Chapter 7: Activity Analysis, Cost Behavior, and Cost Estimation

MULTIPLE CHOICE QUESTIONS

1. The relationship between cost and activity is termed:
   A. cost estimation.
   B. cost prediction.
   C. cost behavior.
   D. cost analysis.
   E. cost approximation.

   Answer: C LO: 1 Type: RC

2. Which of the following costs changes in direct proportion to a change in the activity level?
   A. Variable cost.
   B. Fixed cost.
   C. Semivariable cost.
   D. Step-variable cost.
   E. Step-fixed cost.

   Answer: A LO: 2 Type: RC

3. Montgomery Company has a variable selling cost. If sales volume increases, how will the total variable cost and the variable cost per unit behave?

	Total Variable Cost	Variable Cost Per Unit
A.	Increase	Increase
B.	Increase	Remain constant
C.	Increase	Decrease
D.	Remain constant	Decrease
E.	Decrease	Increase

   Answer: B LO: 2 Type: RC

4. What type of cost exhibits the behavior that follows?

Manufacturing Volume (Units)	Cost Per Unit
50,000	$1.95
70,000	1.95

   A. Variable cost.
   B. Fixed cost.
   C. Semivariable cost.
   D. Discretionary fixed cost.
   E. Step-fixed cost.

   Answer: A LO: 2 Type: N

5. Plaza Corporation observed that when 25,000 units were sold, a particular cost amounted to $70,000, or $2.80 per unit. When volume increased by 15%, the cost totaled $80,500 (i.e., $2.80 per unit). The cost that Plaza is studying can best be described as a:
   A. variable cost.
   B. fixed cost.
   C. semivariable cost.
   D. discretionary fixed cost.
   E. step-fixed cost.

   Answer: A LO: 2 Type: N

6. A company observed a decrease in the cost per unit. All other things being equal, which of the following is probably true?
   A. The company is studying a variable cost, and total volume has increased.
   B. The company is studying a variable cost, and total volume has decreased.
   C. The company is studying a fixed cost, and total volume has increased.
   D. The company is studying a fixed cost, and total volume has decreased.
   E. The company is studying a fixed cost, and total volume has remained constant.

   Answer: C LO: 2 Type: N

7. Webster has the following budgeted costs at its anticipated production level (expressed in hours): variable overhead, $150,000; fixed overhead, $240,000. If Webster now revises its anticipated production slightly downward, it would expect:
   A. total fixed overhead of $240,000 and a lower hourly rate for variable overhead.
   B. total fixed overhead of $240,000 and the same hourly rate for variable overhead.
   C. total fixed overhead of $240,000 and a higher hourly rate for variable overhead.
   D. total variable overhead of less than $150,000 and a lower hourly rate for variable overhead.
   E. total variable overhead of less than $150,000 and a higher hourly rate for variable overhead.

   Answer: B LO: 2 Type: N

8. What type of cost exhibits the behavior that follows?

Manufacturing Volume (Units)	Total Cost	Cost Per Unit
50,000	$150,000	$3.00
80,000	150,000	1.88

   A. Variable cost.
   B. Fixed cost.
   C. Semivariable cost.
   D. Step-variable cost.
   E. Mixed cost.

   Answer: B LO: 2 Type: N

9. When graphed, a typical variable cost appears as:
   A. a horizontal line.
   B. a vertical line.
   C. a u-shaped line.
   D. a diagonal line that slopes downward to the right.
   E. a diagonal line that slopes upward to the right.

   Answer: E LO: 2 Type: RC

10. Norman Company pays a sales commission of 5% on each unit sold. If a graph is prepared, with the vertical axis representing per-unit cost and the horizontal axis representing units sold, how would a line that depicts sales commissions be drawn?
   A. As a straight diagonal line, sloping upward to the right.
   B. As a straight diagonal line, sloping downward to the right.
   C. As a horizontal line.
   D. As a vertical line.
   E. As a curvilinear line.

   Answer: C LO: 2 Type: N

11. When graphed, a typical fixed cost appears as:
   A. a horizontal line.
   B. a vertical line.
   C. a u-shaped line.
   D. a diagonal line that slopes downward to the right.
   E. a diagonal line that slopes upward to the right.

   Answer: A LO: 2 Type: RC

12. Costs that remain the same over a wide range of activity, but jump to a different amount outside that range, are termed:
   A. step-fixed costs.
   B. step-variable costs.
   C. semivariable costs.
   D. curvilinear costs.
   E. mixed costs.

   Answer: A LO: 2 Type: RC

13. Straight-line depreciation is a typical example of a:
   A. variable cost.
   B. step-variable cost.
   C. fixed cost.
   D. mixed cost.
   E. curvilinear cost.

   Answer: C LO: 2 Type: RC

14. Which of the following choices denotes the typical cost behavior of advertising and sales commissions?

	Advertising	Sales Commissions
A.	Variable	Variable
B.	Variable	Fixed
C.	Fixed	Variable
D.	Fixed	Fixed
E.	Semivariable	Variable

Answer: C LO: 2 Type: N

15. Douglas Corporation recently produced and sold 100,000 units. Fixed costs at this level of activity amounted to $50,000; variable costs were $100,000. How much cost would the company anticipate if during the next period it produced and sold 102,000 units?
A. $150,000.
B. $151,000.
C. $152,000.
D. $153,000.
E. Some other amount not listed above.

Answer: C LO: 2 Type: A

16. Extron, Inc., has only variable costs and fixed costs. A review of the company's records disclosed that when 100,000 units were produced, fixed manufacturing costs amounted to $200,000 and the cost per unit manufactured totaled $5. On the basis of this information, how much cost would the firm anticipate at an activity level of 97,000 units?
A. $485,000.
B. $491,000.
C. $494,000.
D. $500,000.
E. Some other amount not listed above.

Answer: B LO: 2 Type: A

17. A review of Parry Corporation's accounting records found that at a volume of 90,000 units, the variable and fixed cost per unit amounted to $8 and $4, respectively. On the basis of this information, what amount of total cost would Parry anticipate at a volume of 85,000 units?
A. $1,020,000.
B. $1,040,000.
C. $1,060,000.
D. $1,080,000.
E. Some other amount not listed above.

Answer: B LO: 2 Type: A

18. Each of Davidson's production managers (annual salary cost, $45,000) can oversee 60,000 machine hours of manufacturing activity. Thus, if the company has 50,000 hours of manufacturing activity, one manager is needed; for 75,000 hours, two managers are needed; for 125,000 hours, three managers are needed; and so forth. Davidson's salary cost can best be described as a:
    A. variable cost.
    B. semivariable cost.
    C. step-variable cost.
    D. fixed cost.
    E. step-fixed cost.

