance, $4,000 F	Volume Variance, $30,000 U

Problem 11-22 (continued)

Alternative approach to the budget variance:

$$\text{Budget Variance} = \text{Actual Fixed Overhead Cost} - \text{Flexible Budget Fixed Overhead Cost}$$

$296,000 – $300,000 = $4,000 F

Alternative approach to the volume variance:

$$\text{Volume Variance} = \begin{array}{c}\text{Fixed Portion of}\\ \text{the Predetermined}\\ \text{Overhead Rate}\end{array} \left(\begin{array}{c}\text{Denominator}\\ \text{Hours}\end{array} - \begin{array}{c}\text{Standard Hours}\\ \text{Allowed}\end{array}\right)$$

$6 per DLH (50,000 DLHs – 45,000 DLHs) = $30,000 U

The overhead variances can be summarized as follows:

Variable overhead:	
Spending variance..	$ 2,300 F
Efficiency variance	2,000 U
Fixed overhead:	
Budget variance...	4,000 F
Volume variance	30,000 U
Underapplied overhead for the year....................	$25,700

Problem 11-23 (45 minutes)

1. The cost formulas below can be developed from the data in the problem using the simple high-low method. The completed flexible budget over an activity range of 80 to 100% of capacity would be:

Elgin Company
Flexible Budget

Overhead Costs	*Cost Formula per MH*	*Percentage of Capacity* 80%	90%	100%
Machine-hours		40,000	45,000	50,000
Variable overhead costs:				
Utilities	$0.80	$ 32,000	$ 36,000	$ 40,000
Supplies	0.10	4,000	4,500	5,000
Indirect labor	0.20	8,000	9,000	10,000
Maintenance	0.40	16,000	18,000	20,000
Total variable overhead cost	$1.50	60,000	67,500	75,000
Fixed overhead costs:				
Utilities		9,000	9,000	9,000
Maintenance		21,000	21,000	21,000
Supervision		10,000	10,000	10,000
Total fixed overhead cost		40,000	40,000	40,000
Total overhead cost		$100,000	$107,500	$115,000

2. The cost formula for all overhead costs would be $40,000 per month plus $1.50 per machine-hour.

3. Elgin Company
Performance Report
For the Month of May

Budgeted machine-hours	40,000	
Standard machine-hours allowed..	41,000	
Actual machine-hours	43,000	*

Overhead Costs	*Cost Formula per MH*	*Actual Cost 43,000 MH*		*Flexible Budget 43,000 MH*	*Spending Variance*
Variable overhead costs:					
Utilities....................	$0.80	$ 33,540	**	$ 34,400	$ 860 F
Supplies	0.10	6,450		4,300	2,150 U
Indirect labor...........	0.20	9,890		8,600	1,290 U
Maintenance...........	0.40	14,190	**	17,200	3,010 F
Total variable overhead cost	$1.50	64,070		64,500	430 F
Fixed overhead costs:					
Utilities....................		9,000		9,000	0
Maintenance...........		21,000		21,000	0
Supervision		10,000		10,000	0
Total fixed overhead cost		40,000		40,000	0
Total overhead cost		$104,070		$104,500	$ 430 F

* 86% of 50,000 MHs = 43,000 MHs
** $42,540 – $9,000 fixed = $33,540
$35,190 – $21,000 fixed = $14,190

4. Assuming that variable overhead really should be proportional to actual machine-hours, the unfavorable spending variance could be the result either of price increases or of waste. Unlike the price variance for materials and the rate variance for labor, the spending variance for variable overhead measures both price and waste elements. This is why the variance is called a “spending” variance. Total spending can be affected as much by waste as it can by prices paid.

Problem 11-23 (continued)

5. Efficiency Variance = SR (AH – SH)
   $1.50 per MH (43,000 MHs – 41,000 MHs) = $3,000 U

   The overhead efficiency variance is really misnamed, since it does not measure efficiency (waste) in use of variable overhead items. The variance arises solely because of the inefficiency in the *base* underlying the incurrence of variable overhead cost. If the incurrence of variable overhead costs is directly tied to the actual machine-hours worked, then the excessive number of machine-hours worked during May has caused the incurrence of $3,000 in variable overhead costs that would have been avoided had production been completed in the standard time allowed. In short, the overhead efficiency variance is independent of any spillage, waste, or theft of overhead supplies or other variable overhead items that may take place during a month.

Problem 11-24 (45 minutes)

1\.

$$\text{Total: } \frac{\$240{,}000}{30{,}000 \text{ DLHs}} = \$8 \text{ per DLH}$$

$$\text{Variable: } \frac{\$60{,}000}{30{,}000 \text{ DLHs}} = \$2 \text{ per DLH}$$

$$\text{Fixed: } \frac{\$180{,}000}{30{,}000 \text{ DLHs}} = \$6 \text{ per DLH}$$

2\.

Direct materials: 4 feet at $3 per foot	$12.00
Direct labor: 1.5 DLHs at $12 per DLH	18.00
Variable overhead: 1.5 DLHs at $2 per DLH	3.00
Fixed overhead: 1.5 DLHs at $6 per DLH	9.00
Standard cost per unit	$42.00

3\. a. 22,000 units × 1.5 DLHs per unit = 33,000 standard DLHs.

b.

Manufacturing Overhead			
Actual costs	244,000	Applied costs (33,000 standard DLHs × $8 per DLH)	264,000
		Overapplied overhead	20,000

4\. Variable overhead variances:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$63,000	35,000 DLHs × $2 per DLH = $70,000	33,000 DLHs × $2 per DLH = $66,000

Spending Variance, $7,000 F

Efficiency Variance, $4,000 U

Problem 11-24 (continued)

Alternative solution:

Variable Overhead Spending Variance = (AH × AR) – (AH × SR)
($63,000) – (35,000 DLHs × $2 per DLH) = $7,000 F

Variable Overhead Efficiency Variance = SR (AH – SH)
$2 per DLH (35,000 DLHs – 33,000 DLHs) = $4,000 U

Fixed overhead variances:

Actual Fixed Overhead Cost	Budgeted Fixed Overhead Cost	Fixed Overhead Cost Applied to Work in Process
$181,000	$180,000	33,000 DLHs × $6 per DLH = $198,000

Budget Variance, $1,000 U

Volume Variance, $18,000 F

Alternative approach to the budget variance:

$$\text{Budget Variance} = \text{Actual Fixed Overhead Cost} - \text{Flexible Budget Fixed Overhead Cost}$$

$181,000 – $180,000 = $1,000 U

Alternative approach to the volume variance:

$$\text{Volume Variance} = \text{Fixed Portion of the Predetermined Overhead Rate} \left(\text{Denominator Hours} - \text{Standard Hours Allowed}\right)$$

$6 per DLH (30,000 DLHs – 33,000 DLHs) = $18,000 F

Problem 11-24 (continued)

Summary of variances:

Variable overhead spending variance	$ 7,000 F
Variable overhead efficiency variance	4,000 U
Fixed overhead budget variance	1,000 U
Fixed overhead volume variance	18,000 F
Overapplied overhead—see part 3	$20,000

5. Only the volume variance would have changed. It would have been unfavorable, since the standard DLHs allowed for the year's production (33,000 DLHs) would have been less than the denominator DLHs (36,000 DLHs).

Problem 11-25 (30 minutes)

1. The Durrant Company
Flexible Budget—Machining Department

Overhead Costs	*Cost Formula per MH*	*Machine-Hours* 10,000	15,000	20,000
Variable:				
Utilities..................	$0.70	$ 7,000	$ 10,500	$ 14,000
Lubricants	1.00	10,000	15,000	20,000
Machine setup	0.20	2,000	3,000	4,000
Indirect labor.........	0.60	6,000	9,000	12,000
Total variable cost	$2.50	25,000	37,500	50,000
Fixed:				
Lubricants		8,000	8,000	8,000
Indirect labor.........		120,000	120,000	120,000
Depreciation		32,000	32,000	32,000
Total fixed cost.........		160,000	160,000	160,000
Total overhead cost ..		$185,000	$197,500	$210,000

Problem 11-25 (continued)

2. The Durrant Company
Overhead Performance Report—Machining Department
For the Month of March

Budgeted machine-hours 20,000
Actual machine-hours 18,000

Overhead Costs	*Cost Formula per MH*	*Actual 18,000 MHs*	*Flexible Budget 18,000 MHs*	*Spending Variance*
Variable:				
Utilities..................	$0.70	$ 12,000	$ 12,600	$ 600 F
Lubricants	1.00	16,500 *	18,000	1,500 F
Machine setup	0.20	4,800	3,600	1,200 U
Indirect labor.........	0.60	12,500	10,800	1,700 U
Total variable cost	$2.50	45,800	45,000	800 U
Fixed:				
Lubricants		8,000	8,000	0
Indirect labor.........		120,000	120,000	0
Depreciation..........		32,000	32,000	0
Total fixed cost.........		160,000	160,000	0
Total overhead cost ..		$205,800	$205,000	$ 800 U

* $24,500 total lubricants – $8,000 fixed lubricants = $16,500 variable lubricants. The variable element of other costs is computed in the same way.

3. In order to compute an overhead efficiency variance, it would be necessary to know the standard hours allowed for the 9,000 units produced during March in the Machining Department.

Problem 11-26 (30 minutes)

1. The company is using a static budget approach, and is comparing budgeted performance at one level of activity to actual performance at a lower level of activity. This mismatching of activity levels causes the variances to be favorable. The report in this format is not useful for measuring either operating efficiency or cost control. All it tells Mr. Arnold is that the budgeted activity level of 35,000 machine-hours was not achieved. It does not tell whether the actual output of the period was produced efficiently, nor does it tell whether overhead spending has been controlled during the month.

Problem 11-26 (continued)

2.

Mason Company
Performance Report—Milling Department

Budgeted machine-hours	35,000
Actual machine-hours	30,000
Standard machine-hours allowed	28,000*

Overhead Costs	*Cost Formula (per MH)*	*(1) Actual Costs Incurred*	*(2) Flexible Budget Based on 30,000 MHs*	*(3) Flexible Budget Based on 28,000 MHs*	*Total Variance (1) – (3)*	*Spending Variance (1) – (2)*	*Efficiency Variance (2) – (3)*
Variable costs:							
Indirect labor.........	$0.60	$ 19,700	$ 18,000	$ 16,800	$ 2,900 U	$1,700 U	$1,200 U
Utilities..................	1.70	50,800	51,000	47,600	3,200 U	200 F	3,400 U
Supplies	0.40	12,600	12,000	11,200	1,400 U	600 U	800 U
Maintenance..........	0.80	24,900	24,000	22,400	2,500 U	900 U	1,600 U
Total variable cost	$3.50	108,000	105,000	98,000	10,000 U	$3,000 U	$7,000 U
Fixed costs:							
Maintenance..........		52,000	52,000	52,000	0		
Supervision		110,000	110,000	110,000	0		
Depreciation..........		80,000	80,000	80,000	0		
Total fixed cost.........		242,000	242,000	242,000	0		
Total overhead cost ..		$350,000	$347,000	$340,000	$10,000 U		

*14,000 units × 2 MHs per unit = 28,000 MHs allowed.

Problem 11-27 (45 minutes)

1. and 2.

	Per Direct Labor-Hour		
	Variable	*Fixed*	*Total*
Denominator of 40,000 DLHs:			
$100,000 ÷ 40,000 DLHs	$2.50		$ 2.50
$320,000 ÷ 40,000 DLHs		$8.00	8.00
Total predetermined rate			$10.50
Denominator of 50,000 DLHs:			
$125,000 ÷ 50,000 DLHs	$2.50		$ 2.50
$320,000 ÷ 50,000 DLHs		$6.40	6.40
Total predetermined rate			$ 8.90

3.

Denominator Activity: 40,000 DLHs		*Denominator Activity: 50,000 DLHs*	
Direct materials, 3 yards @ $5.00 per yard..........	$15.00	Same	$15.00
Direct labor, 2.5 DLHs @ $20.00 per DLH	50.00	Same	50.00
Variable overhead, 2.5 DLHs @ $2.50 per DLH .	6.25	Same	6.25
Fixed overhead, 2.5 DLHs @ $8.00 per DLH..........	20.00	Fixed overhead, 2.5 DLHs @ $6.40 per DLH..........	16.00
Total standard cost per unit..............................	$91.25	Total standard cost per unit	$87.25

4. a. 18,500 units × 2.5 DLHs per unit = 46,250 standard DLHs

b.

Manufacturing Overhead			
Actual costs	446,500	Applied costs (46,250 standard DLHs × $10.50 per DLH)	485,625
		Overapplied overhead	39,125

Problem 11-27 (continued)

c. Variable Overhead Spending Variance = (AH × AR) – (AH × SR)
($124,800) – (48,000 DLHs × $2.50 per DLH) = $4,800 U

Variable Overhead Efficiency Variance = SR (AH – SH)
$2.50 per DLH (48,000 DLHs – 46,250 DLHs) = $4,375 U

Fixed overhead variances:

Actual Fixed Overhead Cost	Budgeted Fixed Overhead Cost	Fixed Overhead Cost Applied to Work in Process
$321,700	$320,000*	46,250 standard DLHs × $8.00 per DLH = $370,000

Budget Variance, $1,700 U

Volume Variance, $50,000 F

*40,000 denominator DLHs × $8 per DLH = $320,000.

Alternative approach to the budget and volume variances:

Budget Variance:

$$\text{Budget Variance} = \text{Actual Fixed Overhead Cost} - \text{Flexible Budget Fixed Overhead Cost}$$

$321,700 – $320,000 = $1,700 U

Volume Variance:

$$\text{Volume Variance} = \text{Fixed Portion of the Predetermined Overhead Rate}\left(\text{Denominator Hours} - \text{Standard Hours Allowed}\right)$$

$8.00 per DLH (40,000 DLHs – 46,250 DLHs) = $50,000 F

Problem 11-27 (continued)

Summary of variances:

Variable overhead spending	$ 4,800 U
Variable overhead efficiency	4,375 U
Fixed overhead budget.............	1,700 U
Fixed overhead volume	50,000 F
Overapplied overhead	$39,125

5. The major disadvantage of using normal activity as the denominator in the predetermined rate is the large volume variance that ordinarily results. This occurs because the denominator activity used to compute the predetermined overhead rate is different from the activity level that is anticipated for the period. In the case at hand, the company has used the normal activity of 40,000 direct labor-hours to compute the predetermined overhead rate, whereas activity for the period was expected to be 50,000 DLHs. This has resulted in a huge favorable volume variance that may be difficult for management to interpret. In addition, the large favorable volume variance in this case has masked the fact that the company did not achieve the budgeted level of activity for the period. The company had planned to work 50,000 DLHs, but managed to work only 46,250 DLHs (at standard). This unfavorable result is concealed due to using a denominator figure that is out of step with current activity.

   On the other hand, by using normal activity as the denominator unit costs are stable from year to year. Thus, management's decisions are not clouded by unit costs that jump up and down as the activity level rises and falls.

Problem 11-28 (20 minutes)

Budgeted machine-hours	3,200
Actual machine-hours	2,700
Standard machine-hours allowed	2,800 *

*14,000 units × 0.2 MH per unit = 2,800 MHs

Overhead Item	*Cost Formula (per MH)*	*(1) Actual Costs Incurred, 2,700 MHs*	*(2) Flexible Budget Based on 2,700 MHs*	*(3) Flexible Budget Based on 2,800 MHs*	*Total Variance (1) − (3)*	*Breakdown of the Total Variance: Spending Variance (1) − (2)*	*Efficiency Variance (2) − (3)*
Supplies	$0.70	$ 1,836	$ 1,890	$ 1,960	$124 F	$ 54 F	$ 70 F
Power	1.20	3,348	3,240	3,360	12 F	108 U	120 F
Lubrication	0.50	1,485	1,350	1,400	85 U	135 U	50 F
Wearing tools ..	3.10	8,154	8,370	8,680	526 F	216 F	310 F
Total overhead cost..............	$5.50	$14,823	$14,850	$15,400	$577 F	$ 27 F	$550 F

Case 11-29 (60 minutes)

1. The computations of the cost formulas appear below.

	Cost	*Variable with respect to*	*Activity level*	*Cost per unit of activity*
Actors and directors' wages	$144,000	performances	60	$2,400
Stagehands' wages	27,000	performances	60	450
Ticket booth personnel and ushers' wages	10,800	performances	60	180
Scenery, costumes, and props	43,000	productions	5	8,600
Theater hall rent	45,000	performances	60	750
Printed programs	10,500	performances	60	175
Publicity	13,000	productions	5	2,600
Administrative expenses (15%)	6,480	productions	5	1,296
Administrative expenses (10%)	4,320	performances	60	72
Fixed administrative expenses (75%)	32,400	—	—	—

Case 11-29 (continued)

2. The performance report is clearest when it is organized by cost behavior. The costs that are variable with respect to the number of productions come first, then the costs that are variable with respect to performances, then the administrative expenses as a special category.

The Munchkin Theater
Flexible Budget Performance Report

Actual number of productions	4
Actual number of performances per production.......	16
Actual total number of performances	64

The performance report is continued on the next page.

Case 11-29 (continued)

Costs	*Cost Formula Per Unit of Activity*	*Actual Costs Incurred*	*Flexible Budget Based on Actual Activity*	*Variance*
Variable costs of productions:				
(Flexible budget based on 4 productions)				
Scenery, costumes, and props	$ 8,600	$ 39,300	$ 34,400	$4,900 U
Publicity	2,600	12,000	10,400	1,600 U
Total variable cost per production*	$11,200	51,300	44,800	6,500 U
Variable costs of performances:				
(Flexible budget based on 64 performances)				
Actors and directors' wages	$2,400	148,000	153,600	5,600 F
Stagehands' wages	450	28,600	28,800	200 F
Ticket booth personnel and ushers' wages	180	12,300	11,520	780 U
Theater hall rent	750	49,600	48,000	1,600 U
Printed programs	175	10,950	11,200	250 F
Total variable cost per performance*	$3,955	249,450	253,120	3,670 F
Administrative expenses:				
Variable per production	$1,296		5,184	
Variable per performance	72		4,608	
Fixed			32,400	
Total administrative expenses		41,650	42,192	542 F
Total cost		$342,400	$340,112	$2,288 U

*Excluding variable portion of administrative expenses

Case 11-29 (continued)

3. The overall unfavorable variance is a very small percentage of the total cost, about 0.7%, which suggests that costs are under control. In addition, the largest unfavorable variance is for scenery, costumes, and props. This may indicate waste, but it may also indicate that more money was spent on these items, which are highly visible to theater-goers, to ensure higher-quality productions.

4. The average costs may not be very good indicators of the additional costs of any particular production or performance. The averages gloss over considerable variations in costs. For example, a production of Peter the Rabbit may require only half a dozen actors and actresses and fairly simple costumes and props. On the other hand, a production of Cinderella may require dozens of actors and actresses and very elaborate and costly costumes and props. Consequently, both the production costs and the cost per performance will be much higher for Cinderella than for Peter the Rabbit. Managers of theater companies know that they must estimate the costs of each new production individually—average costs are of little use for this purpose.

Case 11-30 (45 minutes)

1. Flexible budgets would allow Mark Fletcher to directly compare SoftGro's actual selling expenses (based on the current month's actual activity) with the budgeted selling expenses. In general, flexible budgets:
   - provide management with the tools to evaluate the effects of varying levels of activity on costs, profits, and cash position.
   - enable management to improve planning and decision making.
   - improve the analysis of actual results.

2. Softgro, Inc.
Revised Monthly Selling Expense Report
November

Budgeted unit sales	280,000
Budgeted dollar sales	$11,200,000
Budgeted orders processed	6,500
Budgeted salespersons	90

	Actual	*Flexible Budget*	*Variance*	
Unit sales	310,000	310,000	0	
Dollar sales	$12,400,000	$12,400,000	0	
Orders processed	5,800	5,800	0	
Salespersons	96	96	0	
Advertising expense	$ 1,660,000	$ 1,650,000	$10,000	U
Staff salaries expense	125,000	125,000	0	
Sales salaries expense[1]	115,400	115,200	200	U
Commissions expense[2]	496,000	496,000	0	
Per diem expense[3]	162,600	158,400	4,200	U
Office expense[4]	358,400	366,000	7,600	F
Shipping expense[5]	976,500	992,500	16,000	F
Total	$ 3,893,900	$ 3,903,100	$ 9,200	F

Case 11-30 (continued)

Supporting computations:

[1]Monthly salary for salesperson:
$108,000 ÷ 90 salespersons = $1,200 per salesperson
or
$1,296,000 ÷ 12 ÷ 90 salespersons = $1,200 per salesperson

Budgeted amount:
$1,200 per salesperson × 96 salespersons = $115,200

[2]Commission rate:
$3,200,000 ÷ $80,000,000 = 0.04
or
$448,000 ÷ $11,200,000 = 0.04

Budgeted amount for commissions:
$12,400,000 × 0.04 = $496,000

[3]($148,500 ÷ 90 salespersons) ÷ 15 days per salesperson = $110 per day
or
($1,782,000 ÷ 12 ÷ 90 salespersons) ÷ 15 days per salesperson = $110 per day
($110 per day × 15 days per salesperson) × 96 salespersons = $158,400

[4]($4,080,000 – $3,000,000) ÷ 54,000 orders = $20 per order
($3,000,000 ÷ 12) + ($20 per order × 5,800 orders) = $366,000

[5][$6,750,000 – ($3 per unit × 2,000,000 units)] ÷ 12 = $62,500 monthly fixed expense
$62,500 + ($3 per unit × 310,000 units) = $992,500

Case 11-31 (30 minutes)

It is difficult to imagine how Lance Prating could ethically agree to go along with reporting the favorable $6,000 variance for industrial engineering on the final report, even if the bill were not actually received by the end of the year. It would be misleading to include all of the original contract price of $160,000 on the report, but to exclude part of the final cost of the contract. Collaborating in this attempt to mislead corporate headquarters violates the credibility standard in the Statement of Ethical Professional Practice promulgated by the Institute of Management Accountants. The credibility standard requires that management accountants "disclose fully all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, analyses, or recommendations." Failing to disclose the entire amount owed on the industrial engineering contract violates this standard.

Individuals will differ in how they think Prating should handle this situation. In our opinion, he should firmly state that he is willing to call Maria, but even if the bill does not arrive, he is ethically bound to properly accrue the expenses on the report—which will mean an unfavorable variance for industrial engineering and an overall unfavorable variance. This would require a great deal of personal courage. If the general manager insists on keeping the misleading $6,000 favorable variance on the report, Prating would have little choice except to take the dispute to the next higher managerial level in the company.

It is important to note that the problem may be a consequence of inappropriate use of performance reports by corporate headquarters. If the performance report is being used as a way of "beating up" managers, corporate headquarters may be creating a climate in which managers such as the general manager at the Colorado Springs plant will feel like they must always turn in positive reports. This creates pressure to bend the truth since reality isn't always positive.

Some students may suggest that Prating redo the performance report to recognize efficiency variances. This might make the performance look better, or it might make the performance look worse; we cannot tell from the data in the case. Moreover, it is unlikely that corporate headquarters would permit a performance report that does not follow the usual format, which apparently does not recognize efficiency variances.

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Chapter 12
Segment Reporting and Decentralization

Solutions to Questions

12-1 In a decentralized organization, decision-making authority isn't confined to a few top executives, but rather is spread throughout the organization with lower-level managers and other employees empowered to make decisions.

12-2 The benefits of decentralization include: (1) by delegating day-to-day problem solving to lower-level managers, top management can concentrate on bigger issues such as overall strategy; (2) empowering lower-level managers to make decisions puts decision-making authority in the hands of those who tend to have the most detailed and up-to-date information about day-to-day operations; (3) by eliminating layers of decision-making and approvals, organizations can respond more quickly to customers and to changes in the operating environment; (4) granting decision-making authority helps train lower-level managers for higher-level positions; and (5) empowering lower-level managers to make decisions can increase their motivation and job satisfaction.

12-3 A cost center manager has control over cost, but not revenue or the use of investment funds. A profit center manager has control over both cost and revenue. An investment center manager has control over cost and revenue and the use of investment funds.

12-4 A segment is any part or activity of an organization about which a manager seeks cost, revenue, or profit data. Examples of segments include departments, operations, sales territories, divisions, product lines, and so forth.

12-5 Under the contribution approach, costs are assigned to a segment if and only if the costs are traceable to the segment (i.e., could be avoided if the segment were eliminated). Common costs are not allocated to segments under the contribution approach.

12-6 A traceable cost of a segment is a cost that arises specifically because of the existence of that segment. If the segment were eliminated, the cost would disappear. A common cost, by contrast, is a cost that supports more than one segment, but is not traceable in whole or in part to any one of the segments. If the departments of a company are treated as segments, then examples of the traceable costs of a department would include the salary of the department's supervisor, depreciation of machines used exclusively by the department, and the costs of supplies used by the department. Examples of common costs would include the salary of the general counsel of the entire company, the lease cost of the headquarters building, corporate image advertising, and periodic depreciation of machines shared by several departments.

12-7 The contribution margin is the difference between sales revenue and variable expenses. The segment margin is the amount remaining after deducting traceable fixed expenses from the contribution margin. The contribution margin is useful as a planning tool for many decisions, including those in which fixed costs don't change. The segment margin is useful in assessing the overall profitability of a segment.

12-8 If common costs were allocated to segments, then the costs of segments would be overstated and their margins would be understated. As a consequence, some segments may appear to be unprofitable and managers may be tempted to eliminate them. If a segment were eliminated because of the existence of arbitrarily allocated common costs, the overall profit of the company would decline by the amount of the segment margin because the common cost would remain. The common cost that had been allocated to the segment would then be reallocated to the remaining segments—making them appear less profitable.

12-9 There are often limits to how far down an organization a cost can be traced. Therefore, costs that are traceable to a segment may become common as that segment is divided into smaller segment units. For example, the costs of national TV and print advertising might be traceable to a specific product line, but be a common cost of the geographic sales territories in which that product line is sold.

12-10 Margin refers to the ratio of net operating income to total sales. Turnover refers to the ratio of total sales to average operating assets. The product of the two numbers is the ROI.

12-11 Residual income is the net operating income an investment center earns above the company's minimum required rate of return on operating assets.

12-12 If ROI is used to evaluate performance, a manager of an investment center may reject a profitable investment opportunity whose rate of return exceeds the company's required rate of return but whose rate of return is less than the investment center's current ROI. The residual income approach overcomes this problem since any project whose rate of return exceeds the company's minimum required rate of return will result in an increase in residual income.

12-13 A transfer price is the price charged for a transfer of goods or services between segments of the same organization, such as two departments or divisions. Transfer prices are needed for performance evaluation purposes. The selling unit gets credit for the transfer price and the buying unit must deduct the transfer price as an expense.

12-14 If the selling division has idle capacity, any transfer price above the variable cost of producing an item for transfer will generate some additional profit.

12-15 If the selling division has no idle capacity, then the transfer price would have to cover at least the division's variable cost plus the contribution margin on lost sales.

12-16 Cost-based transfer prices are widely used because they are easily understood and convenient to use. Their disadvantages are that they can lead to poor decisions regarding whether transfers should be made, they provide little incentive for cost control, and the selling division makes no profit.

12-17 Using the market price as the transfer price can lead to incorrect decisions. When the selling division has idle capacity, the cost to the company of the transfer is just the variable cost of the item transferred. However, if the market price is used as the transfer price, the buying division regards the market price as the cost. This can lead to suboptimal pricing and other decisions.

12-18 Variable service department costs should be charged to operating departments using a predetermined rate applied to the actual services consumed. The predetermined rate should be based on budgeted costs and service levels.

12-19 Fixed service department costs should be charged in lump-sum amounts to the operating departments in proportion to their peak-period needs or long-run average needs for the services provided by the service department. Budgeted costs, not actual costs, should be charged.

Exercise 12-1 (10 minutes)

	Total	*CD*	*DVD*
Sales*	$750,000	$300,000	$450,000
Variable expenses**	435,000	120,000	315,000
Contribution margin	315,000	180,000	135,000
Traceable fixed expenses	183,000	138,000	45,000
Product line segment margin	132,000	$ 42,000	$ 90,000
Common fixed expenses not traceable to products	105,000		
Net operating income	$ 27,000		

* CD: 37,500 packs × $8.00 per pack = $300,000;
DVD: 18,000 packs × $25.00 per pack= $450,000.

** CD: 37,500 packs × $3.20 per pack = $120,000;
DVD: 18,000 packs × $17.50 per pack= $315,000.

Exercise 12-2 (10 minutes)

1. $$\text{Margin} = \frac{\text{Net operating income}}{\text{Sales}}$$

$$= \frac{\$5{,}400{,}000}{\$18{,}000{,}000} = 30\%$$

2. $$\text{Turnover} = \frac{\text{Sales}}{\text{Average operating assets}}$$

$$= \frac{\$18{,}000{,}000}{\$36{,}000{,}000} = 0.5$$

3. ROI = Margin × Turnover

= 30% × 0.5 = 15%

Exercise 12-3 (10 minutes)

Average operating assets (a).................	£2,200,000
Net operating income............................	£400,000
Minimum required return: 16% × (a).....	352,000
Residual income....................................	£ 48,000

Exercise 12-4 (20 minutes)

1. The lowest acceptable transfer price from the perspective of the selling division is given by the following formula:

$$\text{Transfer price} \geq \begin{array}{c}\text{Variable cost}\\ \text{per unit}\end{array} + \frac{\begin{array}{c}\text{Total contribution margin}\\ \text{on lost sales}\end{array}}{\text{Number of units transferred}}$$

There is no idle capacity, so each of the 20,000 units transferred from Division X to Division Y reduces sales to outsiders by one unit. The contribution margin per unit on outside sales is \$20 (= \$50 – \$30).

$$\text{Transfer price} \geq (\$30 - \$2) + \frac{\$20 \times 20{,}000}{20{,}000}$$

$$= \$28 + \$20 = \$48$$

The buying division, Division Y, can purchase a similar unit from an outside supplier for \$47. Therefore, Division Y would be unwilling to pay more than \$47 per unit.

$$\text{Transfer price} \leq \text{Cost of buying from outside supplier} = \$47$$

The requirements of the two divisions are incompatible and no transfer will take place.

2. In this case, Division X has enough idle capacity to satisfy Division Y's demand. Therefore, there are no lost sales and the lowest acceptable price as far as the selling division is concerned is the variable cost of \$20 per unit.

$$\text{Transfer price} \geq \$20 + \frac{\$0}{20{,}000} = \$20$$

The buying division, Division Y, can purchase a similar unit from an outside supplier for \$34. Therefore, Division Y would be unwilling to pay more than \$34 per unit.

$$\text{Transfer price} \leq \text{Cost of buying from outside supplier} = \$34$$

In this case, the requirements of the two divisions are compatible and a transfer will hopefully take place at a transfer price within the range:

$$\$20 \leq \text{Transfer price} \leq \$34$$

Exercise 12-5 (15 minutes)

1. and 2.

	Arbon Refinery	*Beck Refinery*	*Total*
Variable cost charges:			
$0.30 per gallon × 260,000 gallons...	$ 78,000		
$0.30 per gallon × 140,000 gallons...		$ 42,000	$120,000
Fixed cost charges:			
60% × $200,000	120,000		
40% × $200,000		80,000	200,000
Total charges	$198,000	$122,000	$320,000

3. Part of the $365,000 in total actual cost will not be allocated to the refineries, as follows:

	Variable Cost	*Fixed Cost*	*Total*
Total actual costs incurred..................	$148,000	$217,000	$365,000
Total charges (above)	120,000	200,000	320,000
Spending variance	$ 28,000	$ 17,000	$ 45,000

The overall spending variance of $45,000 represents costs incurred in excess of the budgeted $0.30 per gallon variable cost and budgeted $200,000 in fixed costs. This $45,000 in unallocated cost is the responsibility of the Transport Services Department.

Exercise 12-6 (20 minutes)

1.

	Total Company	*Geographic Market* *South*	*Central*	*North*
Sales	$1,500,000	$400,000	$600,000	$500,000
Variable expenses	588,000	208,000	180,000	200,000
Contribution margin	912,000	192,000	420,000	300,000
Traceable fixed expenses	770,000	240,000	330,000	200,000
Geographic market segment margin	142,000	$(48,000)	$ 90,000	$100,000
Common fixed expenses not traceable to geographic markets*	175,000			
Net operating income (loss)	$ (33,000)			

*$945,000 – $770,000 = $175,000.

2.

Incremental sales ($600,000 × 15%)	$90,000
Contribution margin ratio ($420,000 ÷ $600,000)	× 70%
Incremental contribution margin	63,000
Less incremental advertising expense	25,000
Incremental net operating income	$38,000

Yes, the advertising program should be initiated.

Exercise 12-7 (15 minutes)

1. ROI computations:

$$\text{ROI} = \frac{\text{Net operating income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Average operating assets}}$$

$$\text{Eastern Division: } \frac{\$90{,}000}{\$1{,}000{,}000} \times \frac{\$1{,}000{,}000}{\$500{,}000} = 9\% \times 2 = 18\%$$

$$\text{Western Division: } \frac{\$105{,}000}{\$1{,}750{,}000} \times \frac{\$1{,}750{,}000}{\$500{,}000} = 6\% \times 3.5 = 21\%$$

2. The manager of the Western Division seems to be doing the better job. Although her margin is three percentage points lower than the margin of the Eastern Division, her turnover is higher (a turnover of 3.5, as compared to a turnover of two for the Eastern Division). The greater turnover more than offsets the lower margin, resulting in a 21% ROI, as compared to an 18% ROI for the other division.

   Notice that if you look at margin alone, then the Eastern Division appears to be the strongest division. This fact underscores the importance of looking at turnover as well as at margin in evaluating performance in an investment center.

Exercise 12-8 (30 minutes)

1. Computation of ROI.

$$\text{Division A: ROI} = \frac{\$300{,}000}{\$6{,}000{,}000} \times \frac{\$6{,}000{,}000}{\$1{,}500{,}000} = 5\% \times 4 = 20\%$$

$$\text{Division B: ROI} = \frac{\$900{,}000}{\$10{,}000{,}000} \times \frac{\$10{,}000{,}000}{\$5{,}000{,}000} = 9\% \times 2 = 18\%$$

$$\text{Division C: ROI} = \frac{\$180{,}000}{\$8{,}000{,}000} \times \frac{\$8{,}000{,}000}{\$2{,}000{,}000} = 2.25\% \times 4 = 9\%$$

2.

	Division A	*Division B*	*Division C*
Average operating assets	$1,500,000	$5,000,000	$2,000,000
Required rate of return	× 15%	× 18%	× 12%
Required operating income ..	$ 225,000	$ 900,000	$ 240,000
Actual operating income	$ 300,000	$ 900,000	$ 180,000
Required operating income (above)	225,000	900,000	240,000
Residual income	$ 75,000	$ 0	$ (60,000)

Exercise 12-8 (continued)

3. a. and b.

	Division A	*Division B*	*Division C*
Return on investment (ROI)...	20%	18%	9%
Therefore, if the division is presented with an investment opportunity yielding 17%, it probably would................................	Reject	Reject	Accept
Minimum required return for computing residual income..	15%	18%	12%
Therefore, if the division is presented with an investment opportunity yielding 17%, it probably would................................	Accept	Reject	Accept

If performance is being measured by ROI, both Division A and Division B probably would reject the 17% investment opportunity. The reason is that these companies are presently earning a return greater than 17%; thus, the new investment would reduce the overall rate of return and place the divisional managers in a less favorable light. Division C probably would accept the 17% investment opportunity, since its acceptance would increase the Division's overall rate of return.

If performance is being measured by residual income, both Division A and Division C probably would accept the 17% investment opportunity. The 17% rate of return promised by the new investment is greater than their required rates of return of 15% and 12%, respectively, and would therefore add to the total amount of their residual income. Division B would reject the opportunity, since the 17% return on the new investment is less than B's 18% required rate of return.

Exercise 12-9 (20 minutes)

1.

	Division A	Division B	Total Company
Sales	$3,500,000 [1]	$2,400,000 [2]	$5,200,000 [3]
Expenses:			
Added by the division	2,600,000	1,200,000	3,800,000
Transfer price paid	—	700,000	—
Total expenses	2,600,000	1,900,000	3,800,000
Net operating income	$ 900,000	$ 500,000	$1,400,000

[1] 20,000 units × $175 per unit = $3,500,000.
[2] 4,000 units × $600 per unit = $2,400,000.

[3] Division A outside sales (16,000 units × $175 per unit)	$2,800,000
Division B outside sales (4,000 units × $600 per unit)	2,400,000
Total outside sales	$5,200,000

Observe that the $700,000 in intracompany sales has been eliminated.

2. Division A should transfer the 1,000 additional units to Division B. Note that Division B's processing adds $425 to each unit's selling price (B's $600 selling price, less A's $175 selling price = $425 increase), but it adds only $300 in cost. Therefore, each tube transferred to Division B ultimately yields $125 more in contribution margin ($425 – $300 = $125) to the company than can be obtained from selling to outside customers. Thus, the company as a whole will be better off if Division A transfers the 1,000 additional tubes to Division B.

Exercise 12-10 (20 minutes)

1.

	Long-Run Average Number of Employees	Percentage
Cutting Department	600	30%
Milling Department	400	20%
Assembly Department	1,000	50%
Total	2,000	100%

	Cutting	Milling	Assembly
Variable cost charges:			
$60 per employee × 500 employees	$ 30,000		
$60 per employee × 400 employees		$ 24,000	
$60 per employee × 800 employees			$ 48,000
Fixed cost charges:			
30% × $600,000	180,000		
20% × $600,000		120,000	
50% × $600,000			300,000
Total charges	$210,000	$144,000	$348,000

2. Part of the total actual cost is not charged to the operating departments as shown below:

	Variable Cost	Fixed Cost	Total
Total actual costs incurred	$105,400	$605,000	$710,400
Total charges	102,000	600,000	702,000
Spending variance	$ 3,400	$ 5,000	$ 8,400

The overall spending variance of $8,400 represents costs incurred in excess of the budgeted variable cost of $60 per employee and the budgeted fixed cost of $600,000. This $8,400 in uncharged costs is the responsibility of the Medical Services Department.

Exercise 12-11 (20 minutes)

1. $75,000 × 40% CM ratio = $30,000 increased contribution margin in Dallas. Since the fixed costs in the office and in the company as a whole will not change, the entire $30,000 would result in increased net operating income for the company.

   It is incorrect to multiply the $75,000 increase in sales by Dallas's 25% segment margin ratio. This approach assumes that the segment's traceable fixed expenses increase in proportion to sales, but if they did, they would not be fixed.

2. a. The segmented income statement follows:

	Total Company		Segments: Houston		Segments: Dallas	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*
Sales	$800,000	100.0	$200,000	100	$600,000	100
Variable expenses	420,000	52.5	60,000	30	360,000	60
Contribution margin	380,000	47.5	140,000	70	240,000	40
Traceable fixed expenses	168,000	21.0	78,000	39	90,000	15
Office segment margin	212,000	26.5	$ 62,000	31	$150,000	25
Common fixed expenses not traceable to segments	120,000	15.0				
Net operating income	$ 92,000	11.5				

   b. The segment margin ratio rises and falls as sales rise and fall due to the presence of fixed costs. The fixed expenses are spread over a larger base as sales increase.

