Chapter 6
Cost-Volume-Profit Relationships

Solutions to Questions

6-1 The contribution margin (CM) ratio is the ratio of contribution margin to total sales revenue. The CM ratio shows the change in contribution margin that will result from a change in total sales. If fixed costs do not change, then a dollar increase in contribution margin will result in a dollar increase in net operating income. Therefore, for planning purposes, knowledge of a product's CM ratio is extremely helpful in forecasting contribution margin and net operating income.

6-2 An incremental analysis focuses on the changes in revenue, cost, and volume 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. Therefore, it will tend to realize the most rapid 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.

6-5 No. A 10% decrease in the selling price will have a greater impact on profits than a 10% increase in variable expenses, since the selling price is a larger figure than the variable expenses. Mathematically, the same percentage applied to a larger base will yield a larger result. In addition, the selling price affects how much of the product will be sold.

6-6 The break-even point is the level of sales at which an organization neither earns a profit nor incurs a loss. It can also be defined as the point where total revenue equals total cost, and as the point where total contribution margin equals total fixed cost.

6-7 Three approaches to break-even analysis are (a) the equation method, (b) the contribution margin method, and (c) the graphical method. In the equation method, the equation is: 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.

In the graphical method, total cost and total revenue data are plotted on a two-axis 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.

6-8 (a) The total revenue line would rise less steeply, and the break-even point would occur at a higher volume of units. (b) Both the fixed cost line and the total cost line would shift upward; the break-even point would occur at a higher volume of units. (c) The total cost line would rise more steeply, and the break-even point would occur at a higher volume of units.

6-9

Sales revenue per car washed	$4.00
Variable expenses per car:	
15% × $4.00.....	0.60
Contribution margin per car.....	$3.40

$$\frac{\text{Total fixed expenses}}{\text{Contribution margin per car}} = \frac{\$1{,}700}{\$3.40} = 500 \text{ cars}$$

6-10 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.

6-11 Company X, with its higher fixed costs and lower variable costs, would have a higher break-even point than Company Y. Hence, Company X would also have the lower margin of safety.

6-12 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.

6-13 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 since it would require more sales to cover the same amount of fixed costs.

Exercise 6-1 (20 minutes)

	Total	*Per Unit*
1. Sales (30,000 units × 1.15 = 34,500 units)....	$172,500	$5.00
Less variable expenses	103,500	3.00
Contribution margin.....	69,000	$2.00
Less fixed expenses.....	50,000	
Net operating income	$ 19,000	
2. Sales (30,000 units × 1.20 = 36,000 units)....	$162,000	$4.50
Less variable expenses	108,000	3.00
Contribution margin.....	54,000	$1.50
Less fixed expenses.....	50,000	
Net operating income	$ 4,000	
3. Sales (30,000 units × 0.95 = 28,500 units)....	$156,750	$5.50
Less variable expenses	85,500	3.00
Contribution margin.....	71,250	$2.50
Less 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
Less variable expenses	86,400	3.20
Contribution margin.....	64,800	$2.40
Less fixed expenses.....	50,000	
Net operating income	$ 14,800	

Exercise 6-2 (30 minutes)

1. The contribution margin per person would be:

Price per ticket		$30
Less 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 ÷ $20 per person
Q = 400 persons; or, at $30 per person, $12,000

Alternative solution:

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

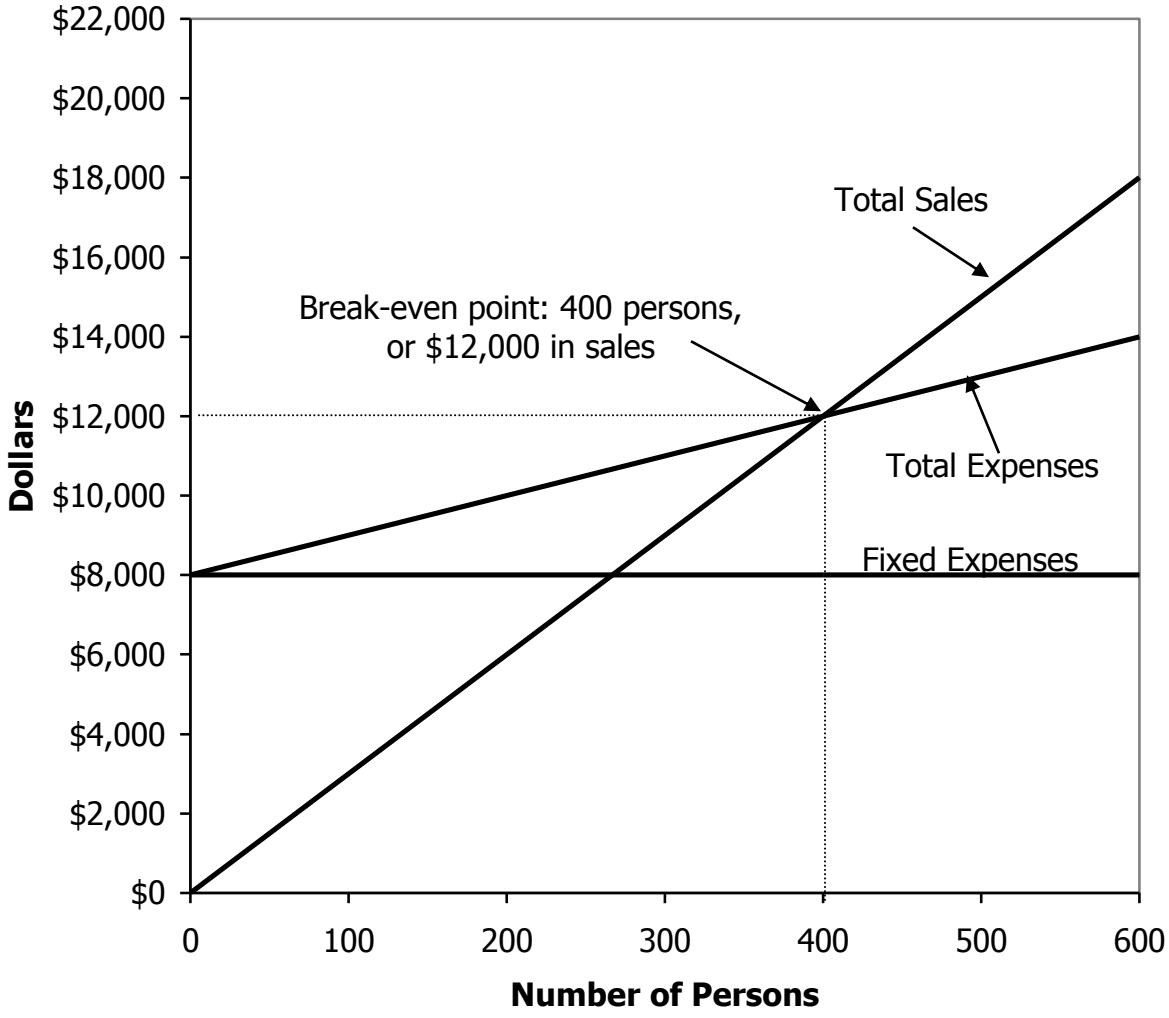
$$= \frac{\$8{,}000}{\$20 \text{ per person}} = 400 \text{ persons}$$