    Answer: E LO: 2 Type: N

19. A cost that has both a fixed and variable component is termed a:
    A. step-fixed cost.
    B. step-variable cost.
    C. semivariable cost.
    D. curvilinear cost.
    E. discretionary cost.

    Answer: C LO: 2 Type: RC

20. A mixed cost is often known as a:
    A. semivariable cost.
    B. step-fixed cost.
    C. variable cost.
    D. curvilinear cost.
    E. discretionary cost.

    Answer: A LO: 2 Type: RC

21. Richard Hamilton has a fast-food franchise and must pay a franchise fee of $35,000 plus 3% of gross sales. In terms of cost behavior, the fee is a:
    A. variable cost.
    B. fixed cost.
    C. step-fixed cost.
    D. semivariable cost.
    E. curvilinear cost.

    Answer: D LO: 2 Type: N

22. Which of the following are examples of a mixed cost?

I. A building that is used for both manufacturing and sales activities.
II. An employee's compensation, which consists of a flat salary plus a commission.
III. Depreciation that relates to five different machines.
IV. Maintenance cost that must be split between sales and administrative offices.

A. I only.
B. II only.
C. I and III.
D. I, III, and IV.
E. I, II, III, and IV.

Answer: B LO: 2 Type: N

23. Which of the following costs exhibits both decreasing and increasing marginal costs over a specific range of activity?
A. Semivariable cost.
B. Curvilinear cost.
C. Step-fixed cost.
D. Step-variable cost.
E. Fixed cost.

Answer: B LO: 2 Type: RC

24. The relevant range is that range of activity:
A. where a company achieves its maximum efficiency.
B. where units produced equal units sold.
C. where management expects the firm to operate.
D. where the firm will earn a profit.
E. where expected results are abnormally high.

Answer: C LO: 3 Type: RC

25. Within the relevant range of activity, costs:
A. can be estimated with reasonable accuracy.
B. can be expected to change radically.
C. exhibit decreasing marginal cost patterns.
D. exhibit increasing marginal cost patterns.
E. cannot be estimated satisfactorily.

Answer: A LO: 3 Type: RC

26. Within the relevant range, a curvilinear cost function can sometimes be graphed as a:
    A. straight line.
    B. jagged line.
    C. vertical line.
    D. curved line.
    E. horizontal line.

    Answer: A LO: 3 Type: RC

27. As a firm begins to operate outside the relevant range, the accuracy of cost estimates for fixed and variable costs:

	Fixed	Variable
A.	increases	increases
B.	increases	decreases
C.	decreases	increases
D.	decreases	decreases
E.	decreases	remains unchanged

    Answer: D LO: 3 Type: N

28. A variable cost that has a definitive physical relationship to the activity measure is called a(n):
    A. discretionary cost.
    B. engineered cost.
    C. managed cost.
    D. programmed cost.
    E. committed cost.

    Answer: B LO: 4 Type: RC

29. Costs that result from an organization's ownership or use of facilities and its basic organizational structure are termed:
    A. discretionary fixed costs.
    B. committed fixed costs.
    C. discretionary variable costs.
    D. committed variable costs.
    E. engineered costs.

    Answer: B LO: 4 Type: RC

30. Property taxes are an example of a(n):
    A. committed fixed cost.
    B. committed variable cost.
    C. discretionary fixed cost.
    D. discretionary variable cost.
    E. engineered cost.

    Answer: A LO: 4 Type: RC

31. Which of the following is not an example of a committed fixed cost?
    A. Property taxes.
    B. Depreciation on buildings.
    C. Salaries of management personnel.
    D. Outlays for advertising programs.
    E. Equipment rental costs.

    Answer: D LO: 4 Type: RC

32. Committed fixed costs would include:
    A. advertising.
    B. research and development.
    C. depreciation on buildings and equipment.
    D. contributions to charitable organizations.
    E. expenditures for direct labor.

    Answer: C LO: 4 Type: RC

33. Amounts spent for charitable contributions are an example of a(n):
    A. committed fixed cost.
    B. committed variable cost.
    C. discretionary fixed cost.
    D. discretionary variable cost.
    E. engineered cost.

    Answer: C LO: 4 Type: RC

34. Which of the following would not typically be classified as a discretionary fixed cost?
    A. Equipment depreciation.
    B. Employee development (education) programs.
    C. Advertising.
    D. Outlays for research and development.
    E. Charitable contributions.

    Answer: A LO: 4 Type: RC

35. Which of the following choices correctly classifies a committed fixed cost and a discretionary fixed cost?

	Committed	Discretionary
A.	Promotion	Management salaries
B.	Building depreciation	Charitable contributions
C.	Management training	Property taxes
D.	Equipment rentals	Equipment depreciation
E.	Research and development	Advertising

    Answer: B LO: 4 Type: RC

36. Which type of fixed cost (1) tends to be more long-term in nature and (2) can be cut back more easily in bad economic times without doing serious harm to organizational goals and objectives?

	Long Term in Nature	Can be Cut Back More Easily In Bad Economic Times
A.	Committed	Committed
B.	Committed	Discretionary
C.	Discretionary	Committed
D.	Discretionary	Discretionary
E.	Committed	No difference between committed and discretionary

Answer: B LO: 4 Type: N

37. High-tech automation combined with a downsizing of a company's hourly labor force often results in:
    A. increased fixed costs and increased variable costs.
    B. increased fixed costs and reduced variable costs.
    C. reduced fixed costs and increased variable costs.
    D. reduced fixed costs and reduced variable costs.
    E. increased discretionary fixed costs and reduced committed fixed costs.

Answer: B LO: 4 Type: RC

38. Which of the following techniques is not used to analyze cost behavior?
    A. Least-squares regression.
    B. High-low method.
    C. Visual-fit method.
    D. Linear programming.
    E. Multiple regression.

Answer: D LO: 5, 6 Type: RC

39. The high-low method and least-squares regression are used by accountants to:
    A. evaluate divisional managers for purposes of raises and promotions.
    B. choose among alternative courses of action.
    C. maximize output.
    D. estimate costs.
    E. control operations.

Answer: D LO: 5 Type: RC

40. Which of the following statements about the visual-fit method is (are) true?

    I. The method results in the creation of a scatter diagram.
    II. The method is <u>not</u> totally objective because of the manner in which the cost line is determined.
    III. The method is especially helpful in the determination of outliers.