   In contrast to the segment ratio, the contribution margin ratio is stable so long as there is no change in either variable expenses or the selling price of a unit of service.

Exercise 12-12 (15 minutes)

1. The company should focus its campaign on Landscaping Clients. The computations are:

	Construction Clients	*Landscaping Clients*
Increased sales	$70,000	$60,000
Market CM ratio	× 35%	× 50%
Incremental contribution margin	$24,500	$30,000
Less cost of the campaign	8,000	8,000
Increased segment margin and net operating income for the company as a whole	$16,500	$22,000

2. The $90,000 in traceable fixed expenses in the previous exercise is now partly traceable and partly common. When we segment Dallas by market, only $72,000 remains a traceable fixed expense. This amount represents costs such as advertising and salaries that arise because of the existence of the construction and landscaping market segments. The remaining $18,000 ($90,000 – $72,000) is a common cost when Dallas is segmented by market. This amount would include such costs as the salary of the manager of the Dallas office that could not be avoided by eliminating either of the two market segments.

Exercise 12-13 (20 minutes)

1. ROI computations:

$$\text{ROI} = \frac{\text{Net operating income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Average operating assets}}$$

Perth: $$\frac{\$630{,}000}{\$9{,}000{,}000} \times \frac{\$9{,}000{,}000}{\$3{,}000{,}000} = 7\% \times 3 = 21\%$$

Darwin: $$\frac{\$1{,}800{,}000}{\$20{,}000{,}000} \times \frac{\$20{,}000{,}000}{\$10{,}000{,}000} = 9\% \times 2 = 18\%$$

2.

	Perth	*Darwin*
Average operating assets (a)...............	$3,000,000	$10,000,000
Net operating income	$630,000	$1,800,000
Minimum required return on average operating assets—16% × (a)...........	480,000	1,600,000
Residual income	$150,000	$ 200,000

3. No, the Darwin Division is simply larger than the Perth Division and for this reason one would expect that it would have a greater amount of residual income. Residual income can't be used to compare the performance of divisions of different sizes. Larger divisions will almost always look better. In fact, in the case above, Darwin does not appear to be as well managed as Perth. Note from Part (1) that Darwin has only an 18% ROI as compared to 21% for Perth.

Exercise 12-14 (15 minutes)

1.
$$\text{Margin} = \frac{\text{Net operating income}}{\text{Sales}}$$

$$= \frac{\$800{,}000}{\$8{,}000{,}000} = 10.00\%$$

$$\text{Turnover} = \frac{\text{Sales}}{\text{Average operating assets}}$$

$$= \frac{\$8{,}000{,}000}{\$3{,}200{,}000} = 2.50$$

$$\text{ROI} = \text{Margin} \times \text{Turnover}$$

$$= 10\% \times 2.50 = 25\%$$

2.
$$\text{Margin} = \frac{\text{Net operating income}}{\text{Sales}}$$

$$= \frac{\$800{,}000(1.00 + 4.00)}{\$8{,}000{,}000(1.00 + 1.50)}$$

$$= \frac{\$4{,}000{,}000}{\$20{,}000{,}000} = 20.00\%$$

$$\text{Turnover} = \frac{\text{Sales}}{\text{Average operating assets}}$$

$$= \frac{\$8{,}000{,}000\ (1.00 + 1.50)}{\$3{,}200{,}000}$$

$$= \frac{\$20{,}000{,}000}{\$3{,}200{,}000} = 6.25$$

$$\text{ROI} = \text{Margin} \times \text{Turnover}$$

$$= 20\% \times 6.25 = 125\%$$

Exercise 12-14 (continued)

3.
$$\text{Margin} = \frac{\text{Net operating income}}{\text{Sales}}$$

$$= \frac{\$800{,}000 + \$250{,}000}{\$8{,}000{,}000 + \$2{,}000{,}000}$$

$$= \frac{\$1{,}050{,}000}{\$10{,}000{,}000} = 10.50\%$$

$$\text{Turnover} = \frac{\text{Sales}}{\text{Average operating assets}}$$

$$= \frac{\$8{,}000{,}000 + \$2{,}000{,}000}{\$3{,}200{,}000 + \$800{,}000}$$

$$= \frac{\$10{,}000{,}000}{\$4{,}000{,}000} = 2.50$$

$$\text{ROI} = \text{Margin} \times \text{Turnover}$$

$$= 10.50\% \times 2.50 = 26.25\%$$

Exercise 12-15 (15 minutes)

	Company A	*Company B*	*Company C*
Sales	$400,000 *	$750,000 *	$600,000 *
Net operating income	$32,000	$45,000 *	$24,000
Average operating assets	$160,000 *	$250,000	$150,000 *
Return on investment (ROI)	20% *	18% *	16%
Minimum required rate of return:			
Percentage	15% *	20%	12% *
Dollar amount	$24,000	$50,000 *	$18,000
Residual income	$8,000	($5,000)	$6,000 *

*Given.

Exercise 12-16 (30 minutes)

1. a. The lowest acceptable transfer price from the perspective of the selling division, the Electrical Division, is given by the following formula:

$$\text{Transfer price} \geq \begin{matrix}\text{Variable cost} \\ \text{per unit}\end{matrix} + \frac{\text{Total contribution margin on lost sales}}{\text{Number of units transferred}}$$

Because there is enough idle capacity to fill the entire order from the Motor Division, there are no lost outside sales. And because the variable cost per unit is $21, the lowest acceptable transfer price as far as the selling division is concerned is also $21.

$$\text{Transfer price} \geq \$21 + \frac{\$0}{10{,}000} = \$21$$

b. The Motor Division can buy a similar transformer from an outside supplier for $38. Therefore, the Motor Division would be unwilling to pay more than $38 per transformer.

$$\text{Transfer price} \leq \text{Cost of buying from outside supplier} = \$38$$

c. Combining the requirements of both the selling division and the buying division, the acceptable range of transfer prices in this situation is:

$$\$21 \leq \text{Transfer price} \leq \$38$$

Assuming that the managers understand their own businesses and that they are cooperative, they should be able to agree on a transfer price within this range and the transfer should take place.

d. From the standpoint of the entire company, the transfer should take place. The cost of the transformers transferred is only $21 and the company saves the $38 cost of the transformers purchased from the outside supplier.

Exercise 12-16 (continued)

2. a. Each of the 10,000 units transferred to the Motor Division must displace a sale to an outsider at a price of $40. Therefore, the selling division would demand a transfer price of at least $40. This can also be computed using the formula for the lowest acceptable transfer price as follows:

$$\text{Transfer price} \geq \$21 + \frac{(\$40 - \$21) \times 10{,}000}{10{,}000}$$

$$= \$21 + (\$40 - \$21) = \$40$$

b. As before, the Motor Division would be unwilling to pay more than $38 per transformer.

c. The requirements of the selling and buying divisions in this instance are incompatible. The selling division must have a price of at least $40 whereas the buying division will not pay more than $38. An agreement to transfer the transformers is extremely unlikely.

d. From the standpoint of the entire company, the transfer should not take place. By transferring a transformer internally, the company gives up revenue of $40 and saves $38, for a loss of $2.

Exercise 12-17 (20 minutes)

1.

	Men's	Women's	Shoes	House-wares	Total
Percentage of 2008 sales	8%	40%	28%	24%	100%
Allocation of 2008 fixed administrative expenses (based on the above percentages)	$ 72,000	$360,000	$252,000	$216,000	$900,000

2.

	Men's	Women's	Shoes	House-wares	Total
2008 allocation (above)	$ 72,000	$360,000	$252,000	$216,000	$900,000
2007 allocation	90,000	225,000	315,000	270,000	900,000
Increase (decrease) in allocation	$(18,000)	$135,000	$ (63,000)	$ (54,000)	$ 0

The manager of the Women's Department undoubtedly will be upset about the increased allocation to the department but will feel powerless to do anything about it. Such an increased allocation may be viewed as a penalty for an outstanding performance.

3. Sales dollars is not ordinarily a good base for allocating fixed costs. The costs allocated to a department will be affected by the sales in *other* departments. In our illustration above, the sales in three departments remained static and the sales in the fourth increased. As a result, less cost was allocated to the departments with static sales and more cost was allocated to the one department that showed improvement during the period.

Exercise 12-18 (15 minutes)

	Division		
	Fab	*Consulting*	*IT*
Sales.......................................	$800,000 *	$650,000	$500,000
Net operating income...............	72,000 *	26,000	40,000 *
Average operating assets	400,000	130,000 *	200,000
Margin	9%	4% *	8% *
Turnover	2.0	5.0 *	2.5
Return on investment (ROI)	18% *	20%	20% *

*Given.

Note that the Consulting and IT Divisions apparently have different strategies to obtain the same 20% return. The Consulting Division has a low margin and a high turnover, whereas the IT Division has just the opposite.

Exercise 12-19 (20 minutes)

1.

(a) Sales	*(b) Net Operating Income**	*(c) Average Operating Assets*	*ROI (b) ÷ (c)*
\$4,500,000	\$290,000	\$800,000	36.25%
\$4,600,000	\$300,000	\$800,000	37.50%
\$4,700,000	\$310,000	\$800,000	38.75%
\$4,800,000	\$320,000	\$800,000	40.00%
\$4,900,000	\$330,000	\$800,000	41.25%
\$5,000,000	\$340,000	\$800,000	42.50%

*Sales × Contribution Margin Ratio – Fixed Expenses

2. The ROI increases by 1.25% for each \$100,000 increase in sales. This happens because each \$100,000 increase in sales brings in an additional profit of \$10,000. When this additional profit is divided by the average operating assets of \$800,000, the result is an increase in the company's ROI of 1.25%.

Increase in sales	\$100,000	(a)
Contribution margin ratio	10%	(b)
Increase in contribution margin and net operating income (a) × (b)	\$10,000	(c)
Average operating assets	\$800,000	(d)
Increase in return on investment (c) ÷ (d)	1.25%	

Exercise 12-20 (30 minutes)

1.

$$\text{Margin} = \frac{\text{Net operating income}}{\text{Sales}}$$

$$= \frac{\$16{,}000}{\$800{,}000} = 2\%$$

$$\text{Turnover} = \frac{\text{Sales}}{\text{Average operating assets}}$$

$$= \frac{\$800{,}000}{\$100{,}000} = 8$$

$$\text{ROI} = \text{Margin} \times \text{Turnover}$$

$$= 2\% \times 8 = 16\%$$

2.

$$\text{Margin} = \frac{\text{Net operating income}}{\text{Sales}}$$

$$= \frac{\$16{,}000 + \$6{,}000}{\$800{,}000 + \$80{,}000}$$

$$= \frac{\$22{,}000}{\$880{,}000} = 2.5\%$$

$$\text{Turnover} = \frac{\text{Sales}}{\text{Average operating assets}}$$

$$= \frac{\$800{,}000 + \$80{,}000}{\$100{,}000}$$

$$= \frac{\$880{,}000}{\$100{,}000} = 8.8$$

$$\text{ROI} = \text{Margin} \times \text{Turnover}$$

$$= 2.5\% \times 8.8 = 22\%$$

Exercise 12-20 (continued)

3.
$$\text{Margin} = \frac{\text{Net operating income}}{\text{Sales}}$$

$$= \frac{\$16{,}000 + \$3{,}200}{\$800{,}000}$$

$$= \frac{\$19{,}200}{\$800{,}000} = 2.4\%$$

$$\text{Turnover} = \frac{\text{Sales}}{\text{Average operating assets}}$$

$$= \frac{\$800{,}000}{\$100{,}000} = 8$$

$$\text{ROI} = \text{Margin} \times \text{Turnover}$$

$$= 2.4\% \times 8 = 19.2\%$$

4.
$$\text{Margin} = \frac{\text{Net operating income}}{\text{Sales}}$$

$$= \frac{\$16{,}000}{\$800{,}000} = 2\%$$

$$\text{Turnover} = \frac{\text{Sales}}{\text{Average operating assets}}$$

$$= \frac{\$800{,}000}{\$100{,}000 - \$20{,}000}$$

$$= \frac{\$800{,}000}{\$80{,}000} = 10$$

$$\text{ROI} = \text{Margin} \times \text{Turnover}$$

$$= 2\% \times 10 = 20\%$$

Problem 12-21 (60 minutes)

1. The disadvantages or weaknesses of the company's version of a segmented income statement are as follows:
   a. The company should include a column showing the combined results of the three territories taken together.
   b. The territorial expenses should be segregated into variable and fixed categories to permit the computation of both a contribution margin and a territorial segment margin.
   c. The corporate expenses are probably common to the territories and should not be allocated.

2. Corporate advertising expenses have apparently been allocated on the basis of sales dollars; the general administrative expenses have apparently been allocated evenly among the three territories. Such allocations can be misleading to management because they seem to imply that these expenses are caused by the segments to which they have been allocated. The segment margin—which only includes costs that are actually caused by the segments—should be used to measure the performance of a segment. A net operating income or loss after allocating common expenses should *not* be used to judge the performance of a segment.

Problem 12-21 (continued)

3.

	Total		*Southern Europe*		*Middle Europe*		*Northern Europe*	
	Amount in €s	*%*	*Amount in €s*	*%*	*Amount in €s*	*%*	*Amount in €s*	*%*
Sales	1,800,000	100.0	300,000	100	800,000	100	700,000	100
Variable expenses:								
Cost of goods sold	648,000	36.0	93,000	31	240,000	30	315,000	45
Shipping expense	89,000	4.9	15,000	5	32,000	4	42,000	6
Total variable expenses	737,000	40.9	108,000	36	272,000	34	357,000	51
Contribution margin	1,063,000	59.1	192,000	64	528,000	66	343,000	49
Traceable fixed expenses:								
Salaries	222,000	12.3	54,000	18	56,000	7	112,000	16
Insurance	39,000	2.2	9,000	3	16,000	2	14,000	2
Advertising	590,000	32.8	105,000	35	240,000	30	245,000	35
Depreciation	81,000	4.5	21,000	7	32,000	4	28,000	4
Total traceable fixed expenses	932,000	51.8	189,000	63	344,000	43	399,000	57
Territorial segment margin	131,000	7.3	3,000	1	184,000	23	(56,000)	(8)
Common fixed expenses:								
Advertising (general)	90,000	5.0						
General administration	60,000	3.3						
Total common fixed expense	150,000	8.3						
Net operating loss	(19,000)	(1.1)						

Note: Columns may not total due to rounding.

Problem 12-21 (continued)

4. The following points should be brought to the attention of management:
   a. Sales in Southern Europe are much lower than in the other two territories. This is not due to lack of salespeople—salaries in Southern Europe are about the same as in Middle Europe, which has the highest sales of the three territories.
   b. Southern Europe is spending less than half as much for advertising as Middle Europe. Perhaps this is the reason for Southern Europe's lower sales.
   c. Northern Europe has a poor sales mix; apparently it is selling a large amount of low-margin items. Note that its contribution margin ratio is only 49%, as compared to 64% or more for the other two territories.
   d. Northern Europe may be overstaffed. Its total salaries are much higher than in either of the other two territories.
   e. Northern Europe is not covering its own traceable costs. Attention should be given to changing the sales mix and reducing expenses in this territory.

Problem 12-22 (30 minutes)

1. Breaking the ROI computation into two separate elements helps the manager to see important relationships that might remain hidden. First, the importance of turnover of assets as a key element to overall profitability is emphasized. Prior to use of the ROI formula, managers tended to allow operating assets to swell to excessive levels. Second, the importance of sales volume in profit computations is stressed and explicitly recognized. Third, breaking the ROI computation into margin and turnover elements stresses the possibility of trading one off for the other in attempts to improve the overall profit picture. That is, a company may shave its margins slightly hoping for a large enough increase in turnover to increase the overall rate of return. Fourth, it permits a manager to reduce important profitability elements to ratio form, which enhances comparisons between units (divisions, etc.) of the organization.

2.

	Companies in the Same Industry		
	A	*B*	*C*
Sales	$4,000,000*	$1,500,000*	$6,000,000
Net operating income	$560,000*	$210,000*	$210,000
Average operating assets	$2,000,000*	$3,000,000	$3,000,000*
Margin	14%	14%	3.5%*
Turnover	2.0	0.5	2.0 *
Return on investment (ROI)	28%	7%*	7%

*Given.

NAA Report No. 35 states (p. 35):

"Introducing sales to measure level of operations helps to disclose specific areas for more intensive investigation. Company B does as well as Company A in terms of profit margin, for both companies earn 14% on sales. But Company B has a much lower turnover of capital than does Company A. Whereas a dollar of investment in Company A supports two dollars in sales each period, a dollar investment in Company B supports only 50 cents in sales each period. This suggests that the analyst should look carefully at Company B's investment. Is the company keeping an inventory larger than necessary for its sales volume? Are receivables being collected promptly? Or did Company A acquire its fixed assets at a price level which was much lower than that at which Company B purchased its plant?"

Problem 12-22 (continued)

Thus, by including sales specifically in ROI computations the manager is able to discover possible problems, as well as reasons underlying a strong or a weak performance. Looking at Company A compared to Company C, notice that C's turnover is the same as A's, but C's margin on sales is much lower. Why would C have such a low margin? Is it due to inefficiency, is it due to geographical location (thereby requiring higher salaries or transportation charges), is it due to excessive materials costs, or is it due to still other factors? ROI computations raise questions such as these, which form the basis for managerial action.

To summarize, in order to bring B's ROI into line with A's, it seems obvious that B's management will have to concentrate its efforts on increasing turnover, either by increasing sales or by reducing assets. It seems unlikely that B can appreciably increase its ROI by improving its margin on sales. On the other hand, C's management should concentrate its efforts on the margin element by trying to pare down its operating expenses.

Problem 12-23 (30 minutes)

1.

	Present	*New Line*	*Total*
(1) Sales	$21,000,000	$9,000,000	$30,000,000
(2) Net operating income	$1,680,000	$630,000 *	$2,310,000
(3) Operating assets	$5,250,000	$3,000,000	$8,250,000
(4) Margin (2) ÷ (1)	8.0%	7.0%	7.7%
(5) Turnover (1) ÷ (3)	4.00	3.00	3.64
(6) ROI (4) × (5)	32%	21%	28%

* Sales	$9,000,000
Variable expenses (65% × $9,000,000)	5,850,000
Contribution margin	3,150,000
Fixed expenses	2,520,000
Net operating income	$ 630,000

2. Fred Halloway will be inclined to reject the new product line, since accepting it would reduce his division's overall rate of return.

3. The new product line promises an ROI of 21%, whereas the company's overall ROI last year was only 18%. Thus, adding the new line would increase the company's overall ROI.

4. a.

	Present	*New Line*	*Total*
Operating assets	$5,250,000	$3,000,000	$8,250,000
Minimum required return	× 15%	× 15%	× 15%
Minimum net operating income	$787,500	$450,000	$1,237,500
Actual net operating income	$1,680,000	$ 630,000	$2,310,000
Minimum net operating income (above)	787,500	450,000	1,237,500
Residual income	$ 892,500	$ 180,000	$1,072,500

b. Under the residual income approach, Fred Halloway would be inclined to accept the new product line, since adding the product line would increase the total amount of his division's residual income, as shown above.

Problem 12-24 (60 minutes)

1. From the standpoint of the selling division, Division A:

$$\text{Transfer price} \geq \begin{array}{c}\text{Variable cost}\\ \text{per unit}\end{array} + \frac{\text{Total contribution margin on lost sales}}{\text{Number of units transferred}}$$

$$\text{Transfer price} \geq (\$63 - \$5) + \frac{(\$100 - \$63) \times 10{,}000}{10{,}000}$$

$$\geq \$58 + \$37 = \$95$$

But, from the standpoint of the buying division, Division B:

$$\text{Transfer price} \leq \text{Cost of buying from outside supplier} = \$92$$

Division B won't pay more than $92 and Division A will not accept less than $95, so no deal is possible. There will be no transfer.

2. a. From the standpoint of the selling division, Division A:

$$\text{Transfer price} \geq \begin{array}{c}\text{Variable cost}\\ \text{per unit}\end{array} + \frac{\text{Total contribution margin on lost sales}}{\text{Number of units transferred}}$$

$$\text{Transfer price} \geq (\$19 - \$4) + \frac{(\$40 - \$19) \times 70{,}000}{70{,}000} = \$15 + \$21 = \$36$$

From the standpoint of the buying division, Division B:

$$\text{Transfer price} \leq \text{Cost of buying from outside supplier} = \$39$$

In this instance, an agreement is possible within the range:

$$\$36 \leq \text{Transfer price} \leq \$39$$

Even though both managers would be better off with *any* transfer price within this range, they may disagree about the exact amount of the transfer price. It would not be surprising to hear the buying division arguing strenuously for $36 while the selling division argues just as strongly for $39.

Problem 12-24 (continued)

b. The loss in potential profits to the company as a whole will be:

Division B's outside purchase price	$39
Division A's variable cost on the internal transfer	36
Potential added contribution margin lost to the company as a whole	$ 3
Number of units	×70,000
Potential added contribution margin and company profits forgone	$210,000

Another way to derive the same answer is to look at the loss in potential profits for each division and then total the losses for the impact on the company as a whole. The loss in potential profits in Division A will be:

Suggested selling price per unit	$38
Division A's variable cost on the internal transfer	36
Potential added contribution margin per unit	$ 2
Number of units	×70,000
Potential added contribution margin and divisional profits forgone	$140,000

The loss in potential profits in Division B will be:

Outside purchase price per unit	$39
Suggested price per unit inside	38
Potential cost avoided per unit	$ 1
Number of units	×70,000
Potential added contribution margin and divisional profits forgone	$70,000

The total of these two amounts ($140,000 + $70,000) equals the $210,000 loss in potential profits for the company as a whole.

Problem 12-24 (continued)

3. a. From the standpoint of the selling division, Division A:

$$\text{Transfer price} \geq \frac{\text{Variable cost}}{\text{per unit}} + \frac{\text{Total contribution margin on lost sales}}{\text{Number of units transferred}}$$

$$\text{Transfer price} \geq \$35 + \frac{\$0}{20{,}000} = \$35$$

From the standpoint of the buying division, Division B:

$$\text{Transfer price} \leq \text{Cost of buying from outside supplier}$$

$$\text{Transfer price} \leq \$60 - (0.05 \times \$60) = \$57$$

In this case, an agreement is possible within the range:

$$\$35 \leq \text{Transfer price} \leq \$57$$

If the managers understand what they are doing and are reasonably cooperative, they should be able to come to an agreement with a transfer price within this range.

b. Division A's ROI should increase. The division has idle capacity, so selling 20,000 units a year to Division B should require no increase in operating assets. Therefore, Division A's turnover should increase. The division's margin should also increase, because its contribution margin will increase by $340,000 as a result of the new sales, with no offsetting increase in fixed costs:

Selling price	$52
Variable costs	35
Contribution margin	$17
Number of units	×20,000
Added contribution margin ..	$340,000

Thus, with both the margin and the turnover increasing, the division's ROI would also increase.

Problem 12-24 (continued)

4. From the standpoint of the selling division, Division A:

$$\text{Transfer price}\ ^{3}\ \begin{array}{c}\text{Variable cost}\\ \text{per unit}\end{array} + \frac{\text{Total contribution margin on lost sales}}{\text{Number of units transferred}}$$

$$\text{Transfer price}\ ^{3}\ \$25 + \frac{(\$45 - \$30) \times 30{,}000}{60{,}000} = \$25 + \$7.50 = \$32.50$$

Problem 12-25 (45 minutes)

1.

	Machine Tools Division	*Special Products Division*
Variable costs:		
$0.50 per machine-hour × 60,000 machine-hours	$30,000	
$0.50 per machine-hour × 60,000 machine-hours		$30,000
Fixed costs:		
65% × $80,000	52,000	
35% × $80,000		28,000
Total cost allocated	$82,000	$58,000

The variable costs are charged using the budgeted rate per machine-hour and the actual machine-hours. The fixed costs are charged in predetermined, lump-sum amounts based on budgeted fixed costs and peak-load capacity. Any difference between budgeted and actual costs is not charged to the operating departments but rather is treated as a spending variance of the maintenance department:

	Variable	*Fixed*
Total actual costs for the month	$78,000	$85,000
Total cost charged above	60,000	80,000
Spending variance—not allocated	$18,000	$ 5,000

2.

Actual variable cost	$ 78,000
Actual fixed cost	85,000
Total actual cost	$163,000

One-half of the total cost, or $81,500, would be allocated to each division, because an equal number of machine-hours was worked in each division during the month.

Problem 12-25 (continued)

3. This method has two major problems. First, allocating the total actual cost of the service department to the operating departments essentially allocates the spending variances to the operating departments. This forces the inefficiencies of the service department onto the operating departments. Second, allocating the fixed costs of the service department according to the actual level of activity in each operating department results in the allocation to one operating department being affected by the actual activity in the other operating departments. For example, if the activity in one operating department falls, the fixed charges to the other operating departments will increase.

4. Managers may understate their peak-period needs to reduce their charges for fixed service department costs. Top management can control such ploys by careful follow-up, with rewards being given to those managers who estimate accurately, and severe penalties assessed against those managers who understate their departments' needs. For example, departments that exceed their estimated peak-period maintenance requirements may be forced to hire outside maintenance contractors, at market rates, to do their maintenance work during peak periods.

Problem 12-26 (30 minutes)

1.

	Total Company		Sales Territory			
			Central		Eastern	
	Amount	%	Amount	%	Amount	%
Sales	$900,000	100.0	$400,000	100	$500,000	100
Variable expenses	408,000	45.3	208,000	52	200,000	40
Contribution margin	492,000	54.7	192,000	48	300,000	60
Traceable fixed expenses	290,000	32.2	160,000	40	130,000	26
Territorial segment margin	202,000	22.4	$ 32,000	8	$170,000	34
Common fixed expenses*	175,000	19.4				
Net operating income	$ 27,000	3.0				

*465,000 – $290,000 = $175,000.

	Central Territory		Product Line			
			Awls		Pows	
	Amount	%	Amount	%	Amount	%
Sales	$400,000	100.0	$100,000	100	$300,000	100
Variable expenses	208,000	52.0	25,000	25	183,000	61
Contribution margin	192,000	48.0	75,000	75	117,000	39
Traceable fixed expenses	114,000	28.5	60,000	60	54,000	18
Product line segment margin	78,000	19.5	$ 15,000	15	$ 63,000	21
Common fixed expenses*	46,000	11.5				
Sales territory segment margin	$ 32,000	8.0				

*$160,000 – $114,000 = $46,000.

Problem 12-26 (continued)

2. Two points should be brought to the attention of management. First, compared to the Eastern territory, the Central territory has a low contribution margin ratio. Second, the Central territory has high traceable fixed expenses. Overall, compared to the Eastern territory, the Central territory is very weak.

3. Again, two points should be brought to the attention of management. First, the Central territory has a poor sales mix. Note that the territory sells very little of the Awls product, which has a high contribution margin ratio. It is this poor sales mix that accounts for the low overall contribution margin ratio in the Central territory mentioned in part (2) above. Second, the traceable fixed expenses of the Awls product seem very high in relation to sales. These high fixed expenses may simply mean that the Awls product is highly leveraged; if so, then an increase in sales of this product line would greatly enhance profits in the Central territory and in the company as a whole.

Problem 12-27 (20 minutes)

1. Operating assets do not include investments in other companies or in undeveloped land.

	Ending Balances	*Beginning Balances*
Cash	$ 130,000	$ 125,000
Accounts receivable	480,000	340,000
Inventory	490,000	570,000
Plant and equipment (net)	820,000	845,000
Total operating assets	$1,920,000	$1,880,000

$$\text{Average operating assets} = \frac{\$1,880,000 + \$1,920,000}{2} = \$1,900,000$$

$$\text{Margin} = \frac{\text{Net operating income}}{\text{Sales}}$$

$$= \frac{\$627,000}{\$4,180,000} = 15\%$$

$$\text{Turnover} = \frac{\text{Sales}}{\text{Average operating assets}}$$

$$= \frac{\$4,180,000}{\$1,900,000} = 2.2$$

$$\text{ROI} = \text{Margin} \times \text{Turnover}$$

$$= 15\% \times 2.2 = 33\%$$

2.

Net operating income	$627,000
Minimum required return (20% × $1,900,000)	380,000
Residual income	$247,000

Problem 12-28 (45 minutes)

1. The lowest acceptable transfer price from the perspective of the selling division is given by the following formula:

$$\text{Transfer price} \geq \begin{matrix}\text{Variable cost}\\ \text{per unit}\end{matrix} + \frac{\text{Total contribution margin on lost sales}}{\text{Number of units transferred}}$$

   The Tuner Division has no idle capacity, so transfers from the Tuner Division to the Assembly Division would cut directly into normal sales of tuners to outsiders. The costs are the same whether a tuner is transferred internally or sold to outsiders, so the only relevant cost is the lost revenue of $20 per tuner that could be sold to outsiders. This is confirmed below:

$$\text{Transfer price} \geq \$11 + \frac{(\$20 - \$11) \times 30{,}000}{30{,}000}$$

$$\geq \$11 + (\$20 - \$11) = \$20$$

   Therefore, the Tuner Division will refuse to transfer at a price less than $20 per tuner.

   The Assembly Division can buy tuners from an outside supplier for $20, less a 10% quantity discount of $2, or $18 per tuner. Therefore, the Division would be unwilling to pay more than $18 per tuner.

$$\text{Transfer price} \leq \text{Cost of buying from outside supplier} = \$18$$

   The requirements of the two divisions are incompatible. The Assembly Division won't pay more than $18 and the Tuner Division will not accept less than $20. Thus, there can be no mutually agreeable transfer price and no transfer will take place.

2. The price being paid to the outside supplier, net of the quantity discount, is only $18. If the Tuner Division meets this price, then profits in the Tuner Division and in the company as a whole will drop by $60,000 per year:

Lost revenue per tuner	$20
Outside supplier's price	<u>$18</u>
Loss in contribution margin per tuner	$2
Number of tuners per year	× <u>30,000</u>
Total loss in profits	<u>$60,000</u>

Problem 12-28 (continued)

Profits in the Assembly Division will remain unchanged, since it will be paying the same price internally as it is now paying externally.

3. The Tuner Division has idle capacity, so transfers from the Tuner Division to the Assembly Division do not cut into normal sales of tuners to outsiders. In this case, the minimum price as far as the Assembly Division is concerned is the variable cost per tuner of $11. This is confirmed in the following calculation:

$$\text{Transfer price}\ ³\ \ \$11 + \frac{\$0}{30{,}000} = \$11$$

The Assembly Division can buy tuners from an outside supplier for $18 each and would be unwilling to pay more than that in an internal transfer. If the managers understand their own businesses and are cooperative, they should agree to a transfer and should settle on a transfer price within the range:

$11£ Transfer price £ $18

4. Yes, $16 is a bona fide outside price. Even though $16 is less than the Tuner Division’s $17 “full cost” per unit, it is within the range given in Part 3 and therefore will provide some contribution to the Tuner Division.

If the Tuner Division does not meet the $16 price, it will lose $150,000 in potential profits:

Price per tuner..........................	$16
Variable costs	11
Contribution margin per tuner.....	$ 5

30,000 tuners × $5 per tuner = $150,000 potential increased profits

This $150,000 in potential profits applies to the Tuner Division and to the company as a whole.

5. No, the Assembly Division should probably be free to go outside and get the best price it can. Even though this would result in lower profits for the company as a whole, the buying division should probably not be forced to purchase inside if better prices are available outside.

Problem 12-28 (continued)

6. The Tuner Division will have an increase in profits:

Selling price	$20
Variable costs	11
Contribution margin per tuner	$ 9

30,000 tuners × $9 per tuner = $270,000 increased profits

The Assembly Division will have a decrease in profits:

Inside purchase price	$20
Outside purchase price	16
Increased cost per tuner	$ 4

30,000 tuners × $4 per tuner = $120,000 decreased profits

The company as a whole will have an increase in profits:

Increased contribution margin in the Tuner Division	$ 9
Decreased contribution margin in the Assembly Division	4
Increased contribution margin per tuner	$ 5

30,000 tuners × $5 per tuner = $150,000 increased profits

So long as the selling division has idle capacity and the transfer price is greater than the selling division's variable costs, profits in the company as a whole will increase if internal transfers are made. However, there is a question of *fairness* as to how these profits should be split between the selling and buying divisions. The inflexibility of management in this situation damages the profits of the Assembly Division and greatly enhances the profits of the Tuner Division.

Problem 12-29 (45 minutes)

1. The segmented income statement follows:

	Total Company	*Wheat Cereal*	*Pancake Mix*	*Flour*
Sales	$600,000	$200,000	$300,000	$100,000
Variable expenses:				
Materials, labor & other	204,000	60,000	126,000	18,000
Sales commissions	60,000	20,000	30,000	10,000
Total variable expenses	264,000	80,000	156,000	28,000
Contribution margin	336,000	120,000	144,000	72,000
Traceable fixed expenses:				
Advertising	123,000	48,000	60,000	15,000
Salaries	66,000	34,000	21,000	11,000
Equipment depreciation*	30,000	12,000	15,000	3,000
Warehouse rent**	12,000	4,000	7,000	1,000
Total traceable fixed expenses	231,000	98,000	103,000	30,000
Product line segment margin	105,000	$ 22,000	$ 41,000	$ 42,000
Common fixed expenses:				
General administration	90,000			
Net operating income	$ 15,000			

* $30,000 × 40%, 50%, and 10% respectively

** $0.50 per square foot × 8,000 square feet, 14,000 square feet, and 2,000 square feet respectively

Problem 12-29 (continued)

2. a. No, the wheat cereal should not be eliminated. The wheat cereal product is covering all of its own costs and is generating a $22,000 segment margin toward covering the company's common costs and toward profits. (Note: Problems relating to the elimination of a product line are covered in more depth in Chapter 13.)

   b.

	Wheat Cereal	*Pancake Mix*	*Flour*
Contribution margin (a)	$120,000	$144,000	$72,000
Sales (b)	$200,000	$300,000	$100,000
Contribution margin ratio (a) ÷ (b)	60%	48%	72%

It is probably unwise to focus all available resources on promoting the pancake mix. The company is already spending nearly as much on the promotion of this product as on the other two products together. Furthermore, the pancake mix has the lowest contribution margin ratio of the three products. Therefore, a dollar of sales of the pancake mix generates less profit than a dollar of sales of either of the two other products. Nevertheless, we cannot say for sure which product should be emphasized in this situation without more information. The problem states that there is ample demand for all three products, which suggests that there is no idle capacity. If the equipment is being fully utilized, increasing the production of any one product would probably require cutting back production of the other products. In Chapter 13 we will discuss how to choose the most profitable product when a production constraint forces such a trade-off among products.

Problem 12-30 (30 minutes)

1. $$\text{ROI} = \frac{\text{Net operating income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Average operating assets}}$$

$$= \frac{\$80{,}000}{\$1{,}000{,}000} \times \frac{\$1{,}000{,}000}{\$500{,}000}$$

$$= 8\% \times 2 = 16\%$$

2. $$\text{ROI} = \frac{\$90{,}000}{\$1{,}000{,}000} \times \frac{\$1{,}000{,}000}{\$500{,}000}$$

= 9%	×	2	=	18%
(Increase)		(Unchanged)		(Increase)

3. $$\text{ROI} = \frac{\$80{,}000}{\$1{,}000{,}000} \times \frac{\$1{,}000{,}000}{\$400{,}000}$$

= 8%	×	2.5	=	20%
(Unchanged)		(Increase)		(Increase)

4. The company has a contribution margin ratio of 40% ($20 CM per unit divided by $50 selling price per unit). Therefore, a $100,000 increase in sales would result in a new net operating income of:

Sales	$1,100,000	100%
Variable expenses	660,000	60%
Contribution margin	440,000	40%
Fixed expenses	320,000	
Net operating income	$ 120,000	

Problem 12-30 (continued)

$$\text{ROI} = \frac{\$120{,}000}{\$1{,}100{,}000} \times \frac{\$1{,}100{,}000}{\$500{,}000}$$

$$= \underset{\text{(Increase)}}{10.91\%} \times \underset{\text{(Increase)}}{2.2} = \underset{\text{(Increase)}}{24\%}$$

A change in sales affects *both* the margin and the turnover.

5. Interest is a financing expense and thus is not used to compute net operating income.

$$\text{ROI} = \frac{\$85{,}000}{\$1{,}000{,}000} \times \frac{\$1{,}000{,}000}{\$625{,}000}$$

$$= \underset{\text{(Increase)}}{8.5\%} \times \underset{\text{(Decrease)}}{1.6} = \underset{\text{(Decrease)}}{13.6\%}$$

6.

$$\text{ROI} = \frac{\$80{,}000}{\$1{,}000{,}000} \times \frac{\$1{,}000{,}000}{\$320{,}000}$$

$$= \underset{\text{(Unchanged)}}{8\%} \times \underset{\text{(Increase)}}{3.125} = \underset{\text{(Increase)}}{25\%}$$

7.

$$\text{ROI} = \frac{\$60{,}000}{\$1{,}000{,}000} \times \frac{\$1{,}000{,}000}{\$480{,}000}$$

$$= \underset{\text{(Decrease)}}{6\%} \times \underset{\text{(Increase)}}{2.08} = \underset{\text{(Decrease)}}{12.5\%}$$

Problem 12-31 (45 minutes)

1. The Consumer Products Division will probably reject the $400 price because it is below the division's variable cost of $420 per DVD player. This variable cost includes the $190 transfer price from the Board Division, which in turn includes $30 per unit in fixed costs. However, from the viewpoint of the Consumer Products Division, the entire $190 transfer price is a variable cost. Consequently, the Consumer Products Division will reject the $400 price offered by the overseas distributor.

2. If both the Board Division and the Consumer Products Division have idle capacity, then from the standpoint of the entire company the $400 offer should be accepted. By rejecting the $400 price, the company will lose $50 per DVD player in potential contribution margin:

Price offered per player		$400
Less variable costs per player:		
Board Division	$120	
Consumer Products Division	230	350
Potential contribution margin per player		$ 50

3. If the Board Division is operating at capacity, any boards transferred to the Consumer Products Division to fill the overseas order will have to be diverted from outside customers. Whether a board is sold to outside customers or is transferred to the Consumer Products Division, its production cost is the same. However, if a board is diverted from outside sales, the Board Division (and the entire company) loses the $190 in revenue. As a consequence, as shown below, there would be a net loss of $20 on each player sold for $400.

Price offered per player		$400
Less:		
Lost revenue from sales of boards to outsiders	$190	
Variable cost of Consumer Products Division	230	420
Net loss per player		($ 20)

4. When the selling division has no idle capacity, as in part (3), market price works very well as a transfer price. The cost to the company of a transfer when there is no idle capacity is the lost revenue from sales to outsiders. If the market price is used as the transfer price, the buying division will view the market price of the transferred item as its cost—which is appropriate since that is the cost to the company. As a consequence, the manager of the buying division should be motivated to make decisions that are in the best interests of the company.

