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, for planning purposes, 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. 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 profits are zero. 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 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.

6-8 (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 fixed costs 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 costs increased, then the total cost line would rise more steeply and the break-even point would occur at a higher unit volume.

6-9

Sales revenue per car washed.....	$4.00
Variable cost per car	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)

1. The new income statement would be:

	Total	*Per Unit*
Sales (10,100 units)	$353,500	$35.00
Less variable expenses	202,000	20.00
Contribution margin	151,500	$15.00
Less fixed expenses.....	135,000	
Net operating income	$ 16,500	

You can get the same net operating income using the following approach.

Original net operating income	$15,000
Change in contribution margin (100 units × $15.00 per unit) ...	1,500
New net operating income	$16,500

2. The new income statement would be:

	Total	*Per Unit*
Sales (9,900 units)	$346,500	$35.00
Less variable expenses	198,000	20.00
Contribution margin	148,500	$15.00
Less fixed expenses.....	135,000	
Net operating income	$ 13,500	

You can get the same net operating income using the following approach.

Original net operating income	$15,000
Change in contribution margin (-100 units × $15.00 per unit)	(1,500)
New net operating income	$13,500

Exercise 6-1 (continued)

3. The new income statement would be:

	Total	*Per Unit*
Sales (9,000 units)	$315,000	$35.00
Less variable expenses ...	180,000	20.00
Contribution margin	135,000	$15.00
Less fixed expenses.....	135,000	
Net operating income	$ 0	

Note: This is the company's break-even point.

Exercise 6-2 (30 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 $24,000.

   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 8,000 units.

Fixed expense	$ 24,000
Variable expense (8,000 units × $18 per unit)	144,000
Total expense	$168,000

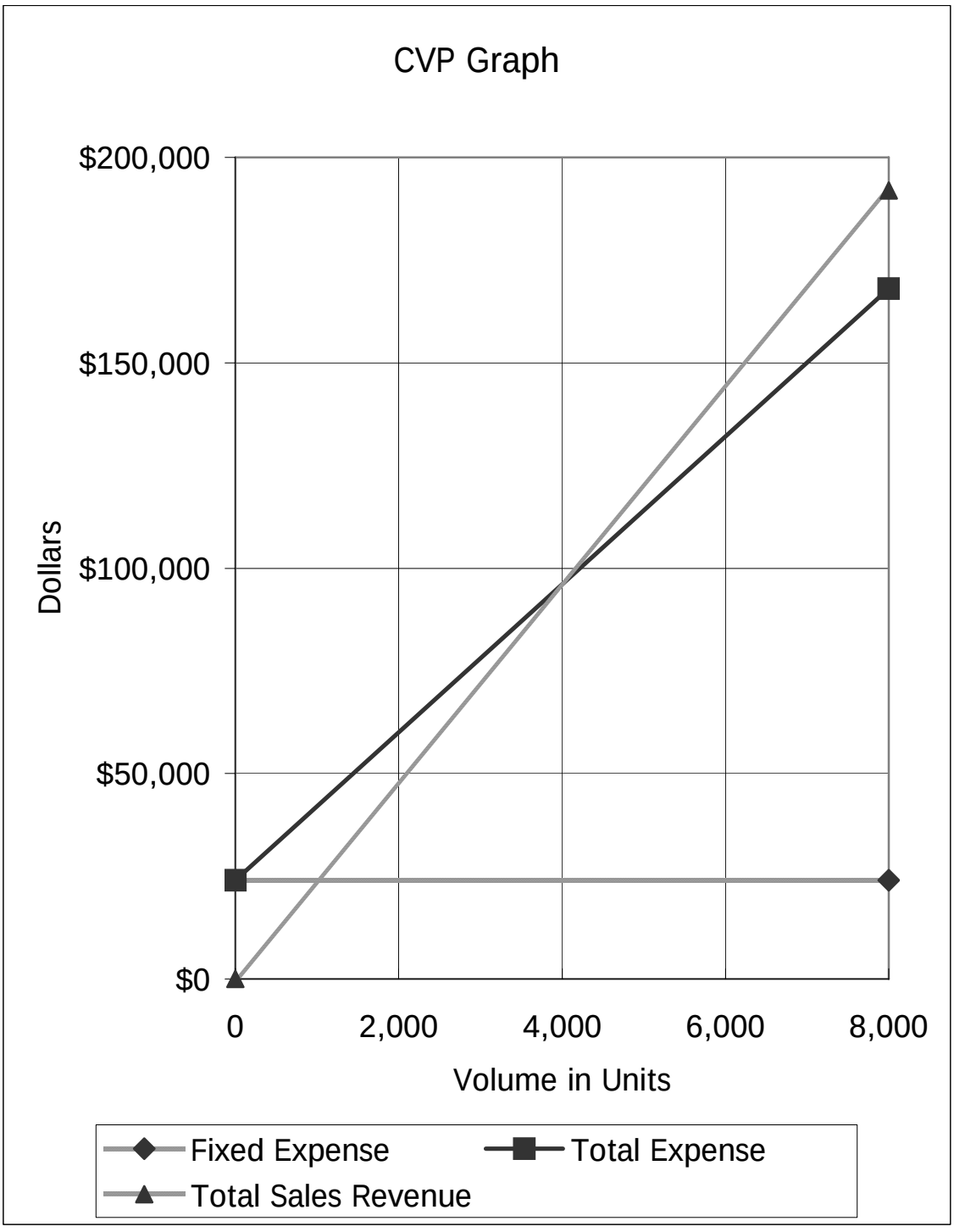
   Step 3. Choose some volume of sales and plot the point representing total sales dollars at the activity level you have selected. We'll use the sales level of 8,000 units again.

Total sales revenue (8,000 units × $24 per unit)	$192,000

2. The break-even point is the point where the total sales revenue and the total expense lines intersect. This occurs at sales of 4,000 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
   $24Q = $18Q + $24,000 + $0
   $6Q = $24,000
   Q = $24,000 ÷ $6 per unit
   Q = 4,000 units

Exercise 6-2 (continued)



Exercise 6-3 (10 minutes)

1. The company's contribution margin (CM) ratio is:

Total sales	$200,000
Total variable expenses	120,000
= Total contribution margin	80,000
÷ Total sales	$200,000
= CM ratio	40%

2. The change in net operating income from an increase in total sales of $1,000 can be estimated by using the CM ratio as follows:

Change in total sales	$1,000
× CM ratio	40 %
= Estimated change in net operating income	$ 400

This computation can be verified as follows:

Total sales	$200,000	
÷ Total units sold	50,000	units
= Selling price per unit	$4.00	per unit

Increase in total sales	$1,000	
÷ Selling price per unit	$4.00	per unit
= Increase in unit sales	250	units
Original total unit sales	50,000	units
New total unit sales	50,250	units

	Original	*New*
Total unit sales	50,000	50,250
Sales	$200,000	$201,000
Less variable expenses	120,000	120,600
Contribution margin	80,000	80,400
Less fixed expenses	65,000	65,000
Net operating income	$ 15,000	$ 15,400

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	$180,000	$189,000	$ 9,000
Less variable expenses	126,000	132,300	6,300
Contribution margin	54,000	56,700	2,700
Less fixed expenses	30,000	35,000	5,000
Net operating income	$ 24,000	$ 21,700	$(2,300)

Assuming no other important factors need 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 $2,300.

Alternative Solution 1

Expected total contribution margin:	
$189,000 × 30% CM ratio	$56,700
Present total contribution margin:	
$180,000 × 30% CM ratio	54,000
Incremental contribution margin	2,700
Change in fixed expenses:	
Less incremental advertising expense	5,000
Change in net operating income	$(2,300)

Alternative Solution 2

Incremental contribution margin:	
$9,000 × 30% CM ratio	$ 2,700
Less incremental advertising expense	5,000
Change in net operating income	$(2,300)

Exercise 6-4 (continued)

2. The $2 increase in variable costs will cause the unit contribution margin to decrease from $27 to $25 with the following impact on net operating income:

Expected total contribution margin with the higher-quality components:	
2,200 units × $25 per unit	$55,000
Present total contribution margin:	
2,000 units × $27 per unit	54,000
Change in total contribution margin	$ 1,000

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
   $15Q = $12Q + $4,200 + $0
   $3Q = $4,200
   Q = $4,200 ÷ $3 per basket
   Q = 1,400 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.....	$15	100%
Less variable expenses	12	80%
Contribution margin	$ 3	20%

   Sales = Variable expenses + Fixed expenses + Profits
   X = 0.80X + $4,200 + $0
   0.20X = $4,200
   X = $4,200 ÷ 0.20
   X = $21,000

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
   = $4,200 ÷ $3 per basket
   = 1,400 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
   = $4,200 ÷ 0.20
   = $21,000

Exercise 6-6 (10 minutes)

1. The equation method yields the required unit sales, Q, as follows:

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$120Q &= \$80Q + \$50{,}000 + \$10{,}000 \\ \$40Q &= \$60{,}000 \\ Q &= \$60{,}000 \div \$40 \text{ per unit} \\ Q &= 1{,}500 \text{ units} \end{aligned}$$

2. The contribution margin yields the required unit sales as follows:

$$\begin{aligned} \text{Units sold to attain target profit} &= \frac{\text{Fixed expenses + Target profit}}{\text{Unit contribution margin}} \\ &= \frac{\$50{,}000 + \$15{,}000}{\$40 \text{ per unit}} \\ &= \frac{\$65{,}000}{\$40 \text{ per unit}} = 1{,}625 \text{ units} \end{aligned}$$

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
   $30Q = $20Q + $7,500 + $0
   $10Q = $7,500
   Q = $7,500 ÷ $10 per unit
   Q = 750 units

Sales (at the budgeted volume of 1,000 units)	$30,000
Break-even sales (at 750 units)	22,500
Margin of safety (in dollars)	$ 7,500

2. The margin of safety as a percentage of sales is as follows:

Margin of safety (in dollars)	$7,500
÷ Sales	$30,000
Margin of safety as a percentage of sales.....	25.0%

Exercise 6-8 (20 minutes)

1. The company's degree of operating leverage would be computed as follows:

Contribution margin	$48,000
÷ Net operating income.....	$10,000
Degree of operating leverage..	4.8

2. A 5% increase in sales should result in a 24% increase in net operating income, computed as follows:

Degree of operating leverage.....	4.8
× Percent increase in sales	5%
Estimated percent increase in net operating income.....	24%