    A. I only.
    B. II only.
    C. I and II.
    D. I and III.
    E. I, II, and III.

    Answer: E LO: 5 Type: RC

41. The nonstatistical method of cost estimation that calls for the creation of a scatter diagram is the:
    A. least-squares regression method.
    B. high-low method.
    C. visual-fit method.
    D. account analysis method.
    E. multiple regression method.

    Answer: C LO: 5 Type: RC

42. Which of the following methods of cost estimation relies on only two data points?
    A. Least-squares regression.
    B. The high-low method.
    C. The visual-fit method.
    D. Account analysis.
    E. Multiple regression.

    Answer: B LO: 5 Type: RC

Use the following to answer questions 43-44:

Swanson and Associates presently leases a copy machine under an agreement that calls for a fixed fee each month and a charge for each copy made. Swanson made 7,000 copies and paid a total of $360 in March; in May, the firm paid $280 for 5,000 copies. The company uses the high-low method to analyze costs.

43. Swanson's variable cost per copy is:
    A. $0.040.
    B. $0.051.
    C. $0.053.
    D. $0.056.
    E. an amount other than those given above.

    Answer: A LO: 5 Type: A

44. Swanson's monthly fixed fee is:
    A. $80.
    B. $102.
    C. $106.
    D. $112.
    E. an amount other than those given above.

    Answer: A LO: 5 Type: A

Use the following to answer questions 45-47:

Atlanta, Inc., which uses the high-low method to analyze cost behavior, has determined that machine hours best explain the company's utilities cost. The company's relevant range of activity varies from a low of 600 machine hours to a high of 1,100 machine hours, with the following data being available for the first six months of the year:

Month	Utilities	Machine Hours
January	$8,700	800
February	8,360	720
March	8,950	810
April	9,360	920
May	9,625	950
June	9,150	900

45. The variable utilities cost per machine hour is:
    A. $0.18.
    B. $4.50.
    C. $5.00.
    D. $5.50.
    E. an amount other than those listed above.

    Answer: D LO: 5 Type: A

46. The fixed utilities cost per month is:
    A. $3,764.
    B. $4,400.
    C. $4,760.
    D. $5,100.
    E. an amount other than those listed above.

    Answer: B LO: 5 Type: A

47. Using the high-low method, the utilities cost associated with 980 machine hours would be:
    A. $9,510.
    B. $9,660.
    C. $9,700.
    D. $9,790.
    E. an amount other than those listed above.

    Answer: D LO: 5 Type: A

48. Hitchcock, Inc., uses the high-low method to analyze cost behavior. The company observed that at 12,000 machine hours of activity, total maintenance costs averaged $7.00 per hour. When activity jumped to 15,000 machine hours, which was still within the relevant range, the average cost per machine hour totaled $6.40. On the basis of this information, the variable cost per machine hour was:
    A. $4.00.
    B. $6.40.
    C. $6.70.
    D. $7.00.
    E. an amount other than those listed above.

    Answer: A LO: 5 Type: A

49. Northridge, Inc., uses the high-low method to analyze cost behavior. The company observed that at 20,000 machine hours of activity, total maintenance costs averaged $10.50 per hour. When activity jumped to 24,000 machine hours, which was still within the relevant range, the average cost per machine hour totaled $9.75. On the basis of this information, the company's fixed maintenance costs were:
    A. $24,000.
    B. $90,000.
    C. $210,00.
    D. $234,000.
    E. an amount other than those listed above.

    Answer: B LO: 5 Type: A

50. The following data relate to the Hodges Company for May and August of the current year:

	May	August
Maintenance hours	10,000	12,000
Maintenance cost	$260,000	$300,000

May and August were the lowest and highest activity levels, and Hodges uses the high-low method to analyze cost behavior. Which of the following statements is true?
A. The variable maintenance cost is $25 per hour.
B. The variable maintenance cost is $25.50 per hour.
C. The variable maintenance cost is $26 per hour.
D. The fixed maintenance cost is $60,000 per month.
E. More than one of the above statements is true.

Answer: D LO: 5 Type: A

Use the following to answer questions 51-53:

Yang Manufacturing, which uses the high-low method, makes a product called Yin. The company incurs three different cost types (A, B, and C) and has a relevant range of operation between 2,500 units and 10,000 units per month. Per-unit costs at two different activity levels for each cost type are presented below.

	Type A	Type B	Type C	Total
5,000 units	$4	$9	$4	$17
7,500 units	$4	$6	$3	$13

51. The cost types shown above are identified by behavior as:

	Type A	Type B	Type C
A.	Fixed	Variable	Semivariable
B.	Fixed	Semivariable	Variable
C.	Variable	Semivariable	Fixed
D.	Variable	Fixed	Semivariable
E.	Semivariable	Variable	Fixed

Answer: D LO: 2, 5 Type: A, N

52. If Yang produces 10,000 units, the total cost would be:
A. $90,000.
B. $100,000.
C. $110,000.
D. $125,000.
E. an amount other than those given above.

Answer: C LO: 5 Type: A, N

53. The cost formula that expresses the behavior of Yang's total cost is:
    A. Y = $0 + $17X.
    B. Y = $20,000 + $13X.
    C. Y = $40,000 + $9X.
    D. Y = $45,000 + $4X.
    E. Y = $60,000 + $5X.

    Answer: E LO: 5 Type: A

54. In regression analysis, the variable that is being predicted is known as the:
    A. independent variable.
    B. dependent variable.
    C. explanatory variable.
    D. interdependent variable.
    E. functional variable.

    Answer: B LO: 5 Type: RC

55. Mohawk Products has determined that the number of machine hours worked (MH) drives the amount of manufacturing overhead incurred (MOH). On the basis of this relationship, a staff analyst has constructed the following regression equation:

    MOH = 240,000 + 8MH

    Which of the choices correctly depicts the nature of Mohawk's variables?

	Dependent	Independent
A.	MOH	MOH
B.	MOH	MH
C.	MH	MOH
D.	MH	MH
E.	8	240,000

    Answer: B LO: 5 Type: N

56. Checkers Corporation, which uses least-squares regression analysis, has derived the following regression equation for estimates of manufacturing overhead: Y = 495,000 + 5.65X. Which of the following statements is true if the primary cost driver is machine hours?
    A. Total manufacturing overhead is represented by the variable "X."
    B. The company anticipates $495,000 of fixed manufacturing overhead.
    C. "X" is commonly known as the dependent variable.
    D. "X" represents the number of machine hours.
    E. Both "B" and "D" are true.