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 6-2 (continued)

3. Cost-volume-profit graph:



Exercise 6-3 (30 minutes)

1. Sales = Variable expenses + Fixed expenses + Profits
   $90Q = $63Q + $135,000 + $0
   $27Q = $135,000
   Q = $135,000 ÷ $27 per lantern
   Q = 5,000 lanterns, or at $90 per lantern, $450,000 in sales

   Alternative solution:

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

$$= \frac{\$135{,}000}{\$27 \text{ per lantern}} = 5{,}000 \text{ lanterns,}$$

   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 6-3 (continued)

3.

	Present: 8,000 Lanterns		*Proposed: 10,000 Lanterns**	
	Total	*Per Unit*	*Total*	*Per Unit*
Sales	$720,000	$90	$810,000	$81 **
Less variable expenses	504,000	63	630,000	63
Contribution margin	216,000	$27	180,000	$18
Less 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 6-4 (15 minutes)

1.

Sales (30,000 doors)	$1,800,000	$60
Less variable expenses	1,260,000	42
Contribution margin	540,000	$18
Less 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 6-5 (30 minutes)

1.

	Model A100		*Model B900*		*Total Company*	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*
Sales	$700,000	100	$300,000	100	$1,000,000	100
Less variable expenses	280,000	40	90,000	30	370,000	37
Contribution margin	$420,000	60	$210,000	70	630,000	63 *
Less 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:

$$\$50,000 \times 63\% \text{ CM ratio} = \$31,500$$

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.

Exercise 6-6 (30 minutes)

1. Sales = Variable expenses + Fixed expenses + Profits
   $40Q = $28Q + $150,000 + $0
   $12Q = $150,000
   Q = $150,000 ÷ $12 per unit
   Q = 12,500 units, or at $40 per unit, $500,000

   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.
$$\text{Units sold to attain target profit} = \frac{\text{Fixed expenses + Target profit}}{\text{Unit contribution margin}}$$

$$= \frac{\$150,000 + \$18,000}{\$12 \text{ per unit}} = 14,000 \text{ units}$$

	Total	*Unit*
Sales (14,000 units × $40 per unit)	$560,000	$40
Less variable expenses (14,000 units × $28 per unit)	392,000	28
Contribution margin (14,000 units × $12 per unit)	168,000	$12
Less fixed expenses	150,000	
Net operating income	$ 18,000	

Exercise 6-6 (continued)

4. Margin of safety in dollar terms:

$$\text{Margin of safety in dollars} = \text{Total sales} - \text{Break-even sales}$$

$$= \$600{,}000 - \$500{,}000 = \$100{,}000$$

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 6-7 (30 minutes)

1. Variable expenses: $60 × (100% – 40%) = $36.

2. a.

Selling price	$60	100%
Less variable expenses	36	60
Contribution margin	$24	40%

Let Q = Break-even point in units.

Sales = Variable expenses + Fixed expenses + Profits
$60Q = $36Q + $360,000 + $0
$24Q = $360,000
Q = $360,000 ÷ $24 per unit
Q = 15,000 units

In sales dollars: 15,000 units × $60 per unit = $900,000

Alternative solution:

Let X = Break-even point in sales dollars.
X = 0.60X + $360,000 + $0
0.40X = $360,000
X = $360,000 ÷ 0.40
X = $900,000

In units: $900,000 ÷ $60 per unit = 15,000 units

b. $60Q = $36Q + $360,000 + $90,000
$24Q = $450,000
Q = $450,000 ÷ $24 per unit
Q = 18,750 units

In sales dollars: 18,750 units × $60 per unit = $1,125,000

Exercise 6–7 (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%
Less 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 6–7 (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 6-7 (continued)

c. $$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \$360{,}000 \div \$27 \text{ per unit}$$

$$= 13{,}333 \text{ units (rounded)}$$

In sales dollars: 13,333 units × $60 per unit = $800,000 (rounded)

Alternative solution:

$$\text{Break-even point in sales dollars} = \frac{\text{Fixed expenses}}{\text{CM ratio}}$$

$$= \$360{,}000 \div 0.45 = \$800{,}000$$

In units: $800,000 ÷ $60 per unit = 13,333 (rounded)

Exercise 6-8 (20 minutes)

a.

	Case #1		*Case #2*	
Number of units sold	9,000	*	14,000	
Sales	$270,000	* $30	$350,000	* $25
Less variable expenses	162,000	* 18	140,000	10
Contribution margin	108,000	$12	210,000	$15 *
Less 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
Less variable expenses	280,000	* 14	90,000	18
Contribution margin	120,000	$ 6 *	70,000	$14
Less 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 %
Less variable expenses	270,000	60	130,000	* 65
Contribution margin	180,000	40%*	70,000	35 %
Less fixed expenses	115,000		60,000	*
Net operating income	$ 65,000	*	$ 10,000	

	Case #3		*Case #4*	
Sales	$700,000	100%	$300,000	* 100 %
Less variable expenses	140,000	20	90,000	* 30
Contribution margin	560,000	80%*	210,000	70 %
Less fixed expenses	470,000	*	225,000	
Net operating income	$ 90,000	*	$ (15,000)	*

*Given

Problem 6-9 (60 minutes)

1. The CM ratio is 30%.

	Total	*Per Unit*	*Percentage*
Sales (13,500 units).....	$270,000	$20	100%
Less 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 6-9 (continued)

3. Sales (27,000 units × $18 per unit*) $486,000
   Less variable expenses
   (27,000 units × $14 per unit) 378,000
   Contribution margin 108,000
   Less fixed expenses ($90,000 + $35,000) 125,000
   Net operating loss ..... $(17,000)

