Chapter 2

Cost Behavior, Activity Analysis, and Cost Estimation

Learning Objectives – Coverage by Question					
	True/False	Multiple Choice	Exercises	Problems	Essays
LO1 – Identify basic patterns of how costs respond to changes in activity cost drivers.	1-2	1-3, 29-35, 37, 40, 57, 58	1, 2, 8, 11		
LO2 – Determine a linear cost estimating equation.	3	4-6, 35, 36, 38, 39, 53, 58, 83	3, 4, 9		
LO3 – Calculate and compare three different approaches to cost estimation.	4-7	7-15, 41-56, 79, 80	5, 6, 10, 12-16		1, 2
LO4 – Identify and discuss problems encountered in cost estimation.	8, 9	16-21, 59, 60			3, 4
LO5 – Describe and develop alternative classifications for activity cost drivers.	10-12	22-28, 61-78, 81, 82	7		5, 6

Chapter 2: Cost Behavior, Activity Analysis, and Cost Estimation

True/False

Topic: Cost Behavior Pattern
LO: 1
1. Mixed cost behavior pattern is unrelated to unit activity level.

Answer: False
Rationale: The variable portion of a mixed cost is related to the unit activity level, because this portion of the mixed cost will increase as activity level increases. The fixed portion of the mixed cost, however, does not vary with the activity level.

Topic: Variable Costs
LO: 1
2. The wheels on an automobile are classified as a variable cost with respect to the volume of cars produced in an automobile assembly plant.

Answer: True
Rationale: Wheels represent direct materials in the production of automobiles; therefore, they represent a variable cost.

Topic: Committed Fixed Cost
LO: 2
3. The depreciation cost for a manufacturing building is an example of a committed fixed cost:

Answer: True
Rationale: Depreciation on the building for a manufacturing company is a committed fixed cost because it cannot be readily eliminated in the short term, and it does not vary with production.

Topic: Cost Estimation
LO: 3
4. The number of units sold is a better independent variable than square feet of all manufacturing facilities in estimating the cost function of a headphone manufacturer.

Answer: True
Rationale: The independent variable in a cost estimation equation should be the variable that relates as closely as possible to the dependent variable (which is total cost). When manufacturing headphones, it is more likely that the number of units produced is more closely related than square footage to total cost.

Topic: High-Low Method
LO: 3

5. The primary advantage of the high-low method of cost estimation over the least-squares regression method is its Limited data requirements.

Answer: True
Rationale: The high-low method is used primarily because of the ease of data collection that it requires. It is not as precise mathematically as other methods, and it is not as effective as the scatter diagram method in identifying outliers, but it is very convenient.

Topic: High-Low Method
LO: 3

6. The high-low method is likely to produce an inaccurate cost estimating equation when the organization has mixed costs.

Answer: False
Rationale: The purpose of the high-low method is to estimate the variable and fixed cost components of mixed costs.

Topic: Scatter Diagram
LO: 3

7. Periods of highest and lowest activity in a scatter diagram are always assumed to be representative of all cost observations.

Answer: False
Rationale: One of the major benefits of the scatter diagram method over the high-low method is that it allows one to readily identify outliers through visual observation. Any significant outliers would be removed from the data set (or ignored) in developing the cost estimation equation.

Topic: Cost Estimation Difficulties
LO: 4

8. Changes in technology during the period of cost observations should not be a concern in estimating cost.

Answer: False
Rationale: Unless all cost observations were collected under the same conditions regarding the technology employed, the estimation equation is likely to be inaccurate in estimating future costs. For the best results, all cost observations should be collected under conditions that are as uniform as possible, except for the level of operations.

Topic: Cost Estimation Difficulties
LO: 4

9. The longer the time period of each observation, the higher the probability of error in matching costs and activity,

Answer: False
Rationale: Just the opposite is true: The shorter the time period of each observation, the higher the probability of error in matching costs and activity, because most matching problems occur either at the beginning or end of the period. By having a longer period for each cost observation, the impact of mismatches at the beginning and end of the period are diluted.

Topic: Changes in Cost Structures
LO: 5

10. Over the past century cost structures in the typical company have shifted significantly as a consequence of breakthroughs in technology, resulting in a major downward shift in direct labor as a percentage of total manufacturing costs.

Answer: True
Rationale: With the increase in automation resulting from new technologies, the percentage of manufacturing costs represented by direct labor has decreased, and the percentage represented by factory overhead has increased.

Topic: Batch Level Cost
LO: 5

11. Preparing the engineering design and preparing tools to make a new product added to a company's product line would be a good example of a batch level activity.

Answer: False
Rationale: Preparing the engineering design and tools to make a new product is an example of a product level activity, not a batch level activity. An example of a batch level activity would be moving a batch of units from one location to another in the manufacturing facility.

Topic: Product Level Cost
LO: 5

12. Advertising a new health beverage is an example of a product-level activity.

Answer: True
Rationale: The activity of advertising a new product creates costs that are driven by the number of new products, not by the number of units produced or the number of batches of product produced.

Multiple Choice

Topic: Fixed Costs
LO: 1
1. Which of the following costs is best classified as fixed costs with respect to volume?
A) Parts used in manufacturing digital cameras
B) Electricity used to heat, light, and cool a hospital
C) Depreciation of a copy machine in the Human Resource Department
D) Salaries of quality inspectors in a production facility

Answer: C
Rationale: Typically, depreciation cost on assets (buildings and equipment) in a staff department such as Human Resources remains constant irrespective of the volume of output.