    Answer: E LO: 5 Type: N

57. Boulder, Inc., recently conducted a least-squares regression analysis to predict selling expenses. The company has constructed the following regression equation: Y = 329,000 + 7.80X. Which of the following statements is false if the primary cost driver is number of units sold?
A. The company anticipates $329,000 of fixed selling expenses.
B. "Y" represents total selling expenses.
C. The company expects both variable and fixed selling expenses.
D. For each unit sold, total selling expenses will increase by $7.80.
E. "X" represents the number of hours worked during the period.

Answer: E LO: 2, 5 Type: N

58. Tempe, Inc., is studying marketing cost and sales volume, and has generated the following information by use of a scatter diagram and a least-squares regression analysis:

	Scatter Diagram	Regression Analysis
Variable cost per unit sold	$6.50	$6.80
Total monthly fixed cost	$45,000	$42,500

Tempe is now preparing an estimate for monthly sales of 18,000 units. On the basis of the data presented, compute the most accurate sales forecast possible.
A. $159,500.
B. $162,000.
C. $164,900.
D. $167,400.
E. An amount other than those listed above.

Answer: C LO: 5 Type: A, N

59. Waller Enterprises has determined that three variables play a key role in determining company revenues. To arrive at an objective forecast of revenues for the next accounting period, Waller should use:
A. simple regression.
B. multiple regression.
C. a scatter diagram.
D. complex regression.
E. the high-low method.

Answer: B LO: 6 Type: N

60. Which of the following tools is not associated with cost estimation?
A. Least-squares regression.
B. Multiple regression.
C. Inversion equations.
D. Time and motion (engineering) studies.
E. Learning curves.

Answer: C LO: 5, 6 Type: RC

61. A staff assistant at Washington Corporation recently determined that the first four units completed in a new manufacturing process took 800 hours to complete, or an average of 200 hours per unit. The assistant also found that when the cumulative output produced doubles, the average labor time declines by 20%. On the basis of this information, how many total hours would Washington use if it produces 16 units?
    A. 128.
    B. 160.
    C. 1,280.
    D. 2,048.
    E. An amount other than those listed above.

    Answer: D LO: 6 Type: A

62. Which of the following is <u>not</u> an issue in the collection of data for cost estimation?
    A. Outliers.
    B. Missing data.
    C. Mismatched time periods.
    D. Inflation.
    E. All of the above are issues in data collection.

    Answer: E LO: 7 Type: RC

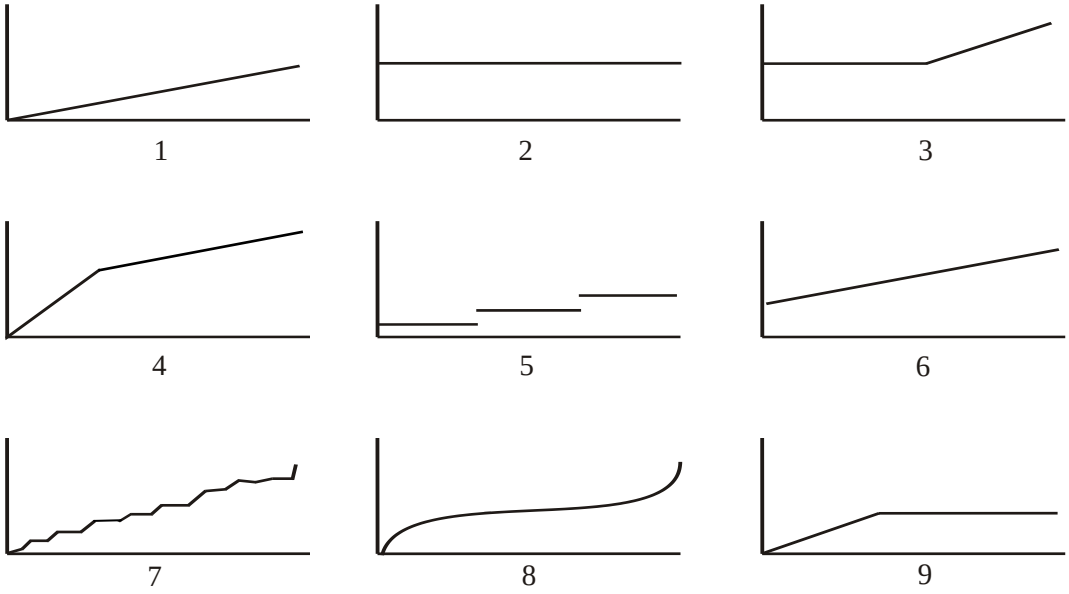
63. A high R^2 measure in regression analysis is preferred because:
    A. it indicates a good fit of the regression line through the data points.
    B. it shows that a great deal of the change in the dependent variable is explained by change in the independent variable.
    C. it means that the independent variable is a good predictor of the dependent variable.
    D. it means that the cost analyst can be relatively confident in his or her cost predictions.
    E. all of the preceding statements are true.

    Answer: E LO: 8 Type: RC

EXERCISES

Cost Behavior Patterns

64. Consider the graphs that follow (the horizontal axis represents activity; the vertical axis represents total dollars).



Required:
For items A-I that follow, choose the graph that best represents the cost behavior pattern described. Note: Graphs can be used more than once.

A. Straight-line depreciation on machinery.
B. The cost of chartering a private airplane. The cost is $800 per hour for the first 6 hours of a flight; it then drops to $600 per hour.
C. The wages of table service personnel in a restaurant. The employees are part-time workers who can be called upon for as little as 4 hours at a time.
D. Weekly wages of store clerks who work 40 hours each week. One clerk is hired for every 125 sales made during the month.
E. The cost of tires used in the production of trucks.
F. Outbound shipping charges that increase at a decreasing rate as sales rise because the firm can use more efficient modes of transportation (e.g., full trailer loads, full rail cars, etc.). Gradually, however, at high levels of sales, freight costs start to increase at an increasing rate, which reflects more transactions made to customers in far-away locations.
G. Equipment leasing costs that are computed at $2 per machine hour worked. The company pays a maximum of $120,000 per month.

