

Review Questions:

CHAPTER 3; Cost Volume Profit

True/False

1. Determining the number of units that must be produced in order to generate enough profit to cover total fixed costs is one reason for using a break-even analysis.

2. An expected value is the weighted average of the outcomes, based on the percentage combinations of the incomes.

3. Which of the following statements about net income (NI) is TRUE?

- NI = operating income plus income taxes.
- NI = operating income plus operating costs.
- NI = operating income less income taxes.
- NI = the absolute (positive) value of income taxes less operating income.

4. The break-even point in CVP analysis is defined as

- the point where output units equal input units.
- the point where unit contribution margin equals fixed costs divided by number of break-even units.
- where revenues less variable costs equal operating income.
- where the unit contribution margin equals the selling price less the unit variable cost.

5. What would be target operating income when fixed costs equal \$6,000, unit contribution margin equals \$40.00, and the number of units equals 400?

- \$ 6,000; b. \$10,000; c. \$16,000; d. \$20,000

6. Chris Muss is going to sell Ad-hoc Disks for \$40 a box; one box is considered to be one unit. The disks cost Chris \$10 a unit. She is planning to rent a booth at the upcoming Area Computer Show. She has three options for attending the show:

- paying a fixed fee of \$3,000,
- paying a \$1,000 fee plus 10% of her revenue made at the convention, or

3. paying 25% of her revenue made at the convention.

What would the indifference point be between option 1 and option 2?

- 500 units; b. 400 units; c. 300 units; d. 200 units

7. The following information is for Winnie Company:

	<i>Product A:</i>	<i>Product B:</i>
Revenue	\$4.00	\$6.00
Variable Cost	\$1.00	\$2.00

Total fixed costs are \$40,000.

What is the break-even point, assuming the sales mix consists of two units of Product A and one unit of Product B?

- 2,000 units of B and 4,000 units of A
- 2,025 units of B and 4,050 units of A
- 4,025 units of B and 8,050 units of A
- 4,000 units of B and 8,000 units of A

8. What is the operating income, assuming actual sales are 300,000 units, and the sales mix is one unit of Product A and two units of Product B?

- \$ 100,000; b. \$1,040,000; c. \$1,060,000; d. \$1,100,000

9. Information, Inc. sells accounting software. Each unit's costs may be separated as follows: selling price of \$100 and variable costs of \$30. Fixed costs are \$10,000. How many units must Information, Inc. sell in order to yield after-tax net income of \$2,400, assuming the tax rate is 40%?

- 200 units; b. 170 units; c. 150 units; d. 145 units

10. Big Sports University is planning to hold a fundraising banquet at one of the local country clubs. It has two options for the banquet:

1. Foothills Country Club

a. Fixed rental cost of \$600; b. \$15.00 per person for food.

2. Downhill Country Club

a. Fixed rental cost of \$1,080. b. A caterer who will charge \$12.00 per person for food.

Big Sports has budgeted \$900 for administrative and marketing expenses. It plans to hire a band, which will cost another \$400. Tickets are expected to be \$40 per person. Any other items required for the event will be donated by its local business supporters.

How many people must purchase tickets, assuming option two is chosen and Big Sports expects to raise \$4,820 for the athletic fund? Assume no one pays

more than the cost of his/her ticket.

a. 257 people; b. 514 people; c. 600 people; d. 610 people

11. Events, as distinguished from actions, would include

- a. personnel policy options.
- b. decisions on time schedules.
- c. decisions on direct material vendors.
- d. a financial recession.

12. Joan Perry has three booth rental options at the bridal fair where she plans to sell her new product. The booth rental options are:

- Option 1: \$4,000 fixed fee
Option 2: \$3,000 fixed fee + 5% of all revenues generated at the fair
Option 3: 20% of all revenues generated at the fair.

The product sells for \$150 per unit. She is able to purchase the units for \$50.00 each.

Which option should Joan choose in order to maximize income, assuming there is a 40% probability that 70 units will be sold and a 60% probability that 40 units will be sold?

- a. Option one with expected income of \$1,200
- b. Option two with expected income of \$1,810
- c. Option three with expected income of \$3,640
- d. Option three with expected income of \$4,060

13. Candee sells candy for \$20.00 a box. The manufacturing cost, all variable, is \$6 a box. The company is planning on renting an exhibition booth for both display and selling purposes at the annual candy convention. The convention coordinator allows three options for each participating company. They are:

- 1. paying a fixed booth fee of \$10,000, plus a \$10 registration fee, or
- 2. paying an \$8,400 fee plus 10% of revenue made at the convention, or
- 3. paying 20% of revenue made at the convention.