Topic: Step Costs
LO: 1
2. Step costs:
A) Are constant within certain ranges of activity but differ outside those ranges of activity
B) Are variable within narrowly defined ranges of activity, but constant over wider ranges of activity
C) Increase with each additional unit produced
D) Have no relation to number of units produced

Answer: A
Rationale: Step costs behave as fixed costs within a relatively narrow range, but increase to a higher level when that range is exceeded. A typical example of step costs is an inspection cost where each inspector can handle a fixed volume of product.

Topic: Fixed Costs
LO: 1
3. Fixed costs *do not* respond to:
A) Capital expenditures made by the company
B) Short-term changes in the amount of activity
C) Changes in committed expenditures
D) Discretionary investments in the company

Answer: B
Rationale: Over the short term, fixed costs are indifferent to activity level changes. For example the cost of property taxes on a building would not change based on activity volume differences.

Topic: Relevant Range
LO: 2
4. The range of operations that falls within the capacity of the current level of fixed costs is referred to as the:
A) Linear average
B) Relevant range
C) Marginal range
D) Operating range

Answer: B
Rationale: When developing a cost model for a firm or segment of a firm, that model is only relevant within the range of capacity of the fixed costs. For example if the current level of fixed cost of $10 million represents a capacity of 2 million units of output, that cost model cannot be used to estimate the cost of producing more than 2 million units.

Topic: Discretionary Fixed Costs
LO: 2

5. Discretionary fixed costs are also known as:
A) Committed fixed costs
B) Capacity costs
C) Managed fixed costs
D) Mixed costs

Answer: C
Rationale: Management decides during each budget period how much it will spend on discretionary items such as charitable contributions and training. These costs are not related to the capacity of operations.

Topic: Discretionary Fixed Costs
LO: 2

6. Which of the following is an example of a discretionary fixed cost?
A) Depreciation of manufacturing facilities
B) Donations to charitable organizations
C) Salaries of production supervisors
D) Property taxes on manufacturing facilities

Answer: B
Rationale: Donations are not related to the capacity of operations, but are determined by the discretion of management.

Topic: Cost Estimation
LO: 3

7. The determination of the mathematical relationship between activity level and cost is known as:
A) Cost control
B) Cost estimation
C) Cost prediction
D) Regression analysis

Answer: B
Rationale: A mathematical equation that models the relationship between cost (the dependent variable) and activity level (the independent variable) is used in estimating costs for different levels of activity.

Topic: Scatter Diagram Method
LO: 3

8. The scatter diagram method of cost estimation:
A) Is influenced by extreme observations
B) Is superior to other methods in its ability to distinguish between discretionary and committed fixed costs
C) Requires the use of judgment
D) Provides a measure of the goodness of fit

Answer: C
Rationale: The scatter diagram method depends of visual observation of the data points on a graph to fit the cost curve to the data. The position of the curve on the graph depends on the judgment of the person observing the data points.

Topic: High-Low Method
LO: 3

9. John Anderson uses gas to heat his home. He has accumulated the following information regarding his monthly gas bill and monthly heating degree-days. The heating degree-days value for a month is found by first subtracting the average temperature for each day from 65 degrees and then summing these daily amounts together for the month.

Month	Heating Degree-Days	Gas Bill
February	850	$129
April	300	$52

What will be the increase in John's monthly gas bill per heating degree-day using the high-low method?

A) $0.14
B) $6.59
C) $0.17
D) $5.77

Answer: A
Rationale: ($129 – $52) / (850 – 300) = $0.14

Topic: Cost Estimation
LO: 3

10. Marci Johnson uses gas to heat her home. She has accumulated the following information regarding her monthly gas bill and monthly heating degree-days. The heating degree-days value for a month is found by first subtracting the average temperature for each day from 65 degrees and then summing these daily amounts together for the month.

Month	Heating Degree-Days	Gas Bill
February	850	$129
April	300	$52

The equation representing the relationship between the gas bill (Y) and heating degree-days (X) is:

A) Y = $0.14
B) Y =$10 + $0.14X
C) Y =$10 – $0.14X
D) Y =$60 + $0.14X

Answer: B
Rationale: ($129 – $52) / (850– 300) = $0.14 = variable cost per heating degree day
$129 – (850 × $0.14) = $10 or $52 – (300 × $0.14) = $10 = fixed costs
Therefore, Y = $10 + $0.14X

Topic: Cost Estimation
LO: 3
11. The Heartland Delivery Service has the following information about its truck fleet miles and operating costs:

Year	Miles	Operating Costs
2015	125,000	$80,000
2016	150,000	$87,500
2017	175,000	$105,000

What is the best estimate of fixed costs for fleet operating expenses in 2017 using the high-low method?
A) $50,000
B) $17,000
C) $17,500
D) $25,000

Answer: C
Rationale: ($105,000 ─ $80,000) / (175,000 – 125,000) = $0.50 per mile variable cost
$105,000 – (175,000 × $0.50) = $17,500

Topic: Cost Estimation
LO: 3
12. The Illinois Tools Machine Shop wants to develop a cost estimating equation for its monthly cost of electricity. It has the following data:

Month	Cost of Electricity (Y)	Direct Labor-Hours (X)
January	$7,000	750
April	$7,500	850
July	$8,500	1,000
October	$7,250	800

What would be the best equation using the high-low method?
A) Y = $2,000 + $4X
B) Y = $2,500 + $6X
C) Y = $1,500 + $8X
D) Y = $500 + $6X