H. The monthly cost of a franchise fee for a fast-food restaurant. The franchisee must pay $20,000 plus 5% of gross dollar sales.
I. The cost of electricity during peak demand periods, which is based on the following schedule:

Up to 20,000 kilowatt hours (KWH): $4,000
Above 20,000 kilowatt hours: $4,000 + $0.02 per KWH

LO: 2 Type: N

Answer:
A. 2 B. 4 C. 7 D. 5 E. 1 F. 8 G. 9 H. 6 I. 3

Cost Behavior Patterns

65. Resource Consulting is studying the costs of several clients, and has found that the accompanying graphs appear as follows:

1. A straight line that gradually slopes upward to the right
2. A curvilinear line that gradually slopes upward to the right
3. A straight line that is parallel to the graph's horizontal axis
4. A straight line that gradually slopes downward to the right
5. A curvilinear line that gradually slopes downward to the right
6. A straight line that gradually slopes upward to the right and then, at a specific point, flattens out to run parallel to the horizontal axis
7. A series of straight lines that appear to resemble a set of steps
8. A straight line that runs parallel to the graph's horizontal axis and then, at a specific point, drops to a lower level

Unless told otherwise, assume that the horizontal axis represents total activity and the vertical axis represents total cost.

Required:
For items A-F, indicate the number of the graph that best represents the cost behavior pattern described. Note: Graphs can be used more than once, and not all graphs need be used.

A. The salary cost of lab technicians employed at a clinic. One technician is needed for every 1,500 patients serviced.
B. The cost of glass used by a manufacturer of automobile windshields.
C. A profit-sharing bonus that is paid to the associate director of a firm that conducts professional-development courses for executives. The bonus is based on revenues from courses that are being run, subject to a maximum amount each year.
D. Flood insurance premiums that are paid by Reliable Manufacturing, which operates a production facility close to a river.

E. The paper cost that is used in the production of a textbook. Note: Assume that for this part only, the graph's vertical axis represents the cost per unit rather than total cost.
F. Tariffs that are paid on products shipped overseas. For one particular country, if fewer than 15,000 units are shipped, the client must pay $4 per unit. The tariff is raised by $1 according to the following schedule:

15,000 to 29,999 units	$5 per unit
30,000 to 44,999 units	$6 per unit
45,000 to 59,999 units	$7 per unit

LO: 2 Type: N

Answer:
A. 7 B. 1 C. 6 D. 3 E. 3 F. 2

Cost Classification, Cost Behavior

66. Consider the six costs that follow.

1. Advertising and promotion costs of a do-it-yourself retailer
2. Surgical supplies used in a hospital's operating room
3. Aircraft depreciation charges of an airline
4. Utility charges that include a minimum-use fee, for a small business
5. Annual business licensing fee paid by a daycare center
6. Truck fuel consumed by a road construction company

Required:
A. Classify each of these costs as variable, committed fixed, discretionary fixed, or semivariable.
B. Briefly describe the behavior of a per-unit variable cost as activity changes.
C. What elements are present in a semivariable cost that cause it to behave in a semivariable manner?
D. Generally speaking, does management have more flexibility when dealing with committed fixed costs or discretionary fixed costs?

LO: 2, 4 Type: RC, N

Answer:
A. 1. Discretionary fixed
2. Variable
3. Committed fixed
4. Semivariable
5. Committed fixed
6. Variable

B. Per-unit variable costs remain constant as activity levels change.

C. Semivariable, or mixed costs, contain both a variable and fixed component.

D. Discretionary fixed costs

Cost Classification, Cost Equation

67. Sunshine Valley Meat Company produces one of the best sausage products in Pennsylvania. The company's controller compiled the following information by analyzing the accounting records:

    1. Meat costs the company $3.25 per pound of sausage produced.
    2. Compensation of production employees is $2.25 per pound of sausage produced.
    3. Supervisory salaries total $23,000 per month.
    4. The company incurs utility costs of $9,000 per month plus $0.35 per pound of sausage produced.
    5. Insurance and property taxes average $6,400 per month.

    Required:
    A. Classify each cost as variable, fixed, or semivariable.
    B. Write a formula to express the behavior of the firm's production costs. (Use the form Y = a + bX, where X denotes the quantity of sausage produced.)

    LO: 2, 5 Type: A, N

    Answer:
    A. 1. Variable
       2. Variable
       3. Fixed
       4. Semivariable
       5. Fixed

B.	Supervision	$23,000	Meat	$3.25
	Fixed utilities	9,000	Labor	2.25
	Insurance and		Variable utilities	0.35
	property taxes	6,400	Total variable	$5.85
	Total fixed	$38,400		

Production cost per month: Y = $38,400 + $5.85X

Cost Analysis, Behavior, and Classification

68. Viscount Corporation has a machining capacity of 200,000 hours per year. Utilization of capacity is normally 75%; it has been as low as 40% and as high as 90%. An analysis of the accounting records revealed the following selected costs:

	At a 40% Utilization Rate	At a 90% Utilization Rate
Cost A:		
Total	$440,000	$ 440,000
Per hour	$5.50	?
Cost B:		
Total	?	$1,944,000
Per hour	$10.80	$10.80
Cost C:		
Total	$680,000	$1,330,000
Per hour	$8.50	$7.39

Viscount uses the high-low method to analyze cost behavior.

Required:

A. Classify each of the costs as being either variable, fixed, or semivariable.
B. Calculate amounts for the two unknowns in the preceding table.
C. Calculate the total amount that Viscount would expect at a 75% utilization rate for Cost A, Cost B, and Cost C.
D. Develop an equation that Viscount can use to predict total cost for any level of hours within its range of operation.

LO: 2, 5 Type: A, N

Answer:

A. Cost A: Fixed (same total amount at each level of activity)
Cost B: Variable (constant per-hour figures)
Cost C: Semivariable (changing total and per-hour figures)

B. Cost A: $440,000 ÷ (200,000 hours x 90%) = $2.44
Cost B: (200,000 hours x 40%) x $10.80 = $864,000

C. Analysis of Cost C (variable portion):
($1,330,000 - $680,000) ÷ [(200,000 x 90%) - (200,000 x 40%)] = $6.50 per hour

Analysis of Cost C (fixed portion):

Total cost at 40% utilization	$680,000
Variable cost (200,000 x 40% x $6.50)	520,000
Fixed cost	$160,000

75% utilization: 200,000 x 75% = 150,000 hours

Cost A	$ 440,000
Cost B (150,000 x $10.80)	1,620,000
Cost C:	
Variable portion (150,000 x $6.50)	975,000
Fixed portion	160,000
Total cost	$3,195,000

D. Variable cost per hour: $10.80 + $6.50 = $17.30
Fixed cost: $440,000 + $160,000 = $600,000
Equation: Y = $600,000 + $17.30X
where Y = total cost and X = number of hours

Cost Behavior, Cost Analysis

69. Walnut Corporation operates a small medical lab in Kansas, one that conducts minor medical procedures (including blood tests and x-rays) for a number of doctors. The lab consumes various medical supplies and is staffed by two technicians, both of whom are paid a monthly salary. In addition, there is an on-site office manager who is also paid by the month.