3. The new income statement reflecting the change in sales would be:

	Amount	*Percent of Sales*
Sales.....	$84,000	100%
Less variable expenses ...	33,600	40%
Contribution margin	50,400	60%
Less fixed expenses.....	38,000	
Net operating income	$12,400	

Net operating income reflecting change in sales	$12,400
Original net operating income	$10,000
Percent change in net operating income	24%

Exercise 6-9 (20 minutes)

1. The overall contribution margin ratio can be computed as follows:

$$\text{Overall CM ratio} = \frac{\text{Total contribution margin}}{\text{Total sales}}$$

$$= \frac{\$30{,}000}{\$100{,}000} = 30\%$$

2. The overall break-even point in sales dollars can be computed as follows:

$$\text{Overall break-even} = \frac{\text{Total fixed expenses}}{\text{Overall CM ratio}}$$

$$= \frac{\$24{,}000}{30\%} = \$80{,}000$$

3. To construct the required income statement, we must first determine the relative sales mix for the two products:

	Claimjumper	*Makeover*	*Total*
Original dollar sales	$30,000	$70,000	$100,000
Percent of total	30%	70%	100%
Sales at break-even	$24,000	$56,000	$80,000

	Claimjumper	*Makeover*	*Total*
Sales	$24,000	$56,000	$80,000
Less variable expenses*	16,000	40,000	56,000
Contribution margin	$ 8,000	$16,000	24,000
Less fixed expenses			24,000
Net operating income			$ 0

*Claimjumper variable expenses: ($24,000/$30,000) × $20,000 = $16,000
Makeover variable expenses: ($56,000/$70,000) × $50,000 = $40,000

Exercise 6-10 (20 minutes)

	Total	*Per Unit*
1. Sales (20,000 units × 1.15 = 23,000 units)	$345,000	$ 15.00
Less variable expenses	207,000	9.00
Contribution margin	138,000	$ 6.00
Less fixed expenses	70,000	
Net operating income	$ 68,000	
2. Sales (20,000 units × 1.25 = 25,000 units)	$337,500	$13.50
Less variable expenses	225,000	9.00
Contribution margin	112,500	$ 4.50
Less fixed expenses	70,000	
Net operating income	$ 42,500	
3. Sales (20,000 units × 0.95 = 19,000 units)	$313,500	$16.50
Less variable expenses	171,000	9.00
Contribution margin	142,500	$ 7.50
Less fixed expenses	90,000	
Net operating income	$ 52,500	
4. Sales (20,000 units × 0.90 = 18,000 units)	$302,400	$16.80
Less variable expenses	172,800	9.60
Contribution margin	129,600	$ 7.20
Less fixed expenses	70,000	
Net operating income	$ 59,600	

Exercise 6-11 (30 minutes)

1. The contribution margin per person would be:

Price per ticket		$35
Less variable expenses:		
Dinner	$18	
Favors and program	2	20
Contribution margin per person		$15

The fixed expenses of the dinner-dance total $6,000. The break-even point would be:

Sales = Variable expenses + Fixed expenses + Profits
$35Q = $20Q + $6,000 + $0
$15Q = $6,000
Q = $6,000 ÷ $15 per person
Q = 400 persons; or, at $35 per person, $14,000

Alternative solution:

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

$$= \frac{\$6{,}000}{\$15 \text{ per person}} = 400 \text{ persons}$$

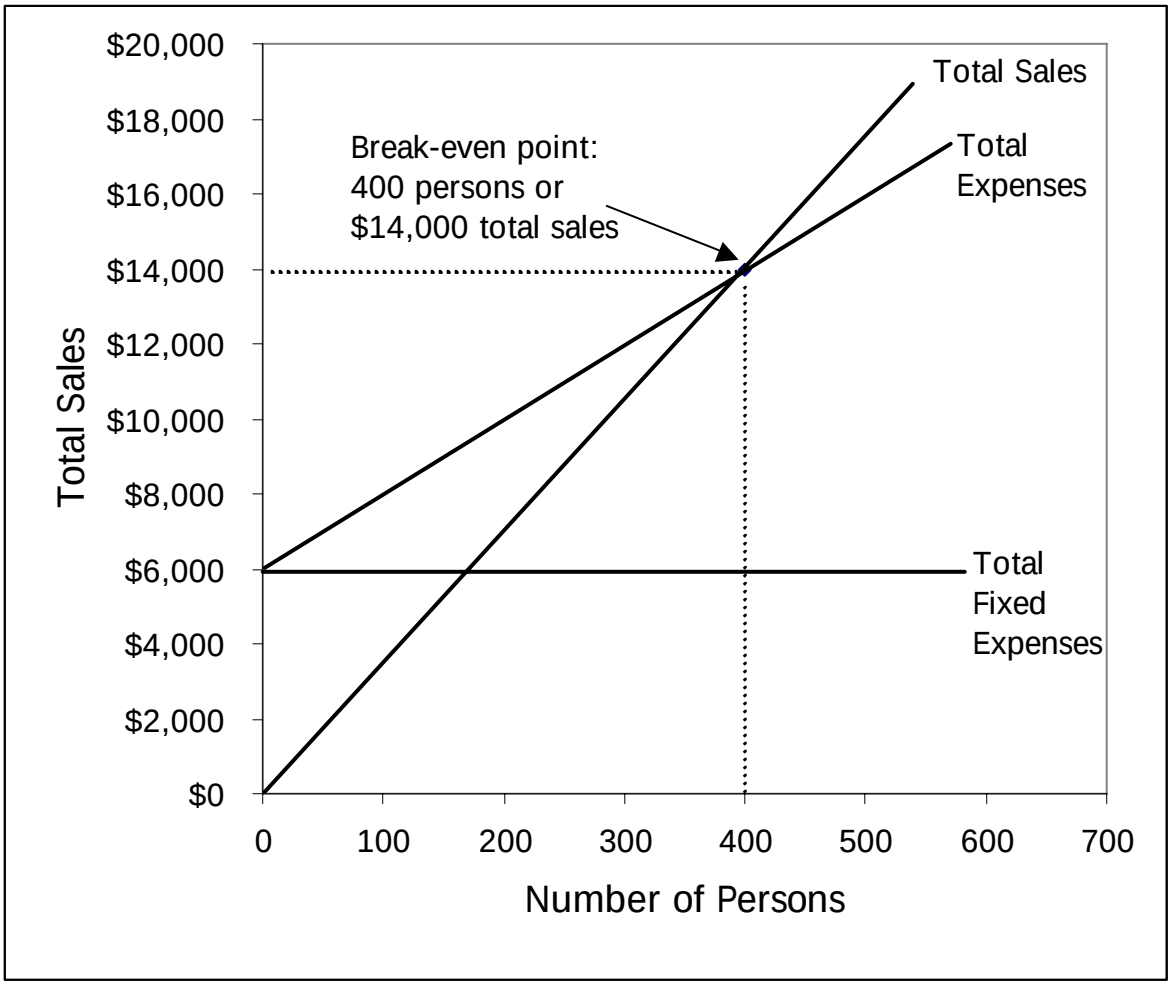
or, at $35 per person, $14,000.

2.

Variable cost per person ($18 + $2)	$20
Fixed cost per person ($6,000 ÷ 300 persons)	20
Ticket price per person to break even	$40

Exercise 6-11 (continued)

3. Cost-volume-profit graph:



Exercise 6-12 (30 minutes)

1. Variable expenses: $40 × (100% – 30%) = $28.

2. a.

Selling price	$40	100%
Less variable expenses	28	70
Contribution margin	$12	30%

Let Q = Break-even point in units.

Sales = Variable expenses + Fixed expenses + Profits
$40Q = $28Q + $180,000 + $0
$12Q = $180,000
Q = $180,000 ÷ $12 per unit
Q = 15,000 units

In sales dollars: 15,000 units × $40 per unit = $600,000

Alternative solution:

Let X = Break-even point in sales dollars.
X = 0.70X + $180,000 + $0
0.30X = $180,000
X = $180,000 ÷ 0.30
X = $600,000

In units: $600,000 ÷ $40 per unit = 15,000 units

b. $40Q = $28Q + $180,000 + $60,000
$12Q = $240,000
Q = $240,000 ÷ $12 per unit
Q = 20,000 units

In sales dollars: 20,000 units × $40 per unit = $800,000

Alternative solution:

X = 0.70X + $180,000 + $60,000
0.30X = $240,000
X = $240,000 ÷ 0.30
X = $800,000

In units: $800,000 ÷ $40 per unit = 20,000 units

Exercise 6-12 (continued)

c. The company's new cost/revenue relationships will be:

Selling price	$40	100%
Less variable expenses ($28 – $4)	24	60
Contribution margin	$16	40%

$$\$40Q = \$24Q + \$180,000 + \$0$$
$$\$16Q = \$180,000$$
$$Q = \$180,000 \div \$16 \text{ per unit}$$
$$Q = 11,250 \text{ units}$$

In sales dollars: 11,250 units × $40 per unit = $450,000

Alternative solution:

$$X = 0.60X + \$180,000 + \$0$$
$$0.40X = \$180,000$$
$$X = \$180,000 \div 0.40$$
$$X = \$450,000$$

In units: $450,000 ÷ $40 per unit = 11,250 units

3. a.

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

$$= \frac{\$180,000}{\$12 \text{ per unit}} = 15,000 \text{ units}$$

In sales dollars: 15,000 units × $40 per unit = $600,000

Alternative solution:

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

$$= \frac{\$180,000}{0.30} = \$600,000$$

In units: $600,000 ÷ $40 per unit = 15,000 units.

Exercise 6-12 (continued)

b.

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

$$= \frac{\$180{,}000 + \$60{,}000}{\$12 \text{ per unit}} = 20{,}000 \text{ units}$$

In sales dollars: 20,000 units × $40 per unit = $800,000

Alternative solution:

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

$$= \frac{\$180{,}000 + \$60{,}000}{0.30} = \$800{,}000$$

In units: $800,000 ÷ $40 per unit = 20,000 units

c.

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

$$= \frac{\$180{,}000}{\$16 \text{ per unit}} = 11{,}250 \text{ units}$$

In sales dollars: 11,250 units × $40 per unit = $450,000

Alternative solution:

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

$$= \frac{\$180{,}000}{0.40} = \$450{,}000$$

In units: $450,000 ÷ $40 per unit = 11,250 units

Exercise 6-13 (30 minutes)

1. Sales = Variable expenses + Fixed expenses + Profits
   $50Q = $32Q + $108,000 + $0
   $18Q = $108,000
   Q = $108,000 ÷ $18 per stove
   Q = 6,000 stoves, or at $50 per stove, $300,000 in sales.