   When the selling division has idle capacity, the cost to the company of the transfer is just the variable cost of producing the item. If the market price is used as the transfer price, the manager of the buying division will view that as his/her cost rather than the real cost to the company, which is just variable cost. Hence, the manager will have the wrong cost information for making decisions as we observed in parts (1) and (2).

Problem 12-32 (20 minutes)

1.

	Milling Department	*Finishing Department*	*Total*
Variable costs:			
20K per meal × 12,000 meals	240,000 K		
20K per meal × 4,000 meals..		80,000 K	320,000 K
Fixed costs:			
70% × 200,000K.................	140,000		
30% × 200,000K.................		60,000	200,000
Total cost allocated.................	380,000 K	140,000 K	520,000 K

2. Any difference between the budgeted and actual variable cost per meal or between the budgeted and actual total fixed cost would not be charged to the other departments. The amount not charged would be:

	Variable Cost	*Fixed Cost*	*Total*
Actual cost incurred during the year	384,000K	215,000K	599,000K
Cost allocated above..........................	320,000	200,000	520,000
Cost not allocated (spending variance).	64,000K	15,000K	79,000K

The costs that are not charged to the other departments are spending variances of the cafeteria and are the responsibility of the cafeteria's manager.

Problem 12-33 (45 minutes)

1. Segments defined as product lines:

		Product Line		
	Leather Division	Garments	Shoes	Handbags
Sales	R1,500,000	R500,000	R700,000	R300,000
Variable expenses	761,000	325,000	280,000	156,000
Contribution margin	739,000	175,000	420,000	144,000
Traceable fixed expenses:				
Advertising	312,000	80,000	112,000	120,000
Administration	107,000	30,000	35,000	42,000
Depreciation	114,000	25,000	56,000	33,000
Total traceable fixed expenses	533,000	135,000	203,000	195,000
Product line segment margin	206,000	R 40,000	R217,000	R (51,000)
Common fixed expenses:				
Administrative*	110,000			
Divisional segment margin	R 96,000			

*R217,000 – R107,000 = R110,000.

Problem 12-33 (continued)

2. Segments defined as markets for the handbag product line:

		Sales Market	
	Handbags	*Domestic*	*Foreign*
Sales	R300,000	R200,000	R100,000
Variable expenses	156,000	86,000	70,000
Contribution margin	144,000	114,000	30,000
Traceable fixed expenses:			
Advertising	120,000	40,000	80,000
Market segment margin	24,000	R 74,000	R(50,000)
Common fixed expenses:			
Administrative	42,000		
Depreciation	33,000		
Total common fixed expenses	75,000		
Product line segment margin	R(51,000)		

3.

	Garments	*Shoes*
Contribution margin (a)	R175,000	R420,000
Sales (b)	R500,000	R700,000
Contribution margin ratio (a) ÷ (b)	35%	60%
Incremental contribution margin:		
35% × R200,000 increased sales	R70,000	
60% × R145,000 increased sales		R87,000
Less cost of the promotional campaign	30,000	30,000
Increased net operating income	R40,000	R57,000

Based on these data, the campaign should be directed toward the shoes product line. Notice that the analysis uses the contribution margin ratio rather than the segment margin ratio.

Case 12-34 (75 minutes)

1. See the segmented statement that follows. Supporting computations for the statement are given below:

Revenues:	
Membership dues (10,000 × $60)	$600,000
Assigned to the Journal (10,000 × $15)	150,000
Assigned to Membership Service	$450,000
Nonmember journal subscriptions (1,000 × $20)	$ 20,000
Advertising (given)	$ 50,000
Books and reports (given)	$ 70,000
Continuing education courses (given)	$230,000
Occupancy costs:	
Membership Services ($100,000 × 0.3 + $20,000)	$ 50,000
Journal ($100,000 × 0.1)	10,000
Books and Reports ($100,000 × 0.1)	10,000
Continuing Education ($100,000 × 0.2)	20,000
Central staff ($100,000 × 0.3)	30,000
Total occupancy costs	$120,000
Printing costs:	
Journal (11,000 × $4)	$ 44,000
Books and Reports (given)	25,000
Continuing Education (plug)	13,000
Total printing costs	$ 82,000
Mailing costs:	
Journal (11,000 × $1)	$ 11,000
Books and Reports (given)	8,000
Central staff (plug)	5,000
Total mailing costs	$ 24,000

Case 12-34 (continued)

A statement detailing revenues by program appears directly below. The segmented income statement follows on the next page.

	Total	*Membership Services*	*Journal*	*Books and Reports*	*Continuing Education*
Revenues:					
Membership dues	$600,000	$450,000	$150,000		
Nonmember journal subscriptions	20,000		20,000		
Advertising	50,000		50,000		
Books and reports	70,000			$ 70,000	
Continuing education courses	230,000				$230,000
Total revenues	970,000	450,000	220,000	70,000	230,000

Case 12-34 (continued)

	Total	*Membership Services*	*Journal*	*Books and Reports*	*Continuing Education*
Total revenues	$970,000	$450,000	$220,000	$70,000	$230,000
Expenses traceable to segments:					
Salaries	320,000	170,000	60,000	40,000	50,000
Occupancy costs	90,000	50,000	10,000	10,000	20,000
Distributions to local chapters	210,000	210,000			
Printing	82,000		44,000	25,000	13,000
Mailing	19,000		11,000	8,000	
Continuing education instructors' fees	60,000				60,000
Total traceable expenses	781,000	430,000	125,000	83,000	143,000
Program segment margin	189,000	$ 20,000	$ 95,000	$(13,000)	$ 87,000
Common expenses:					
Salaries—central staff	120,000				
Occupancy costs	30,000				
Mailing	5,000				
General administrative	27,000				
Total common expenses	182,000				
Excess of revenues over expenses	$ 7,000				

Note: Some may argue that apart from the $20,000 in rental cost directly attributed to Membership Services, occupancy costs are common costs that should not be allocated to programs. The correct treatment of the occupancy costs depends on whether they could be avoided in part by eliminating a program. We have assumed that they could be avoided.

Case 12-34 (continued)

2. While we do not favor the allocation of common costs to segments, the reason most often given for this practice is that segment managers need to be aware of the fact that common costs exist and that they must be covered.

   Arguments against allocation of common costs include:

   - Allocation bases must be chosen arbitrarily since no cause-and-effect relationship exists between common costs and the segments to which they are allocated.
   - Management may be misled into eliminating a profitable segment that appears to be unprofitable because of allocated common costs.
   - Segment managers usually have little control over common costs. They should not be held accountable for costs over which they have little or no control.
   - Allocations of common costs tend to undermine the credibility of performance reports.

Case 12-35 (60 minutes)

1. The Electronics Division is presently operating at capacity; therefore, any sales of the XL5 circuit board to the Clock Division will require that the Electronics Division give up an equal number of sales to outside customers. Using the transfer pricing formula, we get a minimum transfer price of:

$$\text{Transfer price} \geq \begin{matrix}\text{Variable cost}\\ \text{per unit}\end{matrix} + \frac{\text{Total contribution margin on lost sales}}{\text{Number of units transferred}}$$

$$\text{Transfer price} \geq \$8.25 + (\$12.50 - \$8.25)$$

$$\text{Transfer price} \geq \$8.25 + \$4.25$$

$$\text{Transfer price} \geq \$12.50$$

   Thus, the Electronics Division should not supply the circuit board to the Clock Division for $9 each. The Electronics Division must give up revenues of $12.50 on each circuit board that it sells internally. Since management performance in the Electronics Division is measured by ROI and dollar profits, selling the circuit boards to the Clock Division for $9 would adversely affect these performance measurements.

2. The key is to realize that the $10 in fixed overhead and administrative costs contained in the Clock Division's $69.75 cost per timing device is not relevant. There is no indication that winning this contract would actually affect any of the fixed costs. If these costs would be incurred regardless of whether or not the Clock Division gets the oven timing device contract, they should be ignored when determining the effects of the contract on the company's profits. Another key is that the variable cost of the Electronics Division is not relevant either. Whether the circuit boards are used in the timing devices or sold to outsiders, the production costs of the circuit boards would be the same. The only difference between the two alternatives is the revenue on outside sales that is given up when the circuit boards are transferred within the company.

Selling price of the timing devices		$70.00
Less:		
The cost of the circuit boards used in the timing devices (i.e. the lost revenue from sale of circuit boards to outsiders)	$12.50	
Variable costs of the Clock Division excluding the circuit board ($30.00 + $20.75)	50.75	63.25
Net positive effect on the company's profit		$ 6.75

Therefore, the company as a whole would be better off by $6.75 for each timing device that is sold to the oven manufacturer.

3. As shown in part (1) above, the Electronics Division would insist on a transfer price of at least $12.50 for the circuit board. Would the Clock Division make any money at this price? Again, the fixed costs are not relevant in this decision since they would not be affected. Once this is realized, it is evident that the Clock Division would be ahead by $6.75 per timing device if it accepts the $12.50 transfer price.

Selling price of the timing devices		$70.00
Less:		
Purchased parts (from outside vendors)	$30.00	
Circuit board XL5 (assumed transfer price)	12.50	
Other variable costs	20.75	63.25
Clock Division contribution margin		$ 6.75

In fact, since the contribution margin is $6.25, any transfer price within the range of $12.50 to $19.25 (= $12.50 + $6.75) will improve the profits of both divisions. So yes, the managers should be able to agree on a transfer price.

4. It is in the best interests of the company and of the divisions to come to an agreement concerning the transfer price. As demonstrated in part (3) above, any transfer price within the range $12.50 to $19.25 would improve the profits of both divisions. What happens if the two managers do not come to an agreement?

In this case, top management knows that there should be a transfer and could step in and force a transfer at some price within the acceptable range. However, such an action, if done on a frequent basis, would undermine the autonomy of the managers and turn decentralization into a sham.

Our advice to top management would be to ask the two managers to meet to discuss the transfer pricing decision. Top management should not dictate a course of action or what is to happen in the meeting, but should carefully observe what happens in the meeting. If there is no agreement, it is important to know why. There are at least three possible reasons. First, the managers may have better information than the top managers and refuse to transfer for very good reasons. Second, the managers may be uncooperative and unwilling to deal with each other even if it results in lower profits for the company and for themselves. Third, the managers may not be able to correctly analyze the situation and may not understand what is actually in their own best interests. For example, the manager of the Clock Division may believe that the fixed overhead and administrative cost of $10 per timing device really does have to be covered in order to avoid a loss.

If the refusal to come to an agreement is the result of uncooperative attitudes or an inability to correctly analyze the situation, top management can take some positive steps that are completely consistent with decentralization. If the problem is uncooperative attitudes, there are many training companies that would be happy to put on a short course in team building for the company. If the problem is that the managers are unable to correctly analyze the alternatives, they can be sent to executive training courses that emphasize economics and managerial accounting.

Research and Application 12-36 (240 minutes)

1. FedEx succeeds because of its operational excellence customer value proposition. Page 9 of the 10-K describes the company's largest business segment, FedEx Express, by saying "FedEx Express invented express distribution in 1973 and remains the industry leader, providing rapid, reliable, time-definite delivery of packages, documents and freight to more than 220 countries and territories. FedEx Express offers time-certain delivery within one to three business days, serving markets that generate more than 90% of the world's gross domestic product through door-to-door, customs-cleared service with a money- back guarantee. FedEx Express's unmatched air route authorities and extensive transportation infrastructure, combined with leading-edge information technologies, make it world's largest express transportation company." The combination of global scale coupled with one to three day delivery capability testifies to the company's extraordinary operational excellence.

   Page 4 of the 10-K describes FedEx's efforts to integrate its business segments so that customers have a single point of contact with the company for all of their air, ground, or freight transportation needs. This is undoubtedly an important aspect of FedEx's strategy.

2. FedEx's four main business segments are, FedEx Express, FedEx Ground, FedEx Freight, and FedEx Kinko's. Examples of traceable fixed costs for the FedEx Express segment include the costs of operating the primary sorting facility in Memphis, Tennessee, the costs of operating regional hubs in Newark, Oakland, and Fort Worth, and the costs of owning 557 airplanes (see page 22 of the 10-K). Examples of traceable fixed costs for the FedEx Ground segment include the costs of owning 19,700 trailers (see page 14 of the 10-K), the costs of operating 515 facilities and 28 hubs throughout the U.S. and Canada (see page 14 of the 10-K), and the compensation paid to the President and Chief Executive Officer of FedEx Ground, Daniel J. Sullivan (see page 29 of the 10-K).

   Examples of traceable fixed costs for the FedEx Freight segment include the costs of operating 321 service centers, the costs of owning 39,500 vehicles, and the service center manager salaries. Examples of traceable fixed costs for the FedEx Kinko's segment include the utility costs to operate the 1,290 FedEx Kinko's Office and Print Centers, the salaries paid to the Office and Print Center managers, and the rental costs incurred to operate the Office and Print Centers.

Research and Application 12-36 (continued)

Examples of common costs include all of the FedEx sponsorships mentioned on page 19 of the 10-K. For example, the cost of hosting college football's FedEx Orange Bowl is common to the four business segments. Other common costs include the salary paid to the company's CEO Frederick W. Smith, and the fee paid to the company's auditor, Ernst & Young.

3. Page 24 of the 10-K lists all of the sorting facilities for the FedEx Express segment. These sorting facilities are examples of cost centers. Each of the retail FedEx Kinko's Office and Print Centers is a profit center. The four main business segments—FedEx Express, FedEx Ground, FedEx Freight, and FedEx Kinko's—are examples of investment centers.

4. The salary paid to Gary M. Kusin, the President and Chief Executive Officer for FedEx Kinko's is traceable to the FedEx Kinko's business segment, but it is common to each of the FedEx Kinko's retail locations. The cost of operating a FedEx Express regional hub in Newark is traceable to that hub, but the costs are common to the flights that arrive and depart from Newark. The cost of maintaining the company's website (www.fedex.com) is traceable to the company's Information Technology Department but it is common to the four business segments.

5. The margin, turnover, and ROI for all four segments are summarized in the below table (dollar figures are in millions):

	FedEx Express	*FedEx Ground*	*FedEx Freight*	*FedEx Kinko's*
Sales	$19,485	$4,680	$3,217	$2,066
Operating income	$1,414	$604	$354	$100
Segment assets: 2005	$13,130	$2,776	$2,047	$2,987
Segment assets: 2004	$12,443	$2,248	$1,924	$2,903
Average operating assets [Segment assets: 2005 +	$12,787	$2,512	$1,986	$2,945

Segment assets: 2004]/2..				
Margin [Operating income ÷ Sales]	7.3%	12.9%	11.0%	4.8%
Turnover [Sales ÷ Average operating assets]	1.52	1.86	1.62	0.70
ROI [Margin × Turnover]....	11.1%	24.0%	17.8%	3.4%

6. Assuming a 15% required rate of return, the residual income for all four segments would be computed as follows (dollar figures are in millions):

	FedEx Express	*FedEx Ground*	*FedEx Freight*	*FedEx Kinko's*
Average operating assets....	$12,787	$2,512	$1,986	$2,945
Operating income...............	$1,414	$604	$354	$ 100
Minimum required return [15% × Average operating assets]	1,918	377	298	442
Residual income	$ (504)	$227	$ 56	$(342)

7. A $20,000,000 investment that increases operating income by $4,000,000 provides an ROI of 20%. Since the FedEx Express segment is currently earning an ROI of 11.1% (as calculated above), its managers would pursue the investment opportunity because it would increase their overall ROI. The FedEx Ground segment is currently earning an ROI of 24% (as calculated above); therefore, its managers would pass on the investment opportunity because it would lower their overall ROI.

   If the managers are evaluated using residual income, the managers of both segments would pursue the investment opportunity because it would increase their overall residual incomes. Using residual income instead of ROI aligns the incentives of segment managers with the overall goals of the company. The increase in residual income for both segments is shown below (dollar figures are in millions):

	FedEx Express	*FedEx Ground*
Residual income before investment (from requirement 6)...	$(504)	$227
Operating income from the investment............	$ 4	$ 4
Required return on investment in operating assets ($20,000,000 × 15% = $3,000,000)	3	3

Residual income provided by investment opportunity	$ 1	$ 1
Residual income after the investment	$(503)	$228

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Chapter 13
Relevant Costs for Decision Making

Solutions to Questions

13-1 A relevant cost is a cost that differs in total between the alternatives in a decision.

13-2 An incremental cost (or benefit) is the change in cost (or benefit) that will result from some proposed action. An opportunity cost is the benefit that is lost or sacrificed when rejecting some course of action. A sunk cost is a cost that has already been incurred and that cannot be changed by any future decision.

13-3 No. Variable costs are relevant costs only if they differ in total between the alternatives under consideration.

13-4 No. Not all fixed costs are sunk—only those for which the cost has already been irrevocably incurred. A variable cost can be a sunk cost, if it has already been incurred.

13-5 No. A variable cost is a cost that varies in total amount in direct proportion to changes in the level of activity. A differential cost is the difference in cost between two alternatives. If the level of activity is the same for the two alternatives, a variable cost will not be affected and it will be irrelevant.

13-6 No. Only those future costs that differ between the alternatives under consideration are relevant.

13-7 Only those costs that would be avoided as a result of dropping the product line are relevant in the decision. Costs that will not differ regardless of whether the product line is retained or discontinued are irrelevant.

13-8 Not necessarily. An apparent loss may be the result of allocated common costs or of sunk costs that cannot be avoided if the product line is dropped. A product line should be discontinued only if the contribution margin that will be lost as a result of dropping the line is less than the fixed costs that would be avoided. Even in that situation the product line may be retained if its presence promotes the sale of other products.

13-9 Allocations of common fixed costs can make a product line (or other segment) appear to be unprofitable, whereas in fact it may be profitable.

13-10 If a company decides to make a part internally rather than to buy it from an outside supplier, then a portion of the company's facilities have to be used to make the part. The company's opportunity cost is measured by the benefits that could be derived from the best alternative use of the facilities.

13-11 Any resource that is required to make products and get them into the hands of customers could be a constraint. Some examples are machine time, direct labor time, floor space, raw materials, investment capital, supervisory time, and storage space. While not covered in the text, constraints can also be intangible and often take the form of a formal or informal policy that prevents the organization from furthering its goals.

13-12 Assuming that fixed costs are not affected, profits are maximized when the total contribution margin is maximized. A company can maximize its contribution margin by focusing on the products with the greatest amount of contribution margin per unit of the constrained resource.

13-13 Joint products are two or more products that are produced from a common input. Joint costs are the costs that are incurred up to the split-off point. The split-off point is the point in the manufacturing process where joint products can be recognized as individual products.

13-14 Joint costs should not be allocated among joint products. If joint costs are allocated among the joint products, then managers may think they are avoidable costs of the end products. However, the joint costs will continue to be incurred as long as the process is run regardless of what is done with one of the end products. Thus, when making decisions about the end products, the joint costs are not avoidable and are irrelevant.

13-15 As long as the incremental revenue from further processing exceeds the incremental costs of further processing, the product should be processed further.

13-16 Most costs of a flight are either sunk costs, or costs that do not depend on the number of passengers on the flight. Depreciation of the aircraft, salaries of personnel on the ground and in the air, and fuel costs, for example, are the same whether the flight is full or almost empty. Therefore, adding more passengers at reduced fares at certain times of the week when seats would otherwise be empty does little to increase the total costs of making the flight, but can do much to increase the total contribution and total profit.

Exercise 13-1 (15 minutes)

	Case 1		Case 2	
Item	*Relevant*	*Not Relevant*	*Relevant*	*Not Relevant*
a. Sales revenue	X			X
b. Direct materials	X		X	
c. Direct labor	X			X
d. Variable manufacturing overhead	X			X
e. Book value—Model A3000 machine		X		X
f. Disposal value—Model A3000 machine		X	X	
g. Depreciation—Model A3000 machine		X		X
h. Market value—Model B3800 machine (cost)...	X		X	
i. Fixed manufacturing overhead		X		X
j. Variable selling expense ..	X			X
k. Fixed selling expense	X			X
l. General administrative overhead	X			X

Exercise 13-2 (30 minutes)

1. No, the housekeeping program should not be discontinued. It is actually generating a positive program segment margin and is, of course, providing a valuable service to seniors. Computations to support this conclusion follow:

Contribution margin lost if the housekeeping program is dropped		$(80,000)
Fixed costs that can be avoided:		
Liability insurance	$15,000	
Program administrator's salary	37,000	52,000
Decrease in net operating income for the organization as a whole		$(28,000)

Depreciation on the van is a sunk cost and the van has no salvage value since it would be donated to another organization. The general administrative overhead is allocated and none of it would be avoided if the program were dropped; thus it is not relevant to the decision.

The same result can be obtained with the alternative analysis below:

	Current Total	*Total If House-keeping Is Dropped*	*Difference: Net Operating Income Increase or (Decrease)*
Revenues	$900,000	$660,000	$(240,000)
Variable expenses	490,000	330,000	160,000
Contribution margin	410,000	330,000	(80,000)
Fixed expenses:			
Depreciation*	68,000	68,000	0
Liability insurance	42,000	27,000	15,000
Program administrators' salaries	115,000	78,000	37,000
General administrative overhead	180,000	180,000	0
Total fixed expenses	405,000	353,000	52,000
Net operating income (loss)	$ 5,000	$(23,000)	$ (28,000)

*Includes pro-rated loss on disposal of the van if it is donated to a charity.

Exercise 13-2 (continued)

2. To give the administrator of the entire organization a clearer picture of the financial viability of each of the organization's programs, the general administrative overhead should not be allocated. It is a common cost that should be deducted from the total program segment margin. Following the format introduced in Chapter 12 for a segmented income statement, a better income statement would be:

	Total	*Home Nursing*	*Meals on Wheels*	*House-keeping*
Revenues	$900,000	$260,000	$400,000	$240,000
Variable expenses	490,000	120,000	210,000	160,000
Contribution margin	410,000	140,000	190,000	80,000
Traceable fixed expenses:				
Depreciation	68,000	8,000	40,000	20,000
Liability insurance	42,000	20,000	7,000	15,000
Program administrators' salaries	115,000	40,000	38,000	37,000
Total traceable fixed expenses	225,000	68,000	85,000	72,000
Program segment margins	185,000	$ 72,000	$105,000	$ 8,000
General administrative overhead	180,000			
Net operating income (loss)	$ 5,000			

Exercise 13-3 (30 minutes)

1.

	Per Unit Differential Costs		*15,000 units*	
	Make	*Buy*	*Make*	*Buy*
Cost of purchasing		$20		$300,000
Direct materials	$ 6		$ 90,000	
Direct labor	8		120,000	
Variable manufacturing overhead	1		15,000	
Fixed manufacturing overhead, traceable[1]	2		30,000	
Fixed manufacturing overhead, common	0	0	0	0
Total costs	$17	$20	$255,000	$300,000
Difference in favor of continuing to make the parts	$3		$45,000	

[1] Only the supervisory salaries can be avoided if the parts are purchased. The remaining book value of the special equipment is a sunk cost; hence, the $3 per unit depreciation expense is not relevant to this decision. Based on these data, the company should reject the offer and should continue to produce the parts internally.

2.

	Make	*Buy*
Cost of purchasing (part 1)		$300,000
Cost of making (part 1)	$255,000	
Opportunity cost—segment margin forgone on a potential new product line	65,000	
Total cost	$320,000	$300,000
Difference in favor of purchasing from the outside supplier	$20,000	

Thus, the company should accept the offer and purchase the parts from the outside supplier.

Exercise 13-4 (15 minutes)

Only the incremental costs and benefits are relevant. In particular, only the variable manufacturing overhead and the cost of the special tool are relevant overhead costs in this situation. The other manufacturing overhead costs are fixed and are not affected by the decision.

	Per Unit	*Total 10 bracelets*
Incremental revenue	$349.95	$3,499.50
Incremental costs:		
Variable costs:		
Direct materials	143.00	1,430.00
Direct labor	86.00	860.00
Variable manufacturing overhead	7.00	70.00
Special filigree	6.00	60.00
Total variable cost	$242.00	2,420.00
Fixed costs:		
Purchase of special tool		465.00
Total incremental cost		2,885.00
Incremental net operating income		$ 614.50

Even though the price for the special order is below the company's regular price for such an item, the special order would add to the company's net operating income and should be accepted. This conclusion would not necessarily follow if the special order affected the regular selling price of bracelets or if it required the use of a constrained resource.

Exercise 13-5 (30 minutes)

1.

	A	B	C
(1) Contribution margin per unit	$18	$36	$20
(2) Direct labor cost per unit	$12	$32	$16
(3) Direct labor rate per hour	8	8	8
(4) Direct labor-hours required per unit (2) ÷ (3)	1.5	4.0	2.0
Contribution margin per direct labor-hour (1) ÷ (4)	$12	$ 9	$10

2. The company should concentrate its labor time on producing product A:

	A	B	C
Contribution margin per direct labor-hour ..	$12	$9	$10
Direct labor-hours available	× 3,000	× 3,000	× 3,000
Total contribution margin	$36,000	$27,000	$30,000

   Although product A has the lowest contribution margin per unit and the second lowest contribution margin ratio, it has the highest contribution margin per direct labor-hour. Since labor time seems to be the company's constraint, this measure should guide management in its production decisions.

3. The amount Banner Company should be willing to pay in overtime wages for additional direct labor time depends on how the time would be used. If there are unfilled orders for all of the products, Banner would presumably use the additional time to make more of product A. Each hour of direct labor time generates $12 of contribution margin over and above the usual direct labor cost. Therefore, Banner should be willing to pay up to $20 per hour (the $8 usual wage plus the contribution margin per hour of $12) for additional labor time, but would of course prefer to pay far less. The upper limit of $20 per direct labor hour signals to managers how valuable additional labor hours are to the company.

Exercise 13-5 (continued)

If all the demand for product A has been satisfied, Banner Company would then use any additional direct labor-hours to manufacture product C. In that case, the company should be willing to pay up to $18 per hour (the $8 usual wage plus the $10 contribution margin per hour for product C) to manufacture more product C.

Likewise, if all the demand for both products A and C has been satisfied, additional labor hours would be used to make product B. In that case, the company should be willing to pay up to $17 per hour to manufacture more product B.

Exercise 13-6 (10 minutes)

	Product X	*Product Y*	*Product Z*
Sales value after further processing ..	$80,000	$150,000	$75,000
Sales value at split-off point	50,000	90,000	60,000
Incremental revenue........................	30,000	60,000	15,000
Cost of further processing	35,000	40,000	12,000
Incremental profit (loss)..................	$(5,000)	20,000	3,000

Products Y and Z should be processed further, but not Product X.

Exercise 13-7 (30 minutes)

1. The relevant costs of a fishing trip would be:

Fuel and upkeep on boat per trip.....	$25
Junk food consumed during trip*.....	8
Snagged fishing lures	7
Total	$40

* The junk food consumed during the trip may not be completely relevant. Even if Steve were not going on the trip, he would still have to eat. The amount by which the cost of the junk food exceeds the cost of the food he would otherwise consume would be the relevant amount.

The other costs are sunk at the point at which the decision is made to go on another fishing trip.

2. If he fishes for the same amount of time as he did on his last trip, all of his costs are likely to be about the same as they were on his last trip. Therefore, it really doesn't cost him anything to catch the last fish. The costs are really incurred in order to be able to catch fish and would be the same whether one, two, three, or a dozen fish were actually caught. Fishing, not catching fish, costs money. All of the costs are basically fixed with respect to how many fish are actually caught during any one fishing trip, except possibly the cost of snagged lures.

3. In a decision of whether to give up fishing altogether, nearly all of the costs listed by Steve's wife are relevant. If he did not fish, he would not need to pay for boat moorage, new fishing gear, a fishing license, fuel and upkeep, junk food, or snagged lures. In addition, he would be able to sell his boat, the proceeds of which would be considered relevant in this decision. The original cost of the boat, which is a sunk cost, would not be relevant.

Exercise 13-7 (continued)

These three requirements illustrate the slippery nature of costs. A cost that is relevant in one situation can be irrelevant in the next. None of the costs are relevant when we compute the cost of catching a particular fish; some of them are relevant when we compute the cost of a fishing trip; and nearly all of them are relevant when we consider the cost of not giving up fishing. What is even more confusing is that Wendy is correct; the average cost of a salmon is $167, even though the cost of actually catching any one fish is essentially zero. It may not make sense from an economic standpoint to have salmon fishing as a hobby, but as long as Steve is out in the boat fishing, he might as well catch as many fish as he can.

Exercise 13-8 (10 minutes)

Contribution margin lost if the Bath Department is dropped:	
Lost from the Bath Department	$700,000
Lost from the Kitchen Department (10% × $2,400,000)	240,000
Total lost contribution margin	940,000
Less avoidable fixed costs ($900,000 – $370,000)	530,000
Decrease in overall net operating income	$410,000

Exercise 13-9 (15 minutes)

Item	*Relevant Costs* Make	*Relevant Costs* Buy
Direct materials (60,000 @ $4.00)	$240,000	
Direct labor (60,000 @ $2.75)	165,000	
Variable manufacturing overhead (60,000 @ $0.50)..................................	30,000	
Fixed manufacturing overhead, traceable (1/3 of $180,000)..................................	60,000	
Cost of purchasing from outside supplier (60,000 @ $10)		$600,000
Total cost	$495,000	$600,000

The two-thirds of the traceable fixed manufacturing overhead costs that cannot be eliminated, and all of the common fixed manufacturing overhead costs, are irrelevant.

The company would save $105,000 per year by continuing to make the parts itself. In other words, profits would decline by $105,000 per year if the parts were purchased from the outside supplier.

Exercise 13-10 (15 minutes)

1. Monthly profits would be increased by $9,000:

	Per Unit	*Total for 2,000 Units*
Incremental revenue	$12.00	$24,000
Incremental costs:		
Variable costs:		
Direct materials	2.50	5,000
Direct labor	3.00	6,000
Variable manufacturing overhead	0.50	1,000
Variable selling and administrative	1.50	3,000
Total variable cost	$ 7.50	15,000
Fixed costs:		
None affected by the special order		0
Total incremental cost		15,000
Incremental net operating income		$ 9,000

2. The relevant cost is $1.50 (the variable selling and administrative costs). All other variable costs are sunk, since the units have already been produced. The fixed costs would not be relevant, since they would not be affected by the sale of leftover units.

Exercise 13-11 (15 minutes)

The company should accept orders first for Product Z, second for Product X, and third for Product Y. The computations are:

	Product X	*Product Y*	*Product Z*
(a) Direct materials required per unit	$24.00	$15.00	$9.00
(b) Cost per pound.............................	$3.00	$3.00	$3.00
(c) Pounds required per unit (a) ÷ (b)...	8	5	3
(d) Contribution margin per unit	$32.00	$14.00	$21.00
Contribution margin per pound of materials used (d) ÷ (c)	$4.00	$2.80	$7.00

Since Product Z uses the least amount of material per unit of the three products, and since it is the most profitable of the three in terms of its use of this constrained resource, some students will immediately assume that this is an infallible relationship. That is, they will assume that the way to spot the most profitable product is to find the one using the least amount of the constrained resource. The way to dispel this notion is to point out that Product X ·uses more material (the constrained resource) than does Product Y, but yet it is preferred over Product Y. *The key factor is not how much of a constrained resource a product uses, but rather how much contribution margin the product generates per unit of the constrained resource.*

Exercise 13-12 (10 minutes)

Merifulon should be processed further:

Sales value after further processing	$60,000
Sales value at the split-off point	40,000
Incremental revenue from further processing	20,000
Cost of further processing	13,000
Profit from further processing	$ 7,000

The $10,000 in allocated common costs (1/3 × $30,000) will be the same regardless of which alternative is selected, and hence is not relevant to the decision.

Exercise 13-13 (20 minutes)

1.

Fixed cost per mile ($3,500* ÷ 10,000 miles) .	$0.35
Variable operating cost per mile	0.08
Average cost per mile	$0.43

* Depreciation	$2,000
Insurance	960
Garage rent	480
Automobile tax and license	60
Total	$3,500

2. The variable operating costs would be relevant in this situation. The depreciation would not be relevant since it relates to a sunk cost. However, any decrease in the resale value of the car due to its use would be relevant. The automobile tax and license costs would be incurred whether Samantha decides to drive her own car or rent a car for the trip during spring break and are therefore irrelevant. It is unlikely that her insurance costs would increase as a result of the trip, so they are irrelevant as well. The garage rent is relevant only if she could avoid paying part of it if she drives her own car.

3. When figuring the incremental cost of the more expensive car, the relevant costs would be the purchase price of the new car (net of the resale value of the old car) and the increases in the fixed costs of insurance and automobile tax and license. The original purchase price of the old car is a sunk cost and is therefore irrelevant. The variable operating costs would be the same and therefore are irrelevant. (Students are inclined to think that variable costs are always relevant and fixed costs are always irrelevant in decisions. This requirement helps to dispel that notion.)

Exercise 13-14 (30 minutes)

No, the overnight cases should not be discontinued. The computations are:

Contribution margin lost if the cases are discontinued		$(260,000)
Less fixed costs that can be avoided if the cases are discontinued:		
Salary of the product line manager	$ 21,000	
Advertising	110,000	
Insurance on inventories	9,000	140,000
Net disadvantage of dropping the cases		$(120,000)

The same solution can be obtained by preparing comparative income statements:

	Keep Overnight Cases	*Drop Overnight Cases*	*Difference: Net Operating Income Increase or (Decrease)*
Sales	$450,000	$ 0	$(450,000)
Variable expenses:			
Variable manufacturing expenses	130,000	0	130,000
Sales commissions	48,000	0	48,000
Shipping	12,000	0	12,000
Total variable expenses	190,000	0	190,000
Contribution margin	260,000	0	(260,000)
Fixed expenses:			
Salary of line manager	21,000	0	21,000
General factory overhead	104,000	104,000	0
Depreciation of equipment	36,000	36,000	0
Advertising—traceable	110,000	0	110,000
Insurance on inventories	9,000	0	9,000
Purchasing department	50,000	50,000	0
Total fixed expenses	330,000	190,000	140,000
Net operating loss	$ (70,000)	$(190,000)	$(120,000)

Exercise 13-15 (20 minutes)

The costs that are relevant in a make-or-buy decision are those costs that can be avoided as a result of purchasing from the outside. The analysis for this exercise is:

	Per Unit Differential Costs		*20,000 Units*	
	Make	*Buy*	*Make*	*Buy*
Cost of purchasing		$23.50		$470,000
Cost of making:				
Direct materials	$ 4.80		$ 96,000	
Direct labor	7.00		140,000	
Variable manufacturing overhead	3.20		64,000	
Fixed manufacturing overhead	4.00 *		80,000	
Total cost	$19.00	$23.50	$380,000	$470,000

* The remaining $6 of fixed manufacturing overhead cost would not be relevant, since it will continue regardless of whether the company makes or buys the parts.

The $150,000 rental value of the space being used to produce part R-3 represents an opportunity cost of continuing to produce the part internally. Thus, the completed analysis would be:

	Make	*Buy*
Total cost, as above	$380,000	$470,000
Rental value of the space (opportunity cost)	150,000	
Total cost, including opportunity cost	$530,000	$470,000
Net advantage in favor of buying	$60,000	

Profits would increase by $60,000 if the outside supplier's offer is accepted.

Problem 13-16 (30 minutes)

1. Contribution margin lost if the tour is discontinued ..		$(2,100)
Less tour costs that can be avoided if the tour is discontinued:		
Tour promotion ...	$600	
Fee, tour guide ...	700	
Fuel for bus ...	125	
Overnight parking fee, bus...	50	
Room & meals, bus driver and tour guide ...	175	1,650
Net decrease in profits if the tour is discontinued		$ (450)

The following costs are not relevant to the decision:

Cost	*Reason*
Salary of bus driver	The drivers are all on salary and there would be no change in the number of drivers on the payroll.
Depreciation of bus	Depreciation due to wear and tear is negligible and there would be no change in the number of buses in the fleet.
Liability insurance, bus	There would be no change in the number of buses in the fleet.
Bus maintenance & preparation	There would be no change in the size of the maintenance & preparation staff.

Problem 13-16 (continued)

Alternative Solution:

	Keep the Tour	*Drop the Tour*	*Difference: Net Operating Income Increase or (Decrease)*
Ticket revenue	$3,000	$ 0	$(3,000)
Less variable expenses	900	0	900
Contribution margin	2,100	0	(2,100)
Less tour expenses:			
Tour promotion	600	0	600
Salary of bus driver	350	350	0
Fee, tour guide	700	0	700
Fuel for bus	125	0	125
Depreciation of bus	450	450	0
Liability insurance, bus	200	200	0
Overnight parking fee, bus	50	0	50
Room & meals, bus driver and tour guide	175	0	175
Bus maintenance and preparation	300	300	0
Total tour expenses	2,950	1,300	1,650
Net operating loss	$ (850)	$(1,300)	$ (450)

2. The goal of increasing average seat occupancy could be accomplished by dropping tours like the Historic Mansions tour with lower-than-average seat occupancies. This could reduce profits in at least two ways. First, the tours that are eliminated could have contribution margins that exceed their avoidable costs (such as in the case of the "Historic Mansions" tour in part 1). If so, then eliminating these tours would reduce the company's total contribution margin more than it would reduce total costs, and profits would decline. Second, these tours might be acting as "magnets" that draw tourists to other, more profitable tours.

Problem 13-17 (15 minutes)

1.

	Per 16-Ounce T-Bone
Revenue from further processing:	
Selling price of one filet mignon (6 ounces × $3.60 per pound/16 ounces per pound)	$1.35
Selling price of one New York cut (8 ounces × $2.90 per pound/16 ounces per pound)	1.45
Total revenue from further processing	2.80
Less revenue from one T-bone steak	2.25
Incremental revenue from further processing	0.55
Less cost of further processing	0.20
Profit per pound from further processing	$0.35

2. The T-bone steaks should be processed further into the filet mignon and the New York cut. This will yield $0.35 per pound in added profit for the company. The $0.55 "profit" per pound for T-bone steak mentioned in the problem statement is not relevant to the decision, since it contains allocated joint costs. The company will incur the allocated joint costs regardless of whether the T-bone steaks are sold outright or processed further; thus, this cost should be ignored in the decision.

Problem 13-18 (45 minutes)

1. The simplest approach to the solution is:

Gross margin lost if the store is closed		$(228,000)
Less costs that can be avoided:		
Direct advertising	$36,000	
Sales salaries	45,000	
Delivery salaries	7,000	
Store rent	65,000	
Store management salaries (new employee would not be hired to fill vacant position at another store)	15,000	
General office salaries	8,000	
Utilities	27,200	
Insurance on inventories (2/3 × $9,000)	6,000	
Employment taxes*	9,000	218,200
Decrease in company net operating income if the Downtown Store is closed		$(9,800)

*Salaries avoided by closing the store:

Sales salaries	$45,000
Delivery salaries	7,000
Store management salaries	15,000
General office salaries	8,000
Total salaries	75,000
Employment tax rate	× 12%
Employment taxes avoided	$ 9,000

2. The Downtown Store should not be closed. If the store is closed, overall company net operating income will decrease by $9,800 per quarter.