Answer: B
Rationale: ($8,500 – $7,000) / (1,000 – 750) = $6 variable cost period hour
$8,500 – (1,000 × $6) = $2,500 fixed cost.
Therefore, Y = $2,500 + $6X

Topic: Estimating Fixed Costs
LO: 3
13. The following information pertains to Nichole Company's weekly activity and total costs:

Volume of Activity	Total Cost
55 units	$600
60 units	$750
80 units	$800

What are Nichole's weekly fixed costs?
A) $ -0-
B) $ 150
C) $ 160
D) $ 800

Answer: C
Rationale: ($800 – $600) / (80 – 55) = $8 variable cost per unit
$800 – (80 × $8) = $160 fixed costs

Topic: Least Squares versus High-Low
LO: 3
14. Comparing least-squares regression to high-low estimation:
A) Least-squares regression is preferred to high-low estimation because with this method, the computer can make all the decisions after data entry
B) Least-squares regression provides superior estimates to high-low estimation when using unreliable data
C) Least-squares regression provides a means of estimating how well the data fit the model
D) All of the above

Answer: C
Rationale: Least-squares regression is a mathematical model that not only uses the data points to determine the cost curve, but it provides statistics to enable the user to know how well the data fit the cost curve and how reliable the model is in estimating costs.

Topic: Least Squares versus High-Low
LO: 3
15. Comparing least-squares regression to high-low estimation:
A) Least-squares regression better predicts costs outside the range of past observations
B) Least-squares regression makes fuller use of the data
C) Least-squares regression requires fewer calculations
D) All of the above

Answer: B
Rationale: The high-low method only uses two data points in establishing the cost estimation equation; whereas, least squares regression uses all of the available data to provide the best fit of the cost estimation equation to the data.

Topic: Difficulties in Cost Estimation
LO: 4
16. Which one of the following statements about difficulties in cost estimation is *true*?
A) Changes in the company's production technology make estimating the company's production costs easier
B) The shorter the time period, the higher the probability of inappropriately matching activity and cost
C) The stronger the economy, the harder it is to accurately match activity and cost
D) When prices of a company's raw materials or labor are rapidly increasing, cost estimations based on previous periods will overestimate future costs

Answer: B
Rationale: One of the difficulties in collecting data for time periods is making sure that the cost data and the activity data are related to the same time period. Often there are lags between the end of the time period and the measurement of cost. If the time period is short, any errors related to establishing the year-end cutoff are magnified. For longer periods, the effect of the errors is diluted.

Topic: Difficulties in Cost Estimation
LO: 4
17. Which one of the following statements about difficulties of cost estimation is *true*?
A) Data may not be based on normal operating conditions
B) Linear relationships between total costs and activity levels may exist
C) Both A and B
D) None of the above

Answer: A
Rationale: When collecting data for cost estimation, it is important that activity and cost data are representative of typical operations. If data are collected for an operating period when conditions were not similar to expected future conditions, estimates of future costs will not be reliable.

Topic: Difficulties in Cost Estimation
LO: 4
18. This creates difficulties in cost estimations:
A) Changes in technology or prices
B) Identifying cost drivers
C) Matching activity and cost within each observation
D) All of the above

Answer: D
Rationale: All of the above were discussed in the text as possible difficulties in cost estimation.

Topic: Difficulties in Cost Estimation
LO: 4
19. In cost estimation:
A) Care must be taken to make sure that data used in developing cost estimates are based on currently employed technology
B) Changes in technology and prices make cost estimation difficult
C) Only data reflecting a single price level should be used in cost estimation
D) All of the above

Answer: D
Rationale: All of the above were discussed in the text as possible difficulties in cost estimation.

Topic: Difficulties in Cost Estimation
LO: 4
20. In cost estimation:
A) Old price data of cost elements should be used cautiously, if at all
B) Only data reflecting historical price levels should be used in cost estimation
C) The prices of various cost elements are likely to change at the same rates and at the same times
D) All of the above

Answer: A
Rationale: It may be necessary to make adjustments to the cost estimation equation for changes in prices levels that have occurred since the time periods of the data used to develop the cost estimation equation.

Topic: Difficulties in Cost Estimation
LO: 4
21. The development of accurate cost-estimating equations requires the matching of the activity to:
A) Changes in technology and prices
B) Production
C) Related costs within each observation
D) All of the above

Answer: C
Rationale: The first requirement in estimating future costs is collecting accurate data regarding past activity. It is crucial that accurate costs for past activity levels are determined; otherwise, the cost estimation equation will not be reliable.

Topic: Alternate Cost Drivers
LO: 5
22. As a consequence of automation and product diversity, in cost estimation:
A) A facility level approach to estimating costs is increasingly important
B) Companies no longer need to pay attention to estimating overhead
C) Cost estimation is improved with the inclusion of non-unit cost drivers
D) Direct labor is playing an increasingly important role in cost determination

Answer: C
Rationale: With modern production methods, many variable costs may be driven by activities not related to units of production, but rather to non-unit activities such as the number of batches produced, or the number of different products supported by the production facility.

Topic: Facility-Level Activities
LO: 5
23. Facility level activities of an organization would *not* include:
A) Building maintenance
B) Machine set up
C) Property taxes
D) The production supervisor's salary

Answer: B
Rationale: Machine set-up is typically a batch-level activity since there is normally not a set-up of equipment for each unit, but for batches of units. Building maintenance, property taxes, and supervisors' salaries are typical facility-level costs that exist because of the existence of the facility. They are the same as fixed costs in a unit-level cost estimation model.