   Alternative solution:

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

$$= \frac{\$108{,}000}{\$18.00 \text{ per stove}} = 6{,}000 \text{ stoves}$$

   or at $50 per stove, $300,000 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 stoves would have to be sold in order to generate enough contribution margin to cover the fixed costs.

3.

	Present: 8,000 Stoves		*Proposed: 10,000 Stoves**	
	Total	*Per Unit*	*Total*	*Per Unit*
Sales	$400,000	$50	$450,000	$45 **
Less variable expenses	256,000	32	320,000	32
Contribution margin	144,000	$18	130,000	$13
Less fixed expenses	108,000		108,000	
Net operating income	$ 36,000		$ 22,000	

   *8,000 stoves × 1.25 = 10,000 stoves
   **$50 × 0.9 = $45

   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.

Exercise 6-13 (continued)

4. Sales = Variable expenses + Fixed expenses + Profits
   $45Q = $32Q + $108,000 + $35,000
   $13Q = $143,000
   Q = $143,000 ÷ $13 per stove
   Q = 11,000 stoves

Alternative solution:

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

$$= \frac{\$108,000 + \$35,000}{\$13 \text{ per stove}} = 11,000 \text{ stoves}$$

Exercise 6-14 (20 minutes)

a.

	Case #1		*Case #2*	
Number of units sold	15,000 *		4,000	
Sales	$180,000 *	$12	$100,000 *	$25
Less variable expenses...	120,000 *	8	60,000	15
Contribution margin.....	60,000	$ 4	40,000	$10 *
Less fixed expenses.....	50,000 *		32,000 *	
Net operating income	$ 10,000		$ 8,000 *	

	Case #3		*Case #4*	
Number of units sold	10,000 *		6,000 *	
Sales	$200,000	$20	$300,000 *	$50
Less variable expenses...	70,000 *	7	210,000	35
Contribution margin.....	130,000	$13 *	90,000	$15
Less fixed expenses.....	118,000		100,000 *	
Net operating income	$ 12,000 *		$(10,000) *	

b.

	Case #1		*Case #2*	
Sales	$500,000 *	100%	$400,000 *	100%
Less variable expenses...	400,000	80	260,000 *	65
Contribution margin.....	100,000	20% *	140,000	35%
Less fixed expenses	93,000		100,000 *	
Net operating income.....	$ 7,000 *		$ 40,000	

	Case #3		*Case #4*	
Sales.....	$250,000	100%	$600,000 *	100%
Less variable expenses ..	100,000	40	420,000 *	70
Contribution margin.....	150,000	60% *	180,000	30%
Less fixed expenses.....	130,000 *		185,000	
Net operating income	$ 20,000 *		$ (5,000) *	

*Given

Exercise 6-15 (30 minutes)

1. Sales = Variable expenses + Fixed expenses + Profits
   $30Q = $12Q + $216,000 + $0
   $18Q = $216,000
   Q = $216,000 ÷ $18 per unit
   Q = 12,000 units, or at $30 per unit, $360,000

   Alternative solution:

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

$$= \frac{\$216{,}000}{\$18 \text{ per unit}} = 12{,}000 \text{ units}$$

   or at $30 per unit, $360,000

2. The contribution margin is $216,000 since the contribution margin is equal to the fixed expenses at the break-even point.

3.
$$\text{Units sold to attain target profit} = \frac{\text{Fixed expenses + Target profit}}{\text{Unit contribution margin}}$$

$$= \frac{\$216{,}000 + \$90{,}000}{\$18 \text{ per unit}} = 17{,}000 \text{ units}$$

	Total	*Unit*
Sales (17,000 units × $30 per unit)	$510,000	$30
Less variable expenses (17,000 units × $12 per unit)	204,000	12
Contribution margin	306,000	$18
Less fixed expenses.....	216,000	
Net operating income	$ 90,000	

Exercise 6-15 (continued)

4. Margin of safety in dollar terms:

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

$$= \$450{,}000 - \$360{,}000 = \$90{,}000$$

Margin of safety in percentage terms:

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

$$= \frac{\$90{,}000}{\$450{,}000} = 20\%$$

5. The CM ratio is 60%.

Expected total contribution margin: ($500,000 × 60%)	$300,000
Present total contribution margin: ($450,000 × 60%)	270,000
Increased contribution margin	$ 30,000

Alternative solution:
$50,000 incremental sales × 60% CM ratio = $30,000.

Since in this case the company's fixed expenses will not change, quarterly net operating income will also increase by $30,000.

Exercise 6-16 (15 minutes)

1.

	Total	*Per Unit*
Sales (15,000 games)	$300,000	$20
Less variable expenses	90,000	6
Contribution margin	210,000	$14
Less fixed expenses	182,000	
Net operating income	$ 28,000	

The degree of operating leverage would be:

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

$$= \frac{\$210,000}{\$28,000} = 7.5$$

2. a. Sales of 18,000 games would represent a 20% increase over last year's sales. Since the degree of operating leverage is 7.5, net operating income should increase by 7.5 times as much, or by 150% (7.5 × 20%).

   b. The expected total dollar amount of net operating income for next year would be:

Last year's net operating income	$28,000
Expected increase in net operating income next year (150% × $28,000)	42,000
Total expected net operating income	$70,000

Exercise 6-17 (30 minutes)

1.

	Flight Dynamic		*Sure Shot*		*Total Company*	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*
Sales	P150,000	100	P250,000	100	P400,000	100.0
Less variable expenses	30,000	20	160,000	64	190,000	47.5
Contribution margin.....	P120,000	80	P 90,000	36	210,000	52.5*
Less fixed expenses.....					183,750	
Net operating income					P 26,250	

*P210,000 ÷ P400,000 = 52.5%.

2. The break-even point for the company as a whole would be:

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

$$= \frac{\text{P183,750}}{0.525} = \text{P350,000}$$

3. The additional contribution margin from the additional sales would be computed as follows:

   P100,000 × 52.5% CM ratio = P52,500

   Assuming no change in fixed expenses, all of this additional contribution margin of P52,500 should drop to the bottom line as increased net operating income.

   This answer assumes no change in selling prices, variable costs per unit, fixed expense, or sales mix.

Problem 6-18 (60 minutes)

1. Sales = Variable expenses + Fixed expenses + Profits
   $30.00Q = $18.00Q + $150,000 + $0
   $12.00Q = $150,000
   Q = $150,000 ÷ $12.00 per pair
   Q = 12,500 pairs

   12,500 pairs × $30 per pair = $375,000 in sales.

   Alternative solution:

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

$$= \frac{\$150,000}{\$12.00 \text{ per pair}} = 12,500 \text{ pairs}$$

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

$$= \frac{\$150,000}{0.40} = \$375,000 \text{ in sales}$$

2. See the graph on the following page.

3. The simplest approach is:

Break-even sales	12,500 pairs
Actual sales	12,000 pairs
Sales short of break-even	500 pairs

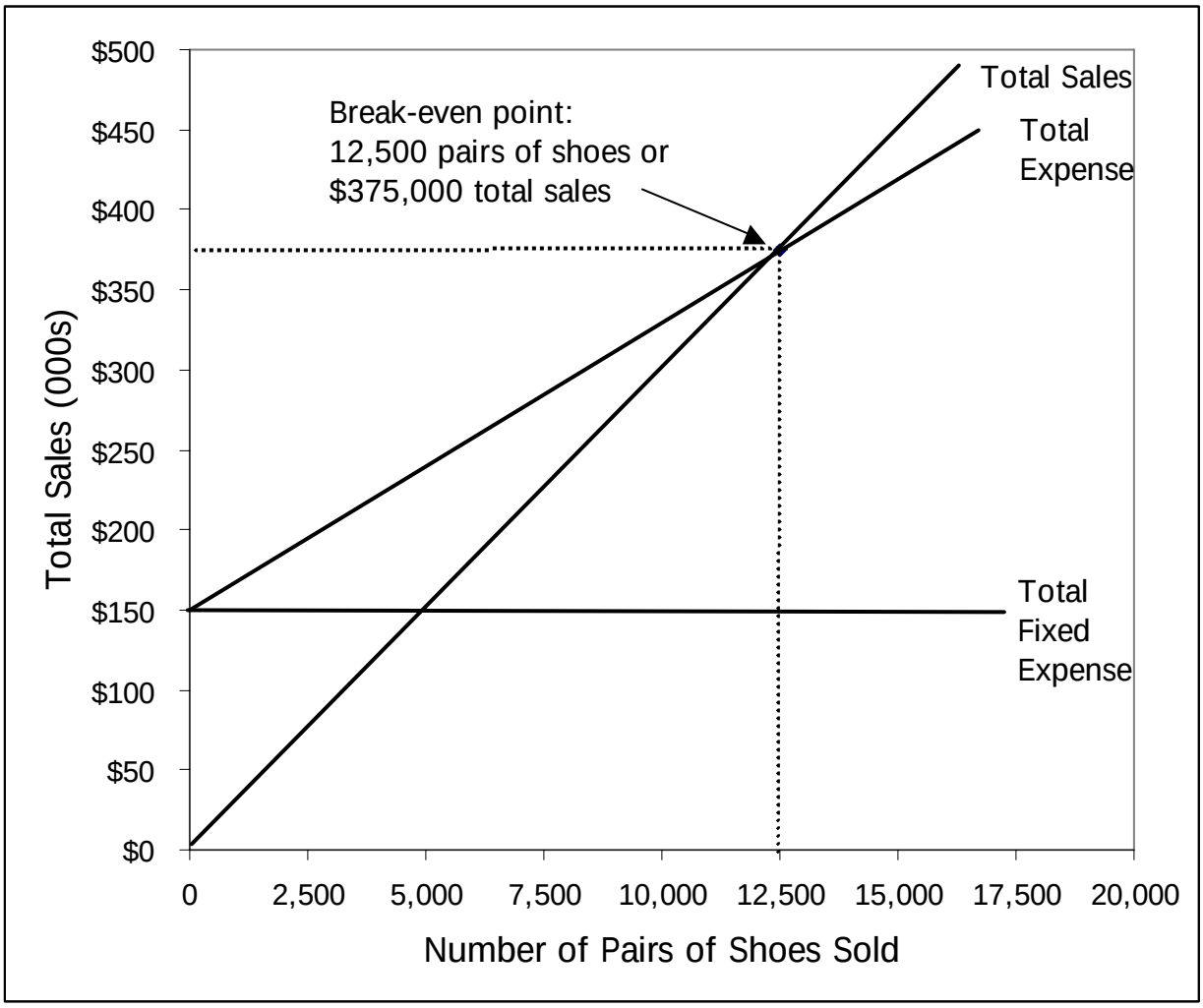
   500 pairs × $12 contribution margin per pair = $6,000 loss

   Alternative solution:

Sales (12,000 pairs × $30.00 per pair)	$360,000
Less variable expenses (12,000 pairs × $18.00 per pair)	216,000
Contribution margin	144,000
Less fixed expenses	150,000
Net operating loss	$ (6,000)

Problem 6-18 (continued)

2. Cost-volume-profit graph:



Problem 6-18 (continued)

4. The variable expenses will now be $18.75 ($18.00 + $0.75) per pair, and the contribution margin will be $11.25 ($30.00 – $18.75) per pair.