Problem 13-18 (continued)

3. The Downtown Store should be closed if $200,000 of its sales are picked up by the Uptown Store. The net effect of the closure will be an increase in overall company net operating income by $76,200 per quarter:

Gross margin lost if the Downtown Store is closed	$(228,000)
Gross margin gained at the Uptown Store:	
$200,000 × 43%	86,000
Net loss in gross margin	(142,000)
Costs that can be avoided if the Downtown Store is closed (part 1)	218,200
Net advantage of closing the Downtown Store	$ 76,200

Problem 13-19 (60 minutes)

1. The fixed overhead costs are common and will remain the same regardless of whether the cartridges are produced internally or purchased outside. Hence, they are not relevant. The variable manufacturing overhead cost per box of pens is $0.30, as shown below:

Total manufacturing overhead cost per box of pens ...	$0.80
Less fixed manufacturing overhead ($50,000 ÷ 100,000 boxes)	0.50
Variable manufacturing overhead cost per box..........	$0.30

The total variable cost of producing one box of Zippo pens is:

Direct materials	$1.50
Direct labor	1.00
Variable manufacturing overhead........	0.30
Total variable cost per box........	$2.80

If the cartridges for the Zippo pens are purchased from the outside supplier, then the variable cost per box of Zippo pens would be:

Direct materials ($1.50 × 80%)	$1.20
Direct labor ($1.00 × 90%)	0.90
Variable manufacturing overhead ($0.30 × 90%).......	0.27
Purchase of cartridges........	0.48
Total variable cost per box........	$2.85

The company should reject the outside supplier's offer. Producing the cartridges internally costs $0.05 less per box of pens than purchasing them from the supplier.

Another approach to the solution is:

Cost avoided by purchasing the cartridges:	
Direct materials ($1.50 × 20%)........	$0.30
Direct labor ($1.00 × 10%)........	0.10
Variable manufacturing overhead ($0.30 × 10%)	0.03
Total costs avoided........	$0.43
Cost of purchasing the cartridges........	$0.48
Cost savings per box by making cartridges internally..	$0.05

Note that the avoidable cost of $0.43 above represents *the cost of making one box of cartridges internally*.

Problem 13-19 (continued)

2. The company would not want to pay any more than \$0.43 per box, since it can make the cartridges for this amount internally.

3. The company has three alternatives for obtaining the necessary cartridges. It can:

   #1 Produce all cartridges internally.
   #2 Purchase all cartridges externally.
   #3 Produce the cartridges for 100,000 boxes internally and purchase the cartridges for 50,000 boxes externally.

The costs under the three alternatives are:

Alternative #1—Produce all cartridges internally:	
Variable costs (150,000 boxes × \$0.43 per box)	\$64,500
Fixed costs of adding capacity	30,000
Total cost	\$94,500
Alternative #2—Purchase all cartridges externally:	
Variable costs (150,000 boxes × \$0.48 per box)	\$72,000
Alternative #3—Produce 100,000 boxes internally, and purchase 50,000 boxes externally:	
Variable costs:	
100,000 boxes × \$0.43 per box..............................	\$43,000
50,000 boxes × \$0.48 per box	24,000
Total cost	\$67,000

Problem 13-19 (continued)

Or, in terms of total cost per box of pens, the answer would be:

Alternative #1—Produce all cartridges internally:	
Variable costs (150,000 boxes × $2.80 per box)	$420,000
Fixed costs of adding capacity	30,000
Total cost	$450,000
Alternative #2—Purchase all cartridges externally:	
Variable costs (150,000 boxes × $2.85 per box)	$427,500
Alternative #3—Produce the cartridges for 100,000 boxes internally, and purchase the cartridges for 50,000 boxes externally:	
Variable costs:	
100,000 boxes × $2.80 per box	$280,000
50,000 boxes × $2.85 per box	142,500
Total cost	$422,500

Thus, the company should accept the outside supplier's offer, but only for the cartridges for 50,000 boxes.

4. In addition to cost considerations, Bronson should take into account the following factors:
   a) The ability of the supplier to meet required delivery schedules.
   b) The quality of the cartridges purchased from the supplier.
   c) Alternative uses of the capacity that is used to make the cartridges.
   d) The ability of the supplier to supply cartridges if volume increases in future years.
   e) The problem of alternative sources of supply if the supplier proves undependable.

Problem 13-20 (30 minutes)

1. Incremental revenue:	
Fixed fee (10,000 pairs × €4 per pair).............	€ 40,000
Reimbursement for costs of production:	
(Variable production cost of €16 plus fixed overhead cost of €5 equals €21 per pair; 10,000 pairs × €21 per pair).........................	210,000
Total incremental revenue	250,000
Incremental costs:	
Variable production costs (10,000 pairs × €16 per pair)...	160,000
Increase in net operating income	€ 90,000

2. Sales revenue through regular channels (10,000 pairs × €32 per pair)*	€320,000
Sales revenue from the army (above)................	250,000
Decrease in revenue received............................	70,000
Less variable selling expenses avoided if the army's offer is accepted (10,000 pairs × €2 per pair)	20,000
Net decrease in net operating income with the army's offer...	€ 50,000

*This assumes that the sales through regular channels can be recovered after the special order has been fulfilled. This may not happen if regular customers who are turned away to fill the special order are permanently lost to competitors.

Problem 13-21 (45 minutes)

1. Product MJ-7 yields a contribution margin of $14 per gallon ($35 – $21 = $14). If the plant closes, this contribution margin will be lost on the 22,000 gallons (11,000 gallons per month × 2 = 22,000 gallons) that could have been sold during the two-month period. However, the company will be able to avoid certain fixed costs as a result of closing down. The analysis is:

Contribution margin lost by closing the plant for two months ($14 per gallon × 22,000 gallons) .		$(308,000)
Costs avoided by closing the plant for two months:		
Fixed manufacturing overhead cost ($60,000 × 2 months = $120,000)................	$120,000	
Fixed selling costs ($310,000 × 10% × 2 months).....................	62,000	182,000
Net disadvantage of closing, before start-up costs..		(126,000)
Add start-up costs		(14,000)
Disadvantage of closing the plant.......................		$(140,000)

No, the company should not close the plant; it should continue to operate at the reduced level of 11,000 gallons produced and sold each month. Closing will result in a $140,000 greater loss over the two-month period than if the company continues to operate. Additional factors are the potential loss of goodwill among the customers who need the 11,000 gallons of MJ-7 each month and the adverse effect on employee morale. By closing down, the needs of customers will not be met (no inventories are on hand), and their business may be permanently lost to another supplier.

Problem 13-21 (continued)

Alternative Solution:

	Plant Kept Open	*Plant Closed*	*Difference—Net Operating Income Increase (Decrease)*
Sales (11,000 gallons × $35 per gallon × 2)	$ 770,000	$ 0	$(770,000)
Less variable expenses (11,000 gallons × $21 per gallon × 2)	462,000	0	462,000
Contribution margin	308,000	0	(308,000)
Less fixed costs:			
Fixed manufacturing overhead cost ($230,000 × 2; $170,000 × 2)	460,000	340,000	120,000
Fixed selling cost ($310,000 × 2; $310,000 × 90% × 2)	620,000	558,000	62,000
Total fixed cost	1,080,000	898,000	182,000
Net operating loss before start-up costs	(772,000)	(898,000)	(126,000)
Start-up costs		(14,000)	(14,000)
Net operating loss	$ (772,000)	$(912,000)	$(140,000)

Problem 13-21 (continued)

2. Ignoring the additional factors cited in part (1) above, Hallas Company should be indifferent between closing down or continuing to operate if the level of sales drops to 12,000 gallons (6,000 gallons per month) over the two-month period. The computations are:

Cost avoided by closing the plant for two months (see above)	$182,000
Less start-up costs	14,000
Net avoidable costs	$168,000

$$\frac{\text{Net avoidable costs}}{\text{Contribution margin per gallon}} = \frac{\$168{,}000}{\$14 \text{ per gallon}}$$

$$= 12{,}000 \text{ gallons}$$

Verification:

	Operate at 12,000 Gallons for Two Months	*Close for Two Months*
Sales (12,000 gallons × $35 per gallon)	$ 420,000	$ 0
Less variable expenses (12,000 gallons × $21 per gallon)	252,000	0
Contribution margin	168,000	0
Less fixed expenses:		
Manufacturing overhead ($230,000 and $170,000 × 2 months)	460,000	340,000
Selling ($310,000 and $279,000 × 2 months)	620,000	558,000
Total fixed expenses	1,080,000	898,000
Start-up costs	0	14,000
Total costs	1,080,000	912,000
Net operating loss	$ (912,000)	$(912,000)

Problem 13-22 (45 minutes)

1.

Selling price per unit	$40
Less variable expenses per unit*	24
Contribution margin per unit	$16

*$9.50 + $10.00 + $2.80 + $1.70 = $24.00

Increased unit sales (80,000 × 25%)	20,000
Contribution margin per unit	× $16
Incremental contribution margin	$320,000
Less added fixed selling expense	150,000
Incremental net operating income	$170,000

Yes, the increase in fixed selling expense would be justified.

2.

Variable production cost per unit	$22.30
Import duties, etc. ($14,000 ÷ 20,000 units)	0.70
Shipping cost per unit	1.50
Break-even price per unit	$24.50

3. If the plant operates at 25% of normal levels, then only 5,000 units will be produced and sold during the three-month period:

80,000 units per year × 3/12 = 20,000 units.
20,000 units × 25% = 5,000 units produced and sold.

Given this information, the simplest approach to the solution is:

Contribution margin lost if the plant is closed (5,000 units × $16 per unit*)		$(80,000)
Fixed costs that can be avoided if the plant is closed:		
Fixed manufacturing overhead cost ($400,000 × 3/12 = $100,000; $100,000 × 40%)	$40,000	
Fixed selling cost ($360,000 × 3/12 = $90,000; $90,000 × 1/3)	30,000	70,000
Net disadvantage of closing the plant		$(10,000)

*$40.00 – ($9.50 + $10.00 + $2.80 + $1.70) = $16.00

Profits would decline by $10,000 if the plant is closed.

Problem 13-22 (continued)

Alternative approach:

	Keep the Plant Open	*Close the Plant*
Sales (5,000 units × $40 per unit)	$ 200,000	$ 0
Variable expenses		
(5,000 units × $24 per unit)	120,000	0
Contribution margin	80,000	0
Fixed expenses:		
Fixed manufacturing overhead cost:		
$400,000 × 3/12	100,000	
$400,000 × 3/12 × 60%		60,000
Fixed selling expense:		
$360,000 × 3/12	90,000	
$360,000 × 3/12 × 2/3		60,000
Total fixed expenses	190,000	120,000
Net operating income (loss)	$(110,000)	$(120,000)

4. The relevant cost is $1.70 per unit, which is the variable selling expense per Zet. Since the blemished units have already been produced, all production costs (including the variable production costs) are sunk. The fixed selling expenses are not relevant since they will remain the same regardless of whether or not the blemished units are sold. The variable selling expense may or may not be relevant—depending on how the blemished units are sold. For example, the units may be sold through a liquidator without incurring the normal variable selling expense.

5. The costs that can be avoided by purchasing from the outside supplier are relevant. These costs are:

Variable production costs	$22.30
Fixed manufacturing overhead cost ($400,000 × 70% = $280,000; $280,000 ÷ 80,000 units)	3.50
Variable selling expense ($1.70 × 60%)	1.02
Total avoidable cost	$26.82

To be acceptable, the outside manufacturer's quotation must be *less* than $26.82 per unit.

Problem 13-23 (60 minutes)

1. The \$2.00 per unit general overhead cost is not relevant to the decision, since the total general company overhead cost will be the same regardless of whether the company decides to make or buy the subassemblies. Also, the depreciation on the old equipment is not a relevant cost since it represents a sunk cost and the old equipment is worn out and must be replaced. The cost of supervision is relevant since this cost can be avoided by buying the subassemblies.

	Differential Costs Per Unit		*Total Differential Costs for 40,000 Units*	
	Make	*Buy*	*Make*	*Buy*
Outside supplier's price		\$8.00		\$320,000
Direct materials	\$2.75		\$110,000	
Direct labor (\$4.00 × 0.75)	3.00		120,000	
Variable overhead (\$0.60 × 0.75)	0.45		18,000	
Supervision	0.75		30,000	
Equipment rental*	1.50		60,000	
Total	\$8.45	\$8.00	\$338,000	\$320,000
Difference in favor of buying	\$0.45		\$18,000	

* \$60,000 per year ÷ 40,000 units per year = \$1.50 per unit

Problem 13-23 (continued)

2. a. Note that unit costs for both supervision and equipment rental will change if the company needs 50,000 subassemblies each year. These fixed costs will be spread over a larger number of units, thereby decreasing the cost per unit.

	Differential Costs Per Unit		*Total Differential Costs—50,000 Units*	
	Make	*Buy*	*Make*	*Buy*
Outside supplier's price		$8.00		$400,000
Direct materials	$2.75		$137,500	
Direct labor	3.00		150,000	
Variable overhead	0.45		22,500	
Supervision ($30,000 ÷ 50,000 units)	0.60		30,000	
Equipment rental ($60,000 ÷ 50,000 units)	1.20		60,000	
Total	$8.00	$8.00	$400,000	$400,000
Difference	$0		$0	

The company would be indifferent between the two alternatives if 50,000 subassemblies were needed each year.

Problem 13-23 (continued)

b. Again, notice that the unit costs for both supervision and equipment rental decrease with the greater volume of units.

	Differential Costs Per Unit		*Total Differential Costs—60,000 Units*	
	Make	*Buy*	*Make*	*Buy*
Outside supplier's price..........		$8.00		$480,000
Direct materials....................	$2.75		$165,000	
Direct labor..........................	3.00		180,000	
Variable overhead	0.45		27,000	
Supervision ($30,000 ÷ 60,000 units)....	0.50		30,000	
Equipment rental ($60,000 ÷ 60,000 units)....	1.00		60,000	
Total	$7.70	$8.00	$462,000	$480,000
Difference in favor of making....	$0.30		$18,000	

The company should rent the new equipment and make the subassemblies if 60,000 units per year are needed.

Problem 13-23 (continued)

3. Other factors that the company should consider include:
   a. Will volume in future years be increasing, or will it remain constant at 40,000 units per year? (If volume increases, then renting the new equipment becomes more desirable, as shown in the computations above.)
   b. Can quality control be maintained if the subassemblies are purchased from the outside supplier?
   c. Does the company have some other profitable use for the space now being used to produce the subassemblies? Does production of the subassemblies require use of a constrained resource?
   d. Will the outside supplier be dependable in meeting shipping schedules?
   e. Can the company begin making the subassemblies again if the supplier proves to be undependable, or are there alternative suppliers?
   f. If the outside supplier's offer is accepted and the need for subassemblies increases in future years, will the supplier have the capacity to provide more than 40,000 subassemblies per year?
   g. Will the rental cost of the equipment change in the future?

Problem 13-24 (45 minutes)

1.

	Marcy	*Tina*	*Cari*	*Lenny*	*Sewing Kit*
Direct labor cost per unit ..	$ 4.80	$ 3.00	$ 8.40	$ 6.00	$ 2.40
Direct labor-hours per unit* (a)	0.40	0.25	0.70	0.50	0.20
Selling price	$35.00	$24.00	$22.00	$18.00	$14.00
Variable costs:					
Direct materials	3.50	2.30	4.50	3.10	1.50
Direct labor	4.80	3.00	8.40	6.00	2.40
Variable overhead	1.60	1.00	2.80	2.00	0.80
Total variable costs	9.90	6.30	15.70	11.10	4.70
Contribution margin (b)	$25.10	$17.70	$ 6.30	$ 6.90	$ 9.30
Contribution margin per DLH (b) ÷ (a)	$62.75	$70.80	$ 9.00	$13.80	$46.50

* Direct labor cost per unit ÷ $12.00 per direct labor-hour

2.

Product	*DLH Per Unit*	*Estimated Sales (units)*	*Total DLHs*
Marcy	0.40	26,000	10,400
Tina	0.25	42,000	10,500
Cari	0.70	40,000	28,000
Lenny	0.50	46,000	23,000
Sewing Kit	0.20	450,000	90,000
Total DLHs required.....			161,900

3. Since the Cari doll has the lowest contribution margin per labor hour, its production should be reduced by 17,000 dolls (11,900 excess DLHs ÷ 0.70 DLH per doll = 17,000 dolls). Thus, production and sales of the Cari doll will be reduced to 23,000 dolls for the year.

4. Since the additional capacity would be used to produce the Cari doll, the company should be willing to pay up to $21.00 per DLH ($12.00 usual labor rate plus $9.00 contribution margin per DLH) for added labor time. Thus, the company could employ workers for overtime at the usual time-and-a-half rate of $18.00 per hour ($12.00 × 1.5 = $18.00) and still improve overall profit.

5. Additional output could be obtained in a number of ways including working overtime, adding another shift, expanding the workforce, contracting out some work to outside suppliers, and eliminating wasted labor time in the production process. The first four methods are costly, but the last method can add capacity at very low cost.

   Technical note: Some would argue that direct labor is a fixed cost in this situation and should be excluded when computing the contribution margin per unit. However, when deciding which products to emphasize, no harm is done by misclassifying a fixed cost as a variable cost—providing that the fixed cost is the constraint. If direct labor were removed from the variable cost category, the net effect would be to bump up the contribution margin per direct labor-hour by $12.00 for each of the products. The products will be *ranked* exactly the same—in terms of the contribution margin per unit of the constrained resource—whether direct labor is considered variable or fixed. However, if labor is not fixed and is not the constraint, including labor cost in the calculation of the contribution margin may lead to incorrect rankings of the products.

Problem 13-25 (45 minutes)

1. A product should be processed further if the incremental revenue from the further processing exceeds the incremental costs. The incremental revenue from further processing of the honey is:

Selling price of a container of honey drop candies ...	\$4.40
Selling price of three-quarters of a pound of honey (\$3.00 × 3/4) ...	2.25
Incremental revenue per container ...	\$2.15

The incremental variable costs are:

Decorative container ...	\$0.40
Other ingredients ...	0.25
Direct labor ...	0.20
Variable manufacturing overhead ...	0.10
Commissions (5% × \$4.40) ...	0.22
Incremental variable cost per container ...	\$1.17

Therefore, the incremental contribution margin is \$0.98 per container (\$2.15 – \$1.17). The cost of purchasing the honeycombs is not relevant because those costs are incurred regardless of whether the honey is sold outright or processed further into candies.

2. The only avoidable fixed costs of the honey drop candies are the master candy maker's salary and the fixed portion of the salesperson's compensation. Therefore, the number of containers of the candy that must be sold each month to justify continued processing of the honey into candies is determined as follows:

Master candy maker's salary ...	\$3,880
Salesperson's fixed compensation ...	2,000
Avoidable fixed costs ...	\$5,880

$$\frac{\text{Avoidable fixed costs}}{\text{Incremental CM per container}} = \frac{\$5{,}880}{\$0.98 \text{ per container}} = 6{,}000 \text{ containers}$$

Problem 13-25 (continued)

If the company can sell more than 6,000 containers of the candies each month, then profits will be higher than if the honey were simply sold outright. If the company cannot sell at least 6,000 containers of the candies each month, then profits will be higher if the company discontinues making honey drop candies. To verify this, we show below the total contribution to profits of sales of 5,000, 6,000, and 7,000 containers of candies, contrasted to sales of equivalent amounts of honey. For example, instead of selling 4,500 pounds of honey, this same amount of honey can be processed into 6,000 containers of candy.

Sales of candies:			
Containers sold per month	5,000	6,000	7,000
Sales revenue @ $4.40 per container	$22,000	$26,400	$30,800
Less incremental variable costs @ $1.17 per container	5,850	7,020	8,190
Incremental contribution margin	16,150	19,380	22,610
Less avoidable fixed costs	5,880	5,880	5,880
Total contribution to profits	$10,270	$13,500	$16,730
Sales of equivalent amount of honey:			
Pounds sold per month*	3,750	4,500	5,250
Sales revenue @ $3.00 per pound	$11,250	$13,500	$15,750

* 5,000 containers × 3/4 pounds per container = 3,750 pounds
6,000 containers × 3/4 pounds per container = 4,500 pounds
7,000 containers × 3/4 pounds per container = 5,250 pounds

If there is a choice between selling 3,750 pounds of honey or selling 5,000 containers of candies, profits would be higher selling the honey outright ($11,250 versus $10,270). The company should be indifferent between selling 4,500 pounds of honey or 6,000 containers of candy. In either case, the contribution to profits would be $13,500. On the other hand, if faced with a choice of selling 5,250 pounds of honey or 7,000 containers of candies, profits would be higher processing the honey into candies ($16,730 versus $15,750).

Case 13-26 (90 minutes)

1. The lowest price Jenco could bid for the one-time special order of 25,000 pounds (25 lots) without losing money would be $34,750—the relevant cost of the order, as shown below.

   Direct materials:

CW-3: 400 pounds per lot × 25 lots = 10,000 pounds. Substitute CN-5 on a one-for-one basis to its total of 5,500 pounds. If CN-5 is not used in this order, it will be salvaged for $500. Therefore, the relevant cost is	$ 500
The remaining 4,500 pounds would be CW-3 at a cost of $0.90 per pound	4,050
JX-6: 300 pounds per lot × 25 lots = 7,500 pounds at $0.60 per pound	4,500
MZ-8: 200 pounds per lot × 25 lots = 5,000 pounds at $1.60 per pound	8,000
BE-7: 100 pounds per lot × 25 lots = 2,500 pounds at $0.55 per pound, the amount Jenco could realize by selling BE-7 [$0.65 market price – $0.10 handling charge]	1,375
Total direct materials cost	18,425

   Direct labor: 30 DLHs per lot × 25 lots = 750 DLHs. Because only 400 hours can be scheduled during regular time this month, overtime would have to be used for the remaining 350 hours.

400 DLHs × $14.00 per DLH	5,600
350 DLHs × $21.00 per DLH	7,350
Total direct labor cost	12,950

   Overhead: This special order will not increase fixed overhead costs. Therefore, only the variable overhead is relevant.

750 DLHs × $4.50 per DLH	3,375
Total relevant cost of the special order	$34,750

Case 13-26 (continued)

2. In this part, we calculate the price for recurring orders of 25,000 pounds (25 lots) using the company's rule of marking up its full manufacturing cost. This is probably not the best pricing policy to follow, but is a common practice in business.

   Direct materials: Because of the possibility that future orders would exhaust existing inventories of CN-5 and BE-7 and new supplies would have to be purchased, all raw materials should be charged at their expected future cost, which is the current market price.

CW-3: 10,000 pounds × $0.90 per pound	$ 9,000
JX-6: 7,500 pounds × $0.60 per pound	4,500
MZ-8: 5,000 pounds × $1.60 per pound	8,000
BE-7: 2,500 pounds × $0.65 per pound	1,625
Total direct materials cost	$23,125

   Direct labor: 60% (i.e., 450 DLHs) of the production of a batch can be done on regular time; but the remaining production (i.e., 300 DLHs) must be done on overtime.

Regular time 450 DLHs × $14.00 per DLH	$ 6,300
Overtime premium 300 DLHs × $21.00 per DLH	6,300
Total direct labor cost	$12,600

   Overhead: The full manufacturing cost includes both fixed and variable manufacturing overhead.

Manufacturing overhead applied:	
750 DLHs × $12.00 per DLH	$ 9,000
Full manufacturing cost	$44,725
Markup (40% × $44,725)	17,890
Selling price (full manufacturing cost plus markup)	$62,615

Case 13-27 (60 minutes)

1. The original cost of the facilities at Ashton is a sunk cost and should be ignored in any decision. The decision being considered here is whether to continue operations at Ashton. The only relevant costs are the future facility costs that would be affected by this decision. If the facility were shut down, the Ashton facility has no resale value. In addition, if the Ashton facility were sold, the company would have to rent additional space at the remaining processing centers. On the other hand, if the facility were to remain in operation, the building should last indefinitely, so the company does not have to be concerned about eventually replacing it. Essentially, there is no real cost at this point of using the Ashton facility despite what the financial performance report indicates. Indeed, it might be a better idea to consider shutting down the other facilities since the rent on those facilities might be avoided.

   The costs that are relevant in the decision to shut down the Ashton facility are:

Increase in rent at Pocatello and Idaho Falls	$400,000
Decrease in local administrative expenses	(60,000)
Net increase in costs..	$340,000

   In addition, there would be costs of moving the equipment from Ashton and there might be some loss of revenues due to disruption of services. In sum, closing down the Ashton facility will almost certainly lead to a decline in FSC's profits.

   Even though closing down the Ashton facility would result in a decline in overall company profits, it would result in an improved performance report for the Great Basin Region (ignoring the costs of moving equipment and potential loss of revenues from disruption of service to customers).

Case 13-27 (continued)

Financial Performance
After Shutting Down the Ashton Facility
Great Basin Region

	Total
Revenues	$20,000,000
Operating expenses:	
Direct labor	12,200,000
Variable overhead	400,000
Equipment depreciation	2,100,000
Facility expenses*	1,500,000
Local administrative expenses**	390,000
Regional administrative expenses	400,000
Corporate administrative expenses	1,600,000
Total operating expense	18,590,000
Net operating income	$ 1,410,000

* $2,000,000 – $900,000 + $400,000 = $1,500,000
** $450,000 – $60,000 = $390,000

2. If the Ashton facility is shut down, FSC's profits will decline, employees will lose their jobs, and customers will at least temporarily suffer some decline in service. Therefore, Braun is willing to sacrifice the interests of the company, its employees, and its customers just to make his performance report look better.

   While Braun is not a management accountant, the Standards of Ethical Conduct for Management Accountants still provide useful guidelines. By recommending closing the Ashton facility, Braun will have to violate the Credibility Standard, which requires the disclosure of all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, analyses, or recommendation. Presumably, if the corporate board were fully informed of the consequences of this action, they would disapprove.

   In sum, it is difficult to describe the recommendation to close the Ashton facility as ethical behavior. In Braun's defense, however, it is not fair to hold him responsible for the mistake made by his predecessor.

Case 13-27 (continued)

It should be noted that the performance report required by corporate headquarters is likely to lead to other problems such as the one illustrated here. The arbitrary allocations of corporate and regional administrative expenses to processing centers may make other processing centers appear to be unprofitable even though they are not. In this case, the problems created by these arbitrary allocations were compounded by using an irrelevant facilities expense figure on the performance report.

3. Prices should be set ignoring the depreciation on the Ashton facility. As argued in part (1) above, the real cost of using the Ashton facility at this point is zero. Any attempt to recover the sunk cost of the original cost of the building by charging higher prices than the market will bear will lead to less business and lower profits.

Case 13-28 (120 minutes)

1. The product margins computed by the accounting department for the drums and mountain bike frames should not be used in the decision of which product to make. The product margins are lower than they should be due to the presence of allocated fixed common costs that are irrelevant in this decision. Moreover, even after the irrelevant costs have been removed, what matters is the profitability of the two products in relation to the amount of the constrained resource—welding time—that they use. A product with a very low margin may be desirable if it uses very little of the constrained resource. In short, the financial data provided by the accounting department are pretty much useless for making this decision.

2. Students may have answered this question assuming that direct labor is a variable cost, even though the case strongly hints that direct labor is a fixed cost. The solution is shown here assuming that direct labor is fixed. The solution assuming that direct labor is variable will be shown in part (4).

Solution assuming direct labor is fixed

		Manufactured	
	Purchased XSX Drums	*XSX Drums*	*Mountain Bike Frames*
Selling price	$154.00	$154.00	$65.00
Variable costs:			
Direct materials	120.00	44.50	17.50
Variable manufacturing overhead	0.00	1.05	0.60
Variable selling and administrative	0.85	0.85	0.40
Total variable cost	120.85	46.40	18.50
Contribution margin	$ 33.15	$107.60	$46.50

Case 13-28 (continued)

3. Since the demand for the welding machine exceeds the 2,000 hours that are available, products that use the machine should be prioritized based on their contribution margin *per welding hour*. The computations are carried out below under the assumption that direct labor is a fixed cost and then under the assumption that it is a variable cost.

Solution assuming direct labor is fixed

	Manufactured	
	XSX Drums	*Mountain Bike Frames*
Contribution margin per unit (above) (a)	$107.60	$46.50
Welding hours per unit (b)	0.8 hour	0.2 hour
Contribution margin per welding hour (a) ÷ (b)	$134.50 per hour	$232.50 per hour

Case 13-28 (continued)

Since the contribution margin per unit of the constrained resource (i.e., welding time) is larger for the mountain bike frames than for the XSX drums, the frames make the most profitable use of the welding machine. Consequently, the company should manufacture as many mountain bike frames as possible up to demand and then use any leftover capacity to produce XSX drums. Buying the drums from the outside supplier can fill any remaining unsatisfied demand for XSX drums. The necessary calculations are carried out below.

Analysis assuming direct labor is a fixed cost

	(a) Quantity	*(b)* Unit Contri-bution Margin	*(c)* Welding Time per Unit	*(a) × (c)* Total Welding Time	Balance of Welding Time	*(a) × (b)* Total Contri-bution
Total hours available...................					2,000	
Mountain bike frames produced ..	3,500	$ 46.50	0.20	700	1,300	$162,750
XSX Drums—make	1,625	107.60	0.80	1,300	0	174,850
XSX Drums—buy	1,375	33.15				45,581
Total contribution margin						383,181
Less: Contribution margin from present operations: 2,500 drums × $107.60 CM per drum.						269,000
Increased contribution margin and net operating income						$114,181

Case 13-28 (continued)

4. The computation of the contribution margins and the analysis of the best product mix are repeated here under the assumption that direct labor costs are variable.

Solution assuming direct labor is a variable cost

		Manufactured	
	Purchased XSX Drums	*XSX Drums*	*Mountain Bike Frames*
Selling price	$154.00	$154.00	$65.00
Variable costs:			
Direct materials	120.00	44.50	17.50
Direct labor	0.00	4.50	22.50
Variable manufacturing overhead	0.00	1.05	0.60
Variable selling and administrative	0.85	0.85	0.40
Total variable cost	120.85	50.90	41.00
Contribution margin	$ 33.15	$103.10	$24.00

Solution assuming direct labor is a variable cost

	Manufactured	
	XSX Drums	*Mountain Bike Frames*
Contribution margin per unit (above) (a)	$103.10	$24.00
Welding hours per unit (b)	0.8 hour	0.2 hour
Contribution margin per welding hour (a) ÷ (b)	$128.88 per hour	$120.00 per hour

When direct labor is assumed to be a variable cost, the conclusion is reversed from the case in which direct labor is assumed to be a fixed cost—the XSX drums appear to be a better use of the constraint than the mountain bike frames. The assumption about the behavior of direct labor really does matter.

Case 13-28 (continued)

Solution assuming direct labor is a variable cost

	(a) Quantity	*(b)* Unit Contri-bution Margin	*(c)* Welding Time per Unit	*(a) × (c)* Total Welding Time	Balance of Welding Time	*(a) × (b)* Total Contri-bution
Total hours available					2,000	
XSX Drums—make	2,500	$103.10	0.80	2,000	0	$257,750
Mountain bike frames produced	0	24.00	0.20	0	0	0
XSX Drums—buy	500	33.15				16,575
Total contribution margin						274,325
Less: Contribution margin from present operations: 2,500 drums × $103.10 CM per drum						257,750
Increased contribution margin and net operating income						$ 16,575

Case 13-28 (continued)

5. The case strongly suggests that direct labor is fixed: "The mountain bike frames could be produced with existing equipment and personnel." Nevertheless, it would be a good idea to examine how much labor time is really needed under the two opposing plans.

	Production	*Direct Labor-Hours Per Unit*	*Total Direct Labor-Hours*
Plan 1:			
Mountain bike frames ..	3,500	1.25*	4,375
XSX drums	1,625	0.25**	406
			4,781
Plan 2:			
XSX drums	2,500	0.25**	625

* $22.50 ÷ $18.00 per hour = 1.25 hours
** $4.50 ÷ $18.00 per hour = 0.25 hour

Some caution is advised. Plan 1 assumes that direct labor is a fixed cost. However, this plan requires over 4,000 more direct labor-hours than Plan 2 and the present situation. A full-time employee works about 1,900 hours a year, so the added workload is about equivalent to two full-time employees. Does the plant really have that much idle time at present? If so, and if shifting workers over to making mountain bike frames would not jeopardize operations elsewhere, then Plan 1 is indeed the better plan. However, if taking on the mountain bike frame as a new product would lead to pressure to hire two more workers, more analysis is in order. It is still best to view direct labor as a fixed cost, but taking on the frames as a new product would lead to a jump in fixed costs of about $68,400 (1,900 hours × $18 per hour × 2). This must be covered by the additional contribution margin or the plan should be rejected. See the additional analysis on the next page.

Case 13-28 (continued)

Contribution margin from Plan 1:	
Mountain bike frames produced (3,500 × $46.50)	$162,750
XSX Drums—make (1,625 × $107.60)	174,850
XSX Drums—buy (1,375 × $33.15)	45,581
Total contribution margin	383,181
Less: Additional fixed labor costs	68,400
Net effect of Plan 1 on net operating income	$314,781
Contribution margin from Plan 2:	
XSX Drums—make (2,500 × $107.60)	$269,000
XSX Drums—buy (500 × $33.15)	16,575
Net effect of Plan 2 on net operating income	$285,575
Net advantage of Plan 1	$ 29,206

Plan 1, introducing the new product, would still be optimal even if two more direct labor employees would have to be hired. The reason for this is subtle. If the company does not make the XSX drums itself, it can still buy them. Thus, using an hour of welding time to make the mountain bike frames does not mean giving up a contribution margin of $128.88 on drums (assuming direct labor is a variable cost). The opportunity cost of using the welding machine to produce mountain bike frames is less than this since a purchased drum can replace a manufactured drum. An amended analysis using the opportunity cost concept appears on the next page.

Amended solution assuming direct labor is fixed

	Manufactured	
	XSX Drums	*Mountain Bike Frames*
Contribution margin per unit (above) (a)	$74.45*	$46.50
Welding hours per unit (b)	0.8 hour	0.2 hour
Contribution margin per welding hour (a) ÷ (b) ..	$93.06 per hour	$232.50 per hour

Amended solution assuming direct labor is a variable cost

	Manufactured	
	XSX Drums	*Mountain Bike Frames*
Contribution margin per unit (above) (a)	$69.95*	$24.00
Welding hours per unit (b)	0.8 hour	0.2 hour
Contribution margin per welding hour (a) ÷ (b) ..	$87.44 per hour	$120.00 per hour

* Net of the $33.15 contribution margin of a purchased drum. If the company does not make a drum, it can purchase one, so the lost contribution from making bike frames rather than drums is less than it otherwise would be.

With this amended approach, assuming direct labor is variable points to the same solution as when direct labor is assumed to be fixed—place the highest priority on making mountain bike frames. This won't always happen.

Case 13-29 (45 minutes)

1. Yes, milling of flour should be discontinued if the price remains at $625, but not for the reason given by the sales manager. The reason it should be discontinued is that the *added* contribution margin that can be obtained from milling a ton of cracked wheat into flour is *less* than the contribution margin that can be obtained from using the milling capacity to produce another ton of cracked wheat and selling it as cereal. The analysis is:

Selling price per ton of cracked wheat	$490
Less variable expenses ($390 materials and $20 labor)...........	410
Contribution margin per ton of cracked wheat........................	$ 80
Added revenue from further milling of cracked wheat into flour ($625 – $490)..	$135
Less costs of further milling ($80 materials and $20 labor)*....	100
Contribution margin per ton of flour	$ 35

* The overhead costs are not relevant, since they are fixed and will remain the same whether the milling capacity is used to produce cracked wheat or flour.

Therefore, the company makes more money using its milling capacity to produce cracked wheat than flour.

2. Since the demand for the two products is unlimited and both require the same amount of milling time, the company should process the cracked wheat into flour only if the contribution margin for flour is at least as large as the contribution margin for cracked wheat. In algebraic form:

Added revenue from milling cracked wheat into flour	-	Costs of further processing	3	Contribution margin of cracked wheat

(Selling price of flour - $490) - $100 3 $80

Selling price of flour 3 $80 + $490 + $100 = $670

Therefore, the selling price of flour should be at least $670; otherwise, the mill should be used to produce cracked wheat.

Case 13-30 (60 minutes)

1. Continuing to obtain covers from its own Greenville Cover Plant would allow Mobile Seating Corporation to maintain its current level of control over the quality of the covers and the timing of their delivery. Keeping the Greenville Cover Plant open also allows Mobile Seating Corporation more flexibility than purchasing the coverings from outside suppliers. Mobile Seating Corporation could more easily alter the coverings' design and change the quantities produced, especially if long-term contracts are required with outside suppliers. Mobile Seating Corporation should also consider the economic impact that closing Greenville Cover will have on the community and how this might affect Mobile Seating Corporation's other operations in the region.

2. a. The following costs can be avoided by closing the plant, and therefore are relevant to the decision:

Materials		$8,000,000
Labor:		
Direct	$6,700,000	
Supervision	400,000	
Indirect plant	1,900,000	9,000,000
Differential pension expense ($1,600,000 – $700,000)		900,000
Total annual relevant costs		$17,900,000

   b. The following costs can't be avoided by closing the plant, and therefore are not relevant to the decision:

Depreciation—equipment	$1,300,000
Depreciation—building	2,100,000
Continuing pension cost	700,000
Plant manager and staff	600,000
Corporate allocation	1,700,000
Total annual continuing costs	$6,400,000

Case 13-30 (continued)

Depreciation is not relevant to the decision because it is a sunk cost. Moreover, whether the plant is closed or continues to operate, all of the remaining book value of the equipment and buildings will eventually be written off. A total of $700,000 of the annual pension expense is not relevant because it would continue whether or not the plant is closed. The amount for plant manager and staff is not relevant because Restin and her staff would continue with Mobile Seating Corporation and administer the three remaining plants. The corporate allocation is not relevant because it represents allocated fixed costs incurred outside the Greenville Cover Plant that presumably would not change if the plant were closed.

c. The following nonrecurring costs would arise in the year that the plant is closed, but would not be incurred in any other year:

Termination charges on canceled material orders ($8,000,000 × 25%)	$2,000,000
Employment assistance	800,000
Total nonrecurring costs	$2,800,000

These two costs are relevant to the decision because they will be incurred only if the plant is closed. The $2,000,000 salvage value of the equipment and buildings offsets these costs.

3. No, the plant should not be closed. The computations are:

	First Year	*Other Years*
Cost of purchasing the covers outside	$(21,000,000)	$(21,000,000)
Annual costs avoided by closing the plant (Part 2a)	17,900,000	17,900,000
Cost of closing the plant (first year non-recurring costs)	(2,800,000)	
Salvage value of buildings and equipment	2,000,000	
Net advantage (disadvantage) of closing the plant	$ (3,900,000)	$ (3,100,000)

Case 13-30 (continued)

4. Factors that should be considered by Mobile Seating Corporation before making a decision include:
   a. Alternative uses of the building and equipment.
   b. Any tax implications.
   c. The outside supplier's prices in future years.
   d. The cost to manufacture coverings at the Greenville Cover Plant in future years.
   e. The value of the time Restin and her staff would have spent managing the Greenville Cover Plant.
   f. The morale of Mobile Seating Corporation employees at other plants.