    Required:
    A. If the lab's patient count increases by, say, 15%, will the lab's total operating costs increase by 15%? Explain.
    B. Walnut is considering opening an additional lab in a new suburban medical building. What will likely happen to the lab's level of fixed cost incurrence? Why?
    C. What analysis methods would be available to the office manager and/or Walnut management if a close look at the lab's cost behavior is desired?

    LO: 2, 5 Type: RC, N

    Answer:
    A. No. The lab has a mixture of both variable and fixed costs. Variable costs (such as supplies) will increase, directly paralleling the increase in clients. The salaries of the technicians and office manager are step-fixed in nature, meaning that a 15% hike in client load will do nothing to these expenditures. A possibility exists, though, that an increase in patient load could create the need for an added technician.

    B. Fixed costs typically do not change when activity changes. However, the opening of a new branch will create the need for added technicians and presumably another office manager, thus causing costs to rise. In addition, facility rental charges will increase and there will be an added cost if the firm leases and/or depreciates equipment. Note: This answer assumes that the original facility will continue with existing personnel and not implement a job-sharing arrangement through a cutback in operating hours.

    C. Possible methods include account classification, visual fit, high-low, and least-squares regression.

Cost Behavior and Analysis; High-Low Method

70. The following selected data were taken from the accounting records of Shook Industrial Manufacturing:

Month	Machine Hours	Manufacturing Overhead
May	46,000	$ 889,000
June	60,000	1,130,000
July	68,000	1,274,000
August	52,000	980,000

July's costs consisted of machine supplies ($170,000), property taxes ($24,000), and plant maintenance ($1,080,000). These costs exhibit the following respective behavior: variable, fixed, and semivariable.

Required:

A. Determine the machine supplies and property taxes for May.
B. By using the high-low method, analyze Shook's plant maintenance cost and calculate the monthly fixed portion and the variable cost per machine hour.
C. Assume that present cost behavior patterns continue into future months. Estimate the total amount of manufacturing overhead the company can expect in September if 56,000 machine hours are worked.

LO: 2, 5 Type: A

Answer:

A. Machine supplies: $170,000 ÷ 68,000 hours = $2.50 per hour; 46,000 hours x $2.50 = $115,000
Property taxes: Fixed at $24,000

B. Plant maintenance in May: $889,000 - $115,000 - $24,000 = $750,000
Variable plant maintenance: ($1,080,000 - $750,000) ÷ (68,000 - 46,000) = $15 per hour
Fixed plant maintenance:

Total plant maintenance for 68,000 hours	$1,080,000
Less: Variable plant maintenance (68,000 x $15)	1,020,000
Fixed cost	$ 60,000

C. Manufacturing overhead at 56,000 hours:

Machine supplies at $2.50 per hour	$ 140,000
Property taxes	24,000
Plant maintenance:	
Variable at $15 per hour	840,000
Fixed	60,000
Total	$1,064,000

High-Low Method vs. Visual-Fit Method

71. Moore Company needs to determine the variable utilities rate per direct machine hour in order to estimate cost for August. Relevant information is as follows.

Month	Machine Hours Worked	Utilities Cost
April	4,800	$4,144
May	5,200	4,300
June	5,600	4,482
July	6,000	4,804

Moore anticipates producing 3,800 units in August, with each unit requiring 1.5 hours of machine time. The company uses the high-low method to analyze costs.

Required:
A. Calculate the variable and fixed components of the utilities cost.
B. Using the data calculated above, estimate the utilities cost for August.
C. Compare the high-low method versus the visual-fit method with respect to (1) number of data observations used in the analysis and (2) objectivity of the results.

LO: 5 Type: A, N

Answer:
A. Variable cost:
($4,804 - $4,144) ÷ (6,000 - 4,800) = $0.55 per hour

Total cost for 6,000 hours	$4,804
Less: Variable cost (6,000 x $0.55)	3,300
Fixed cost	$1,504

B. Variable cost (3,800 x 1.5 x $0.55)	$3,135
Fixed cost	1,504
Total cost	$4,639

C. The high-low method uses only two data observations, the highest and the lowest, whereas the visual-fit method utilizes all data points that have been gathered (except outliers). Many analysts would say the visual-fit method is advantageous in this regard.

However, the visual-fit method lacks total objectivity because of the manner in which the cost line is fit through the data points (drawn by "visual approximation"). The high-low method is therefore said to be more objective.

Cost Estimation, High-Low Method, Relevant Range

72. The Southlake Medical Clinic offers a number of specialized medical services. A review of data for the year just ended revealed variable costs of $32 per patient day, annual fixed costs of $480,000, and semivariable costs, which displayed the following behavior at the "peak" and "valley" of activity:

    January (2,400 patient days): $258,400
    August (2,900 patient days): $278,900

    Required:

    A. Calculate the total cost for an upcoming month (2,800 patient days) if current cost behavior patterns continue. Southlake uses the high-low method to analyze cost behavior.
    B. There is a high probability that Southlake's volume will increase in forthcoming months as patients take advantage of new scientific advances. Can the data and methodology used in part (a) for predicting the costs of 2,800 patient days be employed to estimate the costs for, say, 3,800 patient days? Why or why not?

    LO: 2, 3, 5 Type: A, N

    Answer:

    A. Analysis of semivariable cost (variable portion):
    ($278,900 - $258,400) ÷ (2,900 - 2,400) = $41 per patient day

    Analysis of semivariable cost (fixed portion):

Total cost for 2,900 patient days	$278,900
Less: Variable cost (2,900 x $41)	118,900
Fixed cost	$160,000

Variable cost (2,800 x $32)	$ 89,600
Fixed cost ($480,000 ÷ 12 months)	40,000
Semivariable cost:	
Variable portion (2,800 x $41)	114,800
Fixed portion	160,000
Total cost	$404,400

    B. No. The "peak" and "valley" of operation were 2,900 patient days and 2,400 patient days, respectively. The 3,800-patient-day data point is well outside this range of observed cost relationships and recent activity (i.e., the relevant range). Costs can change outside of this range (e.g., fixed costs may be higher), and the lack of past experience will likely create unknowns for the analyst.