   *$20 – ($20 × 0.10) = $18

4. Sales = Variable expenses + Fixed expenses + Profits
   $ 20Q = $14.60Q* + $90,000 + $4,500
   $5.40Q = $94,500
   Q = $94,500 ÷ $5.40 per unit
   Q = 17,500 units

   *$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%
Less variable expenses	7	35
Contribution margin	$13	65%

Problem 6-9 (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
Less variable expenses...	280,000	14	70	140,000	7	35
Contribution margin.....	120,000	$ 6	30	260,000	$13	65
Less fixed expenses.....	90,000			208,000		
Net operating income.....	$ 30,000			$ 52,000		

Problem 6-9 (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 6-10 (60 minutes)

1. Sales = Variable expenses + Fixed expenses + Profits
   $40Q = $25Q + $300,000 + $0
   $15Q = $300,000
   Q = $300,000 ÷ $15 per shirt
   Q = 20,000 shirts

   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

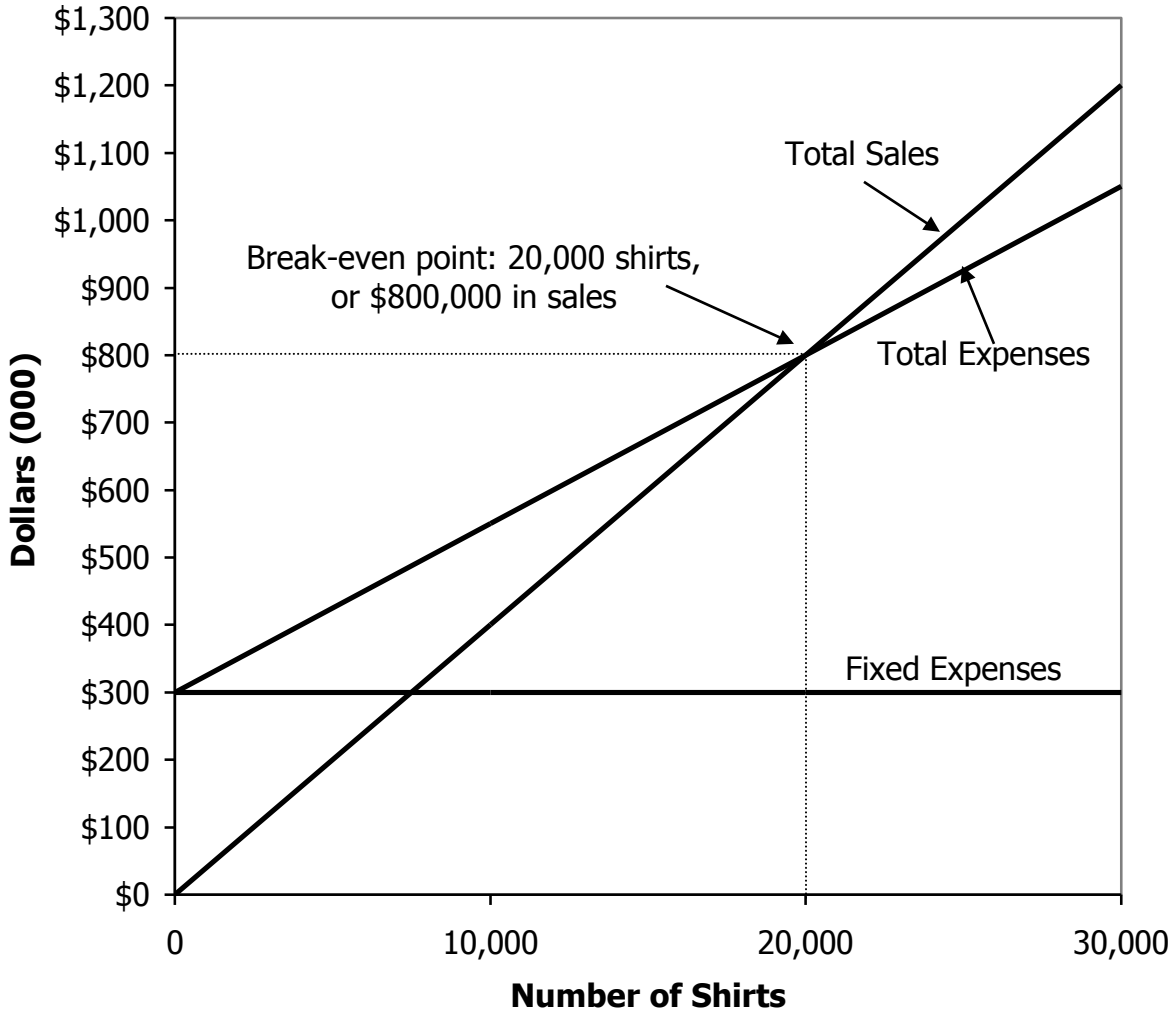
   1,000 shirts × $15 contribution margin per shirt = $15,000 loss

   Alternative solution:

Sales (19,000 shirts × $40 per shirt)	$760,000
Less variable expenses (19,000 shirts × $25 per shirt)	475,000
Contribution margin	285,000
Less fixed expenses	300,000
Net operating loss	$(15,000)

Problem 6-10 (continued)

2. Cost-volume-profit graph:



Problem 6-10 (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 6-10 (continued)

Alternative solution:

Sales (23,500 shirts × $40 per shirt)	$940,000
Less variable expenses [(20,000 shirts × $25 per shirt) + (3,500 shirts × $28 per shirt)]	598,000
Contribution margin	342,000
Less fixed expenses	300,000
Net operating income	$ 42,000

6. a. The new variable expense will be $18 per shirt (the invoice price).

Sales = Variable expenses + Fixed expenses + Profits
$40Q = $18Q + $407,000 + $0
$22Q = $407,000
Q = $407,000 ÷ $22 per shirt
Q = 18,500 shirts

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 6-11 (30 minutes)

1.

	Product							
	Sinks		*Mirrors*		*Vanities*		*Total*	
Percentage of total sales	32%		40%		28%		100%	
Sales	$160,000	100%	$200,000	100%	$140,000	100%	$500,000	100%
Less 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%*
Less fixed expenses							223,600	
Net operating income (loss)							$(8,600)	

*$215,000 ÷ $500,000 = 43%.

Problem 6-11 (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 6-12 (60 minutes)

1. The CM ratio is 60%:

Selling price	$15	100%
Less 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.