Required:

- a. Compute the break-even sales in boxes of each option.
- b. Which option should Candee choose, assuming sales are expected to be 1,000 boxes?

14. Nevada Flower Creations operates retail stores in shopping malls. The average selling price of an arrangement is \$25. The average cost of each sale is

\$15. A new mall is opening where Nevada Flower Creations wants to locate a store, but the location manager is not sure about the rent method to accept. The mall operators offer three options for its retail store rentals as follows:

- 1. paying a fixed rent of \$12,500 a month,
- 2. paying a base rent of \$10,000 plus 8% of revenue received, or
- 3. paying a base rent of \$5,000 plus 20% of revenue received up to a maximum rent of \$20,000.

Required:

- a. Compute the break-even sales of each option and the monthly rent paid at break-even.
- b. At what sales level is the manager indifferent between Options 2 and 3?
- c. Beginning at zero sales, show the sales levels at which each option is preferable up to 5,000 units.

15. Seamless Gutter sells 10 foot sections of gutter for \$12. The unit variable cost per section is \$8.80. Fixed costs total \$4,800.

Required:

- a. What is the contribution margin per section?
- b. What is the break-even point in sections? . . . in dollars?
- c. How many sections must be sold to earn a pretax income of \$4,000?
- d. What is the margin of safety, assuming 1,800 sections are sold?

16. Auto Tires, Inc. sells tires to service stations for an average of \$45 each. The variable costs of each tire is \$30 and monthly fixed manufacturing costs total \$15,000. Other monthly fixed costs of the company total \$12,000.

Required:

- a. What is the break-even level in tires?
- b. What is the margin of safety, assuming sales total \$90,000?
- c. What is the break-even level in tires, assuming variable costs increase by 20 percent?
- d. What is the break-even level in tires, assuming the selling price goes up by 10 percent, fixed manufacturing costs decline by 10 percent and other fixed costs decline by \$150?

17. Karen's Klothes sells blouses for women and girls. The average selling price and variable cost for each product are as follows:

	Women:	Girls
Selling Price	\$18.00	\$15.00
Variable Cost	\$12.75	\$10.50

Fixed costs are \$30,000 and cannot be separated evenly between the two products.

Required:

- a. What is the break-even point in units for each type of blouse, assuming the sales mix is 2:1 in favor of women's blouses? Total sales cannot exceed 7,000 units due to space constraints.
- b. What is the operating income, assuming the sales mix is 2:1 in favor of women's blouses, and sales total 9,900 blouses?

18. Popcorn, Inc. currently sells plain popcorn at the ballpark. During a typical month, the stand reports a profit of \$18,000 with sales of \$100,000 and fixed costs of \$42,000 and variable costs of \$0.64 per box. Next year, the company plans to start selling candy-coated popcorn for \$3 a box. The candy-coated popcorn will have a variable cost of \$0.72. The new equipment and personnel to handle the popcorn will increase monthly fixed costs by \$17,616. Initial sales of candy-coated popcorn should total 10,000 boxes. However, most of the candy-coated popcorn sales are anticipated to come from current plain popcorn purchasers. Consequently, monthly sales of plain popcorn will decline to \$40,000.

After the first year of candy-coated popcorn sales, the company president believes that it will increase to 15,000 boxes a month and that plain popcorn sales will increase to \$67,500 a month.

Required:

- a. Determine the monthly break-even sales in dollars before adding the candy-coated popcorn product.
- b. Determine the monthly break-even sales during the first year of candy-coated popcorn sales, assuming a constant sales mix.

19. Heady Company sells headbands to retailers for \$5. The variable cost of goods sold per headband is \$1, with a selling commission of 10 percent. Fixed manufacturing costs total \$25,000 per month, while fixed selling and administrative costs total \$10,500. The income tax rate for Heady Company is 30 percent.

Required:

- a. What is the break-even point in headbands?
- b. What are target sales in headbands to generate a before tax income of \$3,000?
- c. What are target sales in headbands to generate an after tax income of \$3,080?
- d. What is net income, assuming Heady sells a total of 15,000 headbands?

20. ABC Grocery needs to know the pounds of bananas to have on hand each day. Each pound of bananas costs \$0.25 and can be sold for \$0.40. Unsold bananas are worthless at the end of the day. The following demands were found after studying the last six months' sales:

- 200 pounds of bananas one-fourth of the time
- 300 pounds of bananas one-half of the time
- 400 pounds of bananas one-fourth of the time

Required:

Determine whether ABC Grocery should order 200, 300, or 400 pounds of bananas.

