Intro to Management Science: Modeling and Case Studies, 6e **(Hillier)**
Chapter 1 Introduction

1) Managers need to know the mathematical theory behind the techniques of management science so that they can lead management science teams.

Answer: FALSE
Difficulty: 2 Medium
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Understand
AACSB: Knowledge Application

2) Management scientists use mathematical techniques to make decisions, which are then implemented by managers.

Answer: FALSE
Difficulty: 2 Medium
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Understand
AACSB: Knowledge Application

3) Spreadsheets allow many managers to conduct their own analyses in management science studies.

Answer: TRUE
Difficulty: 2 Medium
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Understand
AACSB: Knowledge Application

4) Managers must rely on management science experts to create and understand managerial problems.

Answer: FALSE
Difficulty: 2 Medium
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Understand
AACSB: Knowledge Application

5) Management science is a discipline that attempts to aid managerial decision making by applying a scientific approach to managerial problems that involve quantitative factors.

Answer: TRUE
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Remember
AACSB: Knowledge Application

6) The discovery of the simplex method in 1947 was the beginning of management science as a discipline.

Answer: FALSE
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Remember
AACSB: Knowledge Application

7) The rapid growth of computing capability and power has led to a corresponding rapid growth of the management science discipline.

Answer: TRUE
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Remember
AACSB: Knowledge Application

8) Managers make decisions based solely on the quantitative factors involved in the problem.

Answer: FALSE
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Remember
AACSB: Knowledge Application

9) A management science team will try to conduct a systematic investigation of a problem that includes careful data gathering, developing and testing hypotheses, and then applying sound logic in the analysis.

Answer: TRUE
Difficulty: 3 Hard
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Apply
AACSB: Reflective Thinking

10) The mathematical model of a business problem is the system of equations and related mathematical expressions that describes the essence of the problem.

Answer: TRUE
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Explain what a mathematical model is
Bloom's: Remember
AACSB: Knowledge Application

11) A mathematical model of a business problem allows a manager to evaluate both quantitative and qualitative aspects of the problem.

Answer: FALSE
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Explain what a mathematical model is
Bloom's: Remember
AACSB: Knowledge Application

12) Once management makes its decisions, the management science team typically is finished with its involvement in the problem.

Answer: FALSE
Difficulty: 2 Medium
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Understand
AACSB: Knowledge Application

13) A cost that varies with the production volume would be a fixed cost.

Answer: FALSE
Difficulty: 2 Medium
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Understand
AACSB: Knowledge Application

14) A cost that varies with the production volume would be a variable cost.

Answer: TRUE
Difficulty: 2 Medium
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Understand
AACSB: Knowledge Application

15) A cost that does not vary with the production volume would be a fixed cost.

Answer: TRUE
Difficulty: 2 Medium
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Understand
AACSB: Knowledge Application

16) A cost that does not vary with the production volume would be a variable cost.

Answer: FALSE
Difficulty: 2 Medium
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Understand
AACSB: Knowledge Application

17) At the break-even point, management is indifferent between producing a product and not producing it.

Answer: TRUE
Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Remember
AACSB: Knowledge Application

18) The best way to solve a break-even problem with a spreadsheet model is to try different production quantities until the quantity that leads to profits of zero is found.

Answer: FALSE
Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a spreadsheet model to perform a break-even analysis
Bloom's: Remember
AACSB: Knowledge Application

19) A constraint is an algebraic variable that represents a quantifiable decision to be made.

Answer: FALSE
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Explain what a mathematical model is
Bloom's: Remember
AACSB: Knowledge Application

20) A decision variable is an algebraic variable that represents a quantifiable decision to be made.

Answer: TRUE
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Explain what a mathematical model is
Bloom's: Remember
AACSB: Knowledge Application

21) A parameter in a model is a variable that represents a decision to be made.

Answer: FALSE
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Explain what a mathematical model is
Bloom's: Remember
AACSB: Knowledge Application

22) The objective function for a model is a mathematical expression of the measure of performance for the problem in terms of the decision variables.

Answer: TRUE
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Explain what a mathematical model is
Bloom's: Remember
AACSB: Knowledge Application

23) Sensitivity analysis is used to check the effect of changes in the model.