Problem 6-12 (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**
Less variable expenses	168,000	6.00	252,000	6.00
Contribution margin	252,000	$ 9.00	315,000	$ 7.50
Less 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 6-13 (45 minutes)

1. Sales (25,000 units × SFr 90 per unit) ..... SFr 2,250,000
   Less variable expenses
   (25,000 units × SFr 60 per unit) 1,500,000
   Contribution margin 750,000
   Less 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 6-13 (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 6-14 (30 minutes)

1. The contribution margin per unit on the first 30,000 units is:

	Per Unit
Selling price	$2.50
Less 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
Less 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 6-14 (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 6-15 (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 6-15 (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 6-16 (30 minutes)

1. The contribution margin per stein would be:

Selling price		$30
Less 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
Less 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:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}} = \frac{\$3{,}000}{\$24 \text{ per stein}} = 125 \text{ steins}$$

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 6-17 (45 minutes)

1. a.

	Alvaro		*Bazan*		*Total*	
	Pesetas	*%*	*Pesetas*	*%*	*Pesetas*	*%*
Sales	80,000	100	48,000	100	128,000	100
Less variable expenses	48,000	60	9,600	20	57,600	45
Contribution margin	32,000	40	38,400	80	70,400	55
Less fixed expenses					66,000	
Net operating income					4,400	

b. Break-even sales = Fixed expenses ÷ CM ratio
= 66,000 pesetas ÷ 0.55 = 120,000 pesetas

Margin of safety in pesetas = Actual sales - Break-even sales
= 128,000 pesetas - 120,000 peseta
= 8,000 pesetas

Margin of safety percentage = Margin of safety in pesetas ÷ Actual sales
= 8,000 pesetas ÷ 128,000 pesetas
= 6.25%

Problem 6-17 (continued)

2. a.

	Alvaro		*Bazan*		*Cano*		*Total*	
	Pesetas	*%*	*Pesetas*	*%*	*Pesetas*	*%*	*Pesetas*	*%*
Sales	80,000	100	48,000	100	32,000	100	160,000	100
Less variable expenses	48,000	60	9,600	20	24,000	75	81,600	51
Contribution margin	32,000	40	38,400	80	8,000	25	78,400	49
Less fixed expenses							66,000	
Net operating income							12,400	

Problem 6-17 (continued)

b. Break-even sales = Fixed expenses ÷ CM ratio
= 66,000 pesetas ÷ 0.49
= 134,694 pesetas

Margin of safety in pesetas = Actual sales - Break-even sales
= 160,000 pesetas - 134,694 peseta
= 25,306 pesetas

Margin of safety percentage = Margin of safety in pesetas ÷ Actual sales
= 25,306 pesetas ÷ 160,000 pesetas
= 15.82%

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 8,000 pesetas to 25,306 pesetas or from 6.25% to 15.82%. 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 6-18 (75 minutes)

1. a.

Selling price	$37.50	100%
Less 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:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{CM per unit}}$$

$$= \frac{\$480{,}000}{\$15 \text{ per skateboard}}$$

$$= 32{,}000 \text{ skateboards}$$

b. The degree of operating leverage would be:

$$\text{Degree of operating leverage} = \frac{\text{Contribution margin}}{\text{Net opearating income}}$$

$$= \frac{\$600{,}000}{\$120{,}000} = 5.0$$

2. The new CM ratio will be:

Selling price	$37.50	100%
Less variable expenses	25.50	68
Contribution margin.....	$12.00	32%

Problem 6-18 (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:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{CM per unit}}$$

$$= \frac{\$480{,}000}{\$12 \text{ per skateboard}}$$

$$= 40{,}000 \text{ skateboards}$$

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:

$$\text{Unit sales to attain target profit} = \frac{\text{Fixed expenses} + \text{Target profit}}{\text{CM per unit}}$$

$$= \frac{\$480{,}000 + \$120{,}000}{\$12 \text{ per skateboard}}$$

$$= 50{,}000 \text{ skateboards}$$

Problem 6-18 (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:

$$\begin{aligned} P &= \$25.50 + 0.40P \\ 0.60P &= \$25.50 \\ P &= \$25.50 \div 0.60 \\ P &= \$42.50 \end{aligned}$$

To verify:		
Selling price	$42.50	100%
Less 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 6-18 (continued)

5. The new CM ratio would be:

Selling price	$37.50		100%
Less variable expenses.....	13.50	*	36
Contribution margin.....	$24.00		64%

*$22.50 – ($22.50 × 40%) = $13.50

The new break-even point would be:

Sales = Variable expenses + Fixed expenses + Profits
$37.50Q = $13.50Q + $912,000* + $0
$24.00Q = $912,000
Q = $912,000 ÷ $24.00 per skateboard
Q = 38,000 skateboards

*$480,000 × 1.9 = $912,000

Alternative solution:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{CM per unit}}$$

$$= \frac{\$912{,}000}{\$24 \text{ per skateboard}}$$

$$= 38{,}000 \text{ skateboards}$$

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 6-18 (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:

$$\text{Unit sales to attain target profit} = \frac{\text{Fixed expenses + Target profit}}{\text{CM per unit}}$$

$$= \frac{\$912{,}000 + \$120{,}000}{\$24 \text{ per skateboard}}$$

$$= 43{,}000 \text{ skateboards}$$

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 6-18 (continued)

b. The contribution income statement would be:

Sales (40,000 skateboards × $37.50 per skateboard).....	$1,500,000
Less variable expenses (40,000 skateboards × $13.50 per skateboard)	540,000
Contribution margin.....	960,000
Less 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 6-19 (60 minutes)

1. Sales = Variable expenses + Fixed expenses + Profits
   $2.00Q = $0.80Q + $60,000 + $0
   $1.20Q = $60,000
   Q = $60,000 ÷ $1.20 per pair
   Q = 50,000 pairs

   50,000 pairs × $2 per pair = $100,000 in sales.