Topic: Batch-Level Activities
LO: 5
24. The following procedure performed at the United States mint is *not* a batch level activity:
A) Inspecting the first units produced to verify proper set-up
B) Movement of manufactured coins to finishing stations
C) Setting up machinery for the stamping process
D) Stamping each individual coin

Answer: D
Rationale: Stamping each individual coin is an example of a unit-level activity since it occurs for each coin produced. All of the other items are examples of batch-level activities.

Topic: Unit-Level Activities
LO: 5
25. The following procedure performed by a dairy is the *best* example of a unit level activity within a manufacturing cost hierarchy:
A) Delivering dairy products to a grocery store
B) Filling milk into half-gallon cartons
C) Homogenizing milk in specially designed tanks
D) Receiving milk from farms

Answer: B
Rationale: Filling half-gallon cartons is a unit-level activity; whereas, the other items listed are batch-level activities.

Topic: Product-Level Activities
LO: 5
26. The following procedure performed by a candy manufacturer is the *best* example of a product level activity within a manufacturing cost hierarchy:
A) Cleaning the mixing machine for the next production run of candy, a special Halloween candy
B) Developing an advertising campaign for a special Halloween candy
C) Inspecting the quality of the candy produced during one of the special Halloween package production runs
D) Resetting the packaging equipment to wrap a special 36-count Halloween package

Answer: B
Rationale: A product-level activity is one that occurs as a result of producing a new product, such as product design activities, or developing an advertising campaign for a new product.

Topic: Customer Cost Hierarchy
LO: 5
27. The following procedure performed by a food wholesaler is the *best* example of a unit level activity within a customer cost hierarchy:
A) Calling a retail customer to inquire if the customer is satisfied with the wholesaler's service
B) Driving the delivery truck to the retail customer's store
C) Sending the retail customer a bill for a recent order
D) Stacking items on the shelf of a retail customer's store

Answer: D
Rationale: In a customer cost hierarchy, activities are classified based on units, orders, customers, and facilities. A unit-level activity is one that is performed for each unit sold. Therefore, stacking items on the shelf is unit-level activity. Calling a customer is customer-level, and driving a truck to the customer's store and sending a bill for a recent order are both order-level activities.

Topic: Customer Cost Hierarchy
LO: 5

28. The following procedure performed by a home oil delivery company is the *best* example of a unit level activity within a customer cost hierarchy:
A) Opening an account for a new customer
B) Processing monthly customer billings
C) Pumping home heating oil into a customer's oil tank
D) Purchasing a new delivery truck

Answer: C
Rationale: In a customer cost hierarchy, activities are classified based on units, orders, customers, and facilities. A unit-level activity is one that is performed for each unit sold. Therefore, pumping home heating oil into a customer's oil tank is a unit-level activity. Opening an account for a new customer, and processing customer billings are either customer-level or order-level activities, and purchasing a new truck is a facility level activity.

Topic: Cost Behavior Patterns
LO: 1

29. Depreciation of a copy machine in the Human Resource Department would best be classified as what type of cost?
A) Variable Cost
B) Fixed cost
C) Mixed cost
D) Step cost

Answer: B

Topic: Cost Behavior Patterns
LO: 1

30. Parts used in manufacturing digital cameras would best be classified as what type of cost?
A) Variable cost
B) Fixed cost
C) Mixed cost
D) Step cost

Answer: A

Topic: Cost Behavior Patterns
LO: 1

31. Electricity used to heat, light, and cool a manufacturing facility would best be classified as what type of cost?
A) Variable cost
B) Fixed cost
C) Mixed cost
D) Step cost

Answer: C

Topic: Cost Behavior Patterns
LO: 1
32. A cost that is constant within a relevant range but differs outside the relevant range of activity is best classified as what type of cost?
A) Variable cost
B) Fixed cost
C) Mixed cost
D) Step cost

Answer: D

Topic: Cost Behavior Patterns
LO: 1
33. Which of the following mathematical expressions best describes a mixed cost?
A) $Y = bX$
B) $Y = a$
C) $Y = a + bX$
D) $Y = a_i$

Answer: C

Topic: Cost Behavior Patterns
LO: 1
34. Over the short term, which type of costs is indifferent to activity level changes?
A) Variable costs
B) Fixed costs
C) Mixed costs
D) Step costs

Answer: B

Topic: Cost Behavior Patterns
LO: 1, 2
35. In the following equation for total cost, $Y = a + bX$, the slope of the total cost line is an approximation of which of the following?
A) Total Cost
B) Fixed Cost
C) Variable Cost
D) Volume

Answer: C

Topic: Relevant Range
LO: 2
36. When developing a cost model for a firm or segment of a firm, the cost model is only applicable within the _____ range of capacity of fixed costs.
A) Operating
B) Average
C) Marginal
D) Relevant

Answer: D

Topic: Cost Behavior Patterns
LO: 1
37. As volume increases, which of the following statements is *not* correct?
A) Variable cost per unit will remain the same.
B) Total fixed will remain the same.
C) Average cost per unit will increase.
D) Total variable costs will increase.