Answer: TRUE
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Explain what a mathematical model is
Bloom's: Remember
AACSB: Knowledge Application

24) Investigating the potential outcomes when estimates turn out to be incorrect is known as "what-if analysis."

Answer: TRUE
Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Remember
AACSB: Knowledge Application

25) "What-if analysis" is a process used to generate estimates for use in mathematical models.

Answer: FALSE
Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Remember
AACSB: Knowledge Application

26) Enlightened future managers should know which of the following?
A) The power and relevance of management science.
B) When management science can and cannot be applied.
C) How to apply the major techniques of management science.
D) How to interpret the results of a management science study.
E) All of the answer choices are correct.

Answer: E
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Remember
AACSB: Knowledge Application

27) The rapid development of the management science discipline can be credited in part to:
A) World War I.
B) George Dantzig.
C) the computer revolution.
D) George Dantzig and the computer revolution.
E) World War I, George Dantzig, and the computer revolution.

Answer: D
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Define the term management science
Bloom's: Remember
AACSB: Knowledge Application

28) Managers may base their decisions on which of the following?
A) Quantitative factors.
B) Their best judgment.
C) Opinions from other managers.
D) Past experience.
E) All of the answer choices are correct.

Answer: E
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Remember
AACSB: Knowledge Application

29) Management science is based strongly on which of the following fields?
A) Mathematics.
B) Computer science.
C) Business administration.
D) Mathematics and computer science only.
E) All of the answer choices are correct.

Answer: D
Difficulty: 1 Easy
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Remember
AACSB: Knowledge Application

30) Which of the following are components of a mathematical model for decision making?
A) Decision variables.
B) An objective function.
C) Constraints.
D) Parameters.
E) All of the answer choices are correct.

Answer: E
Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Explain what a mathematical model is
Bloom's: Remember
AACSB: Knowledge Application

31) Which of the following are steps in a typical management science study?
A) Define the problem and gather data.
B) Formulate a model to represent the problem.
C) Test the model and refine it as needed.
D) Help to implement the recommendations.
E) All of the answer choices are correct.

Answer: E
Difficulty: 2 Medium
Topic: The Nature of Management Science
Learning Objective: Describe the nature of management science
Bloom's: Understand
AACSB: Knowledge Application

32) Which of the following is a mathematical expression that gives the measure of performance for the problem?
A) Decision variable.
B) Parameter.
C) Objective function.
D) Constraint.
E) None of the answer choices are correct.

Answer: C
Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Explain what a mathematical model is
Bloom's: Remember
AACSB: Knowledge Application

33) Which of the following is a constant in a mathematical model?
A) Decision variable.
B) Parameter.
C) Objective function.
D) Constraint.
E) None of the answer choices are correct.

Answer: B
Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Explain what a mathematical model is
Bloom's: Remember
AACSB: Knowledge Application

34) Which of the following is an inequality or equation that expresses a restriction in a mathematical model?
A) Decision variable.
B) Parameter.
C) Objective function.
D) Constraint.
E) None of the answer choices are correct.

Answer: D
Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Explain what a mathematical model is
Bloom's: Remember
AACSB: Knowledge Application

35) A manager has determined that a potential new product can be sold at a price of $10.00 each. The cost to produce the product is $5.00, but the equipment necessary for production must be leased for $25,000 per year. What is the break-even point?
A) 2,500 units.
B) 5,000 units.
C) 7,500 units.
D) 10,000 units.
E) 25,000 units.

Answer: B
Explanation: $$Q = \frac{Fixed\ Cost}{Unit\ Revenue\ -\ Marginal\ Cost} = \frac{\$25,000}{\$10\ -\ \$5} = 5,000 \text{ units}$$
Difficulty: 2 Medium
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Apply
AACSB: Knowledge Application

36) In order to produce a new product, a firm must lease equipment at a cost of $10,000 per year. The managers feel that they can sell 5,000 units per year at a price of $7.50. What is the highest variable cost that will allow the firm to at least break even on this project?
A) $2.50.
B) $3.50.
C) $4.50.
D) $5.50.
E) $6.50.