   Alternative solution:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{CM per unit}} = \frac{\$60{,}000}{\$1.20 \text{ per pair}} = 50{,}000 \text{ pairs}$$

$$\text{Break-even point in dollar sales} = \frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$60{,}000}{0.60} = \$100{,}000 \text{ in sales}$$

2. See the graph on the following page.

3. Sales = Variable expenses + Fixed expenses + Profits
   $2.00Q = $0.80Q + $60,000 + $9,000
   $1.20Q = $69,000
   Q = $69,000 ÷ $1.20 per pair
   Q = 57,500 pairs

   Alternative solution:

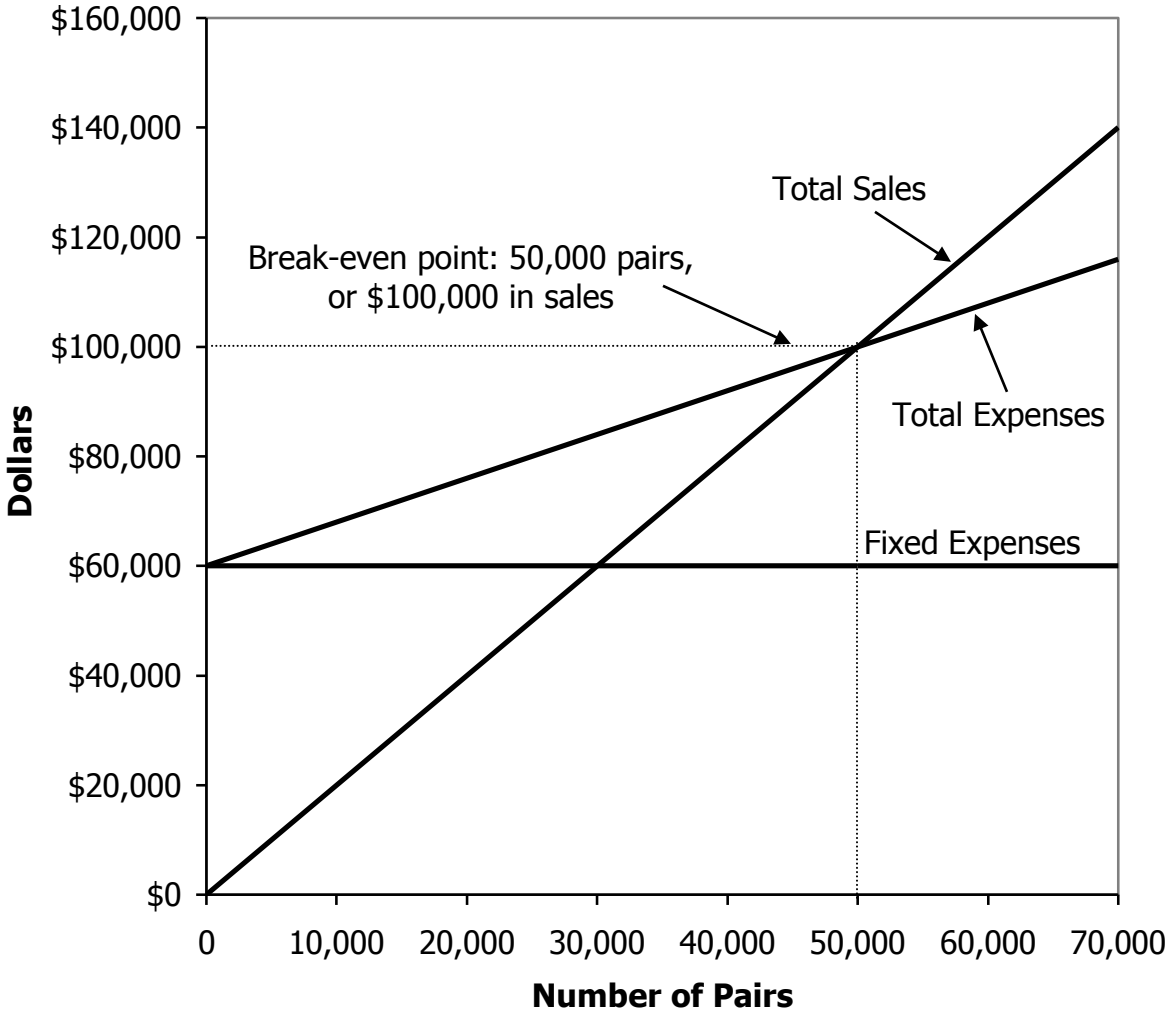
$$\text{Unit sales to attain target profit} = \frac{\text{Fixed expenses + Target profit}}{\text{CM per unit}}$$

$$= \frac{\$60{,}000 + \$9{,}000}{\$1.20 \text{ per pair}}$$

$$= 57{,}500 \text{ pairs}$$

Problem 6-19 (continued)

2. Cost-volume-profit graph:



Problem 6-19 (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 6-20 (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
Less variable expenses	560,000	14	70	320,000	8 *	40
Contribution margin	240,000	$6	30	480,000	$12	60
Less 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 less Break-even sales:		
$800,000 – $640,000	$160,000	
$800,000 – $720,000		$80,000
Margin of safety percentage = Margin of safety divided by Total sales:		
$160,000 ÷ $800,000	20%	
$80,000 ÷ $800,000		10%

Problem 6-20 (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. Notice that no information is given on either 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 + $160,000 + $80,000**
   $960,000 = Variable expenses

   * New level of sales: $800,000 × 1.5 = $1,200,000
   ** New level of net operating income: $48,000 × $1\frac{2}{3}$ = $80,000

   New CM ratio:

Sales	$1,200,000	100%
Less variable expenses	960,000	80
Contribution margin	$ 240,000	20%

   With the above data, the new break-even point can be computed:

$$\text{Break-even point in dollar sales} = \frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$160,000}{0.20} = \$800,000$$

Problem 6-20 (continued)

The greatest risk with the new method is that the president'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 just equal to the break-even level of sales under the new marketing method. Thus, if the new method is adopted and sales remain unchanged, profits will drop from the current level of $48,000 per month to zero.

Although not required in the problem, you may wish to work out the level of sales needed under the new method to generate at least $48,000 in profits each month. The computations are:

$$\text{Dollar sales to attain target profit} = \frac{\text{Fixed expenses + Target profit}}{\text{CM ratio}}$$

$$= \frac{\$160{,}000 + \$48{,}000}{0.20}$$

$$= \$1{,}040{,}000 \text{ in sales each month}$$

Problem 6-21 (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
Less 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
Less fixed expenses:								
Production							120,000	
Advertising							100,000	
Administrative							50,000	
Total fixed expenses							270,000	
Net operating income							$ 62,000	

Problem 6-21 (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
Less 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
Less fixed expenses:								
Production							120,000	
Advertising							100,000	
Administrative							50,000	
Total fixed expenses							270,000	
Net operating income							$ 50,000	

Problem 6-21 (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.