21. Snowmobile, Inc. manufactures two colors of snowmobiles: White and Black. Marketing believes that it can sell between 12,000 and 18,000 of either product during the upcoming year. Because of the overall economic slowdown, the company is preparing to produce only one model for next year because both snowmobiles will be near their break-even points for this range of operations. The following information has been provided by the accounting department:

	<i>White</i>	<i>Black</i>
Selling price	\$2,250	\$2,550
Variable costs	1,350	1,350

For next year, fixed costs will total \$9,450,000 if White is produced and \$11,640,000 if Black is produced. Plant capacity allows up to 107,800 direct manufacturing hours. White takes 9.8 hours to produce and Black requires 11 hours. The company is subject to a 30 percent income tax rate.

Required:

What action should Snowmobile, Inc. take, assuming the marketing manager believes annual sales of either model will be at least 11,000 snowmobiles? Why?

Answers

1. False
2. False
3. c
4. b

5. b $400 = (\$6,000 + N) / \40 ; $\$16,000 = \$6,000 + N$; $\$10,000 = N$
6. a $(\$40 - \$10)X - \$3,000 = [\$40 - \$10 - 0.10(\$40)]X - \$1,000$;
 $\$30X - \$3,000 = \$26X - \$1,000$; $\$4X = \$2,000$; $X = 500$ units
7. d. $N =$ units of product B; and $2N =$ units of product A;
 $(\$4 - \$1)2N + (\$6 - \$2)N - \$40,000 = 0$
 $\$6N + \$4N = \$40,000$
 $\$10N = \$40,000$; $N = 4,000$ units
 Product B = 4,000 units; Product A = 8,000 units

8. c

	<i>Product A</i>	<i>Product B</i>	<i>Total</i>
Sales units	<u>100,000</u>	<u>200,000</u>	<u>300,000</u>
Revenue	\$400,000	\$1,200,000	\$1,600,000
Variable costs	<u>100,000</u>	<u>400,000</u>	<u>500,000</u>
Cont. Mar.	\$300,000	\$ 800,000	\$1,010,000
Fixed costs			<u>40,000</u>
			\$1,060,000

9. a
 $\$100N - \$30N - \$10,000 = \$2,400/(1 - 0.4)$; $\$70N$ $\$10,000 = \$4,000$;
 $\$70N = \$14,000$; $N = 200$ units

10. a
 $\$40X - \$12X - \$2,380 = \$4,820$ $\$28X = \$2,380 + \$4,820$
 $\$28X = \$7,200$; $X = 257.14$ or 257 people

11. d

12. c

- Expected revenues = $0.4(70 \times \$150) + 0.6(40 \times \$150) = \$7,800$
 Expected CM before options = $0.4(70 \times \$100) + 0.6(40 \times \$100) = \$5,200$
 Option 1: $\$5,200 - \$4,000 = \$1,200$
 Option 2: $\$5,200 - \$3,000 - 0.05(\$7,800) = \$1,810$
 Option 3: $\$5,200 - 0.2(\$7,800) = \$3,640$ = maximization of income

13. a.

- Option 1 $N =$ Break-even boxes
 $\$20N - \$6N - (\$10,000 + \$10) = 0$; $\$14N - \$10,010 = 0$
 $N = \$10,010/\14 ; $N = 715$ boxes

- Option 2 $N =$ Break-even boxes
 $\$20N - \$6N - 0.10(\$20N) - \$8,400 = 0$; $\$12N - \$8,400 = 0$
 $N = \$8,400/\12 ; $N = 700$ boxes

- Option 3 $N =$ Break-even boxes
 $\$20N - \$6N - 0.20(\$20N) = 0$; $\$10N - \$0 = 0$
 $N = \$0/\10 ; $N = 0$ boxes

b.

- Option 1 Profit for 1,000 boxes = $\$14 \times 1,000 - \$10,010 = \$3,990$
 Option 2 Profit for 1,000 boxes = $\$12 \times 1,000 - \$8,400 = \$3,600$
 Option 3 Profit for 1,000 boxes = $\$10 \times 1,000 = \$10,000$
 Option 3 is the best choice.

14. a.