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$30.00Q &= \$18.75Q + \$150{,}000 + \$0 \\ \$11.25Q &= \$150{,}000 \\ Q &= \$150{,}000 \div \$11.25 \text{ per pair} \\ Q &= 13{,}333 \text{ pairs (rounded)} \end{aligned}$$

13,333 pairs × $30.00 per pair = $400,000 in sales

Alternative solution:

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

$$= \frac{\$150{,}000}{\$11.25 \text{ per pair}} = 13{,}333 \text{ pairs}$$

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

$$= \frac{\$150{,}000}{0.375} = \$400{,}000 \text{ in sales}$$

5. The simplest approach is:

Actual sales	15,000 pairs
Break-even sales	12,500 pairs
Excess over break-even sales	2,500 pairs

2,500 pairs × $11.50 per pair* = $28,750 profit

*$12.00 present contribution margin – $0.50 commission = $11.50

Alternative solution:

Sales (15,000 pairs × $30.00 per pair)	$450,000
Less variable expenses (12,500 pairs × $18.00 per pair; 2,500 pairs × $18.50 per pair)	271,250
Contribution margin	178,750
Less fixed expenses	150,000
Net operating income	$ 28,750

Problem 6-18 (continued)

6. The new variable expenses will be $13.50 per pair.

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$30.00Q &= \$13.50Q + \$181{,}500 + \$0 \\ \$16.50Q &= \$181{,}500 \\ Q &= \$181{,}500 \div \$16.50 \text{ per pair} \\ Q &= 11{,}000 \text{ pairs} \end{aligned}$$

11,000 pairs × $30.00 per pair = $330,000 in sales.

Although the change will lower the break-even point from 12,500 pairs to 11,000 pairs, 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 has less incentive to sell than under the present commission arrangement, resulting in a potential loss of sales and a reduction of profits. Although it is generally 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 but it does not necessarily follow that this would improve the company's profit.

Problem 6-19 (60 minutes)

1. The CM ratio is 30%.

	Total	*Per Unit*	*Percent of Sales*
Sales (19,500 units).....	$585,000	$30.00	100%
Less variable expenses	409,500	21.00	70
Contribution margin.....	$175,500	$ 9.00	30%

The break-even point is:

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$30.00Q &= \$21.00Q + \$180{,}000 + \$0 \\ \$9.00Q &= \$180{,}000 \\ Q &= \$180{,}000 \div \$9.00 \text{ per unit} \\ Q &= 20{,}000 \text{ units} \end{aligned}$$

20,000 units × $30.00 per unit = $600,000 in sales.

Alternative solution:

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

$$= \frac{\$180{,}000}{\$9.00 \text{ per unit}} = 20{,}000 \text{ units}$$

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

$$= \frac{\$180{,}000}{0.30} = \$600{,}000 \text{ in sales}$$

2. Incremental contribution margin:

$80,000 increased sales × 0.30 CM ratio	$24,000
Less increased advertising cost	16,000
Increase in monthly net operating income.....	$ 8,000

Since the company is now showing a loss of $4,500 per month, if the changes are adopted, the loss will turn into a profit of $3,500 each month ($8,000 less $4,500 = $3,500).

Problem 6-19 (continued)

3. Sales (39,000 units @ $27.00 per unit*) $1,053,000
   Less variable expenses
   (39,000 units @ $21.00 per unit) 819,000
   Contribution margin 234,000
   Less fixed expenses ($180,000 + $60,000) 240,000
   Net operating loss ..... $ (6,000)

   *$30.00 – ($30.00 × 0.10) = $27.00

4. Sales = Variable expenses + Fixed expenses + Profits
   $30.00Q = $21.75Q* + $180,000 + $9,750
   $8.25Q = $189,750
   Q = $189,750 ÷ $8.25 per unit
   Q = 23,000 units

   *$21.00 + $0.75 = $21.75

   Alternative solution:

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

$$= \frac{\$180{,}000 + \$9{,}750}{\$8.25 \text{ per unit}^{**}} = 23{,}000 \text{ units}$$

   **$30.00 – $21.75 = $8.25

5. a. The new CM ratio would be:

	Per Unit	*Percent of Sales*
Sales	$30.00	100%
Less variable expenses...	18.00	60
Contribution margin	$12.00	40%

Problem 6-19 (continued)

The new break-even point would be:

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

$$= \frac{\$180{,}000 + \$72{,}000}{\$12.00 \text{ per unit}} = 21{,}000 \text{ units}$$

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

$$= \frac{\$180{,}000 + \$72{,}000}{0.40} = \$630{,}000$$

b. Comparative income statements follow:

	Not Automated			*Automated*		
	Total	*Per Unit*	*%*	*Total*	*Per Unit*	*%*
Sales (26,000 units)	$780,000	$30.00	100%	$780,000	$30.00	100%
Less variable expenses	546,000	21.00	70	468,000	18.00	60
Contribution margin	234,000	$ 9.00	30%	312,000	$12.00	40%
Less fixed expenses	180,000			252,000		
Net operating income	$ 54,000			$ 60,000		

c. Whether or not the company should automate its operations depends on how much risk the company is willing to take and 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 0.30 to 0.40). The higher CM ratio means that once the break-even point is reached, profits will increase more rapidly than at present. If 26,000 units are sold next month, for example, the higher CM ratio will generate $6,000 more in profits than if no changes are made.

Problem 6-19 (continued)

The greatest risk of automating is that future sales may drop back down to present levels (only 19,500 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:

$$\begin{aligned} \text{Let } Q &= \text{Point of indifference in units sold} \\ \$21.00Q + \$180{,}000 &= \$18.00Q + \$252{,}000 \\ \$3.00Q &= \$72{,}000 \\ Q &= \$72{,}000 \div \$3.00 \text{ per unit} \\ Q &= 24{,}000 \text{ units} \end{aligned}$$

If more than 24,000 units are sold in a month, the proposed plan will yield the greater profits; if less than 24,000 units are sold in a month, the present plan will yield the greater profits (or the least loss).

Problem 6-20 (60 minutes)

1.

Sales price.....	$20.00	100%
Less variable expenses	8.00	40
Contribution margin	$12.00	60%

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

$$= \frac{\$180{,}000}{0.60} = \$300{,}000$$

3. $75,000 increased sales × 0.60 CM ratio = $45,000 increased contribution margin. Since the fixed costs will not change, net operating income should also increase by $45,000.

4. a. $$\text{Degree of operating leverage} = \frac{\text{Contribution margin}}{\text{Net operating income}}$$

$$= \frac{\$240{,}000}{\$60{,}000} = 4$$

b. 4 × 20% = 80% increase in net operating income.

5.

	Last Year: 18,000 units		*Proposed: 24,000 units**		
	Amount	*Per Unit*	*Amount*	*Per Unit*	
Sales.....	$360,000	$20.00	$432,000	$18.00	**
Less variable expenses ...	144,000	8.00	192,000	8.00	
Contribution margin	216,000	$12.00	240,000	$10.00	
Less fixed expenses	180,000		210,000		
Net operating income	$ 36,000		$ 30,000		

*18,000 units + 6,000 units = 24,000 units

**$20.00 × 0.9 = $18.00

No, the changes should not be made.

Problem 6-20 (continued)

6. Expected total contribution margin:

18,000 units × 1.25 × $11.00 per unit*	$247,500
Present total contribution margin:	
18,000 units × $12.00 per unit.....	216,000
Incremental contribution margin, and the amount by which advertising can be increased with net operating income remaining unchanged.....	$ 31,500

*$20.00 – ($8.00 + $1.00) = $11.00

Problem 6-21 (30 minutes)

1.

	Product							
	White		*Fragrant*		*Loonzain*		*Total*	
Percentage of total sales	40%		24%		36%		100%	
Sales	B300,000	100%	B180,000	100%	B270,000	100%	B 750,000	100%
Less variable expenses	216,000	72	36,000	20	108,000	40	360,000	48
Contribution margin	B 84,000	28%	B144,000	80%	B162,000	60%	390,000	52% *
Less fixed expenses							449,280	
Net operating income (loss)							B (59,280)	

*B390,000 ÷ B750,000 = 52%.

2. Break-even sales would be:

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

$$= \frac{\text{B449,280}}{0.520} = \text{B864,000}$$

Problem 6-21 (continued)

3. Memo to the president:

   Although the company met its sales budget of B750,000 for the month, the mix of products 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 20% White, 52% Fragrant, and 28% Loonzain. The actual sales mix was 40% White, 24% Fragrant, and 36% Loonzain.

   As shown by these data, sales shifted away from Fragrant Rice, which provides our greatest contribution per dollar of sales, and shifted toward White Rice, which provides our least contribution per dollar of sales. 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 52%, as compared to a planned CM ratio of 64%. 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 6-22 (45 minutes)

1. Sales (15,000 units × $70 per unit)	$1,050,000
Less variable expenses (15,000 units × $40 per unit)	600,000
Contribution margin	450,000
Less fixed expenses	540,000
Net operating loss	$ (90,000)

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

$$= \frac{\$540{,}000}{\$30 \text{ per unit}} = 18{,}000 \text{ units}$$

18,000 units × $70 per unit = $1,260,000 to break even.

Problem 6-22 (continued)

3.