Case 6-22 (60 minutes)

1 and 2.	*Part 1*		*Part 2a*		*Part 2b*	
	Total	*Per Unit*	*Total*	*Per Unit*	*Total*	*Per Unit*
Sales	$480,000	$12.00	$630,000 [3]	$9.00	$900,000 [4]	$15.00
Less variable expenses:						
Direct materials	120,000	3.00	210,000	3.00	180,000	3.00
Direct labor	65,600	1.64	114,800	1.64	98,400	1.64
Variable overhead	20,000	0.50	35,000	0.50	30,000	0.50
Variable selling:						
Commissions	38,400	0.96 [1]	50,400	0.72 [1]	108,000	1.80 [1]
Shipping	14,000	0.35	24,500	0.35	21,000	0.35
Variable administrative	3,200	0.08	5,600	0.08	4,800	0.08
Total variable exp.	261,200	6.53	440,300	6.29	442,200	7.37
Contribution margin	218,800	$ 5.47	189,700	$2.71	457,800	$ 7.63
Less fixed expenses:						
Manufacturing overhead	70,000 [2]		70,000		70,000	
Selling	110,000		110,000		200,000 [5]	
Administrative	85,000		85,000		85,000	
Total fixed expenses	265,000		265,000		355,000	
Net operating income (loss)	$(46,200)		$(75,300)		$102,800	

[1] 8% of sales dollars for parts 1 and 2a; 12% for part 2b.

[2] $90,000 – (40,000 units × $0.50 per unit) = $70,000.

[3] $12 – ($12 × 25%) = $9; $9 per unit × 70,000 units = $630,000.

[4] $12 + ($12 × 25%) = $15; 40,000 units × 1.5 = 60,000 units; 60,000 units × $15 per unit = $900,000.

[5] $110,000 + $90,000 = $200,000.

Case 6-22 (continued)

3. Selling price per unit $12.00
   Original unit variable expense (from part 1) $6.53
   Less reduction in materials cost 1.73 4.80
   New contribution margin per unit ..... $ 7.20

$$\text{Unit sales to attain target profit} = \frac{\text{Fixed expenses + Target profit}}{\text{CM per unit}}$$

$$= \frac{\$265{,}000 + \$59{,}000}{\$7.20 \text{ per unit}}$$

$$= 45{,}000 \text{ units}$$

4. Contribution margin generated (60,000 units × $5.47 per unit) $328,200
   Less:
   Fixed costs to be covered (from part 1) $265,000
   Target profit (60,000 units × $12 per unit = $720,000; $720,000 × 4.5% = $32,400) 32,400 297,400
   Contribution margin available for increased advertising ..... $ 30,800

Case 6-22 (continued)

5. The quoted price per unit would be computed as follows:

Variable production expense ($3.00 + $1.64 + $0.50)	$ 5.14
Shipping expense ($0.35 × 1.8)	0.63
Variable administrative expense ($0.08 × 0.5)	0.04
Foreign import duty ($3,150 ÷ 15,000 units)	0.21
Present net loss ($46,200 ÷ 15,000 units)	3.08
Desired profit ($18,000 ÷ 15,000 units)	1.20
Quoted price per unit	$10.30

It should be pointed out, however, that the price charged to the overseas distributor should be determined by how much the overseas distributor is willing to pay and competitive conditions rather than by Alpine's desired profit. Any price greater than the cost of $6.02 per unit (=$10.30 - $1.20 - $3.08) would reduce Alpine's loss. On the other hand, if the distributor is willing to pay more than $10.30 per unit, it would be foolish to leave the additional profit on the table.

CASE 6-23 (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

$$\text{CM ratio} = \frac{\text{Contribution margin}}{\text{Sales}} = \frac{\$290,000}{\$720,000} = 0.4028$$

$$\text{Break-even point in total sales dollars} = \frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$282,000}{0.4028} = \$700,100 \text{ (rounded)}$$

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 6-23 (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 6-23 (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 below 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 6-23 (continued)

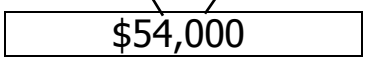
It would be natural to interpret a break-even for a product as the level of sales below which the company would be financially better off dropping the product. Therefore, we should not be surprised if managers, based on the erroneous break-even calculation on the previous page, would decide to drop the 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



Case 6-24 (60 minutes)

1. The total annual fixed cost of the Cardiac Care Department can be computed as follows:

Annual Patient-Days	*Aides @ $18,000*	*Nurses @ $29,000*	*Supervising Nurses @ $38,000*	*Total Personnel*	*Other Fixed Cost*	*Total Fixed Cost*
10,000-12,000	$126,000	$435,000	$114,000	$675,000	$1,370,000	$2,045,000
12,001-13,750	144,000	435,000	114,000	693,000	1,370,000	2,063,000
13,751-16,500	162,000	464,000	152,000	778,000	1,370,000	2,148,000
16,501-18,250	180,000	464,000	152,000	796,000	1,370,000	2,166,000
18,251-20,750	180,000	493,000	190,000	863,000	1,370,000	2,233,000
20,751-23,000	198,000	522,000	190,000	910,000	1,370,000	2,280,000

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 $150 (=$240 revenue - $90 variable cost).

Annual Patient-Days	*(a) Total Fixed Cost*	*(b) Contribution Margin*	*"Break-Even" (a) ÷ (b)*	*Within Relevant Range?*
10,000-12,000	$2,045,000	$150	13,633	No
12,001-13,750	2,063,000	150	13,753	No
13,751-16,500	2,148,000	150	14,320	Yes
16,501-18,250	2,166,000	150	14,440	No
18,251-20,750	2,233,000	150	14,887	No
20,751-23,000	2,280,000	150	15,200	No

Case 6-24 (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 $2,045,000 to $2,063,000 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 $360,000 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	$2,045,000	$360,000	$2,405,000	$150	16,033	No
12,001-13,750	2,063,000	360,000	2,423,000	150	16,153	No
13,751-16,500	2,148,000	360,000	2,508,000	150	16,720	No
16,501-18,250	2,166,000	360,000	2,526,000	150	16,840	Yes
18,251-20,750	2,233,000	360,000	2,593,000	150	17,287	No
20,751-23,000	2,280,000	360,000	2,640,000	150	17,600	No

In this case, the only solution that is within the appropriate relevant range is 16,840 patient-days.