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-Chapter 14
Capital Budgeting Decisions

Solutions to Questions

14-1 Capital budgeting screening decisions concern whether a proposed investment project passes a preset hurdle, such as a 15% rate of return. Capital budgeting preference decisions are concerned with choosing from among two or more alternative investment projects, each of which has passed the hurdle.

14-2 The "time value of money" refers to the fact that a dollar received today is more valuable than a dollar received in the future. A dollar received today can be invested to yield more than a dollar in the future.

14-3 Discounting is the process of computing the present value of a future cash flow. Discounting gives recognition to the time value of money and makes it possible to meaningfully add together cash flows that occur at different times.

14-4 Accounting net income is based on accruals rather than on cash flows. Both the net present value and internal rate of return methods focus on cash flows.

14-5 Discounted cash flow methods are superior to other methods of making capital budgeting decisions because they recognize the time value of money and take into account all future cash flows.

14-6 Net present value is the present value of cash inflows less the present value of the cash outflows. The net present value can be negative if the present value of the outflows is greater than the present value of the inflows.

14-7 One simplifying assumption is that all cash flows occur at the end of a period. Another is that all cash flows generated by an investment project are immediately reinvested at a rate of return equal to the discount rate.

14-8 No. The cost of capital is not simply the interest paid on long-term debt. The cost of capital is a weighted average of the individual costs of all sources of financing, both debt and equity.

14-9 The internal rate of return is the rate of return on an investment project over its life. It is computed by finding that discount rate that results in a zero net present value for the project.

14-10 The cost of capital is a hurdle that must be cleared before an investment project will be accepted. In the case of the net present value method, the cost of capital is used as the discount rate. If the net present value of the project is positive, then the project is acceptable, since its rate of return will be greater than the cost of capital. In the case of the internal rate of return method, the cost of capital is compared to a project's internal rate of return. If the project's internal rate of return is greater than the cost of capital, then the project is acceptable.

14-11 No. As the discount rate increases, the present value of a given future cash flow decreases. For example, the present value factor for a discount rate of 12% for cash to be received ten years from now is 0.322, whereas the present value factor for a discount rate of 14% over the same period is 0.270. If the cash to be received in ten years is $10,000, the present value in the first case is $3,220, but only $2,700 in the second case. Thus, as the discount rate increases, the present value of a given future cash flow decreases.

14-12 The internal rate of return is more than 14% since the net present value is positive. The internal rate of return would be 14% only if the net present value (evaluated using a 14% discount rate) is zero. The internal rate of return would be less than 14% if the net present value (evaluated using a 14% discount rate) is negative.

14-13 The project profitability index is computed by dividing the net present value of the cash flows from an investment project by the investment required. The index measures the profit (in terms of net present value) provided by each dollar of investment in a project. The higher the project profitability index, the more desirable is the investment project.

14-14 The payback period is the length of time for an investment to fully recover its own initial cost out of the cash receipts that it generates.

The payback method acts as a screening tool in weeding out investment proposals. The payback method is useful when a company has cash flow problems. The payback method is also used in industries where obsolescence is very rapid.

14-15 Neither the payback method nor the simple rate of return method considers the time value of money. Under both methods, a dollar received in the future is weighed the same as a dollar received today. Furthermore, the payback method ignores all cash flows that occur after the initial investment has been recovered.

14-16 A tax deductible cash outflow results in some tax savings. The after-tax cost of such an outflow is net of this tax savings. In capital budgeting decisions, all tax-deductible cash expenses should be included on an after-tax cost basis because the after-tax amount represents the actual *net* cash outflow.

14-17 The depreciation tax shield refers to the tax deductibility of depreciation, which is not a cash outflow. In capital budgeting, the depreciation tax shield triggers a cash inflow (tax reduction) equal to the depreciation deduction multiplied by the tax rate.

14-18 An increase in the tax rate would tend to make the new investment less attractive, since net after-tax cash inflows would be reduced.

14-19 One cash inflow would be the proceeds from the sale of the piece of equipment. The other cash inflow would be the income tax reduction that results from the loss on the equipment.

14-20 The purchase of the equipment should be shown as a cash outflow of $40,000. The initial cost of an asset is not immediately deductible for tax purposes. Rather, the cost is deducted in later periods in the form of depreciation.

Exercise 14-1 (10 minutes)

1.

Item	*Year(s)*	*Cash Flow*	*12% Factor*	*Present Value of Cash Flows*
Annual cost savings..	1-10	$4,000	5.650	$ 22,600
Initial investment	Now	$(25,000)	1.000	(25,000)
Net present value.....				$ (2,400)

2.

Item	*Cash Flow*	*Years*	*Total Cash Flows*
Annual cost savings..	$4,000	10	$ 40,000
Initial investment	$(25,000)	1	(25,000)
Net cash flow...........			$ 15,000

Exercise 14-2 (30 minutes)

1.

Annual savings over present method of delivery........	\$5,400
Added contribution margin from expanded deliveries	
(1,800 pizzas × \$2 per pizza)	3,600
Annual cash inflows..	\$9,000

2.

$$\text{Factor of the internal rate of return} = \frac{\text{Investment required}}{\text{Annual cash inflow}}$$

$$= \frac{\$45,000}{\$9,000} = 5.000$$

Looking in Exhibit 14B-2, and scanning along the six-year line, we can see that the factor computed above, 5.000, is closest to 5.076, the factor for the 5% rate of return. Therefore, to the nearest whole percent, the internal rate of return is 5%.

3. The cash flows are not even over the six-year life of the truck because of the extra \$13,000 cash inflow that occurs in the sixth year. Therefore, the approach used above cannot be used to compute the internal rate of return. Using trial-and-error or some other method, the internal rate of return turns out to be about 11%:

	Year(s)	*Amount of Cash Flows*	*11% Factor*	*Present Value of Cash Flows*
Initial investment	Now	\$(45,000)	1.000	\$(45,000)
Annual cash inflows..	1-6	\$9,000	4.231	38,079
Salvage value...........	6	\$13,000	0.535	6,955
Net present value.....				\$ 34

As expected, the extra cash inflow in the sixth year increases the internal rate of return.

Exercise 14-3 (15 minutes)

The equipment's net present value without considering the intangible benefits would be:

Item	*Year(s)*	*Amount of Cash Flows*	*15% Factor*	*Present Value of Cash Flows*
Cost of the equipment ..	Now	$(750,000)	1.000	$(750,000)
Annual cash savings	1-10	$100,000	5.019	501,900
Net present value				$(248,100)

The annual value of the intangible benefits would have to be large enough to offset the $248,100 negative present value for the equipment. This annual value can be computed as follows:

$$\frac{\text{Required increase in present value}}{\text{Factor for 10 years}} = \frac{\$248{,}100}{5.019} = \$49{,}432$$

Exercise 14-4 (10 minutes)

1. The project profitability index for each proposal is:

Proposal	*Net Present Value (a)*	*Investment Required (b)*	*Project Profitability Index (a) ÷ (b)*
A	$34,000	$85,000	0.40
B	$50,000	$200,000	0.25
C	$45,000	$90,000	0.50
D	$51,000	$170,000	0.30

2. The ranking would be:

Proposal	*Project Profitability Index*
C	0.50
A	0.40
D	0.30
B	0.25

Note that proposals D and B have the highest net present values of the four proposals, but they rank at the bottom of the list in terms of the project profitability index.

Exercise 14-5 (10 minutes)

1. The payback period is determined as follows:

Year	*Investment*	*Cash Inflow*	*Unrecovered Investment*
1	$38,000	$2,000	$36,000
2	$6,000	$4,000	$38,000
3		$8,000	$30,000
4		$9,000	$21,000
5		$12,000	$9,000
6		$10,000	$0
7		$8,000	$0
8		$6,000	$0
9		$5,000	$0
10		$5,000	$0

   The investment in the project is fully recovered in the 6th year. To be more exact, the payback period is approximately 6.9 years.

2. Since the investment is recovered prior to the last year, the amount of the cash inflow in the last year has no effect on the payback period.

Exercise 14-6 (10 minutes)

The annual incremental net operating income is determined by comparing the operating cost of the old machine to the operating cost of the new machine and the depreciation that would be taken on the new machine:

Operating cost of old machine	$33,000
Less operating cost of new machine	10,000
Less annual depreciation on the new machine ($80,000 ÷ 10 years)	8,000
Annual incremental net operating income	$15,000
Cost of the new machine	$80,000
Less scrap value of old machine	5,000
Initial investment	$75,000

$$\text{Simple rate of return} = \frac{\text{Annual incremental net operating income}}{\text{Initial investment}}$$

$$= \frac{\$15,000}{\$75,000} = 20\%$$

Exercise 14-7 (15 minutes)

1. a. \$400,000 × 0.794 (Exhibit 14B-1) = \$317,600.
   b. \$400,000 × 0.712 (Exhibit 14B-1) = \$284,800.

2. a. \$5,000 × 4.355 (Exhibit 14B-2) = \$21,775.
   b. \$5,000 × 3.685 (Exhibit 14B-2) = \$18,425.

3. Looking in Exhibit 14B-2, the factor for 10% for 20 years is 8.514. Thus, the present value of Sally's winnings would be:

   \$50,000 × 8.514 = \$425,700.

   Whether or not Sally really won a million dollars depends on your point of view. She will receive a million dollars over the next 20 years; however, in terms of its value *right now* she won much less than a million dollars as shown by the present value computation above.

Exercise 14-8 (10 minutes)

a.

Management consulting fee.......	$100,000
Multiply by 1 – 0.30	× 0.70
After-tax cost..........................	$ 70,000

b.

Increased revenues..................	$40,000
Multiply by 1 – 0.30	× 0.70
After-tax cash flow (benefit)......	$28,000

c. The depreciation deduction is $210,000 ÷ 7 years = $30,000 per year, which has the effect of reducing taxes by 30% of that amount, or $9,000 per year.

Exercise 14-9 (10 minutes)

Item	*Year(s)*	*Amount of Cash Flows*	*16% Factor*	*Present Value of Cash Flows*
Project A:				
Investment required.	Now	$(15,000)	1.000	$(15,000)
Annual cash inflows..	1-10	$4,000	4.833	19,332
Net present value.....				$ 4,332
Project B:				
Investment..............	Now	$(15,000)	1.000	$(15,000)
Cash inflow..............	10	$60,000	0.227	13,620
Net present value.....				$ (1,380)

Project A should be selected. Project B does not provide the required 16% return, as shown by its negative net present value.

Exercise 14-10 (10 minutes)

	Year(s)	*Amount of Cash Flows*	*12% Factor*	*Present Value of Cash Flows*
Purchase of the stock....	Now	$(18,000)	1.000	$(18,000)
Annual dividends*.........	1-4	$720	3.037	2,187
Sale of the stock...........	4	$22,500	0.636	14,310
Net present value				$(1,503)

*900 shares × $0.80 per share per year = $720 per year.

No, Mr. Critchfield did not earn a 12% return on the stock. The negative net present value indicates that the rate of return on the investment is less than the discount rate of 12%.

Exercise 14-11 (30 minutes)

1. $$\text{Factor of the internal rate of return} = \frac{\text{Required investment}}{\text{Annual cash inflow}}$$

$$= \frac{\$136{,}700}{\$25{,}000} = 5.468$$

Looking in Exhibit 14B-2 and scanning along the 14-period line, a factor of 5.468 represents an internal rate of return of 16%.

2.

Item	*Year(s)*	*Amount of Cash Flows*	*16% Factor*	*Present Value of Cash Flows*
Initial investment	Now	$(136,700)	1.000	$(136,700)
Net annual cash inflows	1-14	$25,000	5.468	136,700
Net present value				$ 0

The reason for the zero net present value is that 16% (the discount rate) represents the machine's internal rate of return. The internal rate of return is the rate that causes the present value of a project's cash inflows to just equal the present value of the investment required.

3. $$\text{Factor of the internal rate of return} = \frac{\text{Required investment}}{\text{Annual cash inflow}}$$

$$= \frac{\$136{,}700}{\$20{,}000} = 6.835$$

Looking in Exhibit 14B-2 and scanning along the 14-period line, the 6.835 factor is closest to 6.982, the factor for the 11% rate of return. Thus, to the nearest whole percent, the internal rate of return is 11%.

Exercise 14-12 (10 minutes)

$$\text{Factor of the internal rate of return} = \frac{\text{Required investment}}{\text{Annual cash inflow}}$$

$$= \frac{\$307{,}100}{\$50{,}000} = 6.142$$

Looking in Exhibit 14B-2, and scanning *down* the 14% column, we find that a factor of 6.142 equals 15 years. Thus, the equipment will have to be used for 15 years to yield a return of 14%.

Exercise 14-13 (15 minutes)

1. The payback period would be:

$$\text{Payback Period} = \frac{\text{Investment required}}{\text{Net annual cash inflow}}$$

$$= \frac{\$180,000}{\$37,500 \text{ per year}} = 4.8 \text{ years}$$

No, the equipment would not be purchased, since the 4.8-year payback period exceeds the company's maximum 4-year payback period.

2. The simple rate of return would be computed as follows:

Annual cost savings	$37,500
Less annual depreciation ($180,000 ÷ 12 years)......	15,000
Annual incremental net operating income	$22,500

$$\text{Simple rate of return} = \frac{\text{Annual incremental net operating income}}{\text{Initial investment}}$$

$$= \frac{\$22,500}{\$180,000} = 12.5\%$$

The equipment would not be purchased since its 12.5% rate of return is less than the company's 14% required rate of return.

Exercise 14-14 (30 minutes)

1.

	Amount of Cash Flows		*20%*	*Present Value of Cash Flows*	
Year(s)	*X*	*Y*	*Factor*	*X*	*Y*
1	$1,000	$4,000	0.833	$ 833	$3,332
2	$2,000	$3,000	0.694	1,388	2,082
3	$3,000	$2,000	0.579	1,737	1,158
4	$4,000	$1,000	0.482	1,928	482
				$5,886	$7,054

2. a. From Exhibit 14B-1, the factor for 6% for 3 periods is 0.840. Therefore, the present value of the required investment is:

$$\$12,000 \times 0.840 = \$10,080.$$

b. From Exhibit 14B-1, the factor for 10% for 3 periods is 0.751. Therefore, the present value of the required investment is:

$$\$12,000 \times 0.751 = \$9,012.$$

3.

Option	*Year(s)*	*Amount of Cash Flows*	*10% Factor*	*Present Value of Cash Flows*
A	Now	$500,000	1.000	$500,000
B	1-8	$60,000	5.335	$320,100
	8	$200,000	0.467	93,400
				$413,500

Mark should accept option A. On the surface, option B appears to be a better choice since it promises a total cash inflow of $680,000 ($60,000 × 8 = $480,000; $480,000 + $200,000 = $680,000), whereas option A promises a cash inflow of only $500,000. However, the cash inflows under option B are spread out over eight years, whereas the cash flow under option A is received immediately. Since the $500,000 under option A can be invested at 10%, it would actually accumulate to more than $680,000 at the end of eight years. Consequently, the present value of option A is higher than the present value of option B.

Exercise 14-14 (continued)

4. You should prefer option a:

   Option a: \$50,000 × 1.000 = \$50,000.
   Option b: \$75,000 × 0.507 = \$38,025. (From Exhibit 14B-1)
   Option c: \$12,000 × 4.111 = \$49,332. (From Exhibit 14B-2)

Exercise 14-15 (20 minutes)

Items and Computations	*Year(s)*	*(1) Amount*	*(2) Tax Effect*	*(1) × (2) After-Tax Cash Flows*	*10% Factor*	*Present Value of Cash Flows*
Project A:						
Investment in photocopier	Now	$(50,000)	—	$(50,000)	1.000	$(50,000)
Net annual cash inflows	1-8	$9,000	1 – 0.30	$6,300	5.335	33,611
Depreciation deductions*	1-8	$6,250	0.30	$1,875	5.335	10,003
Salvage value of the photocopier	8	$5,000	1 – 0.30	$3,500	0.467	1,635
Net present value						$(4,751)
Project B:						
Investment in working capital	Now	$(50,000)	—	$(50,000)	1.000	$(50,000)
Net annual cash inflows	1-8	$9,000	1 – 0.30	$6,300	5.335	33,611
Release of working capital	8	$50,000	—	$50,000	0.467	23,350
Net present value						$ 6,961

* $50,000 ÷ 8 years = $6,250 per year

Exercise 14-16 (10 minutes)

1. Note: All present value factors have been taken from Exhibit 14B-1 in Appendix 14B, using a 16% discount rate.

Investment in the equipment		$134,650
Less present value of Year 1 and Year 2 cash inflows:		
Year 1: $45,000 × 0.862	$38,790	
Year 2: $60,000 × 0.743....................	44,580	83,370
Present value of Year 3 cash inflow		$ 51,280

Therefore, the expected cash inflow for Year 3 is:

$51,280 ÷ 0.641 = $80,000.

Exercise 14-17 (30 minutes)

1.

Item	*Year(s)*	*Amount of Cash Flows*	*15% Factor*	*Present Value of Cash Flows*
Initial investment	Now	$(40,350)	1.000	$(40,350)
Annual cash inflows..	1-4	$15,000	2.855	42,825
Net present value.....				$ 2,475

Yes, this is an acceptable investment. Its net present value is positive, which indicates that its rate of return exceeds the minimum 15% rate of return required by the company.

2.

$$\text{Factor of the internal rate of return} = \frac{\text{Investment required}}{\text{Net annual cash inflow}}$$

$$= \frac{\$111{,}500}{\$20{,}000} = 5.575$$

Looking in Exhibit 14B-2, and reading along the 15-year line, we find that a factor of 5.575 represents an internal rate of return of 16%.

3.

$$\text{Factor of the internal rate of return} = \frac{\text{Investment required}}{\text{Net annual cash inflow}}$$

$$= \frac{\$14{,}125}{\$2{,}500} = 5.650$$

Looking in Exhibit 14B-2, and reading along the 10-year line, a factor of 5.650 represents an internal rate of return of 12%. The company did not make a wise investment because the return promised by the machine is less than the required rate of return.

Exercise 14-18 (15 minutes)

Item	*Year(s)*	*Amount of Cash Flows*	*20% Factor*	*Present Value of Cash Flows*
Project A:				
Cost of the equipment	Now	$(300,000)	1.000	$(300,000)
Annual cash inflows	1-7	$80,000	3.605	288,400
Salvage value of the equipment	7	$20,000	0.279	5,580
Net present value				$ (6,020)
Project B:				
Working capital investment	Now	$(300,000)	1.000	$(300,000)
Annual cash inflows	1-7	$60,000	3.605	216,300
Working capital released	7	$300,000	0.279	83,700
Net present value				$ 0

The $300,000 should be invested in Project B rather than in Project A. Project B has a zero net present value, which means that it promises exactly a 20% rate of return. Project A is not acceptable at all, since it has a negative net present value.

Exercise 14-19 (15 minutes)

1. Computation of the annual cash inflow associated with the new ride:

Net operating income	$63,000
Add: Noncash deduction for depreciation	27,000
Net annual cash inflow...............................	$90,000

   The payback computation would be:

$$\text{Payback period} = \frac{\text{Investment required}}{\text{Net annual cash inflow}}$$

$$= \frac{\$450{,}000}{\$90{,}000\text{ per year}} = 5\text{ years}$$

   Yes, the new ride meets the requirement. The payback period is less than the maximum 6 years required by the Park.

2. The simple rate of return would be:

$$\text{Simple rate of return} = \frac{\text{Annual incremental net operating income}}{\text{Initial investment}}$$

$$= \frac{\$63{,}000}{\$450{,}000} = 14\%$$

   Yes, the new ride satisfies the criterion. Its 14% return exceeds the Park's requirement of a 12% return.

Exercise 14-20 (20 minutes)

1. Annual cost of student help in collating $60,000

Annual cost of student help in collating		$60,000
Annual cost of the new collating machine:		
Operator	$18,000	
Maintenance	7,000	25,000
Net annual cost savings (cash inflow)		$35,000

2. The net present value analysis follows:

Items and Computations	Year(s)	(1) Amount	(2) Tax Effect	(1) × (2) After-Tax Cash Flows	14% Factor	Present Value of Cash Flows
Cost of the new collating machine	Now	$(140,000)		$(140,000)	1.000	$(140,000)
Net annual cost savings (above)	1-10	$35,000	1 – 0.30	$24,500	5.216	127,792
Depreciation deductions*	1-10	$14,000	0.30	$4,200	5.216	21,907
Cost of the new roller pads..............	5	$(20,000)	1 – 0.30	$(14,000)	0.519	(7,266)
Salvage value of the new machine	10	$40,000	1 – 0.30	$28,000	0.270	7,560
Net present value						$ 9,993

* $140,000 ÷ 10 years = $14,000 per year

Yes, the new collating machine should be purchased.

Problem 14-21 (30 minutes)

1. The net annual cost savings is computed as follows:

Reduction in labor costs	$240,000
Reduction in material costs	96,000
Total cost reductions	336,000
Less increased maintenance costs ($4,250 × 12)	51,000
Net annual cost savings	$285,000

2. Using this cost savings figure, and other data provided in the text, the net present value analysis is:

	Year(s)	*Amount of Cash Flows*	*18% Factor*	*Present Value of Cash Flows*
Cost of the machine	Now	$(900,000)	1.000	$ (900,000)
Installation and software	Now	$(650,000)	1.000	(650,000)
Salvage of the old machine	Now	$70,000	1.000	70,000
Annual cost savings	1-10	$285,000	4.494	1,280,790
Overhaul required	6	$(90,000)	0.370	(33,300)
Salvage of the new machine	10	$210,000	0.191	40,110
Net present value				$ (192,400)

No, the etching machine should not be purchased. It has a negative net present value at an 18% discount rate.

3. The intangible benefits would have to be worth at least $42,813 per year as shown below:

$$\frac{\text{Required increase in net present value}}{\text{Factor for 10 years}} = \frac{\$192{,}400}{4.494} = \$42{,}813$$

Thus, the new etching machine should be purchased if management believes that the intangible benefits are worth at least $42,813 per year to the company.

Problem 14-22 (15 minutes)

Item	*Year(s)*	*Amount of Cash Flows*	*14% Factor*	*Present Value of Cash Flows*
Cost of equipment required	Now	$(850,000)	1.000	$(850,000)
Working capital required	Now	$(100,000)	1.000	(100,000)
Net annual cash receipts	1-5	$230,000	3.433	789,590
Cost of road repairs	3	$(60,000)	0.675	(40,500)
Salvage value of equipment......	5	$200,000	0.519	103,800
Working capital released	5	$100,000	0.519	51,900
Net present value				$ (45,210)

No, the project should not be accepted; it has a negative net present value. This means that the rate of return on the investment is less than the company's required rate of return of 14%.

Problem 14-23 (30 minutes)

1. The income statement would be:

Sales revenue (72,000 loaves × $1.25 per loaf) ...		$90,000
Less cost of ingredients ($90,000 × 40%)		36,000
Contribution margin..		54,000
Less operating expenses:		
Utilities	$ 9,000	
Salaries..	18,000	
Insurance..	3,000	
Depreciation*	7,200	
Total operating expenses		37,200
Net operating income		$16,800

* $120,000 × 90% = $108,000
$108,000 ÷ 15 years = $7,200 per year.

2. The formula for the simple rate of return is:

$$\text{Simple rate of return} = \frac{\text{Annual incremental net operating income}}{\text{Initial investment}}$$

$$= \frac{\$16{,}800}{\$120{,}000} = 14\%$$

Yes, the oven and equipment would be purchased since their return exceeds Mr. Lugano's 12% requirement.

3. The formula for the payback period is:

$$\text{Payback period} = \frac{\text{Initial investment}}{\text{Net annual cash inflow}}$$

$$= \frac{\$120{,}000}{\$24{,}000\text{ per year*}} = 5\text{ years}$$

*$16,800 net operating income + $7,200 depreciation = $24,000.

Yes, the oven and equipment would be purchased. The payback period is less than the 6-year period Mr. Lugano requires.

Problem 14-24 (20 minutes)

Items and Computations	*Year(s)*	*(1) Amount*	*(2) Tax Effect*	*(1) × (2) After-Tax Cash Flows*	*12% Factor*	*Present Value of Cash Flows*
Investment in new trucks	Now	$(450,000)		$(450,000)	1.000	$(450,000)
Salvage from sale of the old trucks ...	Now	$30,000	1 – 0.30	$21,000	1.000	21,000
Net annual cash receipts	1-8	$108,000	1 – 0.30	$75,600	4.968	375,581
Depreciation deductions*	1-8	$56,250	0.30	$16,875	4.968	83,835
Overhaul of motors	5	$(45,000)	1 – 0.30	$(31,500)	0.567	(17,861)
Salvage from the new trucks	8	$20,000	1 – 0.30	$14,000	0.404	5,656
Net present value						$ 18,211

* $450,000 ÷ 8 years = $56,250 per year

Since the project has a positive net present value, the contract should be accepted.

Problem 14-25 (20 minutes)

1. The annual cash inflows would be:

Reduction in annual operating costs:	
Operating costs, present hand method	$35,000
Operating costs, new machine	14,000
Annual savings in operating costs	21,000
Increased annual contribution margin:	
5,000 packages × $0.60 per package	3,000
Total annual cash inflows	$24,000

2.

Item	*Year(s)*	*Amount of Cash Flows*	*16% Factor*	*Present Value of Cash Flows*
Cost of the machine ...	Now	$(90,000)	1.000	$(90,000)
Overhaul required	5	$(7,500)	0.476	(3,570)
Annual cash inflows....	1-8	$24,000	4.344	104,256
Salvage value............	8	$6,000	0.305	1,830
Net present value				$ 12,516

Problem 14-26 (20 minutes)

1. The formula for the project profitability index is:

$$\text{Project profitability index} = \frac{\text{Net present value}}{\text{Investment required}}$$

   The index for the projects under consideration would be:

   Project 1: $87,270 ÷ $480,000 = 0.18
   Project 2: $73,400 ÷ $360,000 = 0.20
   Project 3: $66,140 ÷ $270,000 = 0.24
   Project 4: $72,970 ÷ $450,000 = 0.16

2. a., b., and c.

	Net Present Value	*Project Profitability Index*	*Internal Rate of Return*
First preference........	1	3	4
Second preference....	2	2	3
Third preference.......	4	1	1
Fourth preference.....	3	4	2

3. Which ranking is best will depend on the company's opportunities for reinvesting funds as they are released from a project. The internal rate of return method assumes that any released funds are reinvested at the internal rate of return. This means that funds released from project #4 would have to be reinvested at a rate of return of 19%, but another project yielding such a high rate of return might be difficult to find.

   The project profitability index approach assumes that funds released from a project are reinvested at a rate of return equal to the discount rate, which in this case is only 10%. On balance, the project profitability index is generally regarded as the most dependable method of ranking competing projects.

   The net present value is inferior to the project profitability index as a ranking device because it does not properly consider the amount of investment. For example, it ranks project #3 as fourth because of its low net present value; yet this project is the best in terms of the amount of cash inflow generated for each dollar of investment (as shown by the project profitability index).

Problem 14-27 (30 minutes)

1. Average weekly use of the washers and dryers would be:

$$\text{Washers: } \frac{\$1{,}800}{\$1.50 \text{ per use}} = 1{,}200 \text{ uses}$$

$$\text{Dryers: } \frac{\$1{,}125}{\$0.75 \text{ per use}} = 1{,}500 \text{ uses}$$

The expected net annual cash receipts would be:

Washer cash receipts ($1,800 × 52)....		$ 93,600
Dryer cash receipts ($1,125 × 52).......		58,500
Total cash receipts.............................		152,100
Less cash disbursements:		
Washer: Water and electricity ($0.075 × 1,200 × 52)..................	$ 4,680	
Dryer: Gas and electricity ($0.09 × 1,500 × 52)....................	7,020	
Rent ($3,000 × 12)..........................	36,000	
Cleaning ($1,500 × 12)....................	18,000	
Maintenance and other ($1,875 × 12)...	22,500	88,200
Net annual cash receipts....................		$ 63,900

2.

Item	Year(s)	Amount of Cash Flows	12% Factor	Present Value of Cash Flows
Cost of equipment...........	Now	$(194,000)	1.000	$(194,000)
Working capital invested..	Now	$(6,000)	1.000	(6,000)
Net annual cash receipts..	1-6	$63,900	4.111	262,693
Salvage of equipment......	6	$19,400	0.507	9,836
Working capital released..	6	$6,000	0.507	3,042
Net present value............				$ 75,571

Yes, Mr. White should invest in the laundromat. The positive net present value indicates that the rate of return on this investment would exceed the 12% required rate of return.

Problem 14-28 (45 minutes)

1.

Labor savings	€190,000	
Ground mulch savings	10,000	€200,000
Less out-of-pocket costs:		
Operator	70,000	
Insurance	1,000	
Fuel	9,000	
Maintenance contract	12,000	92,000
Annual savings in cash operating costs		€108,000

2. The first step is to determine the annual incremental net operating income:

Annual savings in cash operating costs	€108,000
Less annual depreciation (€480,000 ÷ 12 years)	40,000
Annual incremental net operating income	€ 68,000

$$\text{Simple rate of return} = \frac{\text{Annual incremental net operating income}}{\text{Initial investment}}$$

$$= \frac{€68,000}{€480,000} = 14.2\% \text{ (rounded)}$$

3. The formula for the payback period is:

$$\text{Payback period} = \frac{\text{Investment required}}{\text{Net annual cash inflow}}$$

$$= \frac{€480,000}{108,000^{*}} = 4.4 \text{ years (rounded)}$$

* In this case, the cash inflow is measured by the annual savings in cash operating costs.

The harvester meets Mr. Despinoy's payback criterion since its payback period is less than 5 years.

Problem 14-28 (continued)

4. The formula for the internal rate of return is:

$$\text{Factor of the internal rate of return} = \frac{\text{Investment required}}{\text{Net annual cash inflow}}$$

$$= \frac{€480{,}000}{€108{,}000} = 4.4 \text{ (rounded)}$$

Looking at Exhibit 14B-2 in Appendix 14B, and reading along the 12-period line, a factor of 4.4 would represent an internal rate of return of approximately 20%.

Note that the payback and internal rate of return methods would indicate that the investment should be made. The simple rate of return method indicates the opposite since the simple rate of return is less than 16%. The simple rate of return method generally is not an accurate guide in investment decisions.

Problem 14-29 (60 minutes)

1. Computation of the net annual cost savings:

Savings in labor costs ($16 per hour × 20,000 hours)	$320,000
Savings in inventory carrying costs	190,000
Total	510,000
Less increased power and maintenance cost ($2,500 per month × 12 months)	30,000
Net annual cost savings	$480,000

2.

	Year(s)	Amount of Cash Flows	20% Factor	Present Value of Cash Flows
Cost of the robot	Now	$(1,600,000)	1.000	$(1,600,000)
Software and installation	Now	$(700,000)	1.000	(700,000)
Cash released from inventory	1	$300,000	0.833	249,900
Net annual cost savings	1-12	$480,000	4.439	2,130,720
Salvage value	12	$90,000	0.112	10,080
Net present value				$ 90,700

Yes, the robot should be purchased. It has a positive net present value at a 20% discount rate.

3. Recomputation of the annual cost savings:

Savings in labor costs ($16 per hour × 17,500 hours)	$280,000
Savings in inventory carrying costs	190,000
Total	470,000
Less increased power and maintenance cost ($2,500 per month × 12 months)	30,000
Net annual cost savings	$440,000

Problem 14-29 (continued)

Recomputation of the net present value of the project:

	Year(s)	*Amount of Cash Flows*	*20% Factor*	*Present Value of Cash Flows*
Cost of the robot	Now	$(1,600,000)	1.000	$(1,600,000)
Software and installation	Now	$(825,000)	1.000	(825,000)
Cash released from inventory	1	$300,000	0.833	249,900
Net annual cost savings	1-12	$440,000	4.439	1,953,160
Salvage value	12	$90,000	0.112	10,080
Net present value				$ (211,860)

It appears that the company did not make a wise investment because the rate of return that will be earned by the robot is less than 20%. However, see part 4 below. This illustrates the difficulty in estimating data, and also shows what a heavy impact even seemingly small changes in the data can have on net present value. To mitigate these problems, some companies analyze several scenarios showing the "most likely" results, the "best case" results, and the "worst case" results. Probability analysis can also be used when probabilities can be attached to the various possible outcomes.

4. a. Several intangible benefits are usually associated with investments in automated equipment. These intangible benefits include:
   - Greater throughput.
   - Greater variety of products.
   - Higher quality.
   - Reduction in inventories.

   The president should understand that the value of these benefits can equal or exceed any savings that may come from reduced labor cost. However, these benefits are hard to quantify.

   b. $$\frac{\text{Additional present value required}}{\text{Factor for 12 years}} = \frac{\$211,860}{4.439} = \$47,727$$

   Thus, the intangible benefits in part (a) will have to be worth at least $47,727 per year in order for the robot to yield a 20% rate of return.

Problem 14-30 (90 minutes)

1.

$$\text{Factor of the internal rate of return} = \frac{\text{Required investment}}{\text{Annual cash inflow}}$$

$$= \frac{\$142{,}950}{\$37{,}500} = 3.812$$

From Exhibit 14B-2 in Appendix 14B, reading along the 7-period line, a factor of 3.812 equals an 18% rate of return.

Verification of the 18% rate of return:

Item	*Year(s)*	*Amount of Cash Flows*	*18% Factor*	*Present Value of Cash Flows*
Investment in equipment	Now	$(142,950)	1.000	$(142,950)
Annual cash inflows	1-7	$37,500	3.812	142,950
Net present value				$ 0

2.

$$\text{Factor of the internal rate of return} = \frac{\text{Required investment}}{\text{Annual cash inflow}}$$

We know that the investment is $142,950, and we can determine the factor for an internal rate of return of 14% by looking in Exhibit 14B-2 along the 7-period line. This factor is 4.288. Using these figures in the formula, we get:

$$\frac{\$142{,}950}{\text{Annual cash inflow}} = 4.288$$

Therefore, the annual cash inflow would have to be:

$142,950 ÷ 4.288 = $33,337.

Problem 14-30 (continued)

3. a. 5-year life for the equipment:
   The factor for the internal rate of return would still be 3.812 [as computed in (1) above]. From Exhibit 14B-2, reading this time along the 5-period line, a factor of 3.812 is closest to 3.791, the factor for 10%. Thus, to the nearest whole percent, the internal rate of return is 10%.

   b. 9-year life for the equipment:
   The factor of the internal rate of return would again be 3.812. From Exhibit 14B-2, reading along the 9-period line, a factor of 3.812 is closest to 3.786, the factor for 22%. Thus, to the nearest whole percent, the internal rate of return is 22%.

   The 10% return in part (a) is less than the 14% minimum return that Dr. Black wants to earn on the project. Of equal or even greater importance, the following diagram should be pointed out to Dr. Black:

5 years 10%	← 2 years shorter — A reduction of 8%	7 years 18%	2 years longer → — An increase of only 4%	9 years 22%

   As this illustration shows, a *decrease* in years has a much greater impact on the rate of return than an *increase* in years. This is because of the time value of money; added cash inflows far into the future do little to enhance the rate of return, but loss of cash inflows in the near term can do much to reduce it. Therefore, Dr. Black should be *very* concerned about any potential decrease in the life of the equipment, while at the same time realizing that any increase in the life of the equipment will do little to enhance her rate of return.

Problem 14-30 (continued)

4. a. The expected annual cash inflow would be:

$\$37{,}500 \times 120\% = \$45{,}000$

$$\frac{\$142{,}950}{\$45{,}000} = 3.177$$

From Exhibit 14B-2 in Appendix 14B, reading along the 7-period line, a factor of 3.177 is closest to 3.161, the factor for 25%, and is between that factor and the factor for 24%. Thus, to the nearest whole percent, the internal rate of return is 25%.

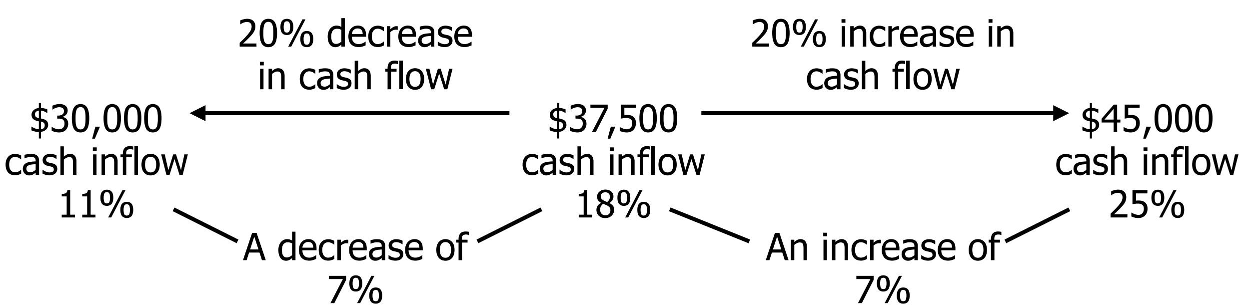
b. The expected annual cash inflow would be:

$\$37{,}500 \times 80\% = \$30{,}000$

$$\frac{\$142{,}950}{\$30{,}000} = 4.765$$

From Exhibit 14B-2 in Appendix 14B, reading along the 7-period line, a factor of 4.765 is closest to 4.712, the factor for 11%. Thus, to the nearest whole percent, the internal rate of return is 11%.

Unlike changes in time, increases and decreases in cash flows at a given point in time have basically the same impact on the rate of return, as shown below:



Problem 14-30 (continued)

5. Since the cash flows are not even over the five-year period (there is an extra $61,375 cash inflow from sale of the equipment at the end of the fifth year), some other method must be used to compute the internal rate of return. Using trial-and-error or more sophisticated methods, it turns out that the actual internal rate of return will be 12%:

Item	*Year(s)*	*Amount of Cash Flows*	*12% Factor*	*Present Value of Cash Flows*
Investment in the equipment .	Now	$(142,950)	1.000	$(142,950)
Annual cash inflow	1-5	$30,000	3.605	108,150
Sale of the equipment	5	$61,375	0.567	34,800
Net present value				$ 0

Problem 14-31 (30 minutes)

1. The present value of cash flows would be:

Item	*Year(s)*	*Amount of Cash Flows*	*18% Factor*	*Present Value of Cash Flows*
Purchase alternative:				
Purchase cost of the plane	Now	$(850,000)	1.000	$(850,000)
Annual cost of servicing, etc..	1-5	$(9,000)	3.127	(28,143)
Repairs:				
First three years.................	1-3	$(3,000)	2.174	(6,522)
Fourth year........................	4	$(5,000)	0.516	(2,580)
Fifth year...........................	5	$(10,000)	0.437	(4,370)
Resale value of the plane	5	$425,000	0.437	185,725
Present value of cash flows ...				$(705,890)
Lease alternative:				
Damage deposit	Now	$ (50,000)	1.000	$ (50,000)
Annual lease payments	1-5	$(200,000)	3.127	(625,400)
Refund of deposit	5	$50,000	0.437	21,850
Present value of cash flows ...				$(653,550)
Net present value in favor of leasing the plane				$ 52,340

2. The company should accept the leasing alternative. Even though the total cash flows for leasing exceed the total cash flows for purchasing, the leasing alternative is attractive because of the company's high required rate of return. One of the principal reasons for the attractiveness of the leasing alternative is the low present value of the resale value of the plane at the end of its useful life. If the required rate of return were lower, this present value would be higher and the purchasing alternative would become more attractive relative to the leasing alternative. Leasing is often attractive because those who offer leasing financing, such as pension funds and insurance companies, have a lower required rate of return than those who lease.