Answer: C

Topic: Discretionary Fixed Costs
LO: 2
38. Which of the following would be classified as a discretionary fixed cost?
A) Depreciation
B) Research and Development
C) Property Taxes
D) Interest on Bonds

Answer: B

Topic: Committed Fixed Costs
LO: 2
39. Committed fixed costs are also known as:
A) Capacity costs
B) Managed fixed costs
C) Mixed costs
D) Step costs

Answer: A

Topic: Cost Behavior Patterns
LO: 1
40. As volume increases, average cost per unit decreases because:
A) Total fixed costs increase
B) Total variable costs increase
C) Total fixed costs stay the same
D) Total variable costs stay the same

Answer: C

Topic: Cost Estimation
LO: 3
41. Which of the following methods of cost estimation utilizes all observations and relies on statistical measures to determine the cost estimation model?
A) High-Low Method
B) Scatter Diagram
C) Least-Squares Regression
D) Linear Programming

Answer: C

Topic: Cost Estimation
LO: 3
42. Which of the following methods of cost estimation utilizes judgment to determine the cost estimation model?
A) High-Low Method
B) Scatter Diagram
C) Least-Squares Regression
D) Linear Programming

Answer: B

The following information applies to questions 43-45.

Really Fast Delivery Services has the collected the following information about operating expenditures for its delivery truck fleet for the past five years:

Year	Miles	Operating Costs
2013	55,000	$195,000
2014	70,000	$210,000
2015	50,000	$180,000
2016	65,000	$205,000
2017	85,000	$225,150

Topic: High-Low Cost Estimation
LO: 3
43. Using the high-low method, what is the cost estimate for *variable* costs for 2018?
A) $1.29
B) $2.00
C) $1.60
D) $1.50

Answer: A
Rationale: ($225,150 – $180,000) / (85,000 – 50,000) = $1.29

Topic: High-Low Cost Estimation
LO: 3
44. Using the high-low method, what is the cost estimate for *fixed* costs for 2018?
A) $100,000
B) $ 70,000
C) $115,500
D) $109,650

Answer: C
Rationale: $225,150 - (85,000 x $1.29) = $115,500 (using high observation)
$180,000 - (50,000 x $1.29) = $115,500 (using low observation)

Topic: High-Low Cost Estimation
LO: 3
45. What is the best estimate of *total operating expenses* for 2018 using the high-low method based on total expected miles of 60,000?
A) $192,900
B) $195,000
C) $196,000
D) $201,000

Answer: A
Rationale: $115,500 + (60,000 x $1.29) = $192,900

Topic: High-Low Cost Estimation
LO: 3
46. The following information pertains to Joe Coffee Company's monthly activity and total costs:

Volume of Activity	Total Cost
550 units	$5,200
600 units	$5,500
750 units	$5,800

What would be the best equation for predicting total costs using the high-low method?
A) Y = $3 + $2,100X
B) Y = $3,550 + $3X
C) Y = $3 + $1,500X
D) Y = $2,250 + $3X

Answer: B
Rationale: ($5,800 – $5,200) / (750 – 550) = $3.00
$5,800 – (750 x $3.00) = $3,550

The following information relates to questions 47-50:

George Rentals offers machine rental services for concrete cutting. Consider the following costs of the company over the relevant range of 4,000 to 10,000 hours of operating time for its concrete cutting equipment.

	Hours of Operating Time			
	4,000	5,000	8,000	10,000
Total Costs:				
Variable Costs	$ 20,000	?	?	?
Fixed Costs	82,000	?	?	?
Total Costs	$102,000	?	?	?
Cost per hour:				
Variable cost	?	?	?	?
Fixed cost	?	?	?	?
Total cost per hour	?	?	?	?

Topic: Cost Estimation
LO: 3
47. What are the estimated total costs at a volume of 5,000 hours?
A) $ 94,000
B) $107,000
C) $108,000
D) $100,000

Answer: B
Rationale: $20,000 / 4,000 = $5.00/hr.
($5 x 5,000) + $82,000 = $107,000

Topic: Cost Estimation
LO: 3
48. What is the estimated total cost per hour at a volume of 8,000 hours?
A) $12.50
B) $14.25
C) $18.00
D) $15.25

Answer: D
Rationale: (8,000 x $5.00) + $82,000 = $122,000 / 8,000 = $15.25

Topic: Cost Estimation
LO: 3
49. What are the estimated total fixed costs at a volume of 10,000 hours?
A) $100,000
B) $94,000
C) $95,000
D) $82,000

Answer: D

Topic: Cost Estimation
LO: 3
50. What is the estimated total fixed cost per hour at a volume 8,000 hours?
A) $10.25
B) $28.00
C) $24.00
D) $37.60

Answer: A
Rationale: $82,000 / 8,000 = $10.25

Topic: High-Low Cost Estimation
LO: 3
51. The primary advantage of the High-Low method over other cost estimation methods is that:
A) It utilizes only two data points rather all data points within a relevant range
B) It relies on judgment to determine the cost estimation model
C) It is a more straightforward approach to determining the variable and fixed elements of mixed costs
D) It can only be applied within the relevant range of observations of the independent variable

Answer: C

The following information applies to questions 52-55.