Case 6-25 (60 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%
Less 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%
Less 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 6-25 (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

$$\text{Net operating income with company sales force} = 0.32X - \$8{,}600{,}000$$

$$\text{Net operating income with the 20\% commissions} = 0.22X - \$6{,}800{,}000$$

The two net operating incomes are equal when:

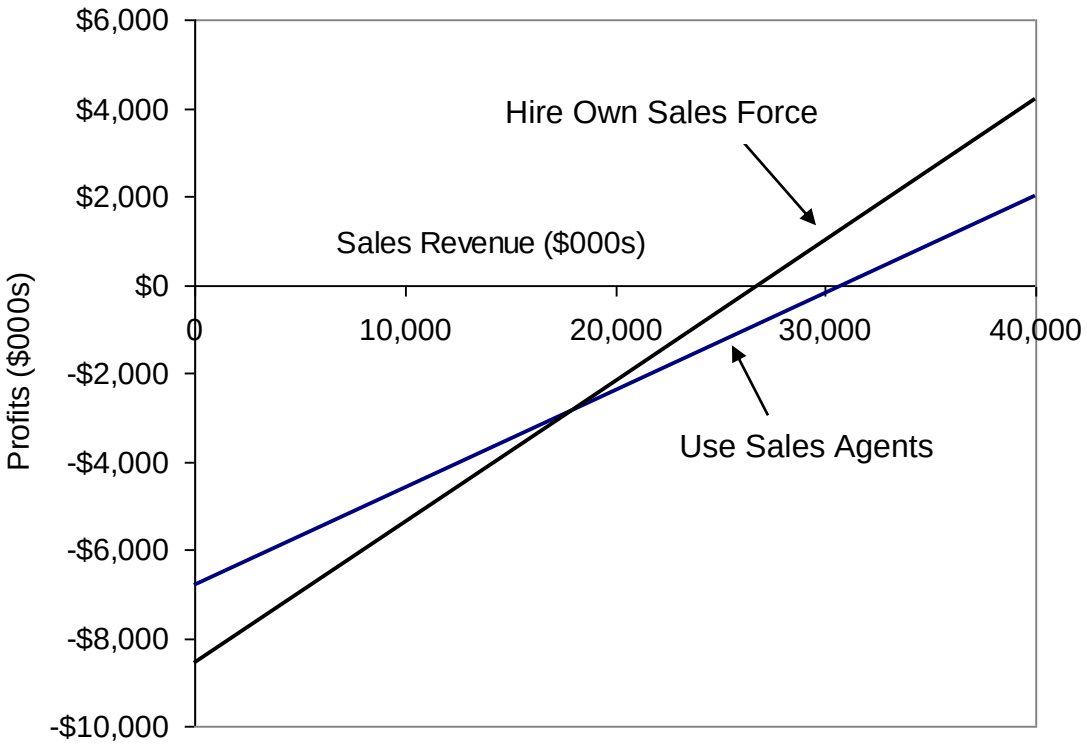
$$\begin{aligned} 0.32X - \$8{,}600{,}000 &= 0.22X - \$6{,}800{,}000 \\ 0.10X &= \$1{,}800{,}000 \\ X &= \$1{,}800{,}000 \div 0.10 \\ X &= \$18{,}000{,}000 \end{aligned}$$

Case 6-25 (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:



Case 6-25 (continued)

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 6-26 (90 minutes)

1. a. Before the income statement can be completed, we need to estimate the company's revenues and expenses for the month.

   The first step is to compute the sales for the month in both units and dollars. Sales in units would be:

   90,000 units (August sales) ÷ 1.20 = 75,000 units sold in July.

   To determine the sales in dollars, we must integrate the break-even point, the margin of safety in dollars, and the margin of safety percentage. The computations are:

   $$\text{Margin of safety in dollars} = \text{Total sales} - \text{Break-even sales}$$

   $$= \text{Total sales} - \$1{,}012{,}500$$

   $$\text{Margin of safety percentage (25\%)} = \frac{\text{Margin of safety in dollars}}{\text{Total sales}}$$

   If the margin of safety in dollars is 25% of total sales, then the break-even point in dollars must be 75% of total sales. Therefore, total sales would be:

   $$\frac{\$1{,}012{,}500}{\text{Total sales}} = 75\%$$

   $$\text{Total sales} = \$1{,}012{,}500 \div 75\%$$

   $$\text{Total sales} = \$1{,}350{,}000$$

   The selling price per unit would be:

   $1,350,000 total sales ÷ 75,000 units = $18 per unit.

   The second step is to determine the total contribution margin for the month of July. This can be done by using the operating leverage concept. Note that a 20% increase in sales has resulted in an 80% increase in net operating income between July and August:

   $$\frac{\text{August increased net income}}{\text{July net income}} = \frac{\$243{,}000 - \$135{,}000}{\$135{,}000} = \frac{\$108{,}000}{\$135{,}000} = 80\%$$

Case 6-26 (continued)

Since the net operating income for August increased by 80% when sales increased by 20%, the degree of operating leverage for July must be 4. Therefore, total contribution margin for July must have been:

$4 \times \$135{,}000 = \$540{,}000.$

With this figure, July's income statement can be completed by inserting known data and computing unknown data:

PUTREX COMPANY
Actual Income Statement
For the Month Ended July 31

	Total		*Per Unit*		*Percent*	
Sales (75,000 units).....	$1,350,000		$18.00		100	
Less variable expenses.....	810,000	*	10.80	*	60	*
Contribution margin.....	540,000		$ 7.20		40	*
Less fixed expenses.....	405,000	*				
Net operating income	$ 135,000					

*Computed by working from known data.

b. The break-even point:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{CM per unit}} = \frac{\$405{,}000}{\$7.20 \text{ per unit}} = 56{,}250 \text{ units}$$

In dollars: 56,250 units × $18 per unit = $1,012,500

Case 6-26 (continued)

c. The margin of safety:

$$\begin{aligned}\text{Margin of safety in dollars} &= \text{Total sales} - \text{Break-even sales}\\ &= \$1{,}350{,}000 - \$1{,}012{,}500 = \$337{,}500\end{aligned}$$

$$\text{Margin of safety percentage} = \frac{\text{Margin of safety in dollars}}{\text{Total sales}}$$

$$= \frac{\$337{,}500}{\$1{,}350{,}000} = 25\%$$

d. The degree of operating leverage:

$$\frac{\text{Contribution margin}}{\text{Net operating income}} = \frac{\$540{,}000}{\$135{,}000} = 4$$

2. a. August's income statement can be completed using data given in the problem and data derived for July's income statement above:

PUTREX COMPANY
Projected Income Statement
For the Month Ended August 31

	Total	*Per Unit*	*Percent*
Sales (90,000 units).....	$1,620,000	$18.00	100
Less variable expenses.....	972,000	10.80	60
Contribution margin.....	648,000	$ 7.20	40
Less fixed expenses.....	405,000		
Net operating income	$ 243,000		

Case 6-26 (continued)

b. The margin of safety:

$$\text{Margin of safety in dollars} = \text{Total sales} - \text{Break-even sales}$$

$$= \$1{,}620{,}000 - \$1{,}012{,}500$$

$$= \$607{,}500$$

$$\text{Margin of safety percentage} = \frac{\text{Margin of safety in dollars}}{\text{Total sales}}$$

$$= \frac{\$607{,}500}{\$1{,}620{,}000} = 37.5\%$$

The degree of operating leverage:

$$\frac{\text{Contribution margin}}{\text{Net operating income}} = \frac{\$648{,}000}{\$243{,}000} = 2.7 \text{ (rounded)}$$

The margin of safety has gone up since the company's sales will be greater in August than they were in July, thus moving the company farther away from its break-even point.