Cost Estimation, High-Low Method, Analysis of Step-Fixed Cost

73. A-1 Corporation extracts ore for eight different companies in Colorado. The firm anticipates variable costs of $65 per ton along with annual fixed overhead of $840,000, which is incurred evenly throughout the year. These costs exclude the following semivariable costs, which are expected to total the amounts shown for the high and low points of ore extraction activity:

March (850 tons): $39,900
August (1,300 tons): $46,200

A-1 uses the high-low method to analyze cost behavior.

Required:
A. Calculate the semivariable cost for an upcoming month when 875 tons will be extracted.
B. Calculate the total cost for that same month.
C. A-1 uses Cortez Trucking to haul extracted ore. Cortez's monthly charges are as follows:

800 - 1,099 tons	$ 70,000
1,100 tons - 1,399 tons	90,000
1,400+ tons	110,000

1. From a cost behavior perspective, what type of cost is this?
2. If A-1 plans to extract 875 tons, is the company being very "cost effective" with respect to Cortez's billing rates? Briefly discuss.

LO: 2, 5 Type: A, N

Answer:

A. Analysis of semivariable cost (variable portion):
($46,200 - $39,900) ÷ (1,300 - 850) = $14 per ton

Analysis of semivariable cost (fixed portion):

Total cost for 1,300 tons	$ 46,200
Less: Variable cost (1,300 x $14)	18,200
Fixed cost	$ 28,000

Variable portion (875 x $14)	$ 12,250
Fixed portion	28,000
Total	$ 40,250

B.

Semivariable cost	$ 40,250
Variable cost (875 x $65)	56,875
Fixed cost ($840,000 ÷ 12)	70,000
Total	$167,125

C. 1. Step-fixed.
2. No. Notice that the bill will be $70,000 for A-1's tonnage, and the firm could have Cortez haul up to 1,099 tons for the same cost. Ideally, A-1 should try to move to the right-hand side of the step to get a better return on its investment.

Cost Behavior/Estimation, High-Low Method, Working Backward

74. Charger Corporation has three costs: A, which is variable; B, which is fixed; and C, which is semivariable. The company, which uses the high-low method, extracted the following data from its accounting records:
    - At 180,000 hours of activity, Cost A totaled $2,610,000.
    - At 140,000 hours, the low point during the period, Cost C totaled $1,498,000; at 200,000 hours, the high point, Cost C's fixed portion amounted to $1.75 per hour.
    - At 160,000 hours of activity, the sum of Costs A, B, and C amounted to $8,162,000.

    Required:
    A. Compute the variable portion (total) of Cost C at 140,000 hours of activity.
    B. Compute Cost C (total) at 160,000 hours of activity.
    C. Compute Cost B (total) at 160,000 hours of activity.

    LO: 2, 5 Type: A, N

    Answer:
    A. Cost C's fixed portion will total the same amount, $350,000 (200,000 hours x $1.75), at both 200,000 hours and 140,000 hours. Thus, the variable portion of C at 140,000 hours will be $1,148,000 ($1,498,000 - $350,000).

    B. The variable portion of Cost C is $8.20 per hour ($1,148,000 ÷ 140,000 hours). Cost C will therefore total $1,662,000 [(160,000 hours x $8.20) + $350,000].

    C. Cost A equals $2,320,000 [($2,610,000 ÷ 180,000 hours) x 160,000 hours. Thus:

Total cost (A + B + C)		$8,162,000
Less: Cost A	$2,320,000	
Cost C	1,662,000	3,982,000
Cost B		$4,180,000

High-Low and Regression Analysis, Interpretation

75. Managers in the Stamping Department have been studying overhead cost and the relationship with machine hours. Data from the most recent 12 months follow.

Month	Overhead	Machine Hours
January	$5,030	2,730
February	1,600	600
March	7,210	3,403
April	4,560	2,200
May	6,880	3,411
June	6,520	2,586
July	6,230	3,364
August	5,570	2,411
September	7,728	3,960
October	5,810	2,897
November	4,580	2,207
December	6,010	2,864

The manager of the department has requested a regression analysis of these two variables (labeled no. 1 below). However, the staff person performing the analysis decided to run another regression that excluded February (labeled no. 2). She observed that the volume of activity was very low for that month because of two factors: a severe flu outbreak and an electrical fire that disrupted operations for about 10 working days.

Regression No. 1		Regression No. 2	
Constant	428.00	Constant	550.00
R^2	0.79	R^2	0.74
b coefficient	1.86	b coefficient	1.90

Required:

A. Prepare an overhead cost breakdown by using the high-low method. The analysis should be useful in helping to predict variable and fixed costs under normal operating conditions.
B. Prepare an estimate of overhead cost for a volume of 3,000 machine hours by using regression no. 1.
C. You now have the ability to analyze three cost estimates from the high-low data in part (a) and the two regression equations. Which one do you feel would provide the best estimate? Explain the factors that support your choice. Note: Do not calculate an overhead cost estimate with regression no. 2.

LO: 5, 8 Type: A, N

Answer:

A. September and April are the high and low months of volume, respectively. February is an outlier and has been eliminated from the analysis since the instructions call for "normal operating conditions."

Analysis of semivariable cost (variable portion):
($7,728 - $4,560) ÷ (3,960 - 2,200) = $1.80 per hour

Analysis of semivariable cost (fixed portion):

Total cost for 3,960 hours	$7,728
Less: Variable cost (3,960 x $1.80)	7,128
Fixed cost	$ 600

B.

Variable cost (3,000 x $1.86)	$5,580
Fixed cost	428
Total cost	$6,008

C. Regression no. 2 would provide the best of the three estimates. The regression equations have substantial advantages over the high-low method since all data are used (not just the highest and lowest points), and quantitative measures of the strength of the relationship are available. Regression no. 2 also eliminates February's data, which are deemed an outlier.

The equation in regression no. 2 is plausible: overhead costs increase as machine hours increase. Although no. 2's R^2 is lower than the R^2 for regression no. 1, it is still very respectable, with 74% (versus 79%) of the change in overhead being explained by the change in machine hours.

Cost Estimation Methods; Cost Analysis

76. Shortly after being hired as an analyst with Harrison Rentals, which is located in upstate New York, Luis Gomez was asked to prepare a report that focused on the company's order processing costs—a cost driven largely by the number of rental invoices written. Luis knew that he could use several different tools to analyze cost behavior, including scatter diagrams, least-squares regression, and the high-low method. In addition, he knew that he could present the results of his analysis in the form of algebraic equations. Those equations follow.