The following data was input into a spreadsheet program to determine the Intercept, Slope and R^2 (RSQ) for Patient Days and Maintenance Costs for a local hospital:

Month	Patient Days (X)	Maintenance Costs (Y)
January	3,300	$4,450
February	4,050	$4,750
March	3,000	$4,200
April	3,750	$4,600
May	4,150	$5,050
June	4,500	$5,400
July	2,600	$4,400
Intercept	$2,734	
Slope	$0.541	
RSQ	0.793	

Topic: Least-Squares Regression
LO: 3
52. The estimated *fixed* maintenance cost for the hospital is:
A) $5,468
B) $2,734
C) $0.793
D) $0.541

Answer: B
Rationale: Fixed cost = Vertical axis intercept

Topic: Least-Squares Regression
LO: 2, 3
53. The estimated *variable* maintenance cost per patient day for the hospital is:
A) $5,468
B) $2,734
C) $0.541
D) $0.793

Answer: C
Rationale: Variable cost per unit = Slope of the total cost line

Topic: Least-Squares Regression
LO: 3
54. The *estimated* total maintenance cost for August based on an estimated 4,000 patient days is:
A) $4,898
B) $3,092
C) $2,734
D) $4,509

Answer: A
Rationale: $2,734 + ($0.541 x 4,000) = $4,898

Topic: Least-Squares Regression
LO: 3
55. The coefficient of determination for the estimated cost model for maintenance is represented by:
A) Slope
B) Intercept
C) The dependent variable (Y)
D) R^2

Answer: D

Topic: Least-Squares Regression
LO: 3
56. The coefficient of determination for estimating packaging costs for a local shipper was determined to be 0.84. Which of the following statement is *not* correct?
A) The coefficient of determination is a measure of the percent of variation in the independent variable that is explained by variations in the dependent variable.
B) Coefficient of determination is often referred to as R-squared by statisticians.
C) The coefficient of determination can have values between zero and one.
D) Coefficient of determination values close to zero suggesting that the equation is not very useful.

Answer: A

Topic: Cost Behavior Pattern
LO: 1
57. An increase in volume within the relevant range will cause:
A) Unit fixed costs to increase.
B) Unit variable costs to decrease.
C) Total fixed costs to stay the same.
D) Total variable costs to decrease.

Answer: C

Topic: Cost Behavior Patterns
LO: 1, 2

58. The graph of an estimated cost represented by cost equation, Y = a + bX, would be best described by which of the following descriptions:
A) A positive slope starting at the point of origin
B) A positive slope starting at the y-intercept
C) A horizontal line starting at the y-intercept
D) A negative slope starting at the y-intercept

Answer: B

Topic: Changes in Technology
LO: 4

59. The introduction of production technology to replace labor in a manufacturing process would likely result in which of the following?
A) A shift in costs from variable costs to fixed costs.
B) A shift in costs from fixed costs to variable costs.
C) An increase in total manufacturing costs.
D) A decrease in total manufacturing costs.

Answer: A

Topic: Activity Cost Drivers
LO: 4

60. The introduction of production technology in a manufacturing process would:
A) Decrease the probability of inappropriately matching activity and costs in the short run
B) Make cost estimation and prediction easier
C) Require the identification of the most appropriate activity that matches costs
D) Increase the probability that the coefficient of determination will decrease in the short run

Answer: C

Topic: Composition of Total Manufacturing Costs
LO: 5

61. Over the past decade, the composition of total manufacturing costs has resulted in which of the following?
A) Manufacturing overhead decreasing as a percent of total manufacturing costs.
B) Direct labor decreasing as a percent of total manufacturing costs.
C) Direct materials decreasing as a percent of total manufacturing costs.
D) Direct labor increasing as a percent of total manufacturing costs.

Answer: B

Topic: Manufacturing Cost Hierarchy
LO: 5
62. The cost of raw materials would best be classified as what type of activity?
A) A unit-level activity
B) A batch-level activity
C) A product-level activity
D) A facility-level activity

Answer: A

Topic: Manufacturing Cost Hierarchy
LO: 5
63. The cost of issuing and tracking a work order would best be classified as what type of activity?
A) A unit-level activity
B) A batch-level activity
C) A product-level activity
D) A facility-level activity

Answer: B

Topic: Manufacturing Cost Hierarchy
LO: 5
64. The cost of maintaining general facilities such as buildings and grounds would best be classified as what type of activity?
A) A unit-level activity
B) A batch-level activity
C) A product-level activity
D) A facility-level activity

Answer: D

Topic: Manufacturing Cost Hierarchy
LO: 5
65. The cost of product marketing such as advertising would best be classified as what type of activity?
A) A unit-level activity
B) A batch-level activity
C) A product-level activity
D) A facility-level activity

Answer: C

The following information relates to questions 66-69.

Rock Bottom's Brew is a successful brewery engaged in the development and production of specialty micro brews. It uses manufacturing cost hierarchy to allocate costs to various activities. During the past year, it has incurred:

Cost	Description
$ 725,000	product development costs
$ 475,000	materials handling costs
$1,250,000	production line labor costs
$ 450,000	production setup costs
$ 250,000	power costs (for cooling beer and running equipment)
$ 875,000	manufacturing facility management costs

Topic: Manufacturing Cost Hierarchy
LO: 5
66. Using the manufacturing cost hierarchy, what is the total cost that would be classified as unit-level activity costs?
A) $ 425,000
B) $1,250,000
C) $1,975,000
D) $1,945,000

Answer: C
Rationale: $475,000 + $1,250,000 + $250,000 = $1,975,000

Topic: Manufacturing Cost Hierarchy
LO: 5
67. Using the manufacturing cost hierarchy, what is the total cost that would be classified as batch-level activity costs?
A) $ 450,000
B) $ 350,000
C) $ 600,000
D) $ 625,000

Answer: A

Topic: Manufacturing Cost Hierarchy
LO: 5
68. Using the manufacturing cost hierarchy, what is the total cost that would be classified as product-level activity costs?
A) $ 460,000
B) $1,250,000
C) $1,825,000
D) $ 725,000