Unit Sales Price	*Unit Variable Expense*	*Unit Contribution Margin*	*Volume (Units)*	*Total Contribution Margin*	*Fixed Expenses*	*Net operating income*
$70	$40	$30	15,000	$450,000	$540,000	$ (90,000)
68	40	28	20,000	560,000	540,000	20,000
66	40	26	25,000	650,000	540,000	110,000
64	40	24	30,000	720,000	540,000	180,000
62	40	22	35,000	770,000	540,000	230,000
60	40	20	40,000	800,000	540,000	260,000
58	40	18	45,000	810,000	540,000	270,000
56	40	16	50,000	800,000	540,000	260,000

Thus, the maximum profit is $270,000. This level of profit can be earned by selling 45,000 units at a price of $58 each.

Problem 6-22 (continued)

4. At a selling price of $58 per unit, the contribution margin is $18 per unit. Therefore:

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

$$= \frac{\$540{,}000}{\$18 \text{ per unit}} = 30{,}000 \text{ units}$$

30,000 units × $58 per unit = $1,740,000 to break even.

This break-even point is different from the break-even point in part (2) because of the change in selling price. With the change in selling price the unit contribution margin drops from $30 to $18, resulting in an increase in the break-even point.

Problem 6-23 (30 minutes)

1. (1) Dollars
   (2) Volume of output, expressed in units, % of capacity, sales, or some other measure
   (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 6-23 (continued)

2. a. Line 3: Remain unchanged.
   Line 9: Have a steeper slope.
   Break-even point: Decrease.

   b. Line 3: Have a flatter slope.
   Line 9: Remain unchanged.
   Break-even point: Decrease.

   c. Line 3: Shift upward.
   Line 9: Remain unchanged.
   Break-even point: Increase.

   d. Line 3: Remain unchanged.
   Line 9: Remain unchanged.
   Break-even point: Remain unchanged.

   e. Line 3: Shift downward and have a steeper slope.
   Line 9: Remain unchanged.
   Break-even point: Probably change, but the direction is uncertain.

   f. Line 3: Have a steeper slope.
   Line 9: Have a steeper slope.
   Break-even point: Remain unchanged in terms of units; increase in terms of total dollars of sales.

   g. Line 3: Shift upward.
   Line 9: Remain unchanged.
   Break-even point: Increase.

   h. Line 3: Shift upward and have a flatter slope.
   Line 9: Remain unchanged.
   Break-even point: Probably change, but the direction is uncertain.

Problem 6-24 (75 minutes)

1. a. Selling price..... $25 100%
Less variable expenses 15 60
Contribution margin $10 40%

Sales = Variable expenses + Fixed expenses + Profits
$25Q = $15Q + $210,000 + $0
$10Q = $210,000
Q = $210,000 ÷ $10 per ball
Q = 21,000 balls

Alternative solution:

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

$$= \frac{\$210,000}{\$10 \text{ per ball}} = 21,000 \text{ balls}$$

b. The degree of operating leverage would be:

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

$$= \frac{\$300,000}{\$90,000} = 3.33 \text{ (rounded)}$$

2. The new CM ratio will be:

Selling price..... $25 100%
Less variable expenses 18 72
Contribution margin..... $ 7 28%

The new break-even point will be:

Sales = Variable expenses + Fixed expenses + Profits
$25Q = $18Q + $210,000 + $0
$7Q = $210,000
Q = $210,000 ÷ $7 per ball
Q = 30,000 balls

Problem 6-24 (continued)

Alternative solution:

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

$$= \frac{\$210{,}000}{\$7 \text{ per ball}} = 30{,}000 \text{ balls}$$

3. Sales = Variable expenses + Fixed expenses + Profits
   $\$25Q = \$18Q + \$210{,}000 + \$90{,}000$
   $\$7Q = \$300{,}000$
   $Q = \$300{,}000 \div \$7 \text{ per ball}$
   $Q = 42{,}857$ balls (rounded)

Alternative solution:

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

$$= \frac{\$210{,}000 + \$90{,}000}{\$7 \text{ per ball}} = 42{,}857 \text{ balls}$$

Thus, sales will have to increase by 12,857 balls (42,857 balls, less 30,000 balls currently being sold) to earn the same amount of net operating income as 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. The effects on Northwood Company are summarized below:

	Present	*Expected*
Combination margin ratio.....	40%	28%
Break-even point (in balls)	21,000	30,000
Sales (in balls) needed to earn a $90,000 profit....	30,000	42,857

Note particularly that if variable costs do increase next year, then the company will just break even if it sells the same number of balls (30,000) as it did last year.

Problem 6-24 (continued)

4. The contribution margin ratio last year was 40%. If we let P equal the new selling price, then:

$$\begin{aligned} P &= \$18 + 0.40P \\ 0.60P &= \$18 \\ P &= \$18 \div 0.60 \\ P &= \$30 \end{aligned}$$

To verify:

Selling price	$30	100%
Less variable expenses.....	18	60
Contribution margin	$12	40%

Therefore, to maintain a 40% CM ratio, a $3 increase in variable costs would require a $5 increase in the selling price.

5. The new CM ratio would be:

Selling price	$25	100%
Less variable expenses.....	9*	36
Contribution margin.....	$16	64%

*$15 – ($15 × 40%) = $9

The new break-even point would be:

$$\begin{aligned} \text{Sales} &= \text{Variable expenses} + \text{Fixed expenses} + \text{Profits} \\ \$25Q &= \$9Q + \$420{,}000 + \$0 \\ \$16Q &= \$420{,}000 \\ Q &= \$420{,}000 \div \$16 \text{ per ball} \\ Q &= 26{,}250 \text{ balls} \end{aligned}$$

Alternative solution:

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

$$= \frac{\$420{,}000}{\$16 \text{ per ball}} = 26{,}250 \text{ balls}$$

Although this new break-even is greater than the company's present break-even of 21,000 balls [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 6-24 (continued)

6. a. Sales = Variable expenses + Fixed expenses + Profits
$\$25Q = \$9Q + \$420{,}000 + \$90{,}000$
$\$16Q = \$510{,}000$
$Q = \$510{,}000 \div \$16 \text{ per ball}$
$Q = 31{,}875 \text{ balls}$

Alternative solution:

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

$$= \frac{\$420{,}000 + \$90{,}000}{\$16 \text{ per ball}} = 31{,}875 \text{ balls}$$

Thus, the company will have to sell 1,875 more balls (31,875 – 30,000 = 1,875) than now being sold to earn a profit of $90,000 per year. However, this is still far less than the 42,857 balls that would have to be sold to earn a $90,000 profit if the plant is not automated and variable labor costs rise next year [see Part (3) above].

b. The contribution income statement would be:

Sales (30,000 balls × $25 per ball)	$750,000
Less variable expenses (30,000 balls × $9 per ball)	270,000
Contribution margin	480,000
Less fixed expenses	420,000
Net operating income	$ 60,000

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

$$= \frac{\$480{,}000}{\$60{,}000} = 8$$

Problem 6-24 (continued)

c. This problem illustrates the difficulty faced by many companies 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, companies 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 6-25 (60 minutes)

1. Sales = Variable expenses + Fixed expenses + Profits
   $40.00Q = $16.00Q + $60,000 + $0
   $24.00Q = $60,000
   Q = $60,000 ÷ $24.00 per pair
   Q = 2,500 pairs

   2,500 pairs × $40.00 per pair = $100,000 in sales

   Alternative solution:

$$\text{Break-even point in unit sales} = \frac{\text{Fixed expenses}}{\text{CM per unit}} = \frac{\$60,000}{\$24.00 \text{ per pair}} = 2,500 \text{ pairs}$$

$$\text{Break-even point in dollar sales} = \frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$60,000}{0.600} = \$100,000$$

2. See the graph at the end of this solution.

3. Sales = Variable expenses + Fixed expenses + Profits
   $40.00Q = $16.00Q + $60,000 + $18,000
   $24.00Q = $78,000
   Q = $78,000 ÷ $24.00 per pair
   Q = 3,250 pairs

   Alternative solution:

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

$$= \frac{\$60,000 + \$18,000}{\$24.00 \text{ per pair}} = 3,250 \text{ pairs}$$

4. Incremental contribution margin:

$25,000 increased sales × 60% CM ratio.....	$15,000
Incremental fixed salary cost	8,000
Increased net income	$ 7,000

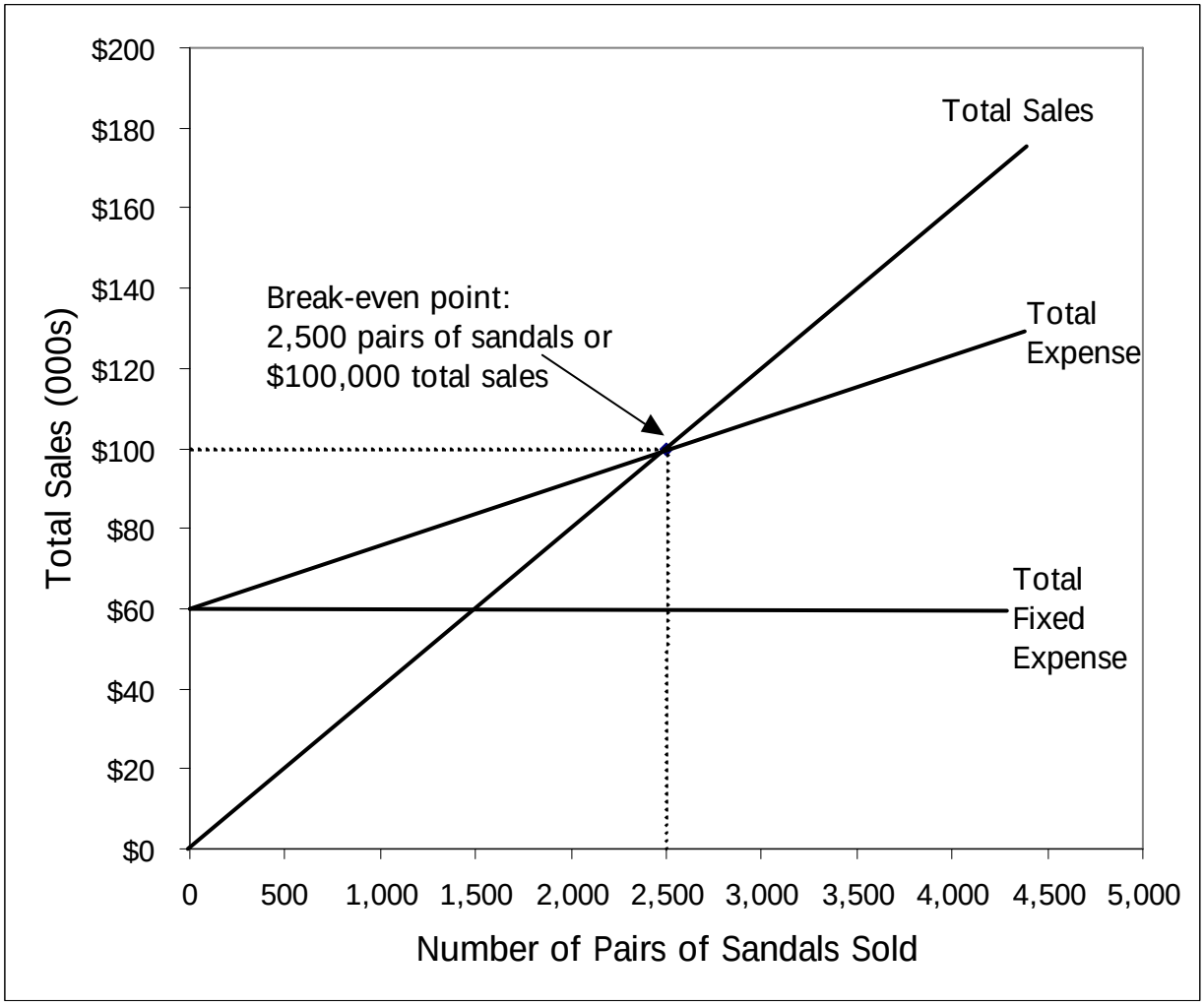
   Yes, the position should be converted to a full-time basis.