Problem 14-32 (30 minutes)

1. The income statement would be:

Sales revenue		¥200,000
Less commissions (40% × ¥200,000)		80,000
Contribution margin.........................		120,000
Less fixed expenses:		
Maintenance................................	¥50,000	
Insurance....................................	10,000	
Depreciation*	36,000	
Total fixed expenses		96,000
Net operating income		¥ 24,000

*¥180,000 ÷ 5 years = ¥36,000 per year

2. The initial investment in the simple rate of return calculations is net of the salvage value of the old equipment as shown below:

$$\text{Simple rate of return} = \frac{\text{Annual incremental net operating income}}{\text{Initial investment}}$$

$$= \frac{¥24{,}000}{¥180{,}000\text{-}¥30{,}000} = \frac{¥24{,}000}{¥150{,}000} = 16\%$$

Yes, the games would be purchased. The return exceeds the 14% threshold set by the company.

3. The payback period would be:

$$\text{Payback period} = \frac{\text{Invesment required}}{\text{Net annual cash inflow}}$$

$$= \frac{¥180{,}000\text{-}¥30{,}000}{¥60{,}000^*} = \frac{¥150{,}000}{¥60{,}000} = 2.5 \text{ years}$$

*Net annual cash inflow = Net operating income + Depreciation = ¥24,000 + ¥36,000 = ¥60,000.

Yes, the games would be purchased. The payback period is less than the 3 years.

Problem 14-33 (30 minutes)

1. The formula for the project profitability index is:

$$\text{Project profitability index} = \frac{\text{Net present value}}{\text{Investment required}}$$

   The project profitability index for each project is:

   Project A: $221,615 ÷ $800,000 = 0.28
   Project B: $210,000 ÷ $675,000 = 0.31
   Project C: $175,175 ÷ $500,000 = 0.35
   Project D: $152,544 ÷ $700,000 = 0.22

2. a., b., and c.

	Net Present Value	*Project Profitability Index*	*Internal Rate of Return*
First preference	A	C	D
Second preference......	B	B	C
Third preference.........	C	A	A
Fourth preference.......	D	D	B

3. Which ranking is best depends on Yancey Company's opportunities for reinvesting funds as they are released from a project. The internal rate of return method assumes that released funds are reinvested at the internal rate of return. For example, funds released from project D would have to be reinvested in another project yielding a rate of return of 22%. It might be difficult to find another project yielding such a high rate of return.

   The project profitability index assumes that funds released from a project are reinvested at a rate of return that is equal to the discount rate, which in this case is only 10%. On balance, the project profitability index is generally regarded as being the most dependable method of ranking competing projects.

   The net present value is inferior to the project profitability index as a ranking device because it does not consider the amount of investment required.

Problem 14-34 (60 minutes)

1. The net cash inflow from sales of the detectors for each year would be:

	Year			
	1	*2*	*3*	*4-12*
Sales in units	4,000	7,000	10,000	12,000
Sales in dollars (@ $45 each)	$ 180,000	$ 315,000	$450,000	$540,000
Less variable expenses (@ $25 each)	100,000	175,000	250,000	300,000
Contribution margin.........	80,000	140,000	200,000	240,000
Less fixed expenses:				
Advertising	70,000	70,000	50,000	40,000
Other fixed expenses* ..	120,000	120,000	120,000	120,000
Total fixed expenses........	190,000	190,000	170,000	160,000
Net cash inflow (outflow).	$(110,000)	$ (50,000)	$ 30,000	$ 80,000

* Depreciation is not a cash outflow and therefore must be eliminated when determining the net cash flow. The analysis is:

Cost of the equipment............	$100,000
Less salvage value (10%).......	10,000
Net depreciable cost..............	$ 90,000

$ 90,000 ÷ 12 years = $7,500 per year depreciation
$127,500 – $7,500 depreciation = $120,000 cash fixed expenses

Problem 14-34 (continued)

2. The net present value of the proposed investment would be:

Item	*Year(s)*	*Amount of Cash Flows*	*20% Factor*	*Present Value of Cash Flows*
Investment in equipment ...	Now	$(100,000)	1.000	$(100,000)
Working capital investment	Now	$(40,000)	1.000	(40,000)
Yearly cash flows	1	$(110,000)	0.833	(91,630)
" " "	2	$(50,000)	0.694	(34,700)
" " "	3	$30,000	0.579	17,370
" " "	4-12	$80,000	2.333 *	186,640
Salvage value of equipment	12	$10,000	0.112	1,120
Release of working capital .	12	$40,000	0.112	4,480
Net present value				$ (56,720)

* Present value factor for 12 periods	4.439
Present value factor for 3 periods	2.106
Present value factor for 9 periods, starting 4 periods in the future	2.333

Since the net present value is negative, the company should not accept the smoke detector as a new product.

Problem 14-35 (45 minutes)

Items and Computations	*Year(s)*	*(1) Amount*	*(2) Tax Effect*	*(1) × (2) After-Tax Cash Flows*	*8% Factor*	*Present Value of Cash Flows*
Alternative 1:						
Investment in the bonds..........	Now	$(200,000)		$(200,000)	1.000	$(200,000)
Interest on the bonds (8% × $200,000)	1-24*	$8,000 *		$8,000	15.247 **	121,976
Maturity of the bonds	24	$200,000		$200,000	0.390 **	78,000
Net present value....................						$(24)***

* 24 six-month interest periods; $8,000 received each interest period.

** Factor for 4% for 24 periods.

*** This amount should be zero; the difference is due to rounding of the discount factors. (Since the bonds yield 8% after taxes, they would have a zero net present value at an 8% discount rate.)

Problem 14-35 (continued)

Items and Computations	*Year(s)*	*(1) Amount*	*(2) Tax Effect*	*(1) × (2) After-Tax Cash Flows*	*8% Factor*	*Present Value of Cash Flows*
Alternative 2:						
Investment in the business	Now	$(200,000)	—	$(200,000)	1.000	$(200,000)
Net annual cash receipts						
($400,000 – $370,000 = $30,000)..	1-12	$30,000	1 – 0.40	$18,000	7.536	135,648
Depreciation deductions:						
Year 1: 14.3% of $80,000	1	$11,440	0.40	$4,576	0.926	4,237
Year 2: 24.5% of $80,000	2	$19,600	0.40	$7,840	0.857	6,719
Year 3: 17.5% of $80,000	3	$14,000	0.40	$5,600	0.794	4,446
Year 4: 12.5% of $80,000	4	$10,000	0.40	$4,000	0.735	2,940
Year 5: 8.9% of $80,000	5	$7,120	0.40	$2,848	0.681	1,939
Year 6: 8.9% of $80,000	6	$7,120	0.40	$2,848	0.630	1,794
Year 7: 8.9% of $80,000	7	$7,120	0.40	$2,848	0.583	1,660
Year 8: 4.5% of $80,000	8	$3,600	0.40	$1,440	0.540	778
Recovery of working capital						
($200,000 – $80,000 = $120,000)..	12	$120,000	—	$120,000	0.397	47,640
Net present value						$ 7,801

The net present value of Alternative 2 is higher than the net present value of Alternative 1. That certainly gives the edge to Alternative 2. However, the additional net present value is so small that it may be outweighed by the higher risk of Alternative 2 and the potential hassles of owning a store.

Problem 14-36 (30 minutes)

1. The total-cost approach:

	Year(s)	Amount of Cash Flows	16% Factor	Present Value of Cash Flows
Purchase the new generator:				
Cost of the new generator	Now	$(20,000)	1.000	$(20,000)
Salvage of the old generator....	Now	$4,000	1.000	4,000
Annual cash operating costs	1-8	$(7,500)	4.344	(32,580)
Salvage of the new generator ..	8	$6,000	0.305	1,830
Present value of the net cash outflows				$(46,750)
Keep the old generator:				
Overhaul needed now	Now	$(8,000)	1.000	$ (8,000)
Annual cash operating costs	1-8	$(12,500)	4.344	(54,300)
Salvage of the old generator.....	8	$3,000	0.305	915
Present value of the net cash outflows				$(61,385)
Net present value in favor of purchasing the new generator ..				$ 14,635

The hospital should purchase the new generator, since it has the lowest present value of total cost.

Problem 14-36 (continued)

2. The incremental-cost approach:

	Year(s)	*Amount of Cash Flows*	*16% Factor*	*Present Value of Cash Flows*
Incremental investment—new generator*	Now	$(12,000)	1.000	$(12,000)
Salvage of the old generator	Now	$4,000	1.000	4,000
Savings in annual cash operating costs	1-8	$5,000	4.344	21,720
Difference in salvage value in 8 years	8	$3,000	0.305	915
Net present value in favor of purchasing the new generator				$ 14,635

*$20,000 – $8,000 = $12,000.

Problem 14-37 (30 minutes)

1. The net present value analysis would be:

Items and Computations	*Year(s)*	*(1) Amount*	*(2) Tax Effect*	*(1) × (2) After-Tax Cash Flows*	*10% Factor*	*Present Value of Cash Flows*
Investment in equipment	Now	$(600,000)		$(600,000)	1.000	$(600,000)
Working capital needed	Now	$(85,000)		$(85,000)	1.000	(85,000)
Net annual cash receipts	1-10	$110,000	1 – 0.30	$77,000	6.145	473,165
Depreciation deductions	1-10	$60,000	0.30	$18,000	6.145	110,610
Cost of restoring land	10	$(70,000)	1 – 0.30	$(49,000)	0.386	(18,914)
Salvage value of the equipment* ...	10	$90,000	1 – 0.30	$63,000	0.386	24,318
Working capital released	10	$85,000		$85,000	0.386	32,810
Net present value						$(63,011)

*$600,000 × 15% = $90,000.

2. No, the investment project should not be undertaken. It has a negative net present value.

Case 14-38 (45 minutes)

1. As a member of the division budget committee that is conducting the postaudit review, Amy Kimbell will be implicitly lending her credibility to any report that is forwarded to the board of directors. If she were to implicitly accept the review by failing to call attention to its shortcomings, she would be violating the credibility standard of the Code of Conduct adopted by the Institute of Management Accountants, which states "Communicate information fairly and objectively. Disclose fully all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, comments, and recommendations presented." The intent of the current postaudit review is clearly to justify the earlier decision to invest in the high-tech operation, rather than to present a fair and balanced view. Unfavorable information has been suppressed.

   Amy is in a delicate situation if the other members of the budget committee are unwilling to heed her concerns. On the one hand, she cannot let the flawed postaudit review go to the board of directors. On the other hand, she needs to maintain good working relations with the other members of the budget committee. And her actions on this committee will likely become known throughout the company and influence her relations with just about everyone she comes into contact with. We suggest that, as diplomatically as she can, she should firmly state that she feels the postaudit review is an important document, but the current version is deeply flawed, and that she respects the opinions of the other members of the committee, but will feel obligated to file a minority report if the current version is sent to the board of directors. Quite often, the threat of such a report is enough to bring the other members of the committee to their senses. If it does not have this effect, then she should file the minority report.

Case 14-38 (continued)

2. Unfortunately, the situation that Amy faces is all too common. Rather than acknowledge mistakes and cut losses, managers (and people in general) too often remain committed to their failing courses of action. This commitment leads people into self-delusion, self-justification, and cover-ups—all of which sap time and energy as well as perpetuating the results of bad decisions. Postaudits, if conducted properly, provide an escape route from this self-defeating behavior.

   The review process is flawed from the very beginning if the postaudit review is prepared by the same people who approved the original proposal. The people who approved the original proposal are probably going to be interested in justifying their original decision rather than in conducting an objective review. Therefore, the postaudit review should be conducted by an independent group—perhaps the company's internal audit office—rather than by the division budget committees.

Case 14-39 (45 minutes)

1. Some students will have difficulty organizing the data into a coherent format. Perhaps the clearest approach is as follows:

Item	*Year(s)*	*Amount of Cash Flows*	*12% Factor*	*Present Value of Cash Flows*
Purchase of facilities:				
Initial payment	Now	$(6,000,000)	1.000	$ (6,000,000)
Annual payments	1-4	$(2,000,000)	3.037	(6,074,000)
Annual cash operating costs	1-20	$(200,000)	7.469	(1,493,800)
Resale value of facilities	20	$5,000,000	0.104	520,000
Present value of cash flows				$(13,047,800)
Lease of facilities:				
Initial deposit	Now	$(400,000)	1.000	$ (400,000)
First lease payment....	Now	$(1,000,000)	1.000	(1,000,000)
Remaining lease payments	1-19	$(1,000,000)	7.366	(7,366,000)
Annual repair and maintenance	1-20	$(50,000)	7.469	(373,450)
Return of deposit	20	$400,000	0.104	41,600
Present value of cash flows				$ (9,097,850)
Net present value in favor of leasing the facilities.....................				$ 3,949,950

This is a least-cost decision. In this particular case, the simplest way to handle the data is the total-cost approach as shown above. The problem with Harry Wilson's approach, in which he simply added up the payments, is that it ignores the time value of money. The purchase option ties up large amounts of funds that could be earning a return elsewhere.

Case 14-39 (continued)

The incremental-cost approach is another way to organize the data, although it is harder to follow and would not be as clear in a presentation to the executive committee. The data could be arranged as follows (students are likely to have many variations):

Lease rather than buy:

Item	*Year(s)*	*Amount of Cash Flows*	*12% Factor*	*Present Value of Cash Flows*
Initial payment avoided[1] ..	Now	$5,000,000	1.000	$5,000,000
Deposit..........................	Now	$(400,000)	1.000	(400,000)
Annual purchase payments avoided.........	1-4	$2,000,000	3.037	6,074,000
Annual lease payments....	1-19	$(1,000,000)	7.366	(7,366,000)
Cash operating cost savings[2]	1-20	$150,000	7.469	1,120,350
Forgone resale value of facilities, net of the return of deposit[3]..........	20	$(4,600,000)	0.104	(478,400)
Net present value in favor of leasing the facilities...				$3,949,950

[1] $6,000,000 – $1,000,000 = $5,000,000
[2] $200,000 – $50,000 = $150,000
[3] $5,000,000 – $400,000 = $4,600,000

2. The present value of $5 million in 20 years is only $520,000 if the company can invest its funds at 12%. Money to be received far into the future is worth very little in terms of present value when the discount rate is high. The facility's future value would have to be more than $37,980,000 (= $3,949,950 ÷ 0.104) higher than Harry Wilson has assumed to overturn the conclusion that leasing is the more attractive alternative.

Case 14-40 (60 minutes)

1. This is a least-cost problem; it can be worked either by the total-cost approach or by the incremental-cost approach. Regardless of which approach is used, we must first compute the annual production costs that would result from each of the machines. The computations are:

	Year			
	1	*2*	*3*	*4-10*
Units produced	20,000	30,000	40,000	45,000
Model 2600: Total cost at $0.90 per unit	$18,000	$27,000	$36,000	$40,500
Model 5200: Total cost at $0.70 per unit	$14,000	$21,000	$28,000	$31,500

Using these data, the solution by the total-cost approach would be:

Item	*Year(s)*	*Amount of Cash Flows*	*18% Factor*	*Present Value of Cash Flows*
Alternative 1: Purchase the model 2600 machine:				
Cost of new machine	Now	$(180,000)	1.000	$(180,000)
Cost of new machine	6	$(200,000)	0.370	(74,000)
Market value of replacement machine	10	$100,000	0.191	19,100
Production costs (above)	1	$(18,000)	0.847	(15,246)
" "	2	$(27,000)	0.718	(19,386)
" "	3	$(36,000)	0.609	(21,924)
" "	4-10	$(40,500)	2.320 *	(93,960)
Repairs and maintenance	1-10	$(6,000)	4.494	(26,964)
Present value of cash outflows				$(412,380)

Case 14-40 (continued)

Item	*Year(s)*	*Amount of Cash Flows*	*18% Factor*	*Present Value of Cash Flows*
Alternative 2: Purchase the model 5200 machine:				
Cost of new machine	Now	$(250,000)	1.000	$(250,000)
Production costs (above)	1	$(14,000)	0.847	(11,858)
" "	2	$(21,000)	0.718	(15,078)
" "	3	$(28,000)	0.609	(17,052)
" "	4-10	$(31,500)	2.320 *	(73,080)
Repairs and maintenance	1-10	$(4,600)	4.494	(20,672)
Present value of cash outflows				$(387,740)
Net present value in favor of Alternative 2				$ 24,640

* Present value factor for 10 periods	4.494
Present value factor for 3 periods	2.174
Present value factor for 7 periods starting 4 periods in the future	2.320

Case 14-40 (continued)

The solution by the incremental-cost approach would be:

Item	*Year(s)*	*Amount of Cash Flows*	*18% Factor*	*Present Value of Cash Flows*
Incremental cost of the model 5200 machine...........	Now	$(70,000)	1.000	$(70,000)
Cost avoided on a replacement model 2600 machine............................	6	$200,000	0.370	74,000
Salvage value forgone on the replacement machine..........	10	$(100,000)	0.191	(19,100)
Savings in production costs....	1	$4,000	0.847	3,388
" " "	2	$6,000	0.718	4,308
" " "	3	$8,000	0.609	4,872
" " "	4-10	$9,000	2.320	20,880
Savings on repairs, etc.	1-10	$1,400	4.494	6,292
Net present value.................				$ 24,640

Thus, the company should purchase the model 5200 machine and keep the presently owned model 2600 machine on standby.

2. An increase in materials cost would make the model 5200 machine less desirable. The reason is that it uses more material per unit than does the model 2600 machine, as evidenced by the greater material cost per unit.

3. An increase in labor cost would make the model 5200 machine more desirable. The reason is that it uses less labor time per unit than does the model 2600 machine, as evidenced by the lower labor cost per unit.

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Chapter 15
"How Well Am I Doing?" Statement of Cash Flows

Solutions to Questions

15-1 The statement of cash flows highlights the major activities that have provided and used cash during a period and shows their effects on the overall cash balance.

15-2 Cash equivalents are short-term, highly liquid investments such as Treasury bills, commercial paper, and money market funds. They are included with cash because investments of this type are made solely for the purpose of generating a return on temporarily idle funds and they can be easily converted to cash.

15-3 (1) Operating activities: Transactions that affect current assets, current liabilities, or net income.

(2) Investing activities: Transactions that involve the acquisition or disposition of noncurrent assets.

(3) Financing activities: Transactions (other than the payment of interest) involving borrowing from creditors, and any transactions (involving the owners of a company.

15-4 Interest is included as an operating activity since it is part of net income. Financing activities are narrowly defined to include only the principal amount borrowed or repaid.

15-5 Since the entire proceeds from a sale of an asset (including any gain) appear as a cash inflow from investing activities, the gain must be deducted from net income to avoid double counting.

15-6 Transactions involving accounts payable are not considered to be financing activities because such transactions relate to a company's day-to-day operating activities rather than to its financing activities.

15-7 The repayment of $300,000 and the borrowing of $500,000 must both be shown "gross" on the statement of cash flows. That is, the company would show $500,000 of cash provided by financing activities and then show $300,000 of cash used by financing activities.

15-8 The direct method reconstructs the income statement on a cash basis by restating revenues and expenses in terms of cash inflows and outflows. The indirect method starts with net income and adjusts it to a cash basis to determine the cash provided by operating activities.

15-9 Depreciation is not really a source of cash, even though it is listed as a "source" on the statement of cash flows. Adding back depreciation charges to net income to compute the amount of cash provided by operating activities creates the *illusion* that depreciation is a source of cash. It isn't. Charges to the accumulated depreciation account are added back to net income since they are equivalent to a decrease in an asset account. [See Exhibit 15-2.]

15-10 An increase in the Accounts Receivable account must be deducted from net income under the indirect method because this is an increase in a noncash asset.

15-11 A decrease in the Accounts Payable account must be added to cost of goods sold under the direct method. The cost of goods sold is increased by the amount of the decrease in accounts payable. Because the cost of goods sold is increased, the net cash flow provided by operating activities is decreased. Note that this is how a change in a liability should be handled according to Exhibit 15-2. The effect of a decrease in a liability is a decrease in cash.

15-12 A sale of equipment for cash would be classified as an investing activity. Any transaction involving the acquisition or disposition of noncurrent assets is classified as an investing activity.

15-13

Cost of goods sold	$250,000	Cost of goods sold adjusted to a cash basis...............................	$245,000
Decrease in inventory	–15,000		
Decrease in accounts payable	+10,000		

Exercise 15-1 (15 minutes)

Transaction	Operating	Investing	Financing	Source	Use
a. Short-term investment securities were purchased .	X				X
b. Equipment was purchased..................................		X			X
c. Accounts payable increased................................	X			X	
d. Deferred taxes decreased..................................	X				X
e. Long-term bonds were issued............................			X	X	
f. Common stock was sold....................................			X	X	
g. A cash dividend was declared and paid			X		X
h. Interest was paid to long-term creditors..............	X				X
i. A long-term mortgage was entirely paid off..........			X		X
j. Inventories decreased......................................	X			X	
k. The company recorded net income of $1 million for the year..	X			X	
l. Depreciation charges totaled $200,000 for the year	X			X	
m. Accounts receivable increased	X				X

Exercise 15-2 (15 minutes)

Net income		$84,000
Adjustments to convert net income to a cash basis:		
Depreciation charges for the year	$50,000	
Increase in accounts receivable	(60,000)	
Increase in inventory	(77,000)	
Decrease in prepaid expenses	2,000	
Increase in accounts payable	30,000	
Decrease in accrued liabilities	(4,000)	
Increase in deferred income taxes	6,000	(53,000)
Net cash provided by operating activities		$31,000

Exercise 15-3 (15 minutes)

Sales	$1,000,000	
Adjustments to a cash basis:		
Less increase in accounts receivable	− 60,000	$940,000
Cost of goods sold	580,000	
Adjustments to a cash basis:		
Plus increase in inventory	+ 77,000	
Less increase in accounts payable	− 30,000	627,000
Selling and administrative expenses	300,000	
Adjustments to a cash basis:		
Less decrease in prepaid expenses	− 2,000	
Plus decrease in accrued liabilities	+ 4,000	
Less depreciation charges	− 50,000	252,000
Income taxes	36,000	
Adjustments to a cash basis:		
Less increase in deferred income taxes	− 6,000	30,000
Net cash provided by operating activities		$ 31,000

Note that the $31,000 agrees with the cash provided by operating activities figure under the indirect method in the previous exercise.

Exercise 15-4 (30 minutes)

Holly Company
Statement of Cash Flows
For the Year Ended December 31, 2008

Operating activities:		
Net income		$20
Adjustments to convert net income to a cash basis:		
Depreciation charges for the year	$10	
Increase in accounts receivable	(7)	
Increase in inventory	(14)	
Increase in accounts payable	6	(5)
Net cash provided by operating activities		15
Investing activities:		
Additions to plant and equipment	(30)	
Net cash used for investing activities		(30)
Financing activities:		
Increase in common stock	20	
Cash dividends	(8)	
Net cash provided by financing activities		12
Net decrease in cash		(3)
Cash, January 1, 2008		7
Cash, December 31, 2008		$ 4

Exercise 15-4 (continued)

While not a requirement, a worksheet may be helpful.

	Change	*Source or Use?*	*Cash Flow Effect*	*Adjust-ments*	*Adjusted Effect*	*Classi-fication*
Assets (except cash and cash equivalents)						
Current assets:						
Accounts receivable	+7	Use	–7		–7	Operating
Inventory	+14	Use	–14		–14	Operating
Noncurrent assets:						
Plant and equipment	+30	Use	–30		–30	Investing
Liabilities, Contra assets, and Stockholders' Equity						
Contra assets:						
Accumulated depreciation	+10	Source	+10		+10	Operating
Current liabilities:						
Accounts payable	+6	Source	+6		+6	Operating
Stockholders' equity:						
Common stock	+20	Source	+20		+20	Financing
Retained earnings:						
Net income	+20	Source	+20		+20	Operating
Dividends	–8	Use	–8		–8	Financing
Additional entries						
None						
Total			–3		–3	

Exercise 15-5 (15 minutes)

Sales	$500	
Adjustments to a cash basis:		
Increase in accounts receivable	–7	$493
Cost of goods sold	300	
Adjustments to a cash basis:		
Increase in inventory	+14	
Increase in accounts payable	–6	308
Selling and administrative expenses	180	
Adjustments to a cash basis:		
Depreciation charges for the year	–10	170
Net cash provided by operating activities		$ 15

Exercise 15-6 (10 minutes)

Item	*Amount*	*Add*	*Deduct*
Accounts Receivable..................	$70,000 decrease	X	
Accrued Interest Receivable	$6,000 increase		X
Inventory	$110,000 increase		X
Prepaid Expenses......................	$3,000 decrease	X	
Accounts Payable.......................	$40,000 decrease		X
Accrued Liabilities	$9,000 increase	X	
Deferred Income Taxes Liability ..	$15,000 increase	X	
Sale of equipment......................	$8,000 gain		X
Sale of long-term investments	$12,000 loss	X	

Exercise 15-7 (30 minutes)

1.

Net income		$75
Adjustments to convert net income to a cash basis:		
Depreciation charges	$40	
Decrease in accounts receivable	10	
Increase in inventory	(30)	
Decrease in prepaid expenses	5	
Increase in accounts payable	20	
Decrease in accrued liabilities	(10)	
Increase in taxes payable	10	
Increase in deferred taxes	5	
Loss on sale of long-term investments	5	
Gain on sale of land	(40)	15
Net cash provided by operating activities		$90

2.

Herald Company
Statement of Cash Flows

Operating activities:		
Net cash provided by operating activities (see above)		$ 90
Investing activities:		
Proceeds from sale of long-term investments	$ 45	
Proceeds from sale of land	70	
Additions to long-term investments	(20)	
Additions to plant & equipment	(150)	
Net cash used for investing activities		(55)
Financing activities:		
Decrease in bonds payable	(20)	
Increase in common stock	40	
Cash dividends	(35)	
Net cash used by financing activities		(15)
Net increase in cash (net cash flow)		20
Cash balance, beginning		100
Cash balance, ending		$120

Exercise 15-7 (continued)

While not a requirement, a worksheet may be helpful.

	Change	*Source or Use?*	*Cash Flow Effect*	*Adjust-ments*	*Adjusted Effect*	*Classi-fication*
Assets (except cash and cash equivalents)						
Current assets:						
Accounts receivable	–10	Source	+10		+10	Operating
Inventory	+30	Use	–30		–30	Operating
Prepaid expenses	–5	Source	+5		+5	Operating
Noncurrent assets:						
Long-term investments	–30	Source	+30	–50	–20	Investing
Plant and equipment	+150	Use	–150		–150	Investing
Land	–30	Source	+30	–30	0	Investing
Liabilities, Contra assets, and Stockholders' Equity						
Contra assets:						
Accumulated depreciation	+40	Source	+40		+40	Operating
Current liabilities:						
Accounts payable	+20	Source	+20		+20	Operating
Accrued liabilities	–10	Use	–10		–10	Operating
Taxes payable	+10	Source	+10		+10	Operating

Exercise 15-7 (continued)

	Change	*Source or Use?*	*Cash Flow Effect*	*Adjust-ments*	*Adjusted Effect*	*Classi-fication*
Noncurrent liabilities:						
Bonds payable	–20	Use	–20		–20	Financing
Deferred income taxes	+5	Source	+5		+5	Operating
Stockholders' equity:						
Common stock	+40	Source	+40		+40	Financing
Retained earnings:						
Net income	+75	Source	+75		+75	Operating
Dividends	–35	Use	–35		–35	Financing
Additional entries						
Proceeds from sale of investments				+45	+45	Investing
Loss on sale of investments				+5	+5	Operating
Proceeds from sale of land				+70	+70	Investing
Gain on sale of land				–40	–40	Operating
Total			+20	0	+20	

Exercise 15-8 (15 minutes)

Sales	$600	
Adjustments to a cash basis:		
Decrease in accounts receivable	+10	$610
Cost of goods sold	250	
Adjustments to a cash basis:		
Increase in inventory	+30	
Increase in accounts payable	–20	260
Selling and administrative expenses	280	
Adjustments to a cash basis:		
Decrease in prepaid expenses	–5	
Decrease in accrued liabilities	+10	
Depreciation charges	–40	245
Income taxes	30	
Adjustments to a cash basis:		
Increase in taxes payable	–10	
Increase in deferred taxes	–5	15
Net cash provided by operating activities		$ 90

Problem 15-9 (20 minutes)

Transaction	*Operating*	*Investing*	*Financing*	*Source, Use, or Neither*	*Reported in Separate Schedule?*
a. Bonds were retired by paying the principal amount due			X	Use	
b. Equipment was purchased by giving a long-term note to the seller				Neither	Yes
c. Interest was paid on a note, decreasing Interest Payable	X			Use	
d. Accrued taxes were paid	X			Use	
e. A long-term loan was made to a supplier.		X		Use	
f. Interest was received on the long-term loan in (e) above, reducing Interest Receivable	X			Source	
g. Cash dividends were declared and paid			X	Use	
h. A building was acquired in exchange for shares of the company's common stock				Neither	Yes
i. Common stock was sold for cash to investors			X	Source	
j. Equipment was sold for cash		X		Source	
k. Equipment was sold in exchange for a long-term note				Neither	Yes
l. Convertible bonds were converted into common stock				Neither	Yes

Problem 15-10 (30 minutes)

1\. and 2. Eaton Company
Statement of Cash Flows
For the Year Ended December 31, 2008

Operating activities:		
Net income		$ 56
Adjustments to convert net income to cash basis:		
Depreciation charges	25	
Increase in accounts receivable	(80)	
Decrease in inventory	35	
Increase in prepaid expenses	(2)	
Increase in accounts payable	75	
Decrease in accrued liabilities	(10)	
Gain on sale of investments	(5)	
Loss on sale of equipment	2	
Increase in deferred income taxes	8	48
Net cash provided by operating activities		104
Investing activities:		
Proceeds from sale of long-term investments	12	
Proceeds from sale of equipment	18	
Additions to plant and equipment	(110)	
Net cash used for investing activities		(80)
Financing activities:		
Increase in bonds payable	25	
Decrease in common stock	(40)	
Cash dividends	(16)	
Net cash used for financing activities		(31)
Net decrease in cash		(7)
Cash balance, January 1, 2008		11
Cash balance, December 31, 2008		$ 4

Problem 15-10 (continued)

While not a requirement, a worksheet may be helpful.

	Change	*Source or Use?*	*Cash Flow Effect*	*Adjust-ments*	*Adjusted Effect*	*Classi-fication*
Assets (except cash and cash equivalents)						
Current assets:						
Accounts receivable..........	+80	Use	–80		–80	Operating
Inventory.........................	–35	Source	+35		+35	Operating
Prepaid expenses	+2	Use	–2		–2	Operating
Noncurrent assets:						
Plant and equipment	+80	Use	–80	–30	–110	Investing
Long-term investments......	–7	Source	+7	–7	0	Investing
Liabilities, Contra assets, and Stockholders' Equity						
Contra assets:						
Accumulated depreciation..	+15	Source	+15	+10	+25	Operating
Current liabilities:						
Accounts payable	+75	Source	+75		+75	Operating
Accrued liabilities	–10	Use	–10		–10	Operating

Problem 15-10 (continued)

	Change	*Source or Use?*	*Cash Flow Effect*	*Adjust-ments*	*Adjusted Effect*	*Classi-fication*
Noncurrent liabilities:						
Bonds payable	+25	Source	+25		+25	Financing
Deferred income taxes	+8	Source	+8		+8	Operating
Stockholders' equity:						
Common stock	–40	Use	–40		–40	Financing
Retained earnings:						
Net income	+56	Source	+56		+56	Operating
Dividends	–16	Use	–16		–16	Financing
Additional entries						
Proceeds from sale of equipment				+18	+18	Investing
Loss on sale of equipment				+2	+2	Operating
Proceeds from sale of long-term investments				+12	+12	Investing
Gain on sale of long-term investments				–5	–5	Operating
Total			–7	0	–7	

Problem 15-11 (30 minutes)

1. Sales	$750	
Adjustments to a cash basis:		
Increase in accounts receivable	–80	$670
Cost of goods sold	450	
Adjustments to a cash basis:		
Decrease in inventory	–35	
Increase in accounts payable	–75	340
Selling and administrative expenses	223	
Adjustments to a cash basis:		
Increase in prepaid expenses	+2	
Decrease in accrued liabilities	+10	
Depreciation charges	–25	210
Income taxes	24	
Adjustments to a cash basis:		
Increase in deferred income taxes	–8	16
Net cash provided by operating activities		$104

Problem 15-11 (continued)

2. Eaton Company
Statement of Cash Flows
For the Year ended December 31, 2008

Operating activities:		
Cash received from customers		$670
Less cash disbursements for:		
Cost of merchandise sold	$340	
Selling and administrative expenses	210	
Income taxes	16	
Total cash disbursements		566
Net cash provided by operating activities		104
Investing activities:		
Proceeds from sale of long-term investments	12	
Proceeds from sale of equipment	18	
Additions to plant and equipment	(110)	
Net cash used for investing activities		(80)
Financing activities:		
Increase in bonds payable	25	
Decrease in common stock	(40)	
Cash dividends	(16)	
Net cash used for financing activities		(31)
Net decrease in cash		(7)
Cash balance, January 1, 2008		11
Cash balance, December 31, 2008		$ 4

Problem 15-12 (45 minutes)

1. and 2.

Foxboro Company
Statement of Cash Flows
For Year 2

Operating activities:		
Net income		$ 63,000
Adjustments to convert net income to cash basis:		
Depreciation charges	$ 45,000	
Increase in accounts receivable	(70,000)	
Increase in inventory	(48,000)	
Decrease in prepaid expenses	9,000	
Increase in accounts payable	50,000	
Decrease in accrued liabilities	(8,000)	
Gain on sale of equipment	(6,000)	
Increase in deferred income taxes	4,000	(24,000)
Net cash provided by operating activities		39,000
Investing activities:		
Proceeds from sale of equipment	26,000	
Loan to Harker Company	(40,000)	
Additions to plant and equipment	(150,000)	
Net cash used for investing activities		(164,000)
Financing activities:		
Increase in bonds payable	90,000	
Increase in common stock	60,000	
Cash dividends	(33,000)	
Net cash provided by financing activities		117,000
Net decrease in cash		(8,000)
Cash balance, beginning of year		19,000
Cash balance, end of year		$ 11,000

Problem 15-12 (continued)

3. The relatively small amount of cash provided by operating activities during the year was largely the result of a large increase in accounts receivable. (The large increase in inventory was offset by a large increase in accounts payable.) Most of the cash that was provided by operating activities was paid out in dividends. The small amount that remained, combined with the cash provided by the issue of bonds and the issue of common stock, was insufficient to purchase a large amount of equipment and make a loan to another company. As a result, the cash on hand declined sharply during the year.

Problem 15-12 (continued)

While not a requirement, a worksheet may be helpful.

	Change	Source or Use?	Cash Flow Effect	Adjust-ments	Adjusted Effect	Classi-fication
Assets (except cash and cash equivalents)						
Current assets:						
Accounts receivable	+70	Use	–70		–70	Operating
Inventory	+48	Use	–48		–48	Operating
Prepaid expenses	–9	Source	+9		+9	Operating
Noncurrent assets:						
Loan to Harker Company ...	+40	Use	–40		–40	Investing
Plant and equipment	+120	Use	–120	–30	–150	Investing
Liabilities, Contra assets, and Stockholders' Equity						
Contra assets:						
Accumulated depreciation ..	+35	Source	+35	+10	+45	Operating
Current liabilities:						
Accounts payable	+50	Source	+50		+50	Operating
Accrued liabilities	–8	Use	–8		–8	Operating

Problem 15-12 (continued)

	Change	Source or Use?	Cash Flow Effect	Adjust-ments	Adjusted Effect	Classi-fication
Noncurrent liabilities:						
Bonds payable	+90	Source	+90		+90	Financing
Deferred income taxes.......	+4	Source	+4		+4	Operating
Stockholders' equity:						
Common stock	+60	Source	+60		+60	Financing
Retained earnings:						
Net income	+63	Source	+63		+63	Operating
Dividends	–33	Use	–33		–33	Financing
Additional entries						
Proceeds from sale of equipment				+26	+26	Investing
Gain on sale of equipment....				–6	–6	Operating
Total			–8	0	–8	

Problem 15-13 (45 minutes)

1. Sales	$700,000	
Adjustments to a cash basis:		
Increase in accounts receivable	–70,000	$630,000
Cost of goods sold	400,000	
Adjustments to a cash basis:		
Increase in inventory	+48,000	
Increase in accounts payable	–50,000	398,000
Selling and administrative expenses	216,000	
Adjustments to a cash basis:		
Decrease in prepaid expenses	– 9,000	
Decrease in accrued liabilities	+ 8,000	
Depreciation charges	–45,000	170,000
Income taxes	27,000	
Adjustments to a cash basis:		
Increase in deferred income taxes	– 4,000	23,000
Net cash provided by operating activities		$ 39,000

Problem 15-13 (continued)

2. Foxboro Company
Statement of Cash Flows
For Year 2

Operating activities:		
Cash received from customers		$630,000
Less cash disbursements for:		
Cost of merchandise purchased	$398,000	
Selling and administrative expenses	170,000	
Income taxes	23,000	
Total cash disbursements		591,000
Net cash provided by operating activities		39,000
Investing activities:		
Proceeds from sale of equipment	26,000	
Loan to Harker Company	(40,000)	
Additions to plant and equipment	(150,000)	
Net cash used for investing activities		(164,000)
Financing activities:		
Increase in bonds payable	90,000	
Increase in common stock	60,000	
Cash dividends	(33,000)	
Net cash provided by financing activities		117,000
Net decrease in cash		(8,000)
Cash balance, beginning of year		19,000
Cash balance, end of year		$ 11,000

Problem 15-13 (continued)

3. The decline in cash is explainable largely by the company's inability to generate a significant amount of cash from operating activities. Note that the company generated only $39,000 from operating activities, although net income was $63,000 for the year. This small amount of cash generated is due primarily to the buildup of accounts receivable. Even though an additional $150,000 was obtained from bonds and common stock ($90,000 + $60,000 = $150,000), the cash available was not sufficient to expand the plant, make a substantial loan to another company, and pay a large cash dividend. As a result, cash declined during the year.

Problem 15-14 (45 minutes)

1. and 2.