The degree of operating leverage operates in the opposite manner from the margin of safety. As a company moves farther away from its break-even point, the degree of operating leverage decreases. The reason it decreases is that both contribution margin and net operating income are increasing at the same *dollar* rate as additional units are sold, and, mathematically, dividing one by the other will yield a progressively smaller figure. As sales increase, the sale of an additional unit will have a progressively smaller percentage impact on total net operating income.

Case 6-26 (continued)

3. The new variable expense will total $11.70 per unit ($10.80 + $0.90), and the new contribution margin ratio will be:

Sales	$18.00	100%
Less variable expenses	11.70	65
Contribution margin	$ 6.30	35%

The target profit per unit will be:

15% × $18 = $2.70.

Therefore,

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$18.00Q &= \$11.70Q + \$405{,}000 + \$2.70Q \\ \$3.60Q &= \$405{,}000 \\ Q &= \$405{,}000 \div \$3.60 \text{ per unit} \\ Q &= 112{,}500 \text{ units} \end{aligned}$$

Alternative solution:

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ X &= 0.65X + \$405{,}000 + 0.15X \\ 0.20X &= \$405{,}000 \\ X &= \$405{,}000 \div 0.20 \\ X &= \$2{,}025{,}000; \text{ or, at } \$18 \text{ per unit, } 112{,}500 \text{ units} \end{aligned}$$

Group Exercise 6-27

1. The answer to this question will vary from school to school.

2. Managers will hire more support staff, such as security and vending personnel, for big games that predictably draw more people. These costs are variable with respect to the number of *expected* attendees, but are fixed with respect to the number of people who actually buy tickets. Most other costs are fixed with respect to both the number of expected and actual tickets sold—including the costs of the coaching staff, athletic scholarships, uniforms and equipment, facilities, and so on.

3. The answer to this question will vary from school to school, but a clear distinction should be drawn between the costs that are variable with respect to the number of tickets sold (i.e., actual attendees) versus the costs that are variable with respect to the number of tickets that are expected to be sold. The costs that are variable with respect to the number of tickets actually sold, given the number of expected tickets sold, are probably inconsequential since, as discussed above, staffing is largely decided based on expectations.

4. The answer to this question will vary from school to school. The lost profit is the difference between the ticket price and the variable cost of filling a seat multiplied by the number of unsold seats.

5. The answer to this question will vary from school to school.

6. The answer to this question will vary from school to school, but should be based on the answers to parts (4) and (5) above.

Group Exercise 6-28

Parts 1, 2, and 3

	Affected by adding service to an airport?	*Affected by adding a flight?*	*Variable with respect to seats filled?*
Fuel and oil	Yes	Yes	Somewhat
Flying operations labor (flight crews—pilots, copilots, navigators, and flight engineers)	Yes	Yes	No
Passenger service labor (flight attendants)	Yes	Yes	Somewhat
Aircraft traffic and servicing labor (personnel servicing aircraft and handling passengers at gates, baggage, and cargo)	Yes	Yes	Somewhat
Promotions and sales labor (reservations and sales agents, advertising and publicity)	Somewhat	No	No
Maintenance labor (maintenance of flight equipment and ground property and equipment)	Yes	Somewhat	No
Maintenance materials and overhead	Yes	Yes	No
Ground property and equipment (landing fees, and rental expenses and depreciation for ground property and equipment)	Yes	Somewhat	No
Flight equipment (rental expenses and depreciation on aircraft frames and engines)	Yes	Yes	No
General overhead (administrative personnel, utilities, insurance, communications, etc.)	Somewhat	No	No

Group Exercise 6-28 (continued)

4. The variable cost of filling a seat on an already-scheduled flight is very small. The number of flight attendants on a flight might have to be augmented and the number of meals served would have to be increased, but beyond that there would be very little variable cost. Fuel costs would increase because of the added weight, but not by very much. Consequently, almost all of the ticket price falls directly to the bottom line as increased net operating income. This makes airline profits very sensitive to the load factor. As the percentage of seats filled by paying passengers increases, profits increase dramatically. The downside of this is that if the load factor declines, losses can happen very quickly.

   Airlines have very high fixed costs and very low variable costs, which gives them a lot of operating leverage. When operating leverage is high, profits are sensitive because each item sold contributes more to revenue, above fixed costs. Thus, beyond the break-even point, profits grow more rapidly than they would if operating leverage was low. However, if the break-even point is not reached, then losses are greater, because a higher proportion of costs is fixed.

Group Exercise 6-29

1. If 9% increases continue for ten years, then the cost of tuition and room and board at a private college will cost 2.37 times as much as today ($1.09^{10}=2.37$). Thus, a college education that costs $100,000 today would cost $237,000 in ten years. This appears to be quite unaffordable—particularly if family incomes increase at much less than the 9% rate.

2. The cost of adding an additional student to a class is virtually zero. Basically, all of a college's costs are fixed with respect to how many students are enrolled in a particular scheduled class.

3. Increasing enrollment will lead to more efficient use of the currently underutilized capacity of higher education. If more students are enrolled in a college whose enrollments are below capacity, then the cost per student should decrease. Consequently, tuition should decrease as well, unless capacity is expanded to accommodate the additional students.

4. Private colleges should benefit more than public colleges from increasing enrollments because tuition is generally higher at private institutions; therefore, more revenue will be received from additional students. The revenue stream tends to be much more constant at public colleges, which rely on funds provided by the state. This shields public colleges somewhat during periods of decreasing enrollments, but prevents them from realizing the full benefits of increasing enrollments.