Problem 6-25 (continued)

5. a. $$\text{Degree of operating leverage} = \frac{\text{Contribution margin}}{\text{Net operating income}} = \frac{\$72,000}{\$12,000} = 6$$

   b. 6.00 × 50% sales increase = 300% *increase* in net operating income. Thus, net operating income next year would be: $12,000 + ($12,000 × 300%) = $48,000.

2. Cost-volume-profit graph:



Problem 6-26 (30 minutes)

1. The contribution margin per unit on the first 16,000 units is:

	Per Unit
Sales price	$3.00
Less variable expenses	1.25
Contribution margin	$1.75

The contribution margin per unit on anything over 16,000 units is:

	Per Unit
Sales price	$3.00
Less variable expenses	1.40
Contribution margin	$1.60

Thus, for the first 16,000 units sold, the total amount of contribution margin generated would be:

16,000 units × $1.75 per unit = $28,000

Since the fixed costs on the first 16,000 units total $35,000, the $28,000 contribution margin above is not enough to permit the company to break even. Therefore, in order to break even, more than 16,000 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 16,000 units	$35,000
Less contribution margin from the first 16,000 units	28,000
Remaining unrecovered fixed costs	7,000
Add monthly rental cost of the additional space needed to produce more than 16,000 units	1,000
Total fixed costs to be covered by remaining sales	$ 8,000

Problem 6-26 (continued)

The additional sales of units required to cover these fixed costs would be:

$$\frac{\text{Total remaining fixed costs}}{\text{Unit contribution margin on added units}} = \frac{\$8{,}000}{\$1.60 \text{ per unit}} = 5{,}000 \text{ units}$$

Therefore, a total of 21,000 units (16,000 + 5,000) must be sold in order for the company to break even. This number of units would equal total sales of:

21,000 units × $3.00 per unit = $63,000 in total sales.

2. $$\frac{\text{Target profit}}{\text{Unit contribution margin}} = \frac{\$12{,}000}{\$1.60 \text{ per unit}} = 7{,}500 \text{ units}$$

Thus, the company must sell 7,500 units above the break-even point to earn a profit of $12,000 each month. These units, added to the 21,000 units required to break even, would equal total sales of 28,500 units each month to reach the target profit figure.

3. If a bonus of $0.10 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 $1.60 to $1.50 per unit.

The desired monthly profit would be:

25% × ($35,000 + $1,000) = $9,000

Thus,

$$\frac{\text{Target profit}}{\text{Unit contribution margin}} = \frac{\$9{,}000}{\$1.50 \text{ per unit}} = 6{,}000 \text{ units}$$

Therefore, the company must sell 6,000 units above the break-even point to earn a profit of $9,000 each month. These units, added to the 21,000 units required to break even, would equal total sales of 27,000 units each month.

Problem 6-27 (30 minutes)

1. The contribution margin per sweatshirt would be:

Selling price		$13.50
Less variable expenses:		
Purchase cost of the sweatshirts	$8.00	
Commission to the student salespersons	1.50	9.50
Contribution margin		$ 4.00

Since there are no fixed costs, the number of unit sales needed to yield the desired $1,200 in profits can be obtained by dividing the target $1,200 profit by the unit contribution margin:

$$\frac{\text{Target profit}}{\text{Unit contribution margin}} = \frac{\$1{,}200}{\$4.00 \text{ per sweatshirt}} = 300 \text{ sweatshirts}$$

300 sweatshirts × $13.50 per sweatshirt = $4,050 in total sales.

2. Since an order has been placed, there is now a "fixed" cost associated with the purchase price of the sweatshirts (i.e., the sweatshirts can't be returned). For example, an order of 75 sweatshirts requires a "fixed" cost (investment) of $600 (75 sweatshirts × $8.00 per sweatshirt = $600). The variable cost drops to only $1.50 per sweatshirt, and the new contribution margin per sweatshirt becomes:

Selling price	$13.50
Less variable expenses (commissions only)	1.50
Contribution margin	$12.00

Since the "fixed" cost of $600 must be recovered before Mr. Hooper shows any profit, the break-even computation would be:

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

$$= \frac{\$600}{\$12.00 \text{ per sweatshirt}} = 50 \text{ sweatshirts}$$

50 sweatshirts × $13.50 per sweatshirt = $675 in total sales

If a quantity other than 75 sweatshirts were ordered, the answer would change accordingly.

Problem 6-28 (60 minutes)

1. The income statements would be:

	Present			*Proposed*		
	Amount	*Per Unit*	*%*	*Amount*	*Per Unit*	*%*
Sales	$450,000	$30	100%	$450,000	$30	100%
Less variable expenses	315,000	21	70	180,000	12*	40
Contribution margin	135,000	$ 9	30%	270,000	$18	60%
Less fixed expenses	90,000			225,000		
Net operating income	$ 45,000			$ 45,000		

*$21 – $9 = $12.

2.

	Present	*Proposed*
a. Degree of operating leverage	$\frac{\$135,000}{\$45,000} = 3$	$\frac{\$270,000}{\$45,000} = 6$
b. Break-even point in dollars	$\frac{\$90,000}{0.30} =$ $300,000	$\frac{\$225,000}{0.60} =$ $375,000
c. Margin of safety = Total sales – Break-even sales:		
$450,000 – $300,000	$150,000	
$450,000 – $375,000		$75,000
Margin of safety percentage = Margin of safety ÷ Total sales:		
$150,000 ÷ $450,000	33 1/3%	
$75,000 ÷ $450,000		16 2/3%

Problem 6-28 (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 reason is that the new equipment will increase the CM ratio, permitting profits to rise more rapidly in years that sales are strong. However, in periods of economic recession, the company will be worse off with the new equipment. The greater fixed costs created by the new equipment will cause losses to be deeper and sustained more quickly than at present. Thus, management must decide whether the potential for 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	
$585,000*	=	Variable expenses + $180,000 + $54,000**	
$351,000	=	Variable expenses	

   *New level of sales: $450,000 × 1.30 = $585,000

   **New level of net operating income: $45,000 × 1.2 = $54,000

   New CM ratio:

Sales	$585,000	100%
Less variable expenses	351,000	60
Contribution margin	$234,000	40%

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

$$\text{Break-even point in dollar sales} = \frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$180{,}000}{0.4} = \$450{,}000$$

Problem 6-28 (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 $450,000, which is just equal to the break-even level of sales under the new marketing method. Thus, if the new marketing strategy is adopted and sales remain unchanged, profits will drop from the current level of $45,000 per month to zero.

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 $45,000 in profits the company is currently earning each month? The computations are:

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

$$= \frac{\$180{,}000 + \$45{,}000}{0.40}$$

$$= \$562{,}500 \text{ in sales each month}$$

Thus, sales would have to increase by at least 25% ($562,500 is 25% higher than $450,000) in order to make the company better off with the new marketing strategy than with the current situation. This appears to be extremely risky.

Problem 6-29 (45 minutes)

1. a.

	Hawaiian Fantasy		*Tahitian Joy*		*Total*	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*
Sales	$300,000	100.0	$500,000	100.0	$800,000	100.0
Less variable expenses	180,000	60.0	100,000	20.0	280,000	35.0
Contribution margin	$120,000	40.0	$400,000	80.0	520,000	65.0
Less fixed expenses					475,800	
Net operating income					$ 44,200	

b. $$\text{Break-even point in dollar sales} = \frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$475,800}{0.650} = \$732,000$$

$$\text{Margin of safety} = \text{Actual sales} - \text{Break-even sales}$$

$$= \$800,000 - \$732,000 = \$68,000$$

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

$$= \frac{\$68,000}{\$800,000} = 8.5\%$$

Problem 6-29 (continued)

2. a.

	Hawaiian Fantasy		*Tahitian Joy*		*Samoan Delight*		*Total*	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*	*Amount*	*%*
Sales	$300,000	100.0	$500,000	100	$450,000	100.0	$1,250,000	100.0
Less variable expenses	180,000	60.0	100,000	20	360,000	80.0	640,000	51.2
Contribution margin	$120,000	40.0	$400,000	80	$ 90,000	20.0	610,000	48.8
Less fixed expenses							475,800	
Net operating income							$ 134,200	

Problem 6-29 (continued)

b. $$\text{Break-even point in dollar sales} = \frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$475{,}800}{0.488} = \$975{,}000$$

$$\text{Margin of safety} = \text{Actual sales} - \text{Break-even sales}$$

$$= \$1{,}250{,}000 - \$975{,}000 = \$275{,}000$$

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

$$= \frac{\$275{,}000}{\$1{,}250{,}000} = 22\%$$

3. The reason for the increase in the break-even point can be traced to the decrease in the company's overall contribution margin ratio when the third product is added. Note from the income statements above that this ratio drops from 65% to 48.8% with the addition of the third product. This product (the Samoan Delight) has a CM ratio of only 20%, which causes the average contribution margin per dollar of sales to shift downward.