Allied Products
Statement of Cash Flows
For the Year Ended December 31, 2008

Operating activities:		
Net income		$ 70,000
Adjustments to convert net income to cash basis:		
Depreciation charges	$ 60,000	
Increase in accounts receivable	(90,000)	
Increase in inventory	(54,000)	
Decrease in prepaid expenses	8,000	
Increase in accounts payable	45,000	
Decrease in accrued liabilities	(7,000)	
Gain on sale of investments	(20,000)	
Loss on sale of equipment	6,000	
Increase in deferred income taxes	3,000	(49,000)
Net cash provided by operating activities		21,000
Investing activities:		
Proceeds from sale of long-term investments	50,000	
Proceeds from sale of equipment	44,000	
Additions to plant and equipment	(200,000)	
Net cash used for investing activities		(106,000)
Financing activities:		
Increase in bonds payable	100,000	
Decrease in common stock	(5,000)	
Cash dividends	(28,000)	
Net cash provided by financing activities		67,000
Net decrease in cash		(18,000)
Cash balance, January 1, 2008		33,000
Cash balance, December 31, 2008		$ 15,000

Problem 15-14 (continued)

3. Although the company reported a large net income for the year, a relatively small amount of cash was provided by operating activities due to increases in both accounts receivable and inventory. Note particularly that operations didn't generate enough cash to even pay the cash dividends for the year. Although the company obtained cash from sales of assets and an issue of bonds, this was not sufficient to cover the cost of a $200,000 increase in plant and equipment for the year. More care should have been taken in planning this major investment in plant assets. Also, the company should probably get better control over its accounts receivable. (Although inventory also increased during the year, this increase was largely offset by the increase in accounts payable.)

Problem 15-14 (continued)

While not a requirement, a worksheet may be helpful.

	Change	*Source or Use?*	*Cash Flow Effect*	*Adjust-ments*	*Adjusted Effect*	*Classi-fication*
Assets (except cash and cash equivalents)						
Current assets:						
Accounts receivable	+90	Use	–90		–90	Operating
Inventory	+54	Use	–54		–54	Operating
Prepaid expenses	–8	Source	+8		+8	Operating
Noncurrent assets:						
Long-term investments	–30	Source	+30	–30	0	Investing
Plant and equipment	+110	Use	–110	–90	–200	Investing
Liabilities, Contra assets, and Stockholders' Equity						
Contra assets:						
Accumulated depreciation ..	+20	Source	+20	+40	+60	Operating
Current liabilities:						
Accounts payable	+45	Source	+45		+45	Operating
Accrued liabilities	–7	Use	–7		–7	Operating

Problem 15-14 (continued)

	Change	*Source or Use?*	*Cash Flow Effect*	*Adjust-ments*	*Adjusted Effect*	*Classi-fication*
Noncurrent liabilities:						
Bonds payable	+100	Source	+100		+100	Financing
Deferred income taxes	+3	Source	+3		+3	Operating
Stockholders' equity:						
Common stock	–5	Use	–5		–5	Financing
Retained earnings:						
Net income	+70	Source	+70		+70	Operating
Dividends	–28	Use	–28		–28	Financing
Additional entries						
Proceeds from sale of long-term investments				+50	+50	Investing
Gain from sale of investments				–20	–20	Operating
Proceeds from sale of equipment				+44	+44	Investing
Loss on sale of equipment				+6	+6	Operating
Total			–18	0	–18	

Problem 15-15 (30 minutes)

1. Sales	$800,000	
Adjustments to a cash basis:		
Increase in accounts receivable	–90,000	$710,000
Cost of goods sold	500,000	
Adjustments to a cash basis:		
Increase in inventory	+54,000	
Increase in accounts payable	–45,000	509,000
Selling and administrative expenses	214,000	
Adjustments to a cash basis:		
Decrease in prepaid expenses	– 8,000	
Decrease in accrued liabilities	+ 7,000	
Depreciation charges	–60,000	153,000
Income taxes	30,000	
Adjustments to a cash basis:		
Increase in deferred income taxes	– 3,000	27,000
Net cash provided by operating activities		$ 21,000

Problem 15-15 (continued)

2. Allied Products
Statement of Cash Flows
For the Year Ended December 31, 2008

Operating activities:		
Cash received from customers		$710,000
Less cash disbursements for:		
Cost of merchandise purchased	$509,000	
Selling and administrative expenses	153,000	
Income taxes	27,000	
Total cash disbursements		689,000
Net cash provided by operating activities		21,000
Investing activities:		
Proceeds from sale of long-term investments	50,000	
Proceeds from sale of equipment	44,000	
Additions to plant and equipment	(200,000)	
Net cash used for investing activities		(106,000)
Financing activities:		
Increase in bonds payable	100,000	
Decrease in common stock	(5,000)	
Cash dividends	(28,000)	
Net cash provided by financing activities		67,000
Net decrease in cash		(18,000)
Cash balance, January 1, 2008		33,000
Cash balance, December 31, 2008		$ 15,000

Problem 15-16 (75 minutes)

1. See the worksheet at the end of the solution.

2. Alcorn Products
Statement of Cash Flows
For the Year Ended December 31, 2008

Operating activities:		
Net income		$170,000
Adjustments to convert net income to cash basis:		
Depreciation charges	$ 95,000	
Amortization of patents	6,000	
Increase in accounts receivable	(180,000)	
Decrease in inventory	12,000	
Increase in prepaid expenses	(5,000)	
Increase in accounts payable	300,000	
Decrease in accrued liabilities	(17,000)	
Gain on sale of long-term investments	(60,000)	
Loss on sale of equipment	20,000	
Increase in deferred income taxes	15,000	186,000
Net cash provided by operating activities		356,000
Investing activities:		
Proceeds from sale of long-term investments	110,000	
Proceeds from sale of equipment	70,000	
Loans to subsidiaries	(50,000)	
Additions to plant and equipment	(700,000)	
Net cash used for investing activities		(570,000)

Problem 15-16 (continued)

Financing activities:		
Increase in long-term notes	600,000	
Increase in common stock	90,000	
Retire long-term notes	(380,000)	
Cash dividends to stockholders..........................	(75,000)	
Net cash provided by financing activities............		235,000
Net increase in cash and cash equivalents...........		21,000
Cash balance, January 1, 2008...........................		50,000
Cash balance, December 31, 2008......................		$ 71,000

Problem 15-16 (continued)

3. The large amount of cash provided by operating activities is traceable for the most part to the $300,000 increase in accounts payable. If the accounts payable had remained basically unchanged, the same as inventory, then operating activities would have provided very little cash and the company might have experienced serious cash problems.

   Note particularly that the cash provided by operating activities was used to purchase plant and equipment. Thus, the company is using cash derived from a short-term source (buildup of accounts payable) to finance long-term asset acquisitions. In short, although the company is generating substantial cash from operating activities, the *quality* of this source is open to question.

   In the company's financing activities, it appears that long-term debt sources, rather than equity sources, are being used to provide for expansion. Although companies frequently use debt to finance expansion, the level of debt in this company is increasing rapidly. (See Chapter 16 for a discussion of the Debt-to-Equity ratio and other financial ratios.)

Problem 15-16 (continued)

	Change	Source or Use?	Cash Flow Effect	Adjust-ments	Adjusted Effect	Classi-fication
Assets (except cash and cash equivalents)						
Current assets:						
Accounts receivable	+180	Use	–180		–180	Operating
Inventory	–12	Source	+12		+12	Operating
Prepaid expenses	+5	Use	–5		–5	Operating
Noncurrent assets:						
Long-term investments	–50	Source	+50	–50	0	
Loans to subsidiaries	+50	Use	–50		–50	Investing
Plant and equipment	+570	Use	–570	–130	–700	Investing
Patents	–6	Source	+6		+6	Operating
Liabilities, Contra assets, and Stockholders' Equity						
Contra assets:						
Accumulated depreciation	+55	Source	+55	+40	+95	Operating
Current liabilities:						
Accounts payable	+300	Source	+300		+300	Operating
Accrued liabilities	–17	Use	–17		–17	Operating

Problem 15-16 (continued)

	Change	*Source or Use?*	*Cash Flow Effect*	*Adjust-ments*	*Adjusted Effect*	*Classi-fication*
Noncurrent liabilities:						
Long-term notes	+220	Source	+220	+380	+600	Financing
Deferred income taxes	+15	Source	+15		+15	Operating
Stockholders' equity:						
Common stock	+90	Source	+90		+90	Financing
Retained earnings:						
Net income	+170	Source	+170		+170	Operating
Dividends	–75	Use	–75		–75	Financing
Additional entries						
Retire long-term notes				–380	–380	Financing
Proceeds from sale of equipment				+70	+70	Investing
Loss on sale of equipment				+20	+20	Operating
Proceeds from sale of long-term investments				+110	+110	Investing
Gain on sale of long-term investments				–60	–60	Operating
Total			+21	0	+21	

Problem 15-17 (30 minutes)

Sales	$3,000,000	
Adjustments to a cash basis:		
Increase in accounts receivable	–180,000	$2,820,000
Cost of goods sold	1,860,000	
Adjustments to a cash basis:		
Decrease in inventory	–12,000	
Increase in accounts payable	–300,000	1,548,000
Selling and administrative expenses	930,000	
Adjustments to a cash basis:		
Increase in prepaid expenses	+5,000	
Decrease in accrued liabilities	+17,000	
Depreciation charges	–95,000	
Patent amortization	–6,000	851,000
Income tax expense	80,000	
Adjustments to a cash basis:		
Increase in deferred income taxes	–15,000	65,000
Net cash provided by operating activities		$ 356,000

Problem 15-18 (60 minutes)

Before the statement of cash flows can be prepared, we must first determine the following amounts:

The gain on sale of equipment.
The cost of plant and equipment purchased during the year.
The depreciation charges for the year.
The net income for the year.

The computations follow:

Plant and Equipment			
Bal.	2,850,000		
(2)	500,000	(1)	160,000
Bal.	3,190,000		

Accumulated Depreciation			
		Bal.	975,000
(1)	145,000	(3)	210,000
		Bal.	1,040,000

Explanation of entries:

(1) The entry to record the sale of equipment:

Cash	35,000	
Accumulated Depreciation	145,000	
Plant and Equipment		160,000
Gain on Sale of Equipment		20,000

(2) The balancing entry to record the plant and equipment purchased during the year ($500,000).

(3) The balancing entry to record the depreciation charges for the year ($210,000).

The company's Retained Earnings account increased by $75,000 and cash dividends totaled $10,000 for the year. Therefore, the net income for the year must have been: $75,000 + $10,000 = $85,000.

Problem 15-18 (continued)

Given the amounts above, the statement of cash flows would be as follows:

Damocles Company
Statement of Cash Flows
For the Year

Operating activities:		
Net income		$ 85,000
Adjustments to convert net income to cash basis:		
Depreciation charges	$210,000	
Increase in accounts receivable	(170,000)	
Decrease in inventory	63,000	
Increase in prepaid expenses	(4,000)	
Increase in accounts payable	48,000	
Decrease in accrued liabilities	(5,000)	
Gain on sale of equipment	(20,000)	
Add increase in deferred income taxes	9,000	131,000
Net cash provided by operating activities		216,000
Investing activities:		
Decrease in long-term loan to subsidiary	80,000	
Proceeds from sale of equipment	35,000	
Additions to long-term investments	(90,000)	
Additions to plant and equipment	(500,000)	
Net cash used for investing activities		(475,000)
Financing activities:		
Increase in bonds payable	200,000	
Increase in common stock	300,000	
Decrease in preferred stock	(180,000)	
Cash dividends	(10,000)	
Net cash provided by financing activities		310,000
Net increase in cash		51,000
Cash balance, beginning		109,000
Cash balance, ending		$160,000

Problem 15-18 (continued)

While not a requirement, a worksheet may be helpful.

	Change	*Source or Use?*	*Cash Flow Effect*	*Adjust-ments*	*Adjusted Effect*	*Classi-fication*
Assets (except cash and cash equivalents)						
Current assets:						
Accounts receivable	+170	Use	–170		–170	Operating
Inventory	–63	Source	+63		+63	Operating
Prepaid expenses	+4	Use	–4		–4	Operating
Noncurrent assets:						
Long-term loans	–80	Source	+80		+80	Investing
Long-term investments	+90	Use	–90		–90	Investing
Plant and equipment	+340	Use	–340	–160	–500	Investing
Liabilities, Contra assets, and Stockholders' Equity						
Contra assets:						
Accumulated depreciation	+65	Source	+65	+145	+210	Operating
Current liabilities:						
Accounts payable	+48	Source	+48		+48	Operating
Accrued liabilities	–5	Use	–5		–5	Operating

Problem 15-18 (continued)

	Change	Source or Use?	Cash Flow Effect	Adjust-ments	Adjusted Effect	Classi-fication
Noncurrent liabilities:						
Bonds payable	+200	Source	+200		+200	Financing
Deferred income taxes.......	+9	Source	+9		+9	Operating
Stockholders' equity:						
Preferred stock..................	–180	Use	–180		–180	Financing
Common stock..................	+300	Source	+300		+300	Financing
Retained earnings:						
Net income	+85	Source	+85		+85	Operating
Dividends.......................	–10	Use	–10		–10	Financing
Additional entries						
Proceeds from sale of equipment........................				+35	+35	Investing
Gain on sale of equipment....				–20	–20	Operating
Total			+51	0	+51	

Research and Application 15-19 (240 minutes)

1. Netflix mentions four competitive strengths on page 3 of its 10-K: comprehensive library of titles, personalized merchandising, scalable business model, and convenience, selection and fast delivery. These strengths suggest that Netflix's strategy relies on a combination of customer intimacy and operational excellence. Netflix is attempting to create customer intimacy by using proprietary personalized merchandising software to tailor a comprehensive library of 55,000 titles to the unique viewing interests of individual customers. The company's operational excellence value proposition is a function of providing customers with convenient internet-based access to and fast delivery of a large selection of DVD movies. It is also a function of the company's scalable business model. In other words, Netflix's internet-based business model allows it to increase sales without the need to build and staff costly retail outlets.

   While students can make defensible arguments in favor of either value proposition, most internet companies attract customers by offering convenient order placement and delivery of products such as books, DVDs, airline tickets, etc. at low prices. Although these companies seek to increase sales by using software that tailors their offerings to individual customer preferences, the bedrock of their success hinges on operational excellence.

2. Netflix faces numerous business risks as described on pages 8-20 of the annual report. Students may appropriately contend that many of these risks call into question the viability of Netflix's strategy. Here are four risks faced by Netflix. Two of these risks are largely uncontrollable and two have suggested control activities:

- Risk: Video on Demand (VOD) technology, which enables cable and internet providers to immediately transmit movies to customers on demand, may supplant the Netflix business model. Netflix customers cannot get immediate access to the movies they wish to watch because they have to wait until they arrive by mail. Netflix does not have a readily available control activity to reduce this risk, which continues to grow as the quality and speed of VOD content delivery improves.

Research and Application 15-19 (continued)

- Risk: Studios will alter their filmed entertainment release date practices in a manner that threatens Netflix's sales. Page 10 of the 10-K says "DVDs currently enjoy a significant competitive advantage over other distribution channels, such as pay-per-view and VOD, because of the early distribution window for DVDs…. Currently, studios distribute their filmed entertainment content approximately three to six months after theatrical release to the home video market, seven to nine months after theatrical release to pay-per-view and VOD, one year after theatrical release to satellite and cable, and two to three years after theatrical release to basic cable and syndicated networks." If movie studios choose to shrink or close the window of time that companies such as Netflix can rent new DVD releases without competition from competing mediums (such as pay-per-view and VOD), it will lower retailers' DVD rental revenues. Netflix does not have a readily available control activity to reduce this risk.
- Risk: Computer viruses could disrupt Netflix's website. In addition, computer hackers could obtain unauthorized accessed to customers' credit card numbers. Either event would damage the company's reputation and sales growth goals. Control activities: Invest generously in firewalls and encryption technology to keep website and sensitive customer information secure.
- Risk: Inaccurate forecasts may lead to excessive inventory of some movie titles and stockouts of other titles. Control activities: Create software that allows users to rate movies that they have viewed. The customer feedback helps predict what movie titles will thrive or dive.

Research and Application 15-19 (continued)

3. The comparative balance sheet is shown below and on the following page:

Netflix, Inc.
Comparative Balance Sheet
(in thousands)

	Beginning Balance	Ending Balance	Change	Source Or Use?
Assets				
Current assets:				
Cash and cash equivalents	$174,461	$212,256	+37,795	
Prepaid expenses	2,741	7,848	+5,107	Use
Prepaid revenue sharing expenses	4,695	5,252	+557	Use
Deferred tax assets	0	13,666	+13,666	Use
Other current assets	5,449	4,669	−780	Source
Total current assets	187,346	243,691		
DVD library, net	42,158	57,032	+14,874	Use
Intangible assets, net	961	457	−504	Source
Property and equipment, net	18,728	40,213	+21,485	Use
Deposits	1,600	1,249	−351	Source
Deferred tax assets	0	21,239	+21,239	Use
Other assets	1,000	800	−200	Source
Total assets	$251,793	$364,681		

Research and Application 15-19 (continued)

Liabilities and Stockholders' Equity				
Current liabilities:				
Accounts payable	$ 49,775	$ 63,491	+13,716	Source
Accrued expenses	13,131	25,563	+12,432	Source
Deferred revenue	31,936	48,533	+16,597	Source
Current portion of capital leases	68	0	−68	Use
Total current liabilities	94,910	137,587		
Deferred rent	600	842	+242	Source
Total liabilities	95,510	138,429		
Stockholders' Equity:				
Common stock	53	55	+2	Source
Additional paid-in capital	292,843	317,194	+24,351	Source
Deferred stock-based compensation	(4,693)	(1,326)	+3,367	Source
Accumulated other comp. income	(222)	0	+222	Source
Accumulated deficit	(131,698)	(89,671)	+42,027	Source
Total stockholders' equity	156,283	226,252		
Total liabilities and stockholders' equity	$251,793	$364,681		

Research and Application 15-19 (continued)

4. The changes shown on the balance sheet are accounted for on the statement of cash flows as follows (all amounts are in thousands):

- The change in the Cash and Cash Equivalents of $37,795 is shown on the statement of cash flows as the Net Increase in Cash and Cash Equivalents.
- The changes in Prepaid Expenses, Prepaid Revenue Sharing Expenses, and Other Current Assets are accounted for in the operating activities section of the statement of cash flows under Changes in Prepaid Expenses and Other Current Assets. The reconciliation is as follows:

Balance Sheet:	
Prepaid expenses (Use)..	($5,107)
Prepaid revenue sharing expenses (Use)...............	(557)
Other current assets (Source)...............................	780
Use of cash	($4,884)
Statement of Cash Flows:	
Change in prepaid expenses and other current assets (Use)...	($4,884)

- The changes in Deferred Tax Assets in the current and noncurrent asset sections of the balance sheet are accounted for in the operating activities section of the statement of cash flows under Adjustments to Reconcile Net Income to Net Cash Provided by Operating Activities. The reconciliation is as follows:

Balance Sheet:	
Deferred tax assets—current (Use)	($13,666)
Deferred tax assets—noncurrent (Use)..................	(21,239)
Use of cash	($34,905)
Statement of Cash Flows:	
Adjustments to net income—Deferred taxes (Use) .	($34,905)

Research and Application 15-19 (continued)

- The change in the DVD Library, Net account on the balance sheet is accounted for in the operating and investing activities sections of the statement of cash flows. The reconciliation is as follows:

Balance Sheet:	
DVD library, net (Use)	($14,874)
Statement of Cash Flows:	
Adjustment to net income—amortization of DVD library (Source)	$96,883
Adjustment to net income—gain on disposal of DVDs (Use)	(3,588)
Acquisitions of DVD library (Use)	(113,950)
Proceeds from sale of DVDs (Source)	5,781
Use of cash	($14,874)

- The change in the Intangible Assets, Net account on the balance sheet is accounted for in the operating and investing activities sections of the statement of cash flows. The reconciliation is as follows:

Balance Sheet:	
Intangible assets, net (Source)	$504
Statement of Cash Flows:	
Adjustments to net income—amortization of intangible assets (Source)	$985
Acquisition of intangible asset (Use)	(481)
Source of cash	$504

- The change in the Property and Equipment, Net account on the balance sheet is accounted for in the operating and investing activities sections of the statement of cash flows. The reconciliation is as follows:

Balance Sheet:	
Property and equipment, net (Use)	($21,485)
Statement of Cash Flows:	
Adjustments to net income—depreciation of property and equipment (Source)	$ 9,134
Purchases of property and equipment (Use)	(30,619)
Use of cash	($21,485)

Research and Application 15-19 (continued)

- The changes in the Deposits and Other Assets balance sheet accounts are accounted for in the investing activities section of the statement of cash flows. The reconciliation is as follows:

Balance Sheet:	
Deposits (Source)	$351
Other assets (Source)	200
Source of cash	$551
Statement of Cash Flows:	
Deposits and other assets	$551

- The changes in the Accounts Payable ($13,716), Accrued Expenses ($12,432), Deferred Revenue ($16,597), and Deferred Rent ($242) balance sheet accounts are directly recorded in the operating activities section of the statement of cash flows.
- The change in the Current Portion of Capital Leases account on the balance sheet is accounted for in the operating and financing activities sections of the balance sheet. The reconciliation is as follows:

Balance Sheet:	
Current portion of capital leases (Use)	($68)
Statement of Cash Flows:	
Adjustments to net income—non-cash interest expense (Source)	$11
Principal payments on notes payable and capital lease obligations (Use)	(79)
Use of cash	$68

- The Common Stock, Additional Paid-In Capital, and Deferred Stock-Based Compensation balance sheet accounts are recorded in the operating and financing activities sections of the statement of cash flows. The reconciliation is as follows:

Research and Application 15-19 (continued)

Balance Sheet:	
Common stock (Source)	$ 2
Additional paid-in capital (Source)	24,351
Deferred stock-based compensation (Source)	3,367
Source of cash	$27,720
Statement of Cash Flows:	
Adjustments to net income—stock-based compensation expense (Source)	$14,327
Proceeds from issuance of commons stock (Source)	13,393
Source of cash	$27,720

- The change in the Accumulated Other Comprehensive Income balance sheet account ($222) is directly accounted for in the financing activities section of the statement of cash flows. The change in the Accumulated Deficit balance sheet account ($42,027) corresponds with the net income reported in the statement of cash flows.

5. Using the approach mentioned in the In Business box, Netflix's free cash flows is calculated as follows (amounts are in thousands):

Net operating income		$ 2,989
Add Depreciation and amortization:		
Property and equipment	$ 9,134	
DVD library	96,883	
Intangible assets	985	107,002
Deduct capital expenditures and dividends:		
Purchases of property and equipment	(30,619)	
Acquisition of intangible asset	(481)	
Acquisition of DVD library	(113,950)	(145,050)
Free cash flow		($ 35,059)

* Netflix did not pay any dividends

Netflix is not generating enough free cash flow to sustain its operations. Unless Netflix can reverse this trend, the company will need to attempt to obtain additional cash from creditors or investors to sustain its on-going investments in important assets such as the DVD library.

Chapter 16
"How Well Am I Doing?" Financial Statement Analysis

Solutions to Questions

16-1 Horizontal analysis examines how a particular item on a financial statement such as sales or cost of goods sold behaves over time. Vertical analysis involves analysis of items on an income statement or balance sheet for a single period. In vertical analysis of the income statement, all items are typically stated as a percentage of sales. In vertical analysis of the balance sheet, all items are typically stated as a percentage of total assets.

16-2 By looking at trends, an analyst hopes to get some idea of whether a situation is improving, remaining the same, or deteriorating. Such analyses can provide insight into what is likely to happen in the future. Rather than looking at trends, an analyst may compare one company to another or to industry averages using common-size financial statements.

16-3 Price-earnings ratios reflect investors' expectations concerning future earnings. The higher the price-earnings ratio, the greater the growth in earnings investors expect. For this reason, two companies might have the same current earnings and yet have quite different price-earnings ratios. By definition, a stock with current earnings of $4 and a price-earnings ratio of 20 would be selling for $80 per share.

16-4 A company in a rapidly growing technological industry would probably have many opportunities to make investments at a rate of return higher than stockholders could earn in other investments. From the stockholders' perspective, it would be better for the company to invest in such opportunities than to pay out dividends. Thus, one would expect the company to have a low dividend payout ratio.

16-5 The dividend yield is the return on an investment in shares of stock from simply collecting dividends. The other source of return on an investment in stock is increases in market value. The dividend yield is computed by dividing the dividend per share by the current market price per share.

16-6 Financial leverage results from borrowing funds at an interest rate that differs from the rate of return on assets acquired using those funds. If the rate of return on the assets is higher than the interest rate at which the funds were borrowed, financial leverage is positive and stockholders gain. If the return on the assets is lower than the interest rate, financial leverage is negative and the stockholders lose.

16-7 If the company experiences wide fluctuations in earnings and net cash flows from operations, stockholders might be pleased that the company has no debt. In hard times, interest payments might be very difficult to meet.

On the other hand, if investments within the company can earn a rate of return that exceeds the interest rate on debt, stockholders would get the benefits of positive leverage if the company took on debt.

16-8 The market value of a share of common stock often exceeds the book value per share. Book value represents the cumulative effects on the balance sheet of past activities, evaluated using historical prices. The market value of the stock reflects investors' expectations about the company's future earnings. For most companies, market value exceeds book value because investors anticipate future earnings growth.

16-9 A 2 to 1 current ratio might not be adequate for several reasons. First, the composition of the current assets may be heavily weighted toward slow-turning and difficult-to-liquidate inventory, or the inventory may contain large amounts of obsolete goods. Second, the receivables may be low quality, including large amounts of accounts that may be difficult to collect.

Exercise 16-1 (15 minutes)

1.

	This Year	*Last Year*
Sales	100.0%	100.0%
Cost of goods sold	63.2%	60.0%
Gross margin	36.8%	40.0%
Selling and administrative expenses:		
Selling expenses	18.0%	17.5%
Administrative expenses	13.6%	14.6%
Total selling and administrative expenses	31.6%	32.1%
Net operating income	5.2%	7.9%
Interest expense	1.4%	1.0%
Net income before taxes	3.8%	6.9%

2. The company's major problem seems to be the increase in cost of goods sold, which increased from 60.0% of sales last year to 63.2% of sales this year. This suggests that the company is not passing the increases in costs of its products on to its customers. As a result, cost of goods sold as a percentage of sales has increased and gross margin has decreased. Selling expenses and interest expense have both increased slightly during the year, which suggests that costs generally are going up in the company. The only exception is the administrative expenses, which have decreased from 14.6% of sales last year to 13.6% of sales this year. This probably is a result of the company's efforts to reduce administrative expenses during the year.

Exercise 16-2 (30 minutes)

1. Calculation of the gross margin percentage:

$$\text{Gross margin percentage} = \frac{\text{Gross margin}}{\text{Sales}}$$

$$= \frac{\$23{,}000}{\$66{,}000} = 34.8\%$$

2. Calculation of the earnings per share:

$$\text{Earnings per share} = \frac{\text{Net income - Preferred dividends}}{\text{Average number of common shares outstanding}}$$

$$= \frac{\$1{,}980 - \$60}{600 \text{ shares}} = \$3.20 \text{ per share}$$

3. Calculation of the price-earnings ratio:

$$\text{Price-earnings ratio} = \frac{\text{Market price per share}}{\text{Earnings per share}}$$

$$= \frac{\$26}{\$3.20} = 8.1$$

4. Calculation of the dividend payout ratio:

$$\text{Dividend payout ratio} = \frac{\text{Dividends per share}}{\text{Earnings per share}}$$

$$= \frac{\$0.75}{\$3.20} = 23.4\%$$

5. Calculation of the dividend yield ratio:

$$\text{Dividend yield ratio} = \frac{\text{Dividends per share}}{\text{Market price per share}}$$

$$= \frac{\$0.75}{\$26.00} = 2.9\%$$

Exercise 16-2 (continued)

6. Calculation of the return on total assets:

$$\text{Return on total assets} = \frac{\text{Net income} + [\text{Interest expense} \times (1 - \text{Tax rate})]}{\text{Average total assets}}$$

$$= \frac{\$1{,}980 + [\$800 \times (1 - 0.40)]}{(\$65{,}810 + \$68{,}480)/2} = 3.7\%$$

7. Calculation of the return on common stockholders' equity:

Beginning balance, stockholders' equity (a)..	$39,610
Ending balance, stockholders' equity (b)......	41,080
Average stockholders' equity [(a) + (b)]/2...	40,345
Average preferred stock..............................	1,000
Average common stockholders' equity	$39,345

$$\text{Return on common stockholders' equity} = \frac{\text{Net income} - \text{Preferred dividends}}{\text{Average common stockholders' equity}}$$

$$= \frac{\$1{,}980 - \$60}{\$39{,}345} = 4.9\%$$

8. Calculation of the book value per share:

$$\text{Book value per share} = \frac{\text{Total stockholders' equity} - \text{Preferred stock}}{\text{Number of common shares outstanding}}$$

$$= \frac{\$41{,}080 - \$1{,}000}{600 \text{ shares}} = \$66.80 \text{ per share}$$

Exercise 16-3 (30 minutes)

1. Calculation of working capital:

   Working capital = Current assets - Current liabilities

   = $22,680 - $19,400 = $3,280

2. Calculation of the current ratio:

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$= \frac{\$22{,}680}{\$19{,}400} = 1.17$$

3. Calculation of the acid-test ratio:

$$\text{Acid-test ratio} = \frac{\text{Cash + Marketable securities + Accounts receivable + Short-term notes}}{\text{Current liabilities}}$$

$$= \frac{\$1{,}080 + \$0 + \$9{,}000 + \$0}{\$19{,}400} = 0.52$$

4. Calculation of accounts receivable turnover:

$$\text{Accounts receivable turnover} = \frac{\text{Sales on account}}{\text{Average accounts receivable balance}}$$

$$= \frac{\$66{,}000}{(\$6{,}500 + \$9{,}000)/2} = 8.5$$

Exercise 16-3 (continued)

5. Calculation of the average collection period:

$$\text{Average collection period} = \frac{\text{365 days}}{\text{Accounts receivable turnover}}$$

$$= \frac{\text{365 days}}{8.5} = \text{42.9 days}$$

6. Calculation of inventory turnover:

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold}}{\text{Average inventory balance}}$$

$$= \frac{\$43{,}000}{(\$10{,}600 + \$12{,}000)/2} = 3.8$$

7. Calculation of the average sale period:

$$\text{Average sale period} = \frac{\text{365 days}}{\text{Inventory turnover}}$$

$$= \frac{\text{365 days}}{3.8} = \text{96.1 days}$$

Exercise 16-4 (15 minutes)

1. Calculation of the times interest earned ratio:

$$\text{Times interest earned ratio} = \frac{\text{Earnings before interest expense and income taxes}}{\text{Interest expense}}$$

$$= \frac{\$4{,}100}{\$800} = 5.1$$

2. Calculation of the debt-to-equity ratio:

$$\text{Debt-to-equity ratio} = \frac{\text{Total liabilities}}{\text{Stockholders' equity}}$$

$$= \frac{\$27{,}400}{\$41{,}080} = 0.67$$

Exercise 16-5 (15 minutes)

1. The trend percentages are:

	Year 5	*Year 4*	*Year 3*	*Year 2*	*Year 1*
Sales	125.0	120.0	110.0	105.0	100.0
Current assets:					
Cash	80.0	90.0	105.0	110.0	100.0
Accounts receivable	140.0	124.0	108.0	104.0	100.0
Inventory	112.0	110.0	102.0	108.0	100.0
Total current assets	118.8	113.1	104.1	106.9	100.0
Current liabilities	130.0	106.0	108.0	110.0	100.0

2. Sales: The sales are increasing at a steady rate, with a particularly strong gain in Year 4.

   Assets: Cash declined from Year 3 through Year 5. This may have been due to the growth in both inventories and accounts receivable. In particular, the accounts receivable grew far faster than sales in Year 5. The decline in cash may reflect delays in collecting receivables. This is a matter for management to investigate further.

   Liabilities: The current liabilities jumped up in Year 5. This was probably due to the buildup in accounts receivable in that the company doesn't have the cash needed to pay bills as they come due.

Exercise 16-6 (20 minutes)

1. Return on total assets:

$$\text{Return on total assets} = \frac{\text{Net income} + \left[\text{Interest expense} \times (1\text{-Tax rate})\right]}{\text{Average total assets}}$$

$$= \frac{\$470{,}000 + \left[\$90{,}000 \times (1 - 0.30)\right]}{(\$5{,}000{,}000 + \$4{,}800{,}000)/2}$$

$$= \frac{\$533{,}000}{\$4{,}900{,}000} = 10.9\% \text{ (rounded)}$$

2. Return on common stockholders' equity:

Net income	$470,000
Preferred dividends: 7% × $800,000	$56,000
Average stockholders' equity	
($3,100,000 + $2,900,000)/2	$3,000,000
Average preferred stock ($800,000 + $800,000)/2 ...	800,000
Average common stockholders' equity (b)	$2,200,000

$$\text{Return on common stockholders' equity} = \frac{\text{Net income - Preferred dividends}}{\text{Average common stockholders' equity}}$$

$$= \frac{\$470{,}000 - \$56{,}000}{\$2{,}200{,}000} = 18.8\% \text{ (rounded)}$$

3. The company has positive financial leverage, since the return on common stockholders' equity (18.8%) is greater than the return on total assets (10.9%). This positive leverage arises from the long-term debt, which has an after-tax interest cost of only 8.4% [12% interest rate × (1 – 0.30)], and the preferred stock, which carries a dividend rate of only 7%. Both of these figures are smaller than the return that the company is earning on its total assets; thus, the difference goes to the common stockholders.

Exercise 16-7 (15 minutes)

1. Current assets

($80,000 + $460,000 + $750,000 + $10,000)....	$1,300,000
Current liabilities ($1,300,000 ÷ 2.5)	520,000
Working capital	$ 780,000

2.

$$\text{Acid-test ratio} = \frac{\text{Cash + Marketable securities} \\ \text{+ Accounts receivable + Short-term notes}}{\text{Current liabilities}}$$

$$= \frac{\$80{,}000 + \$0 + \$460{,}000 + \$0}{\$520{,}000} = 1.04 \text{ (rounded)}$$

3. a. Working capital would not be affected by a $100,000 payment on accounts payable:

Current assets ($1,300,000 – $100,000)	$1,200,000
Current liabilities ($520,000 – $100,000)....	420,000
Working capital.......................................	$ 780,000

b. The current ratio would increase if the company makes a $100,000 payment on accounts payable:

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$= \frac{\$1{,}200{,}000}{\$420{,}000} = 2.9 \text{ (rounded)}$$

Exercise 16-8 (30 minutes)

1. Gross margin percentage:

$$\text{Gross margin percentage} = \frac{\text{Gross margin}}{\text{Sales}} = \frac{\$840{,}000}{\$2{,}100{,}000} = 40\%$$

2. Current ratio:

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} = \frac{\$490{,}000}{\$200{,}000} = 2.45$$

3. Acid-test ratio:

$$\text{Acid test ratio} = \frac{\begin{array}{c}\text{Cash + Marketable securities}\\ \text{+ Accounts receivable + Short-term notes}\end{array}}{\text{Current liabilities}}$$

$$= \frac{\$21{,}000 + \$0 + \$160{,}000 + \$0}{\$200{,}000} = 0.91 \text{ (rounded)}$$

4. Average collection period:

$$\text{Accounts receivable turnover} = \frac{\text{Sales on account}}{\text{Average accounts receivable}}$$

$$= \frac{\$2{,}100{,}000}{(\$160{,}000 + \$140{,}000)/2} = 14$$

$$\text{Average collection period} = \frac{\text{365 days}}{\text{Accounts receivable turnover}}$$

$$= \frac{\text{365 days}}{14} = \text{26.1 days (rounded)}$$

Exercise 16-8 (continued)

5. Average sale period:

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold}}{\text{Average inventory}}$$

$$= \frac{\$1{,}260{,}000}{(\$300{,}000 + \$260{,}000)/2} = 4.5$$

$$\text{Average sale period} = \frac{365 \text{ days}}{4.5} = 81.1 \text{ days (rounded)}$$

6. Debt-to-equity ratio:

$$\text{Debt-equity ratio} = \frac{\text{Total liabilities}}{\text{Stockholders' equity}}$$

$$= \frac{\$500{,}000}{\$800{,}000} = 0.63 \text{ (rounded)}$$

7. Times interest earned:

$$\text{Times interest earned} = \frac{\text{Earnings before interest and income taxes}}{\text{Interest expense}}$$

$$= \frac{\$180{,}000}{\$30{,}000} = 6.0$$

8. Book value per share:

$$\text{Book value per share} = \frac{\text{Total stockholders' equity - Preferred stock}}{\text{Common shares outstanding}}$$

$$= \frac{\$800{,}000 - \$0}{20{,}000 \text{ shares*}} = \$40 \text{ per share}$$

*$100,000 total par value ÷ $5 par value per share = 20,000 shares

Exercise 16-9 (20 minutes)

1. Earnings per share:

$$\text{Earnings per share} = \frac{\text{Net income - Preferred dividends}}{\text{Average common shares outstanding}}$$

$$= \frac{\$105{,}000 - \$0}{20{,}000 \text{ shares}} = \$5.25 \text{ per share}$$

2. Dividend payout ratio:

$$\text{Dividend payout ratio} = \frac{\text{Dividends per share}}{\text{Earnings per share}} = \frac{\$3.15}{\$5.25} = 60\%$$

3. Dividend yield ratio:

$$\text{Dividend yield ratio} = \frac{\text{Dividends per share}}{\text{Market price per share}} = \frac{\$3.15}{\$63.00} = 5\%$$

4. Price-earnings ratio:

$$\text{Price-earnings ratio} = \frac{\text{Market price per share}}{\text{Earnings per share}} = \frac{\$63.00}{\$5.25} = 12.0$$

Exercise 16-10 (20 minutes)

1. Return on total assets:

$$\text{Return on total assets} = \frac{\text{Net income} + \left[\text{Interest expense} \times (1\text{-Tax rate})\right]}{\text{Average total assets}}$$

$$= \frac{\$105{,}000 + \left[\$30{,}000 \times (1 - 0.30)\right]}{(\$1{,}100{,}000 + \$1{,}300{,}000)/2}$$

$$= \frac{\$126{,}000}{\$1{,}200{,}000} = 10.5\%$$

2. Return on common stockholders' equity:

$$\frac{\text{Return on common}}{\text{stockholders' equity}} = \frac{\text{Net income - Preferred dividends}}{\text{Average total stockholders' equity - Average preferred stock}}$$

$$= \frac{\$105{,}000 - \$0}{(\$725{,}000 + \$800{,}000)/2 - \$0}$$

$$= \frac{\$105{,}000}{\$762{,}500} = 13.8\% \text{ (rounded)}$$

3. Financial leverage was positive because the rate of return to the common stockholders (13.8%) was greater than the rate of return on total assets (10.5%). This positive leverage is traceable in part to the company's current liabilities, which may carry no interest cost, and to the bonds payable, which have an after-tax interest cost of only 7%.