Answer: D

Explanation: $Q = \frac{Fixed\ cost}{Unit\ Revenue - Marginal\ Cost}$, therefore

$Marginal\ Cost = Unit\ Revenue - \frac{Fixed\ Cost}{Q} = \$7.50 - \frac{\$10,000}{5,000} = \$5.50$

Difficulty: 3 Hard
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Analyze
AACSB: Analytical Thinking

37) A manager has determined that a potential new product can be sold at a price of $20.00 each. The cost to produce the product is $10.00, but the equipment necessary for production must be leased for $75,000 per year. What is the break-even point?
A) 2,500 units.
B) 5,000 units.
C) 7,500 units.
D) 10,000 units.
E) 25,000 units.

Answer: C

Explanation: $Q = \frac{Fixed\ Cost}{Unit\ Revenue - Marginal\ Cost} = \frac{\$75,000}{\$20 - \$10} = 7,500\ units$

Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Remember
AACSB: Knowledge Application

38) Production has indicated that they can produce widgets at a cost of $4.00 each if they lease new equipment at a cost of $10,000. Marketing has estimated the number of units they can sell at a number of prices (shown below). Which price/volume option will allow the firm to avoid losing money on this project?
A) 4,000 units at $5.00 each.
B) 3,000 units at $7.50 each.
C) 1,500 units at $10.00 each.
D) 1,000 units at $15.00 each
E) 25,000 units.

Answer: B
Explanation: Calculating the break-even for each price, it is clear that 3,000 units at $7.50 each is the only option where the sales forecast exceeds the break-even point.

$$Q_{\$5.00} = \frac{\$10{,}000}{\$5 - \$4} = 10{,}000 \text{ units},$$

$$Q_{\$7.50} = \frac{\$10{,}000}{\$7.50 - \$4} = 2{,}857 \text{ units},$$

$$Q_{\$10.00} = \frac{\$10{,}000}{\$10 - \$4} = 1{,}667 \text{ units},$$

$$Q_{\$12.50} = \frac{\$10{,}000}{\$12.50 - \$4} = 1{,}176 \text{ units},$$

$$Q_{\$15.00} = \frac{\$10{,}000}{\$15 - \$4} = 909 \text{ units}$$

Difficulty: 3 Hard
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Evaluate
AACSB: Analytical Thinking

39) A manager has determined that a potential new product can be sold at a price of $50.00 each. The cost to produce the product is $35.00, but the equipment necessary for production must be leased for $100,000 per year. What is the break-even point?
A) 3,333 units.
B) 5,000 units.
C) 6,667 units.
D) 7,500 units.
E) 8,167 units.

Answer: C
Explanation: $Q = \frac{Fixed\ Cost}{Unit\ Revenue - Marginal\ Cost} = \frac{\$100{,}000}{\$50 - \$35} = 6{,}667\ units$
Difficulty: 2 Medium
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Apply
AACSB: Knowledge Application

40) In order to produce a new product, a firm must lease equipment at a cost of $25,000 per year. The managers feel that they can sell 10,000 units per year at a price of $15.00. What is the highest variable cost that will allow the firm to at least break even on this project?
A) $12.50.
B) $13.50.
C) $14.50.
D) $15.50.
E) $16.50.

Answer: A
Explanation: $Q = \frac{Fixed\ Cost}{Unit\ Revenue - Marginal\ Cost}$ therefore
$Marginal\ Cost = Unit\ Revenue - \frac{Fixed\ Cost}{Q} = \$15.00 - \frac{\$25{,}000}{10{,}000} = \$12.50$
Difficulty: 3 Hard
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Analyze
AACSB: Analytical Thinking

41) A manager has determined that a potential new product can be sold at a price of $100.00 each. The cost to produce the product is $75.00, but the equipment necessary for production must be leased for $175,000 per year. What is the break-even point?
A) 3,000 units.
B) 5,000 units.
C) 7,000 units.
D) 10,000 units.
E) 25,000 units.

Answer: C
Explanation: $Q = \frac{Fixed\ Cost}{Unit\ Revenue - Marginal\ Cost} = \frac{\$175{,}000}{\$100 - \$75} = 7{,}000\ \text{units}$
Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Remember
AACSB: Analytical Thinking

42) Production has indicated that they can produce widgets at a cost of $3.00 each if they lease new equipment at a cost of $10,000. Marketing has estimated the number of units they can sell at a number of prices (shown below). Which price/volume option will allow the firm to avoid losing money on this project?
A) 7,500 units at $17.50 each.
B) 4,000 units at $20.00 each.
C) 3,000 units at $22.50 each.
D) 2,500 units at $25.00 each
E) 1,500 units at $27.50 each.