   This problem shows the somewhat tenuous nature of break-even analysis when the company has more than one product. The analyst must be very careful of his or her assumptions regarding sales mix, including the addition (or deletion) of new 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 $68,000 to $275,000 or from 8.5% to 22%. 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 6-30 (60 minutes)

1.

CARBEX, INC.
Income Statement For April

	Standard		*Deluxe*		*Total*	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*
Sales	$240,000	100	$150,000	100	$390,000	100.0
Less variable expenses:						
Production	60,000	25	60,000	40	120,000	30.8
Sales commission	36,000	15	22,500	15	58,500	15.0
Total variable expenses	96,000	40	82,500	55	178,500	45.8
Contribution margin	$144,000	60	$ 67,500	45	$211,500	54.2
Less fixed expenses:						
Advertising					105,000	
Depreciation					21,700	
Administrative					63,000	
Total fixed expenses					189,700	
Net operating income					$ 21,800	

CARBEX, INC.
Income Statement For May

	Standard		*Deluxe*		*Total*	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*
Sales	$60,000	100	$375,000	100	$435,000	100.0
Less variable expenses:						
Production	15,000	25	150,000	40	165,000	37.9
Sales commission	9,000	15	56,250	15	65,250	15.0
Total variable expenses	24,000	40	206,250	55	230,250	52.9
Contribution margin	$36,000	60	$168,750	45	204,750	47.1
Less fixed expenses:						
Advertising					105,000	
Depreciation					21,700	
Administrative					63,000	
Total fixed expenses					189,700	
Net operating income					$ 15,050	

Problem 6-30 (continued)

2. The sales mix has shifted over the last year from Standard sets to Deluxe sets. This shift has caused a decrease in the company's overall CM ratio from 54.2% in April to 47.1% in May. For this reason, even though total sales (in dollars) are greater, net operating income is lower.

3. Sales commissions could be based on contribution margin, rather than on sales price. A flat rate on total contribution margin, as the text suggests, might encourage the salespersons to emphasize the product with the greatest contribution to the profits of the firm.

4. a. The break-even in dollar sales can be computed as follows:

$$\frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$189{,}700}{0.542} = \$350{,}000$$

   b. May's break-even point is higher than April's. This is because the company's overall CM ratio has gone down, i.e., the sales mix has shifted from the more profitable to the less profitable units.

Case 6-31 (60 minutes)

1. and 2.	*Part 1*		*Part 2a*		*Part 2b*	
	Total	*Per Unit*	*Total*	*Per Unit*	*Total*	*Per Unit*
Sales	$450,000	$10.00	$600,000[3]	$8.00	$720,000[4]	$12.00
Less variable expenses:						
Direct materials	90,000	2.00	150,000	2.00	120,000	2.00
Direct labor	78,300	1.74	130,500	1.74	104,400	1.74
Variable overhead	13,500	0.30	22,500	0.30	18,000	0.30
Variable selling:						
Commissions	27,000	0.60[1]	36,000	0.48[1]	64,800	1.08[1]
Shipping	5,400	0.12	9,000	0.12	7,200	0.12
Variable administrative	1,800	0.04	3,000	0.04	2,400	0.04
Total variable expenses	216,000	4.80	351,000	4.68	316,800	5.28
Contribution margin	234,000	$ 5.20	249,000	$3.32	403,200	$ 6.72
Less fixed expenses:						
Manufacturing overhead	85,000[2]		85,000		85,000	
Selling (advertising, etc.)	120,000		120,000		220,000[5]	
Administrative (salaries, etc.)	48,000		48,000		48,000	
Total fixed expenses	253,000		253,000		353,000	
Net operating income (loss)	$(19,000)		$ (4,000)		$ 50,200	

[1]6% of sales dollars for parts 1 and 2a; 9% for part 2b.
[2]$98,500 – (45,000 units × $0.30) = $85,000.
[3]$10.00 – ($10.00 × 20%) = $8.00; $8.00 × 75,000 units = $600,000.
[4]45,000 units × 1 1/3 = 60,000 units; $10.00 + ($10.00 × 20%) = $12.00; 60,000 units × $12.00 = $720,000.
[5]$120,000 + $100,000 = $220,000.

Case 6-31 (continued)

3. Selling price per unit $10.00
   Original unit variable expense (from part 1) $4.80
   Less reduction in materials cost..... 0.70 4.10
   New contribution margin per unit ..... $ 5.90

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

$$= \frac{\$253{,}000 + \$30{,}200}{\$5.90 \text{ per unit}} = 48{,}000 \text{ units}$$

4. Contribution margin generated (60,000 units × $5.20 per unit) $312,000
   Less:
   Fixed costs to be covered (from part 1) $253,000
   Target profit (60,000 units × $10 per unit = $600,000; $600,000 × 4.5% = $27,000)..... 27,000 280,000
   Contribution margin available for increased advertising..... $ 32,000

5. The quoted price per unit would be:

Variable production expense ($2.00 + $1.74 + $0.30)...	$4.04
Shipping expense ($0.12 × 1.5)	0.18
Variable administrative expense ($0.04 × 0.75)	0.03
Special insurance fee ($5,700 ÷ 9,500 units)	0.60
Present net operating loss ($19,000 ÷ 9,500 units).....	2.00
Desired profit ($14,250 ÷ 9,500 units).....	1.50
Quoted price per unit.....	$8.35

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 Whitney Company's desired profit. Any price greater than the cost of $4.85 per unit (= $8.35 – $1.50 – $2.00) would reduce Whitney's net operating loss. On the other hand, if the distributor is willing to pay more than $8.35 per unit, it would be foolish to leave the additional profit on the table.

Case 6-32 (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:

33,000 units (July sales) ÷ 1.10 = 30,000 units sold in June.

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:

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

$$= \text{Total sales} - \$180{,}000$$

$$\text{Margin of safety percentage (20\%)} = \frac{\text{Margin of safety in dollars}}{\text{Total sales}}$$

If the margin of safety in dollars is 20% of total sales, then the break-even point in dollars must be 80% of total sales. Therefore, total sales would be:

$$\frac{\$180{,}000}{\text{Total sales}} = 80\%$$

$$\text{Total sales} = \$180{,}000 \div 80\%$$

$$= \$225{,}000$$

The selling price per unit would be:

$225,000 total sales ÷ 30,000 units = $7.50 per unit.

The second step is to determine the total contribution margin for the month of June. This can be done by using the operating leverage concept. Note that a 10% increase in sales has resulted in a 50% increase in net operating income between June and July:

$$\frac{\text{July increased net income}}{\text{June net income}} = \frac{\$40{,}500 - \$27{,}000}{\$27{,}000} = \frac{\$13{,}500}{\$27{,}000} = 50\%$$

Case 6-32 (continued)

Since the net operating income for July increased by 50% when sales increased by 10%, the degree of operating leverage for June must be 5. Therefore, total contribution margin for June must have been:

$$5 \times \$27{,}000 = \$135{,}000.$$

June's income statement can now be completed by simply inserting known data and computing unknown data:

PYRRHIC COMPANY
Actual Income Statement
For the Month Ended June 30

	Total		*Per Unit*		*Percent*	
Sales (30,000 units).....	$225,000		$7.50		100	
Less variable expenses....	90,000	*	3.00	*	40	*
Contribution margin.....	135,000		$4.50		60	*
Less fixed expenses.....	108,000	*				
Net operating income	$ 27,000					

*Computed by working from known data.

b. The break-even point:

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

$$= \frac{\$108{,}000}{\$4.50 \text{ per unit}} = 24{,}000$$

In dollars: 24,000 units × $7.50 per unit = $180,000

c. Margin of safety in dollars = Total sales - Break-even sales

= $225,000 - $180,000 = $45,000

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

$$= \frac{\$45{,}000}{\$225{,}000} = 20\%$$

Case 6-32 (continued)

d. The degree of operating leverage:

$$\frac{\text{Contribution margin}}{\text{Net income}} = \frac{\$135,000}{\$27,000} = 5$$

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

PYRRHIC COMPANY
Projected Income Statement
For the Month Ended July 31

	Total	*Per Unit*	*Percent*
Sales (33,000 units).....	$247,500	$7.50	100
Less variable expenses.....	99,000	3.00	40
Contribution margin.....	148,500	$4.50	60
Less fixed expenses.....	108,000		
Net operating income	$ 40,500		

b. Margin of safety in dollars = Total sales - Break-even sales

$$= \$247,500 - \$180,000 = \$67,500$$

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

$$= \frac{\$67,500}{\$247,500} = 27.3\% \text{ (rounded)}$$

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

$$= \frac{\$148,500}{\$40,500} = 3.7 \text{ (rounded)}$$

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

Case 6-32 (continued)

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 number.

3. The increased labor cost will be $0.60 per unit, 1/3 of $1.80 per unit. The new variable expense will therefore total $3.60 per unit, and the new contribution margin ratio will be:

Sales	$7.50	100%
Less variable expenses	3.60	48
Contribution margin	$3.90	52%

The target profit per unit will be:

20% × $7.50 = $1.50.

Therefore,

Sales = Variable expenses + Fixed expenses + Profits
$7.50Q = $3.60Q + $108,000 + $1.50Q
$2.40Q = $108,000
Q = $108,000 ÷ $2.40 per unit
Q = 45,000 units

Alternative solution:

Sales = Variable expenses + Fixed expenses + Profits
X = 0.48X + $108,000 + 0.20X
0.32X = $108,000
X = $108,000 ÷ 0.32
X = $337,500; or, at $7.50 per unit, 45,000 units

Case 6-33 (75 minutes)

Before proceeding with the solution, it is helpful first to restructure the data into contribution format for each of the three alternatives. (The data in the statements below are in thousands.)