Answer: D

Topic: Manufacturing Cost Hierarchy
LO: 5
69. Using the manufacturing cost hierarchy, what is the total cost that would be classified as facility-level activity costs?
A) $ 500,000
B) $1,750,000
C) $ 875,000
D) $2,000,000

Answer: C

Topic: Cost Drivers
LO: 5
70. *Number of employees* is most appropriate as a cost driver for which of the following types of activity costs?
A) Machining
B) Purchasing
C) Assembly
D) Payroll

Answer: D

Topic: Cost Drivers
LO: 5
71. *Number of parts per unit* is most appropriate as a cost driver for which of the following types of activity costs?
A) Machining
B) Purchasing
C) Assembly
D) Payroll

Answer: C

Topic: Cost Drivers
LO: 5
72. *Number of invoices* is most appropriate as a cost driver for which of the following types of activity costs?
A) Machining
B) Purchasing
C) Assembly
D) Payroll

Answer: B

Topic: Cost Drivers
LO: 5
73. *Number of machine hours* is most appropriate as a cost driver for which of the following types of activity costs?
A) Machining
B) Purchasing
C) Assembly
D) Payroll

Answer: A

The following information relates to questions 74-78.

Kratz Manufacturing Company uses an activity-based costing system. It has the following manufacturing activity areas, related cost drivers and cost allocation rates:

Activity	Cost Driver	Cost Allocation Rate
Machine setup	Number of setups	$50.00
Materials handling	Number of parts	0.50
Machining	Machine hours	13.00
Assembly	Direct labor hours	22.00
Inspection	Number of finished units	14.00

During the month, 100 units were produced, with no defects, requiring three setups. Each unit consisted of 17 parts, 3 direct labor hours and 2.5 machine hours. Direct materials cost $50 per finished unit.

Topic: Cost Drivers
LO: 5
74. What is the total manufacturing cost for machine setups?
A) $150
B) $500
C) $250
D) $300

Answer: A
Rationale: (3 x $50) = $150

Topic: Cost Drivers
LO: 5
75. What is the total manufacturing cost for materials handling?
A) $375
B) $500
C) $850
D) $750

Answer: C
Rationale: (17 x $0.50) x 100 = $850

Topic: Cost Drivers
LO: 5
76. What is the total manufacturing cost for inspections?
A) $1,100
B) $1,400
C) $ 900
D) $ 700

Answer: B
Rationale: 100 x $14 = $1,400

Topic: Cost Drivers
LO: 5
77. What is the total manufacturing cost for the period?
A) $80,675
B) $10,625
C) $32,100
D) $17,250

Answer: D
Rationale: 100 x [(17 x $0.50) + (3 x $22) + (2.5 x $13) + $50 + $14] + (3 x $50) materials handling = $17,250

Topic: Cost Drivers
LO: 5
78. What is the per unit manufacturing cost for the period?
A) $806.75
B) $106.25
C) $321.00
D) $172.50

Answer: D
Rationale: $17,250 / 100 = $172.50

Topic: Multiple Regression
LO: 3
79. Office Supply store costs are expressed as a function of the unit sales of its two products: office chairs and task desks. Assume fixed costs are $9,000 per month and the variable costs are $60 per office chair and $125 per task desk.

What are Office Supply's estimated costs for the month if 100 office chairs and 52 task desks are sold?
A) $21,500
B) $25,000
C) $22,000
D) $20,500

Answer: A
Rationale: $9,000 + ($60 x 100) + ($125 x 52) = $21,500

Topic: Coefficient of Determination
LO: 3
80. Given the equation, Y= 4,000 + 2.5X. The coefficient of determination (R-Squared) is calculated to be 0.70 (or 70%). This equation implies

A) 70% of the variation in Y is explained in X
B) 70% of the variation in X is explained in Y
C) There is no relationship between X and Y, since it not 90% or 95%
D) Since 30% (100% – 70%) is closer to zero there is strong direct relationship between X and Y

Answer: A
Rationale: Coefficient of determination explains the relationship of the independent variable (X) by the dependent variable (Y). The closer the number is to 1 or 100%, the stronger the relationship. 70% change in Y can be explained by change in X.

Topic: Topic: Manufacturing Cost Hierarchy
LO: 5
81. Axe Manufacturers produces a product with the following manufacturing cost hierarchy for its only current product.

Activity Level	Cost
Unit	10 per unit
Batch	250 per batch
Product	5,000 per year
Facility	25,000 per year

Next year Axe plans to manufacture 25,000 units of product, in batches of 250 units.

Axe's predicted manufacturing cost for next year is:
A) $735,500
B) $750,000
C) $330,000
D) $305,000

Answer: D
Rationale:

Unit Cost = $10 per unit X 25,000 unit =	$250,000
Batch = (25,000 units ÷ 250 units per batch) x $250 per batch =	25,000
Product	5,000
Facility	25,000
Total Manufacturing cost	$305,000

Topic: Topic: Manufacturing Cost Hierarchy
LO: 5

82. Howell sells specialized products produced by electronics companies to engineering firms. Howell sells these products at a price based on Howell's purchase price. Howell's customer cost hierarchy is as follows:

Activity Level	Cost
Unit	40% of selling price
Batch	$200 per sales order
Customer	$500 per customer per year
Facility	$60,000 per year

Next year Howell plans to sell $4,000,000 of product to the 100 engineering firms they serve. They anticipate that each firm will place an average of 4 orders.