Answer: D
Explanation: Calculating the break-even for each price, it is clear that 2,500 units at $25.00 each is the only option where the sales forecast equals the break-even point.

$$Q_{\$17.50} = \frac{\$25{,}000}{\$17.50 - \$15.00} = 10{,}000 \text{ units},$$

$$Q_{\$20.00} = \frac{\$25{,}000}{\$20.00 - \$15.00} = 5{,}000 \text{ units},$$

$$Q_{\$22.50} = \frac{\$25{,}000}{\$22.50 - \$15.00} = 3{,}334 \text{ units},$$

$$Q_{\$25.00} = \frac{\$25{,}000}{\$25.00 - \$15.00} = 2{,}500 \text{ units},$$

$$Q_{\$25.00} = \frac{\$25{,}000}{\$27.50 - \$15.00} = 2{,}000 \text{ units}$$

Difficulty: 3 Hard
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Evaluate
AACSB: Analytical Thinking

43) When evaluating a project to determine the break-even quantity, the advantage of a spreadsheet model is?
A) Users can't see the formulas used.
B) Calculations are always rounded to the nearest integer.
C) The analyst can use Excel's "BREAKEVEN" function to perform the calculation
D) A number of different estimates can be quickly evaluated once the model is constructed.
E) There are no advantages to spreadsheet modeling of break-even analysis.

Answer: D
Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a spreadsheet model to perform a break-even analysis
Bloom's: Remember
AACSB: Knowledge Application

44) Which of the following is TRUE about the break-even point?
A) When sales are equal to the break-even point, profit will be zero.
B) When sales exceed the break-even point, profits will be negative.
C) When sales are below the break-even point, profits will be positive.
D) Once sales exceed the break-even point, profits no longer change if sales increase further.
E) The total revenue and total cost are equal at the point where profits are maximized.

Answer: A
Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Remember
AACSB: Knowledge Application

45) Which of the following statements about the break-even quantity is FALSE?
A) When sales are equal to the break-even point, profit will be zero.
B) When sales exceed the break-even point, profits will be positive.
C) When sales are below the break-even point, profits will be negative.
D) Once sales exceed the break-even point, profits continue to increase as sales increase.
E) The total revenue and total cost are equal at the point where profits are maximized.

Answer: A
Difficulty: 1 Easy
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Understand
AACSB: Knowledge Application

46) Business analytics is a field which.
A) is the same as operations research.
B) aids managerial decision making through the use of data.
C) uses descriptive analytics to predict the future.
D) uses prescriptive analytics to analyze trends.
E) uses predictive analytics to determine the best course of action.

Answer: B
Difficulty: 1 Easy
Topic: The Relationship between Analytics and Management Science
Learning Objective: Describe the relationship between analytics and management science
Bloom's: Remember
AACSB: Knowledge Application

47) Descriptive analytics is the process of using data to.
A) analyze trends.
B) predict what will happen in the future.
C) determine the break-even point.
D) solve linear programming problems.
E) determine the best course of action for the future.

Answer: A
Difficulty: 1 Easy
Topic: The Relationship between Analytics and Management Science
Learning Objective: Describe the relationship between analytics and management science
Bloom's: Remember
AACSB: Knowledge Application

48) Predictive analytics is the process of using data to.
A) analyze trends.
B) predict what will happen in the future.
C) determine the break-even point.
D) solve linear programming problems.
E) determine the best course of action for the future.

Answer: B
Difficulty: 1 Easy
Topic: The Relationship between Analytics and Management Science
Learning Objective: Describe the relationship between analytics and management science
Bloom's: Remember
AACSB: Knowledge Application

49) Prescriptive analytics is the process of using data to.
A) analyze trends.
B) predict what will happen in the future.
C) determine the break-even point.
D) solve linear programming problems.
E) determine the best course of action for the future.

Answer: E
Difficulty: 1 Easy
Topic: The Relationship between Analytics and Management Science
Learning Objective: Describe the relationship between analytics and management science
Bloom's: Remember
AACSB: Knowledge Application

50) In order to produce a new product, a firm must lease new equipment. The managers feel that they can sell 10,000 units per year at a price of $7.50. If the variable cost of production is $5.00 per unit, what is the most the firm can spend to lease the new equipment without losing money?
A) $10,000.
B) $15,000.
C) $20,000.
D) $25,000.
E) $30,000.