	15% Commission		*20% Commission*		*Own Sales Force*	
Sales	$16,000	100%	$16,000	100%	$16,000.0	100.0%
Less variable expenses:						
Manufacturing	7,200		7,200		7,200.0	
Commissions (15%, 20% 7.5%)	2,400		3,200		1,200.0	
Total variable expenses	9,600	60	10,400	65	8,400.0	52.5
Contribution margin	6,400	40%	5,600	35%	7,600.0	47.5%
Less fixed expenses:						
Manufacturing overhead	2,340		2,340		2,340.0	
Marketing	120		120		2,520.0 *	
Administrative	1,800		1,800		1,725.0 **	
Interest	540		540		540.0	
Total fixed expenses	4,800		4,800		7,125.0	
Income before income taxes	1,600		800		475.0	
Less income taxes (30%)	480		240		142.5	
Net income	$ 1,120		$ 560		$ 332.5	

*$120,000 + $2,400,000 = $2,520,000.
**$1,800,000 – $75,000 = $1,725,000.

Case 6-33 (continued)

1. When the income before taxes is zero, income taxes will also be zero and net income will be zero. Therefore, the break-even calculations can be based on the income before taxes.

   a. Break-even point in dollar sales if the commission remains 15%.

   $$\frac{\text{Fixed costs}}{\text{CM ratio}} = \frac{\$4{,}800{,}000}{0.40} = \$12{,}000{,}000$$

   b. Break-even point in dollar sales if the commission increases to 20%.

   $$\frac{\text{Fixed costs}}{\text{CM ratio}} = \frac{\$4{,}800{,}000}{0.35} = \$13{,}714{,}286$$

   c. Break-even point in dollar sales if the company employs its own sales force.

   $$\frac{\text{Fixed costs}}{\text{CM ratio}} = \frac{\$7{,}125{,}000}{0.475} = \$15{,}000{,}000$$

2. In order to generate a $1,120,000 net income, the company must generate $1,600,000 in income before taxes. Therefore,

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

$$= \frac{\$4{,}800{,}000 + \$1{,}600{,}000}{0.35} = \frac{\$6{,}400{,}000}{0.35} = \$18{,}285{,}714$$

3. To determine the volume of sales at which net income would be equal under either the 20% commission plan or the company sales force plan, we find the volume of sales where costs before income taxes under the two plans are equal.

$$\begin{aligned} X &= \text{Total sales revenue} \\ 0.65X + \$4{,}800{,}000 &= 0.525X + \$7{,}125{,}000 \\ 0.125X &= \$2{,}325{,}000 \\ X &= \$2{,}325{,}000 \div 0.125 \\ X &= \$18{,}600{,}000 \end{aligned}$$

Case 6-33 (continued)

Thus, at a sales level of $18,600,000 either plan would yield the same income before taxes and net income. Below this sales level, the commission plan would yield the largest net income; above this sales level, the sales force plan would yield the largest net income.

4. a., b., and c.

	15% Commission	*20% Commission*	*Own Sales Force*
Contribution margin (Part 1) (x) ...	$6,400,000	$5,600,000	$7,600,000
Income before taxes (Part 1) (y) ..	$1,600,000	$ 800,000	$ 475,000
Degree of operating leverage: (x) ÷ (y)	4	7	16

5. We would continue to use the sales agents for at least one more year, and possibly for two more years. The reasons are as follows:

   First, use of the sales agents would have a less dramatic effect on net income.

   Second, use of the sales agents for at least one more year would give the company more time to hire competent people and get the sales group organized.

   Third, the sales force plan doesn't become more desirable than the use of sales agents until the company reaches sales of $18,600,000 a year. This level probably won't be reached for at least one more year, and possibly two years.

   Fourth, the sales force plan will be highly leveraged since it will greatly increase fixed costs (and decrease variable costs). One or two years from now, when sales have reached the $18,600,000 level, the company can benefit greatly from this leverage. For the moment, profits will be greater and risks will be less by staying with the agents, even at the higher 20% commission rate.

Case 6-34 (75 minutes)

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

Annual Patient-Days	*Aides @ $18,000*	*Nurses @ $26,000*	*Supervising Nurses @ $36,000*	*Total Personnel*	*Other Fixed Cost*	*Total Fixed Cost*
10,000-14,000	$378,000	$286,000	$144,000	$808,000	$454,000	$1,262,000
14,001-17,000	396,000	312,000	144,000	852,000	454,000	1,306,000
17,001-23,725	396,000	338,000	144,000	878,000	454,000	1,332,000
23,726-25,550	450,000	364,000	180,000	994,000	454,000	1,448,000
25,551-27,375	468,000	364,000	180,000	1,012,000	454,000	1,466,000
27,376-29,200	522,000	416,000	216,000	1,154,000	454,000	1,608,000

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 $80 (=$130 revenue - $50 variable cost).

Annual Patient-Days	*(a) Total Fixed Cost*	*(b) Contribution Margin*	*"Break-Even" (a) ÷ (b)*	*Within Relevant Range?*
10,000-14,000	$1,262,000	$80	15,775	No
14,001-17,000	1,306,000	80	16,325	Yes
17,001-23,725	1,332,000	80	16,650	No
23,726-25,550	1,448,000	80	18,100	No
25,551-27,375	1,466,000	80	18,325	No
27,376-29,200	1,608,000	80	20,100	No

Case 6-34 (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 14,000 patient-days, the computed break-even is 15,755 patient-days. However, this level of activity is outside this relevant range. To serve 15,755 patient-days, the fixed costs would have to be increased from $1,262,000 to $1,306,000 by adding one more aide and one more nurse. The only "break-even" that occurs within its own relevant range is 16,325. This is the only legitimate break-even.

3. The level of activity required to earn a profit of $200,000 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?*
10,000-14,000	$1,262,000	$200,000	$1,462,000	$80	18,275	No
14,001-17,000	1,306,000	200,000	1,506,000	80	18,825	No
17,001-23,725	1,332,000	200,000	1,532,000	80	19,150	Yes
23,726-25,550	1,448,000	200,000	1,648,000	80	20,600	No
25,551-27,375	1,466,000	200,000	1,666,000	80	20,825	No
27,376-29,200	1,608,000	200,000	1,808,000	80	22,600	No

In this case, the only solution that is within the appropriate relevant range is 19,150 patient-days.

Case 6-35 (60 minutes)

Note: This is a problem that will challenge the very best students' conceptual and analytical skills.

1. The overall break-even sales can be determined using the CM ratio.

	Velcro	*Metal*	*Nylon*	*Total*
Sales	$165,000	$300,000	$340,000	$805,000
Variable expenses	125,000	140,000	100,000	365,000
Contribution margin	$ 40,000	$160,000	$240,000	440,000
Fixed expenses				400,000
Net operating income				$ 40,000

$$\text{CM ratio} = \frac{\text{Contribution margin}}{\text{Sales}} = \frac{\$440,000}{\$805,000} = 0.5466$$

$$\text{Break-even point in total sales dollars} = \frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$400{,}000}{0.5466} = \$732{,}000 \text{ (rounded)}$$

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:

	Velcro	*Metal*	*Nylon*
Unit selling price	$1.65	$1.50	$0.85
Variable cost per unit	1.25	0.70	0.25
Unit contribution margin (a)	$0.40	$0.80	$0.60
Product fixed expenses (b)	$20,000	$80,000	$60,000
Break-even point in units sold (b) ÷ (a)	50,000	100,000	100,000

Case 6-35 (continued)

b. If the company were to sell exactly the break-even quantities computed above, the company would lose $240,000—the amount of the common fixed cost. This can be verified as follows:

	Velcro	*Metal*	*Nylon*	*Total*
Unit sales	50,000	100,000	100,000	
Sales	$82,500	$150,000	$85,000	$ 317,500
Variable expenses	62,500	70,000	25,000	157,500
Contribution margin	$20,000	$ 80,000	$60,000	160,000
Fixed expenses				400,000
Net operating income				$(240,000)

At this point, many students conclude that something is wrong with their answer to part (a) since a result in which the company loses money operating at the break-evens for the individual products does not seem to make sense. 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 $317,500 whereas the total sales at the overall break-even computed in part (1) is $732,000.

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 6-35 (continued)

Allocation of common fixed expenses on the basis of sales revenue:

	Velcro	*Metal*	*Nylon*	*Total*
Sales	$165,000	$300,000	$340,000	$805,000
Percentage of total sales	20.497%	37.267%	42.236%	100.0%
Allocated common fixed expense*	$49,193	$ 89,441	$101,366	$240,000
Product fixed expenses	20,000	80,000	60,000	160,000
Allocated common and product fixed expenses (a)	$69,193	$169,441	$161,366	$400,000
Unit contribution margin (b)	$0.40	$0.80	$0.60	
"Break-even" point in units sold (a) ÷ (b)	172,983	211,801	268,943	

*Total common fixed expense × percentage of total sales

If the company sells 172,983 units of the Velcro product, 211,801 units of the Metal product, and 268,943 units of the Nylon product, the company will indeed break even overall. However, the apparent break-evens for two of the products are higher than their normal annual sales.

	Velcro	*Metal*	*Nylon*
Normal annual sales volume	100,000	200,000	400,000
"Break-even" annual sales	172,983	211,801	268,943
"Strategic" decision	drop	drop	retain

It would be natural for managers 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 above erroneous break-even calculation, would decide to drop the Velcro and Metal products and concentrate on the company's "core competency," which appears to be the Nylon product.

Case 6-35 (continued)

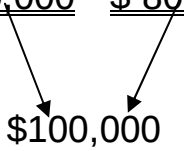
If the managers drop the Velcro and Metal products, the company would face a loss of $60,000 computed as follows:

	Velcro	*Metal*	*Nylon*	*Total*
Sales	dropped	dropped	$340,000	$340,000
Variable expenses			100,000	100,000
Contribution margin			$240,000	240,000
Fixed expenses*				300,000
Net operating income				$(60,000)

* By dropping the two products, the company reduces its fixed expenses by only $100,000 (=$20,000 + $80,000). Therefore, the total fixed expenses are $300,000 rather than $400,000.

By dropping the two products, the company would go from making a profit of $40,000 to suffering a loss of $60,000. The reason is that the two dropped products were contributing $100,000 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.

	Velcro	*Metal*	*Nylon*	*Total*
Sales	$165,000	$300,000	$340,000	$805,000
Variable expenses	125,000	140,000	100,000	365,000
Contribution margin	40,000	160,000	240,000	440,000
Product fixed expenses	20,000	80,000	60,000	160,000
Product segment margin	$ 20,000	$ 80,000	$180,000	280,000
Common fixed expenses				240,000
Net operating income				$ 40,000



Group Exercise 6-36

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 6-37

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.

Group Exercise 6-38

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 6-38 (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.