- Option 1 $N =$ Break-even units
 $\$25N - \$15N - \$12,500 = 0$; $\$10N - \$12,500 = 0$
 $N = \$12,500/\10 ; $N = 1,250$ units
 Rent at break-even = $\$12,500$

- Option 2 $N =$ Break-even units;
 $\$25N - \$15N - 0.08(\$25N) - \$10,000 = 0$; $\$8N - \$10,000 = 0$
 $N = \$10,000/\8 ; $N = 1,250$ units
 Rent at break-even = $\$10,000 + (0.08 \times \$25 \times 1,250) = \$12,500$

- Option 3 $N =$ Break-even units
 $\$25N - \$15N - 0.20(\$25N) - \$5,000 = 0$; $\$5N - \$5,000 = 0$
 $N = \$5,000/\5 ; $N = 1,000$ units
 Rent at break-even = $\$5,000 + (0.20 \times \$25 \times 1,000) = \$10,000$

- b. Option 2 equals Option 3 when sales are 1,667 units and favors Option 2 when sales are over 1,667.
 $\$10,000 + 0.08(\$25N) = \$5,000 + 0.20(\$25N)$; $\$5,000 = \$3N$
 $N = 5,000/3$; $N = 1,667$ units

- c. Option 3 from 0 to 1,500 units for $\$5,000$ plus $\$5$ per unit.
 Option 1 from 1,501 to 5,000 for $\$12,500$.
 Option 2 is never used because low levels favor Option 3 and higher levels favor Option 1, see part b. and computations below.
 Option 1 equals Option 2 when sales are 1,250 and favors Option 1 above 1,250 units.

- $\$12,500 = \$10,000 + 0.08(\$25N)$
 $\$2,500 = \$2N$; $N = 1,250$

- Option 1 equals Option 3 when sales are 1,500 and favors Option 1 above 1,500 units.

- $\$2,500 = \$1,000 + 0.20(\$5N)$
 $\$1,500 = \$1N$; $N = 1,500$ units

15. a. Contribution margin per section = $\$12.00 - \$8.80 = \$3.20$

b. $N = \text{Break-even point in sections}$

$\$12.00N - \$8.80N - \$4,800 = 0; \quad \$3.20N - \$4,800 = 0;$

$N = \$4,800/\$3.20; \quad N = 1,500 \text{ sections}$

Break-even dollars = $1,500 \times \$12 = \$18,000$

c. $N = \text{Target sales in sections}$

$\$12.00N - \$8.80N - \$4,800 - \$4,000 = 0; \quad \$3.20N - \$8,800 = 0$

$N = \$8,800/\$3.20; \quad N = 2,750 \text{ sections}$

d. Margin of safety = Sales - Break-even sales = $(\$12.00 \times 1,800) - \$18,000$

$= \$21,600 - \$18,000 = \$3,600$

16. a. $N = \text{Break-even units}$

$\$45N - \$30N - \$15,000 - \$12,000 = 0; \quad \$15N - \$27,000 = 0$

$N = \$27,000/\$15; \quad N = 1,800 \text{ tires}$

b. Margin of safety = $\$90,000 - (\$45 \times 1,800) = \$9,000$

c. $N = \text{Break-even units}$

$\$45N - \$36N - \$15,000 - \$12,000 = 0; \quad \$9N - \$27,000 = 0$

$N = \$27,000/\$9 \quad N = 3,000 \text{ tires}$

d. $N = \text{Break-even units}$

$\$49.50N - \$30N - \$13,500 - \$11,850 = 0 \quad \$19.50N - \$25,350 = 0$

$N = \$25,350/\$19.50 \quad N = 1,300 \text{ tires}$

17. a. $N = \text{break-even in girls' blouses}$ $2N = \text{break-even in women's blouses}$

$\$15N + \$18(2N) - \$10.5N - \$12.75(2N) - \$30,000 = 0$

$\$51N - \$36N - \$30,000 = 0 \quad \$15N - \$30,000 = 0$

$N = \$30,000/\$15 \quad N = 2,000 \text{ blouses}$

Therefore, to break even, 2,000 girls' blouses and 4,000 women's blouses need to be sold.

	Girls	Women	Total
Sales in units	<u>3,300</u>	<u>6,600</u>	<u>9,900</u>
Revenue	\$49,500	\$118,800	\$168,300

Variable costs	<u>34,650</u>	<u>84,150</u>	<u>118,800</u>
Cont. Mar.	\$14,850	\$ 34,650	\$ 49,500
Fixed costs			<u>30,000</u>
Operating income			\$ 19,500

18.

a. Contribution margin = Fixed costs + Profit = $\$42,000 + \$18,000 = \$60,000$

Variable costs = Sales - Contribution margin = $\$100,000 - \$60,000 = \$40,000$

Units sold = $\$40,000/\$0.64 = 62,500 \text{ boxes}$

Selling price = $\$100,000/62,500 = \1.60 per box

Unit Variable costs = $\$40,000/62,500 = \3.20

$N = \text{Break-even units}$

$\$1.60 - \$0.64N - \$42,000 = 0 \quad \$0.96N - \$42,000 = 0$

$N = \$42,000/\$0.96 \quad N = 43,750 \text{ boxes}$

b. Ratio equal to 1 plain popcorn box to 2 candy-coated popcorn boxes.