Answer: D
Explanation: $Q = \frac{Fixed\ Cost}{Unit\ Revenue - Marginal\ Cost}$ therefore
$Fixed\ Cost = Q(Unit\ Revenue - Marginal\ Cost) = 10,000(7.50 - 5.00) = \$25,000.$

If the firm has lease costs of $25,000 or less the product will not lose money.
Difficulty: 3 Hard
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Analyze
AACSB: Analytical Thinking

51) A group is planning a conference. The cost to rent the space is $1,000. Each attendee will be charged $50.00 to attend, but the group provides a lunch (the group will pay $10.00 for each lunch). What is the break-even point?
A) 20 attendees.
B) 25 attendees.
C) 30 attendees.
D) 35 attendees.
E) 40 attendees.

Answer: B
Explanation: $Q = \frac{Fixed\ Cost}{Unit\ Revenue - Marginal\ Cost} = \frac{\$1{,}000}{\$50 - \$10} = 25$ attendees
Difficulty: 2 Medium
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Apply
AACSB: Knowledge Application

52) A training firm is planning to offer a one-day class at a local facility. The class is projected to have 50 students, each of whom will pay $25.00 to attend. The firm provides materials to each student (materials cost the firm $10.00 per student). What is the most the firm can afford to pay to rent the facility for one day?
A) $250.
B) $500.
C) $750.
D) $1,000.
E) $1,250.

Answer: C
Explanation: $Q = \frac{Fixed\ Cost}{Unit\ Revenue - Marginal\ Cost}$, therefore
$Fixed\ Cost = Q(Unit\ Revenue - Marginal\ Cost) = 50(25 - 10) = \$750.$

If the firm has rental costs of $750 or less the product will not lose money.
Difficulty: 3 Hard
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Analyze
AACSB: Analytical Thinking

53) A tour company is planning a bus trip to a local museum. The company will lease a bus from a local bus owner for $400 and estimates that it will spend $15.00 per person for admission and lunch. Which of the following volume/price alternatives will allow the firm to avoid losing money on the trip?
A) 20 customers at $30.00 each.
B) 30 customers at $27.50 each.
C) 40 customers at $25.00 each.
D) 50 customers at $22.50 each
E) 60 customers at $20.00 each.

Answer: C

Explanation: Calculating the break-even for each price, it is clear that 40 customers at $25.00 each is the only option where the sales forecast meets or exceeds the break-even point.

$$Q_{\$30.00} = \frac{\$400}{\$30 - \$15} = 27 \text{ customers},$$

$$Q_{\$27.50} = \frac{\$400}{\$27.50 - \$15} = 32 \text{ customers},$$

$$Q_{\$25.00} = \frac{\$400}{\$25 - \$15} = 40 \text{ customers},$$

$$Q_{\$22.50} = \frac{\$400}{\$22.50 - \$15} = 54 \text{ customers},$$

$$Q_{\$20.00} = \frac{\$400}{\$20 - \$15} = 80 \text{ customers}$$

Difficulty: 3 Hard
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Evaluate
AACSB: Analytical Thinking

54) You have decided to start a vending machine business. A local store has space available for your machine but wants to charge you an annual fee to use the space. You estimate that you can sell 5,000 cans of soda each year. You sell a can of soda for $1.25, which allows you a profit of $0.50 per can. What is the most you would spend to lease the space for one year?
A) $1,000.
B) $2,500.
C) $5,000.
D) $7,500.
E) $10,000.

Answer: B
Explanation: Since your price is $1.25 and your profit is $0.50, your cost per unit must be $1.25 – $0.50 = $0.75. $Q = \frac{Fixed\ Cost}{Unit\ Revenue - Marginal\ Cost}$, therefore
$Fixed\ Cost = Q(Unit\ Revenue - Marginal\ Cost) = 5{,}000(1.25 - 0.75) = \$2{,}500.$

If the store will lease the space for $2,500 or less the project will not lose money.
Difficulty: 3 Hard
Topic: An Illustration of the Management Science Approach: Break-Even Analysis
Learning Objective: Use a mathematical model to perform a break-even analysis
Bloom's: Analyze
AACSB: Analytical Thinking