    Scatter diagram: OP = $56,000 + $6.80RI
    Least-squares regression: OP = $59,000 + $6.75RI
    High-low method: OP = $53,500 + $7.25RI

    where OP = total order processing costs and RI = number of rental invoices written

    Luis had analyzed data over the past 12 months and built equations based on these data, purposely including the slowest month of the year and the busiest month so that things would "…tend to even out." He observed that February was especially slow because of a paralyzing blizzard, one that forced the company to close for four days.

    Required:

    A. Will scatter diagrams, least-squares regression, and the high-low method normally result in the same equation? Why?
    B. Assuming the use of least-squares regression, explain what the $59,000 and $6.75 figures represent.
    C. Assuming the use of a scatter diagram, predict the order processing cost of an upcoming month when Harrison expects to write 2,500 rental invoices.
    D. Did Luis err in constructing the equations on data of the past 12 months? Briefly discuss. If "yes," determine which of the three tools is likely to be affected the most and explain why.

    LO: 5, 7 Type: A, N

Answer:

A. No. The three methods produce equations by different means. Scatter diagrams and least-squares regression rely on an examination of all data points. The scatter diagram, however, requires an analyst to fit a line through the points by visual approximation, or "eyeballing." In contrast, least-squares regression involves the use of statistical formulas to derive the best possible fit of the line through the points. Finally, the high-low method is based on an analysis of only two data points: the highest and the lowest.

B. These amounts represent the fixed and variable elements of the company's order processing cost. Fixed cost totals $59,000, and Harrison incurs $6.75 of variable cost for each invoice written.

C. OP = $56,000 + $6.80RI
OP = $56,000 + ($6.80 x 2,500)
OP = $73,000

D. Yes, he did err by including February data. February is not representative because of the effects of the blizzard. The month is an outlier and should be eliminated from the data set.

The equation constructed by using the high-low method is likely to be affected the most since the equation is based on only two data points. One of those two points should have been excluded from the analysis.

Using and Analyzing a Regression Equation

77. North Company is making plans for the introduction of a new product, which has a target selling price of $7 per unit. The following estimates of manufacturing costs have been derived for 6 million units, to be produced during the first year:

Direct material: $6,000,000
Direct labor: $2,100,000 (at $14 per hour)

Overhead costs have not yet been estimated, but monthly data on total production and overhead for the past 12 months have been analyzed by using least-squares regression. The major overhead cost driver is direct labor hours, with the following results:

Computed values:
Fixed overhead cost: $3,200,000
Coefficient of independent variable: $2.25

Required:

A. Prepare the company's regression equation (Y = a + bX) to estimate overhead.
B. Calculate the predicted overhead cost at an activity level of 6,300,000 units.
C. What is North's dependent variable in this case?
D. How can the company evaluate the "quality" of its regression equation?

LO: 5, 8 Type: A, N

Answer:

A. Y = $3,200,000 + $2.25X

B. Direct labor:
For 6 million units, direct labor totals 150,000 hours ($2,100,000 ÷ $14);
For 1 unit, direct labor totals 0.025 hours (150,000 ÷ 6,000,000);
For 6,300,000 units, direct labor totals 157,500 hours (6,300,000 x 0.025).

Y = $3,200,000 + (157,500 x $2.25) = $3,554,375

C. The dependent variable is Y, or total overhead cost.

D. There are two ways to evaluate the regression equation:
1. Determine whether the relationship makes economic sense. Is it plausible that overhead cost is related to direct labor hours? Does the estimated regression equation look reasonable? Answering these questions requires a good understanding of the production process
2. Use the coefficient of determination, R^2, to assess the regression equation's goodness of fit.

DISCUSSION QUESTIONS

Cost Behavior Characteristics

78. Compare and contrast the following types of costs: (1) variable and step-variable and (2) fixed and step-fixed.

LO: 2 Type: RC

Answer:

(1) A variable cost changes in direct proportion to a change in an activity level or cost driver, with a typical example being direct material. A step-variable cost is nearly variable, but it increases in small steps rather than continuously (e.g., additional direct labor).

(2) A fixed cost remains unchanged as the activity level varies (e.g., rent). In contrast, a step-fixed cost remains fixed over a sizable range of activity, but jumps to a different amount for activities outside that range (e.g., the salaries of new employees who are needed because of volume changes).

The Relevant Range

79. Define the term "relevant range" and explain its importance in understanding cost behavior.

    LO: 3 Type: RC

    Answer:
    The relevant range is the range of activity within which management expects a company to operate. This can be based on past experience and/or sales projections.

    This concept is important because management need not concern itself with extremely high or low levels of activity that are unlikely to occur. Also, observed cost relationships are typically valid within the relevant range and can therefore be used for purposes of estimation at other levels within that range.

Committed Costs and Discretionary Costs

80. Differentiate between committed costs and discretionary costs. Be sure to present two examples of each and explain which of the two cost types would likely be cut should a company encounter financial difficulties.

    LO: 4 Type: RC

    Answer:
    A committed cost is a fixed amount that stems from an organization's ownership or use of facilities, and its basic organizational structure. Property taxes, rent, and salaries of top management are examples of committed costs.

    A discretionary cost, also a fixed amount, occurs as a result of a management decision to spend a particular amount of money for some purpose. Examples are advertising, training, promotion, and contributions to charitable organizations.

    The distinction between committed and discretionary costs is that committed costs can be changed only by major decisions with long-term implications. Discretionary costs can be changed in the short run and, thus, are cost-cutting targets should an organization encounter financial difficulties.

Deficiencies of the Visual-Fit and High-Low Methods

81. Both the visual-fit and high-low methods of cost estimation have inherent limitations. Briefly identify the major deficiency associated with each method.

    LO: 5 Type: RC

    Answer:
    The visual-fit method suffers from a lack of objectivity. Given that the cost line is created by visual approximation or "eyeballing," different cost analysts will likely produce different lines. The high-low method, on the other hand, is objective. However, it uses only two data points and ignores the rest, thus generalizing about cost behavior by relying on only a very small percentage of possible data observations.

Least-Squares Regression and Multiple Regression

82. Distinguish between least-squares regression and multiple regression as cost estimation methods.

    LO: 5, 6 Type: RC

    Answer:
    In the least-squares regression (LSR) method, the cost line is positioned to minimize the sum of the squared deviations between the cost line and the data points. The cost line fit to the data using LSR is called a regression line. The statistical equation for this line is represented by the formula: $Y = a + bX$, with X denoting activity level (independent variable) and Y denoting the total cost (dependent variable).

    The multiple-regression line has all the same properties of the simple LSR line, but more than one independent variable is taken into consideration. The use of more independent variables can better explain accompanying changes in cost.