$N = \text{Break-even in plain popcorn boxes}$

$2N = \text{Break-even in candy-coated popcorn boxes}$

$\$3(2)N + \$1.60N - \$0.72(2N) - \$0.64N - \$59,616 = 0$

$\$7.60N - \$2.08N - \$59,616 = 0$

$N = \$59,616/\$5.52 \quad N = 10,800 \text{ boxes}$

Therefore, 10,800 boxes of plain popcorn and 21,600 boxes of candy-coated popcorn need to be sold to break even.

19. a. $N = \text{Break-even}$

$\$5N - \$1N - \$5(0.10)N - \$25,000 - \$10,500 = 0$

$\$3.50N - \$35,500 = 0 \quad N = \$35,500/\3.50

$N = 10,143 \text{ headbands}$

b. $N = \text{Target units}$

$\$5N - \$1N - \$5(0.10)N - \$25,000 - \$10,500 - \$3,000 = 0$

$\$3.50 - \$38,500 = 0 \quad N = \$38,500/\3.50

$N = 11,000 \text{ headbands}$

c. $N = \text{Target units}$

$\$5N - \$1N - \$5(0.1)N - \$25,000 - \$10,500 - \$3,080/0.7 = 0$

$\$3.50N - \$35,500 - \$4,400 = 0$

$N = \$39,900/\$3.50 \quad N = 11,400 \text{ bands}$

d. Sales (5x15,000) \$75,000

Variable costs:

Manufacturing (1 x 15,000) \$15,000

Selling (5 x 15,000 x 0.10) 7,500

Contribution margin 22,500

Fixed: \$52,500

Manufacturing \$25,000

Selling and administrative 10,500

35,500

Operating income		\$17,000
Income taxes	(3,000 x 0.30)	<u>5,100</u>
Net income		\$11,900

	<i>White</i>	<i>Black</i>
Sales	\$24,750,000	\$24,990,000
Variable costs	<u>14,850,000</u>	<u>13,230,000</u>
Contribution margin	\$ 9,900,000	\$11,760,000
Fixed costs	<u>9,450,000</u>	<u>11,640,000</u>
Operating income	\$450,000	\$120,000

20.

Quantity Ordered	Demand Probability			Expected Value
	200	300	400	
200	\$30	\$30	\$30	\$30.00
300	5	45	45	35.00
400	(20)	20	60	20.00
p	0.25	0.50	0.25	

Demand example: 300 units ordered; but demand is either 300 or 400 units:
 (\$0.40 x 300) (\$0.25 x 300) = \$45

Expected value example: Order 400:
 (\$ (20) x 0.25) + (\$20 x 0.50) + (\$60 x 0.25) = \$20

Should order 300 pounds of bananas to maximize profit.

21. Although Black has the highest contribution margin, it also has the highest fixed costs.

A break-even analysis could be undertaken to determine if both products are above break-even at plant capacity.

Break-even units White
 = \$2,250N - \$1,350N - \$9,450,000 = \$900N - \$9,450,000
 = \$9,450,000/\$900 = 10,500 snowmobiles

Break-even units Black
 = \$2,550N - \$1,350N - \$11,640,000 = \$1,200N - \$11,640,000
 = \$11,640,000/\$1,200 = 9,700 snowmobiles

Plant capacity of White = 107,800 hrs./9.8 = 11,000 snowmobiles

Plant capacity of Black = 107,800 hrs./11 = 9,800 snowmobiles

Both snowmobiles have break-even points below their plant capacity, so the decision process can continue.

Management may decide that the further away from the break-even point a product can be sold, the safer the operation. Therefore, the margin of safety may be determined for each snowmobile. Remember that Black is limited to 9,800 units.

	<i>White</i>	<i>Black</i>
Sales at maximum level	\$24,750,000	\$24,990,000
Break-even sales	23,625,000	24,735,000
Margin of safety	\$ 1,125,000	255,000

Lastly, a review of the contribution margin and income statement may be necessary.

Tax computations are not necessary for this decision. Therefore, one can conclude that the White is the best product to produce even though its contribution margin is less than that of Black.