   10% interest rate × (1 – 0.30) = 7% after-tax cost.

Problem 16-11 (60 minutes)

		This Year	Last Year
1. a.	Current assets (a)	$2,060,000	$1,470,000
	Current liabilities (b)	1,100,000	600,000
	Working capital (a) – (b)	$ 960,000	$ 870,000
b.	Current assets (a)	$2,060,000	$1,470,000
	Current liabilities (b)	$1,100,000	$600,000
	Current ratio (a) ÷ (b)	1.87	2.45
c.	Cash + marketable securities + accounts receivable + short-term notes (a)	$740,000	$650,000
	Current liabilities (b)	$1,100,000	$600,000
	Acid-test ratio (a) ÷ (b)	0.67	1.08
d.	Sales on account (a)	$7,000,000	$6,000,000
	Average receivables (b)	$525,000	$375,000
	Accounts receivable turnover (a) ÷ (b)	13.3	16.0
	Average collection period: 365 days ÷ accounts receivable turnover	27.4 days	22.8 days
e.	Cost of goods sold (a)	$5,400,000	$4,800,000
	Average inventory (b)	$1,050,000	$760,000
	Inventory turnover ratio (a) ÷ (b)	5.1	6.3
	Average sale period: 365 days ÷ inventory turnover	71.6 days	57.9 days
f.	Total liabilities (a)	$1,850,000	$1,350,000
	Stockholders' equity (b)	$2,150,000	$1,950,000
	Debt-to-equity ratio (a) ÷ (b)	0.86	0.69
g.	Net income before interest and taxes (a)	$630,000	$490,000
	Interest expense (b)	$90,000	$90,000
	Times interest earned (a) ÷ (b)	7.0	5.4

Problem 16-11 (continued)

2. a.

Modern Building Supply
Common-Size Balance Sheets

	This Year	*Last Year*
Current assets:		
Cash	2.3%	6.1%
Marketable securities	0.0%	1.5%
Accounts receivable, net	16.3%	12.1%
Inventory	32.5%	24.2%
Prepaid expenses	0.5%	0.6%
Total current assets	51.5%	44.5%
Plant and equipment, net	48.5%	55.5%
Total assets	100.0%	100.0%
Liabilities:		
Current liabilities	27.5%	18.2%
Bonds payable, 12%	18.8%	22.7%
Total liabilities	46.3%	40.9%
Stockholders' equity:		
Preferred stock, $50 par, 8%	5.0%	6.1%
Common stock, $10 par	12.5%	15.2%
Retained earnings	36.3%	37.9%
Total stockholders' equity	53.8%	59.1%
Total liabilities and equity	100.0%	100.0%

Note: Columns may not total down due to rounding.

Problem 16-11 (continued)

b. Modern Building Supply
Common-Size Income Statements

	This Year	*Last Year*
Sales	100.0%	100.0%
Cost of goods sold	77.1%	80.0%
Gross margin	22.9%	20.0%
Selling and administrative expenses	13.9%	11.8%
Net operating income	9.0%	8.2%
Interest expense	1.3%	1.5%
Net income before taxes	7.7%	6.7%
Income taxes	3.1%	2.7%
Net income	4.6%	4.0%

3. The following points can be made from the analytical work in parts (1) and (2) above:

   The company has improved its profit margin from last year. This is attributable to an increase in gross margin, which is offset somewhat by an increase in operating expenses. In both years the company's net income as a percentage of sales equals or exceeds the industry average of 4%.

   Although the company's working capital has increased, its current position actually has deteriorated significantly since last year. Both the current ratio and the acid-test ratio are well below the industry average, and both are trending downward. (This shows the importance of not just looking at the working capital in assessing the financial strength of a company.) Given the present trend, it soon will be impossible for the company to pay its bills as they come due.

Problem 16-11 (continued)

The drain on the cash account seems to be a result mostly of a large buildup in accounts receivable and inventory. This is evident both from the common-size balance sheet and from the financial ratios. Notice that the average collection period has increased by 4.6 days since last year, and that it is now 9 days over the industry average. Many of the company's customers are not taking their discounts, since the average collection period is 27 days and collection terms are 2/10, n/30. This suggests financial weakness on the part of these customers, or sales to customers who are poor credit risks. Perhaps the company has been too aggressive in expanding its sales.

The inventory turnover was only 5 times this year as compared to over 6 times last year. It takes three weeks longer for the company to turn its inventory than the average for the industry (71 days as compared to 50 days for the industry). This suggests that inventory stocks are higher than they need to be.

The loan should be approved on the condition that the company take immediate steps to get its accounts receivable and inventory back under control. This would mean more rigorous checks of creditworthiness before sales are made and perhaps declining credit to slow paying customers. It would also mean a sharp reduction of inventory levels to a more manageable size. If these steps are taken, it appears that sufficient funds could be generated to repay the loan in a reasonable period of time.

Problem 16-12 (60 minutes)

1\. a.

	This Year	Last Year
Net income	$324,000	$240,000
Less preferred dividends	16,000	16,000
Net income remaining for common (a)	$308,000	$224,000
Average number of common shares (b)	50,000	50,000
Earnings per share (a) ÷ (b)	$6.16	$4.48

b.

	This Year	Last Year
Dividends per share (a)*	$2.16	$1.20
Market price per share (b)	$45.00	$36.00
Dividend yield ratio (a) ÷ (b)	4.8%	3.33%

*$108,000 ÷ 50,000 shares = $2.16;
$60,000 ÷ 50,000 shares = $1.20

c.

	This Year	Last Year
Dividends per share (a)	$2.16	$1.20
Earnings per share (b)	$6.16	$4.48
Dividend payout ratio (a) ÷ (b)	35.1%	26.8%

d.

	This Year	Last Year
Market price per share (a)	$45.00	$36.00
Earnings per share (b)	$6.16	$4.48
Price-earnings ratio (a) ÷ (b)	7.3	8.0

Investors regard Modern Building Supply less favorably than other companies in the industry. This is evidenced by the fact that they are willing to pay only 7.3 times current earnings for a share of the company's stock, as compared to 9 times current earnings for other companies in the industry. If investors were willing to pay 9 times current earnings for Modern Building Supply's stock, then it would be selling for about $55 per share (9 × $6.16), rather than for only $45 per share.

Problem 16-12 (continued)

e.

	This Year	*Last Year*
Total stockholders' equity	$2,150,000	$1,950,000
Less preferred stock	200,000	200,000
Common stockholders' equity (a)	$1,950,000	$1,750,000
Number of common shares outstanding (b)	50,000	50,000
Book value per share (a) ÷ (b)	$39.00	$35.00

A market price in excess of book value does not mean that the price of a stock is too high. Market value is an indication of investors' perceptions of future earnings and/or dividends, whereas book value is a result of already completed transactions.

2. a.

	This Year	*Last Year*
Net income	$ 324,000	$ 240,000
Add after-tax cost of interest paid: [$90,000 × (1 – 0.40)]	54,000	54,000
Total (a)	$ 378,000	$ 294,000
Average total assets (b).....................	$3,650,000	$3,000,000
Return on total assets (a) ÷ (b)	10.4%	9.8%

b.

	This Year	*Last Year*
Net income	$ 324,000	$ 240,000
Less preferred dividends....................	16,000	16,000
Net income remaining for common (a)	$ 308,000	$ 224,000
Average total stockholders' equity*	$2,050,000	$1,868,000
Less average preferred stock	200,000	200,000
Average common stockholders' equity (b)...	$1,850,000	$1,668,000

*1/2($2,150,000 + $1,950,000); 1/2($1,950,000 + $1,786,000).

Return on common stockholders' equity (a) ÷ (b)..............................	16.6%	13.4%

Problem 16-12 (continued)

c. Financial leverage is positive in both years, since the return on common equity is greater than the return on total assets. This positive financial leverage is due to three factors: the preferred stock, which has a dividend of only 8%; the bonds, which have an after-tax interest cost of only 7.2% [12% interest rate × (1 – 0.40) = 7.2%]; and the accounts payable, which may bear no interest cost.

3. We would recommend keeping the stock. The stock's downside risk seems small, since it is selling for only 7.3 times current earnings as compared to 9 times earnings for other companies in the industry. In addition, its earnings are strong and trending upward, and its return on common equity (16.6%) is extremely good. Its return on total assets (10.4%) compares favorably with that of the industry.

   The risk, of course, is whether the company can get its cash problem under control. Conceivably, the cash problem could worsen, leading to an eventual reduction in profits through inability to operate, a reduction in dividends, and a precipitous drop in the market price of the company's stock. This does not seem likely, however, since the company can easily control its cash problem through more careful management of accounts receivable and inventory. If this problem is brought under control, the price of the stock could rise sharply over the next few years, making it an excellent investment.

Problem 16-13 (30 minutes)

1. a. Computation of working capital:

Current assets:	
Cash	$ 70,000
Marketable securities	12,000
Accounts receivable, net	350,000
Inventory	460,000
Prepaid expenses	8,000
Total current assets (a)	900,000
Current liabilities:	
Accounts payable	200,000
Accrued liabilities	60,000
Notes due in one year	100,000
Total current liabilities (b)	360,000
Working capital (a) − (b)	$540,000

b. Computation of the current ratio:

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} = \frac{\$900,000}{\$360,000} = 2.5$$

c. Computation of the acid-test ratio:

$$\text{Acid-test ratio} = \frac{\begin{array}{c}\text{Cash + Marketable securities}\\ \text{+ Accounts receivable + Short-term notes}\end{array}}{\text{Current liabilities}}$$

$$= \frac{\$70,000 + \$12,000 + \$350,000}{\$360,000} = \frac{\$432,000}{\$360,000} = 1.2$$

Problem 16-13 (continued)

2.

	Transaction	*The Effect on* Working Capital	Current Ratio	Acid-Test Ratio
(a)	Declared a cash dividend	Decrease	Decrease	Decrease
(b)	Paid accounts payable	None	Increase	Increase
(c)	Collected cash on accounts receivable	None	None	None
(d)	Purchased equipment for cash	Decrease	Decrease	Decrease
(e)	Paid a cash dividend previously declared	None	Increase	Increase
(f)	Borrowed cash on a short-term note	None	Decrease	Decrease
(g)	Sold inventory at a profit	Increase	Increase	Increase
(h)	Wrote off uncollectible accounts	None	None	None
(i)	Sold marketable securities at a loss	Decrease	Decrease	Decrease
(j)	Issued common stock for cash	Increase	Increase	Increase
(k)	Paid off short-term notes	None	Increase	Increase

Problem 16-14 (90 minutes)

1\. a.

	This Year	Last Year
Net income	$ 280,000	$ 168,000
Add after-tax cost of interest:		
$120,000 × (1 – 0.30)	84,000	
$100,000 × (1 – 0.30)		70,000
Total (a)	$ 364,000	$ 238,000
Average total assets (b)	$5,330,000	$4,640,000
Return on total assets (a) ÷ (b)	6.8%	5.1%

b.

Net income	$ 280,000	$ 168,000
Less preferred dividends	48,000	48,000
Net income remaining for common (a)	$ 232,000	$ 120,000
Average total stockholders' equity	$3,120,000	$3,028,000
Less average preferred stock	600,000	600,000
Average common equity (b)	$2,520,000	$2,428,000
Return on common stockholders' equity (a) ÷ (b)	9.2%	4.9%

c. Leverage is positive for this year because the return on common equity (9.2%) is greater than the return on total assets (6.8%). For last year, leverage is negative because the return on the common equity (4.9%) is less than the return on total assets (5.1%).

2\. a.

Net income remaining for common [see above] (a)	$232,000	$120,000
Average number of common shares outstanding (b)	50,000	50,000
Earnings per share (a) ÷ (b)	$4.64	$2.40

b.

Dividends per share (a)	$1.44	$0.72
Market price per share (b)	$36.00	$20.00
Dividend yield ratio (a) ÷ (b)	4.0%	3.6%

Problem 16-14 (continued)

		This Year	*Last Year*
c.	Dividends per share (a)	$1.44	$0.72
	Earnings per share (b)	$4.64	$2.40
	Dividend payout ratio (a) ÷ (b)	31.0%	30.0%
d.	Market price per share (a)	$36.00	$20.00
	Earnings per share (b)	$4.64	$2.40
	Price-earnings ratio (a) ÷ (b)	7.8	8.3

Notice from the data given in the problem that the typical P/E ratio for companies in Hedrick's industry is 10. Hedrick Company presently has a P/E ratio of only 7.8, so investors appear to regard it less well than they do other companies in the industry. That is, investors are willing to pay only 7.8 times current earnings for a share of Hedrick Company's stock, as compared to 10 times current earnings for a share of stock for the typical company in the industry.

e.	Stockholders' equity	$3,200,000	$3,040,000
	Less preferred stock	600,000	600,000
	Common stockholders' equity (a)	$2,600,000	$2,440,000
	Number of common shares outstanding (b)	50,000	50,000
	Book value per share (a) ÷ (b)	$52.00	$48.80

Note that the book value of Hedrick Company's stock is greater than its market value for both years. This does not necessarily indicate that the stock is selling at a bargain price. Market value is an indication of investors' perceptions of future earnings and/or dividends, whereas book value is a result of already completed transactions.

f.	Gross margin (a)	$1,050,000	$860,000
	Sales (b)	$5,250,000	$4,160,000
	Gross margin percentage (a) ÷ (b)	20.0%	20.7%

Problem 16-14 (continued)

3\. a.

	This Year	Last Year
Current assets (a)	$2,600,000	$1,980,000
Current liabilities (b)	1,300,000	920,000
Working capital (a) − (b)	$1,300,000	$1,060,000

b.

	This Year	Last Year
Current assets (a)	$2,600,000	$1,980,000
Current liabilities (b)	$1,300,000	$920,000
Current ratio (a) ÷ (b)	2.0	2.15

c.

	This Year	Last Year
Cash + marketable securities + accounts receivable + short-term notes (a)	$1,220,000	$1,120,000
Current liabilities (b)	$1,300,000	$920,000
Acid-test ratio (a) ÷ (b)	0.94	1.22

d.

	This Year	Last Year
Sales on account (a)	$5,250,000	$4,160,000
Average receivables (b)	$750,000	$560,000
Accounts receivable turnover (a) ÷ (b)	7.0	7.4
Average collection period: 365 days ÷ accounts receivable turnover	52 days	49 days

e.

	This Year	Last Year
Cost of goods sold (a)	$4,200,000	$3,300,000
Average inventory balance (b)	$1,050,000	$720,000
Inventory turnover ratio (a) ÷ (b)	4.0	4.6
Average sales period: 365 days ÷ inventory turnover ratio	91 days	79 days

f.

	This Year	Last Year
Total liabilities (a)	$2,500,000	$1,920,000
Stockholders' equity (b)	$3,200,000	$3,040,000
Debt-to-equity ratio (a) ÷ (b)	0.78	0.63

g.

	This Year	Last Year
Net income before interest and income taxes (a)	$520,000	$340,000
Interest expense (b)	$120,000	$100,000
Times interest earned (a) ÷ (b)	4.3	3.4

Problem 16-14 (continued)

4. As stated by Marva Rossen, both net income and sales are up from last year. The return on total assets has improved from 5.1% last year to 6.8% this year, and the return on common equity is up to 9.2% from 4.9% the year before. But this appears to be the only bright spot. Virtually all other ratios are below what is typical for the industry, and, more important, they are trending downward. The deterioration in the gross margin percentage, while not large, is worrisome. Sales and inventories have increased substantially, which should ordinarily result in an improvement in the gross margin percentage as fixed costs are spread over more units. However, the gross margin percentage has declined.

   Notice particularly that the average collection period has lengthened to 52 days—about three weeks over the industry—and that the inventory turnover is 50% longer than the industry. The increase in sales may have been obtained at least in part by extending credit to high-risk customers. Also notice that the debt-to-equity ratio is rising rapidly. If the $1,000,000 loan is granted, the ratio will rise further to 1.09.

   In our opinion, what the company needs is more equity—not more debt. Therefore, the loan should not be approved. The company should be encouraged to issue more common stock.

Problem 16-15 (30 minutes)

1. Hedrick Company
Comparative Balance Sheets

	This Year	*Last Year*
Current assets:		
Cash	5.6%	8.5%
Marketable securities	0.0%	2.0%
Accounts receivable, net	15.8%	12.1%
Inventory	22.8%	16.1%
Prepaid expenses	1.4%	1.2%
Total current assets	45.6%	39.9%
Plant and equipment, net	54.4%	60.1%
Total assets	100.0%	100.0%
Current liabilities	22.8%	18.5%
Bonds payable, 10%	21.1%	20.2%
Total liabilities	43.9%	38.7%
Stockholders' equity:		
Preferred stock, 8%, $30 par value	10.5%	12.1%
Common stock, $40 par value	35.1%	40.3%
Retained earnings	10.5%	8.9%
Total stockholders' equity	56.1%	61.3%
Total liabilities and equity	100.0%	100.0%

Note: Columns may not total down due to rounding.

Problem 16-15 (continued)

2. Hedrick Company
Comparative Income Statements

	This Year	*Last Year*
Sales	100.0%	100.0%
Cost of goods sold	80.0%	79.3%
Gross margin	20.0%	20.7%
Selling and administrative expenses	10.1%	12.5%
Net operating income	9.9%	8.2%
Interest expense	2.3%	2.4%
Net income before taxes	7.6%	5.8%
Income taxes (30%)	2.3%	1.7%
Net income	5.3%	4.0%

Note: Columns may not total down due to rounding.

3. The company's current position has declined substantially between the two years. Cash this year represents only 5.6% of total assets, whereas it represented 10.5% last year (Cash + Marketable Securities). In addition, both accounts receivable and inventory are up from last year, which helps to explain the decrease in the Cash account. The company is building inventories, but not collecting from customers. (See Problem 16-14 for a ratio analysis of the current assets.) Apparently part of the financing required to build inventories was supplied by short-term creditors, as evidenced by the increase in current liabilities.

   Looking at the income statement, the gross margin percentage has deteriorated. Ordinarily, the increase in sales (and in inventories) should have resulted in an increase in the gross margin percentage since fixed manufacturing costs would be spread across more units. Note that the other operating expenses are down as a percentage of sales—possibly because of the existence of fixed expenses.

Problem 16-16 (45 minutes)

1. Decrease — Sale of inventory at a profit will be reflected in an increase in retained earnings, which is part of stockholders' equity. An increase in stockholders' equity will result in a decrease in the ratio of assets provided by creditors as compared to assets provided by owners.
2. No effect — Purchasing land for cash has no effect on earnings or on the number of shares of common stock outstanding. One asset is exchanged for another.
3. Increase — A sale of inventory on account will increase the quick assets (cash, accounts receivable, marketable securities) but have no effect on the current liabilities. For this reason, the acid-test ratio will increase.
4. No effect — Payments on account reduce cash and accounts payable by equal amounts; thus, the net amount of working capital is not affected.
5. Decrease — When a customer pays a bill, the accounts receivable balance is reduced. This increases the accounts receivable turnover, which in turn decreases the average collection period.
6. Decrease — Declaring a cash dividend will increase current liabilities, but have no effect on current assets. Therefore, the current ratio will decrease.
7. Increase — Payment of a previously declared cash dividend will reduce both current assets and current liabilities by the same amount. An equal reduction in both current assets and current liabilities will always result in an increase in the current ratio, so long as the current assets exceed the current liabilities.
8. No effect — Book value per share is not affected by the current market price of the company's stock.

Problem 16-16 (continued)

9.	Decrease	The dividend yield ratio is obtained by dividing the dividend per share by the market price per share. If the dividend per share remains unchanged and the market price goes up, then the yield will decrease.
10.	Increase	Selling property for a profit would increase net income and therefore the return on total assets would increase.
11.	Increase	A write-off of inventory will reduce the inventory balance, thereby increasing the turnover in relation to a given level of cost of goods sold.
12.	Increase	Since the company's assets earn at a rate that is higher than the rate paid on the bonds, leverage is positive, increasing the return to the common stockholders.
13.	No effect	Changes in the market price of a stock have no direct effect on the dividends paid or on the earnings per share and therefore have no effect on this ratio.
14.	Decrease	A decrease in net income would mean less income available to cover interest payments. Therefore, the times-interest-earned ratio would decrease.
15.	No effect	Write-off of an uncollectible account against the Allowance for Bad Debts will have no effect on total current assets. For this reason, the current ratio will remain unchanged.
16.	Decrease	A purchase of inventory on account will increase current liabilities, but will not increase the quick assets (cash, accounts receivable, marketable securities). Therefore, the ratio of quick assets to current liabilities will decrease.
17.	Increase	The price-earnings ratio is obtained by dividing the market price per share by the earnings per share. If the earnings per share remains unchanged, and the market price goes up, then the price-earnings ratio will increase.
18.	Decrease	Payments to creditors will reduce the total liabilities of a company, thereby decreasing the ratio of total debt to total equity.

Problem 16-17 (30 minutes)

a. The market price is going down. The dividends paid per share over the three-year period are unchanged, but the dividend yield is going up. Therefore, the market price per share of stock must be decreasing.

b. The earnings per share is increasing. Again, the dividends paid per share have remained constant. However, the dividend payout ratio is decreasing. In order for the dividend payout ratio to be decreasing, the earnings per share must be increasing.

c. The price-earnings ratio is going down. If the market price of the stock is going down [see part (a) above], and the earnings per share are going up [see part (b) above], then the price-earnings ratio must be decreasing.

d. In Year 1, leverage was negative because in that year the return on total assets exceeded the return on common equity. In Year 2 and in Year 3, leverage was positive because in those years the return on common equity exceeded the return on total assets employed.

e. It is becoming more difficult for the company to pay its bills as they come due. Although the current ratio has improved over the three years, the acid-test ratio is down. Also note that the accounts receivable and inventory are both turning more slowly, indicating that an increasing portion of the current assets is being made up of those items, from which bills cannot be paid.

f. Customers are paying their bills more slowly in Year 3 than in Year 1. This is evidenced by the decline in accounts receivable turnover.

g. Accounts receivable is increasing. This is evidenced both by a slowdown in turnover and in an increase in total sales.

h. The level of inventory undoubtedly is increasing. Notice that the inventory turnover is decreasing. Even if sales (and cost of goods sold) just remained constant, this would be evidence of a larger average inventory on hand. However, sales are not constant but rather are increasing. With sales increasing (and undoubtedly cost of goods sold also increasing), the average level of inventory must be increasing as well in order to service the larger volume of sales.

Problem 16-18 (45 minutes)

1. The loan officer stipulated that the current ratio prior to obtaining the loan must be higher than 2.0, the acid-test ratio must be higher than 1.0, and the interest on the loan must be no more than one-fourth of net operating income. These ratios are computed below:

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$= \frac{\$435{,}000}{\$246{,}000} = 1.8 \text{ (rounded)}$$

$$\text{Acid-test ratio} = \frac{\text{Cash + Marketable securities + Accounts receivable + Short-term notes}}{\text{Current liabilities}}$$

$$= \frac{\$105{,}000 + \$0 + \$75{,}000 + \$0}{\$246{,}000} = 0.7 \text{ (rounded)}$$

$$\frac{\text{Net operating income}}{\text{Interest on the loan}} = \frac{\$30{,}000}{\$120{,}000 \times 0.10 \times (6/12)} = 5.0$$

The company would not qualify for the loan because both its current ratio and its acid-test ratio are too low.

Problem 16-18 (continued)

2. By reclassifying the $68 thousand net book value of the old equipment as inventory, the current ratio would improve, but the acid-test ratio would be unaffected. Inventory is considered a current asset for purposes of computing the current ratio, but is not included in the numerator when computing the acid-test ratio.

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$= \frac{\$435{,}000 + \$68{,}000}{\$246{,}000} = 2.0 \text{ (rounded)}$$

$$\text{Acid-test ratio} = \frac{\begin{array}{c}\text{Cash + Marketable securities}\\ \text{+ Accounts receivable + Short-term notes}\end{array}}{\text{Current liabilities}}$$

$$= \frac{\$105{,}000 + \$0 + \$75{,}000 + \$0}{\$246{,}000} = 0.7 \text{ (rounded)}$$

Even if this tactic had succeeded in qualifying the company for the loan, we strongly advise against it. Inventories are assets the company has acquired to sell to customers in the normal course of business. Used production equipment is not inventory—even if there is a clear intention to sell it in the near future. The loan officer would not expect used equipment to be included in inventories; doing so would be intentionally misleading.

Problem 16-18 (continued)

Nevertheless, the old equipment is an asset that could be turned into cash. If this were done, the company would immediately qualify for the loan since the $68 thousand in cash would be included in the numerator in both the current ratio and in the acid-test ratio.

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$= \frac{\$435{,}000 + \$68{,}000}{\$246{,}000} = 2.0\ \text{(rounded)}$$

$$\text{Acid-test ratio} = \frac{\begin{array}{c}\text{Cash + Marketable securities}\\ \text{+ Accounts receivable + Short-term notes}\end{array}}{\text{Current liabilities}}$$

$$= \frac{(\$105{,}000 + \$68{,}000) + \$0 + \$75{,}000 + \$0}{\$246{,}000}$$

$$= 1.0\ \text{(rounded)}$$

However, other options may be available. The old equipment is being used to relieve bottlenecks in the heat-treating process and it would be desirable to keep this standby capacity. We would advise Jurgen to fully and honestly explain the situation to the loan officer. The loan officer might insist that the equipment be sold before any loan is approved, but she might instead grant a waiver of the current ratio and acid-test ratio requirements on the basis that they could be satisfied by selling the old equipment. Or she may approve the loan on the condition that the equipment is pledged as collateral. In that case, Jurgen would only have to sell the equipment if he would otherwise be unable to pay back the loan.

Problem 16-19 (60 minutes or longer)

Tanner Company
Income Statement
For the Year Ended December 31

		Key
Sales	$2,700,000	
Cost of goods sold	1,800,000	(h)
Gross margin	900,000	(i)
Selling and administrative expenses	585,000	(j)
Net operating income	315,000	(a)
Interest expense	45,000	
Net income before taxes	270,000	(b)
Income taxes (40%)	108,000	(c)
Net income	$ 162,000	(d)

Tanner Company
Balance Sheet
December 31

Current assets:		
Cash	$ 80,000	(f)
Accounts receivable, net	200,000	(e)
Inventory	320,000	(g)
Total current assets	600,000	(g)
Plant and equipment	900,000	(q)
Total assets	$1,500,000	(p)
Current liabilities	$ 250,000	
Bonds payable, 10%	450,000	(k)
Total liabilities	700,000	(l)
Stockholders' equity:		
Common stock, $2.50 par value	100,000	(m)
Retained earnings	700,000	(o)
Total stockholders' equity	800,000	(n)
Total liabilities and equity	$1,500,000	(p)

Problem 16-19 (continued)

Computation of missing amounts (other computational sequences are possible):

a.
$$\text{Times interest earned} = \frac{\text{Earnings before interest and taxes}}{\text{Interest expense}}$$

$$= \frac{\text{Earnings before interest and taxes}}{\$45{,}000}$$

$$= 7.0$$

Earnings before interest and taxes = $45,000 × 7.0 = $315,000

b. Net income before taxes = $315,000 – $45,000 = $270,000.

c. Income taxes = $270,000 × 40% tax rate = $108,000.

d. Net income = $270,000 – $108,000 = $162,000.

e.
$$\text{Accounts receivable turnover} = \frac{\text{Sales on account}}{\text{Average accounts receivable balance}}$$

$$= \frac{\$2{,}700{,}000}{\text{Average accounts receivable balance}} = 15.0$$

$$\text{Average accounts receivable balance} = \$2{,}700{,}000 \div 15.0 = \$180{,}000$$

Therefore, the average accounts receivable balance for the year must have been $180,000. The beginning balance was $160,000, so the ending balance must have been $200,000.

Problem 16-19 (continued)

f.

$$\text{Acid-test ratio} = \frac{\begin{array}{c}\text{Cash + Marketable securities}\\ \text{+ Accounts receivable + Short-term notes}\end{array}}{\text{Current liabilities}}$$

$$= \frac{\begin{array}{c}\text{Cash + Marketable securities}\\ \text{+ Accounts receivable + Short-term notes}\end{array}}{\$250{,}000} = 1.12$$

Cash + \$0 + \$200,000 + \$0 = \$250,000 × 1.12 = \$280,000

Cash = \$80,000

g.

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$= \frac{\text{Current assets}}{\$250{,}000} = 2.4$$

Current assets=\$250,000 × 2.4=\$600,000

Current assets = Cash + Accounts receivable + Inventory

\$600,000 = \$80,000 + \$200,000 + Inventory

Inventory = \$600,000 - \$80,000 - \$200,000 = \$320,000

h.

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold}}{\text{Average inventory}}$$

$$= \frac{\text{Cost of goods sold}}{(\$280{,}000 + \$320{,}000)/2}$$

$$= \frac{\text{Cost of goods sold}}{\$300{,}000} = 6.0$$

Cost of goods sold=\$300,000 × 6.0=\$1,800,000

Problem 16-19 (continued)

i. Gross margin = \$2,700,000 – \$1,800,000

j. Net operating income
   = Gross margin – Selling and administrative expenses
   \$315,000 = \$900,000 – Selling and administrative expenses
   Selling and administrative expenses = \$900,000– \$315,000 = \$585,000.

k. The interest expense for the year was \$45,000 and the interest rate was 10%, so the bonds payable must total \$450,000.

l. Total liabilities = \$250,000 + \$450,000 = \$700,000.

m.

$$\text{Earnings per share} = \frac{\text{Net income-Preferred dividends}}{\text{Average number of common shares outstanding}}$$

$$= \frac{\$162{,}000}{\text{Average number of common shares outstanding}}$$

$$= \$4.05 \text{ per share}$$

$$\text{Average number of common shares outstanding} = \$162{,}000 \div \$4.05 \text{ per share}$$

$$= 40{,}000 \text{ shares}$$

The stock is \$2.50 par value per share, so the total common stock must be \$100,000.

n.

$$\text{Debt-to-equity ratio} = \frac{\text{Total liabilities}}{\text{Stockholders' equity}}$$

$$= \frac{\$700{,}000}{\text{Stockholders' equity}} = 0.875$$

Stockholders' equity = \$700,000 ÷ 0.875 = \$800,000

Problem 16-19 (continued)

o. Total stockholders' equity = Common stock + Retained earnings
$800,000 = $100,000 + Retained earnings
Retained earnings = $800,000 − $100,000 = $700,000

p. Total assets = Total liabilities + Total stockholders' equity
Total assets = $700,000 + $800,000 = $1,500,000. This answer can also be obtained through the return on total assets ratio:

$$\text{Return on total assets} = \frac{\text{Net income} + [\text{Interest expense} \times (1\text{-Tax rate})]}{\text{Average total assets}}$$

$$= \frac{\$162{,}000 + [\$45{,}000 \times (1 - 0.40)]}{\text{Average total assets}}$$

$$= \frac{\$189{,}000}{\text{Average total assets}} = 14.0\%$$

Average total assets = $189,000 ÷ 0.14 = $1,350,000

Therefore the average total assets must be $1,350,000. The total assets at the beginning of the year were $1,200,000, so the total assets at the end of the year must have been $1,500,000 (which would also equal the total of the liabilities and the stockholders' equity).

q. Total assets = Total current assets + Plant and equipment
$1,500,000 = $600,000 + Plant and equipment
Plant and equipment = $1,500,000 − $600,000 = $900,000

Research and Application 16-20 (240 minutes)

1. The 5-year horizontal analysis in dollar and percentage form is summarized below (dollar amounts are in millions):

	2004	*2003*	*2002*	*2001*	*2000*
Sales	$45,682	$40,928	$36,519	$32,602	$29,462
Earnings from continuing operations.....	$1,885	$1,619	$1,376	$1,101	$962

	2004	*2003*	*2002*	*2001*	*2000*
Sales	155%	139%	124%	111%	100%
Earnings from continuing operations.....	196%	168%	143%	114%	100%

The data reveal that Target has increased sales by 55% over the last five years. More importantly, the sales growth has been profitable; Target's earnings from continuing operations have increased 96% over the same time period. Also, Target has consistently improved its performance. There were no unexpected drops in sales or earnings. This type of consistency is valued by investors.

Research and Application 16-20 (continued)

2. The common size comparative balance sheet is shown below (dollar amounts are in millions):

Target Corporation Common-Size Comparative Balance Sheet January 29, 2005 and January 31, 2004				
			Common-Size Percentages	
	2004	*2003*	*2004*	*2003*
Assets				
Current assets:				
Cash and cash equivalents	$ 2,245	$ 708	7.0%	2.3%
Accounts receivable, net	5,069	4,621	15.7%	14.7%
Inventory	5,384	4,531	16.7%	14.4%
Other current assets	1,224	1,000	3.8%	3.2%
Current assets—discontinued	0	2,092	0%	6.7%
Total current assets	13,922	12,952	43.1%	41.2%
Property and equipment:				
Land	3,804	3,312	11.8%	10.5%
Buildings and improvements	12,518	11,022	38.8%	35.1%
Fixtures and equipment	4,988	4,577	15.4%	14.6%
Construction-in-progress	962	969	3.0%	3.1%
Accumulated depreciation	(5,412)	(4,727)	(16.8%)	(15.0%)
Property and equipment, net	16,860	15,153	52.2%	48.2%
Other non-current assets	1,511	1,377	4.7%	4.4%
Non-current assets—discontinued	0	1,934	0.0%	6.2%
Total assets	$32,293	$31,416	100.0%	100.0%

Research and Application 16-20 (continued)

			Common-Size Percentages	
	2004	*2003*	*2004*	*2003*
Liabilities and shareholders' investment				
Current liabilities:				
Accounts payable	$ 5,779	$ 4,956	17.9%	15.8%
Accrued liabilities	1,633	1,288	5.1%	4.1%
Income taxes payable	304	382	0.8%	1.2%
Current portion of long-term debt	504	863	1.6%	2.7%
Current liabilities—discontinued	0	825	0.0%	2.6%
Total current liabilities	8,220	8,314	25.5%	26.5%
Long-term debt	9,034	10,155	28.0%	32.3%
Deferred income taxes	973	632	3.0%	2.0%
Other noncurrent liabilities	1,037	917	3.2%	2.9%
Noncurrent liabilities—discontinued	0	266	0.0%	0.9%
Total liabilities	19,264	20,284	59.7%	64.6%
Shareholders' investment:				
Common stock	74	76	0.2%	0.2%
Additional paid-in-capital	1,810	1,530	5.6%	4.9%
Retained earnings	11,148	9,523	34.5%	30.3%
Accumulated other income	(3)	3	(0.0%)	0.0%
Total shareholders' investment	13,029	11,132	40.3%	35.4%
Total liabilities and shareholders' investment	$32,293	$31,416	100.0%	100.0%

Research and Application 16-20 (continued)

3. Target uses sales for its vertical analysis of profitability. This can be confirmed by verifying how Target computed its gross margin rates (31.2% for 2004 and 30.6% for 2003) and selling, general and administrative (SG&A) expense rates (21.4% for 2004 and 21.2% for 2003) that are shown on pages 17-18 of the annual report. The computations are shown below:

	2004	*2003*
Sales	$45,682	$40,928
Cost of sales	31,445	28,389
Gross margin	$14,237	$12,539
Gross margin	$14,237	$12,539
Sales	÷ $45,682	÷ $40,928
Gross margin rate	31.2%	30.6%
SG&A expense	$9,797	$8,657
Sales	÷ $45,682	÷ $40,928
SG&A rate.......................	21.4%	21.2%

Target uses sales instead of total revenues as a base because total revenues include net credit card revenues. Page 17 of the annual report says "Net credit card revenues represent income derived from finance charges, late fees and other revenues from use of our Target Visa and proprietary Target Card." These sources of revenue do not relate to the company's primary business operations. Computing common-size income statement percentages using total revenue as the baseline could potentially distort conclusions about operational performance.

4. The calculations for these ratios are shown below (all numbers except per share information and percentages are in millions):

Earnings per share:	*2004*
Earnings from continuing operations............................	$1,885
Average number of common shares outstanding	÷ 903.8
Earnings per share—continuing operations....................	$2.09
*Target did not have any preferred stock outstanding	

Research and Application 16-20 (continued)

Price-earnings ratio:	*2004*
Market price per share	$49.49
Earnings per share—continuing operations	÷ $2.09
Price-earnings ratio	23.68
Dividend payout ratio:	
Dividends per share	$0.31
Earnings per share—continuing operations	÷ $2.09
Dividend payout ratio	14.8%
Dividend yield ratio:	
Dividends per share	$0.31
Market price per share	÷ $49.49
Dividend yield ratio	0.6%
Return on total assets:	
Earnings from continuing operations	$1,885
Add back interest expense: $570 × (1 − 0.378*)..........	355
Total (a)...	$2,240
Average total assets ($31,416 + $32,293)/2 (b)	$31,855
Return on total assets (a) ÷ (b)	7.0%
*Provision for income taxes ($1,146) divided by earnings before income taxes ($3,031) = 37.8%.	
Return on common stockholders' equity:	
Earnings from continuing operations	$1,885
Average common stockholders' equity ($13,029 + $11,132)/2	÷ $12,081
Return on common stockholders' equity	15.6%
Book value per share:	
Common stockholders' equity	$13,029
Number of common shares outstanding	÷ 890.6
Book value per share...	$14.63

Research and Application 16-20 (continued)

5. The calculations for these ratios are shown below (all dollar figures are in millions):

Working capital:	*2004*
Current assets	$13,922
Current liabilities	8,220
Working capital	$ 5,702
Current ratio:	
Current assets	$13,922
Current liabilities	÷ $8,220
Current ratio	1.69
Acid-test ratio:	
"Quick" assets ($2,245 + $5,069)	$7,314
Current liabilities	÷ $8,220
Acid-test ratio	0.89
Inventory turnover:	
Cost of sales	$31,445
Average inventory ($5,384 + $4,531)/2	÷ $4,958
Inventory turnover	6.34
Average sales period:	
Number of days in a year	365 days
Inventory turnover	÷ 6.34
Average sale period in days	57.6 days

Note to instructors: The accounts receivable turnover and average collection period are not calculated because it is impossible to determine the portion of Target's total sales that are credit sales.

Research and Application 16-20 (continued)

6. The calculations for these ratios are shown below (all dollar figures are in millions):

Times interest earned ratio:	*2004*
Earnings before interest expense and income taxes..	$3,601
Interest expense	÷ $570
Times interest earned..	6.3
Debt-to-equity ratio:	
Total liabilities..	$19,264
Stockholder's equity	÷ $13,029
Debt-to-equity ratio...	1.48

7. Target has better liquidity than Wal-Mart as measured by the current and acid-test ratios. Target turns over its inventory less frequently than Wal*Mart which is renowned for its supply chain management practices. While Wal*Mart's times interest earned ratio is much higher than Target's, both companies provide sufficient comfort to their long-term creditors in this regard. The companies have comparable debt-to-equity ratios. Target's return on total assets is lower than Wal-Mart's; however, Target's slightly higher price-earnings ratio suggests that investors believe Target has modestly stronger earnings growth prospects than Wal-Mart.

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