Howell's predicted customer costs for next year are:

A. $ 80,000
B. $ 300,000
C. $1,790,000
D. $3,500,000

Answer: C
Rationale:

Unit	40% of ($4,000,000)	$1,600,000
Batch	$200 per 4 orders x 100 firms	80,000
Customer	$500 x 100	50,000
Facility		60,000
		$1,790,000

Topic: Average Cost
LO: 2

83. At a sales volume of 25 units the average cost is $205 per unit and the variable cost is $5 per unit. Assuming a linear cost behavior pattern, if sales double to 50 units the average cost will be:

A) $110
B) $105
C) $205
D) $210

Answer: B
Rationale: Variable cost = $5 x 25 units = $125
Total cost = $205 x 25 units = $5,125
Fixed cost = $5,125 - $125 = $5,000

Variable cost for 50 units = $5 x 50 units = $250
Fixed cost = $5,000
Total cost = $5,000 + $250 = $5,250
Average per unit cost = $5,250 / 50 units = $105

Exercises

Topic: Classifying Cost Behavior
LO: 1

1. Classify the total costs of each of the following as variable, fixed, mixed, or step. Sales volume is the cost driver.

_____ a. Wages of machine operator who is paid based on number of units produced on the machine

_____ b. Keyboards purchased from a subcontract supplier in a computer assembly plant

_____ c. Property taxes

_____ d. Salaries of quality inspectors when each inspector can evaluate a maximum of 500 units per day

_____ e. Annual salary for the vice president of manufacturing

_____ f. Electric power in a factory

_____ g. Raw materials used in production

_____ h. Water consumed by the plant, which is based on a flat fee plus actual consumption

_____ i. Overhead costs in the factory for incidental components such as small screws and rivets.

_____ j. Fire insurance on factory building

Answer:

Variable a. Wages of machine operator who is paid based on number of units produced on the machine

Variable b. Keyboards purchased from a subcontract supplier in a computer assembly plant

Fixed c. Property taxes

Step d. Salaries of quality inspectors when each inspector can evaluate a maximum of 500 units per day

Fixed e. Annual salary for the vice president of manufacturing

Mixed f. Electric power in a factory

Variable g. Raw materials used in production

Mixed h. Water consumed by the plant, which is based on a flat fee plus actual consumption

Variable i. Overhead costs in the factory for incidental components such as small screws and rivets.

Fixed j. Fire insurance on factory building

Topic: Cost Behavior Patterns
LO: 1

2. Phenning Company had the following costs for the past three years in which it produced 40,000, 48,000, and 60,000 units, respectively.

	Year1	Year 2	Year 3
Direct Materials	$80,000	$96,000	$120,000
Utilities Expense	44,000	98,000	104,000
Property Taxes	12,000	12,000	12,000
Travel Expense	6,000	6,000	6,000
Direct Labor	60,000	72,000	90,000
Maintenance Expense	22,000	26,000	32,000

Identify which of the costs were variable, fixed, and mixed.

Answer:

Direct Materials:	Variable
Utilities Expense:	Mixed
Property Taxes:	Fixed
Travel Expense:	Fixed
Direct Labor:	Variable
Maintenance Expense	Mixed

Topic: Computing Average Unit Costs
LO: 2

3. The total monthly operating costs of Kristy's Yogurt Ice Cream Shack are:

$3,500 + $0.90X, where X = 12 ounce serving

a. Calculate the average cost per serving at each of the following monthly volumes: 1,000, 2,000, 3,000 and 5,000, and

b. Determine the monthly volume at which the average cost per serving is $1.90

Answer:

a) Average cost @ 1,000 units = [$3,500 + ($0.90 x 1,000)] /1,000 = $4.40
Average cost @ 2,000 units = [$3,500 + ($0.90 x 2,000)] /2,000 = $2.65
Average cost @ 3,000 units = [$3,500 + ($0.90 x 3,000)] /3,000 = $2.07
Average cost @ 5,000 units = [$3,500 + ($0.90 x 5,000)] /5,000 = $1.60

b)

Desired average cost per serving	$1.90
Less Variable cost per serving	(0.90)
Fixed cost per serving	$1.00

$3,500 (total fixed cost) / $1.00 (per unit fixed cost) = 3,500 units
Proof: [$3,500 + ($0.90 X 3,500)] / 3,500 = $1.90 average cost per serving

Topic: Committed and Discretionary Fixed Costs
LO: 2
4. Indicate whether each of the following fixed costs are committed or discretionary.

a. Depreciation on the factory
b. Cancellable lease on the corporate jet
c. Super Bowl TV advertisement
d. Annual scheduled maintenance on the air conditioning system
e. Annual donation to the local Boys and Girls Clubs
f. Salary of the director of training who is on a three-year contract
g. Travel for employees to attend professional development seminars

Answer:
a. Committed
b. Discretionary
c. Discretionary
d. Discretionary
e. Discretionary
f. Committed
g. Discretionary

Topic: High-Low Cost Estimation
LO: 3
5. Assume RCA Cable Company has the following information available about fleet miles and operating costs for its service department:

Year	Fleet Miles	Operating Costs
2016	123,500	$114,350
2017	181,500	$157,850

Using the high-low method, develop a cost-estimating equation for total annual operating costs.

Answer:
Variable costs = ($157,850 – $114,350) / (181,500 – 123,500) = $0.75 per mile.

Fixed costs = $157,850 – ($0.75 x 181,500) = $21,725 *or* $114,350 – ($0.75 x 123,500) = $21,725.

Total annual costs = $21,725 + $0.75X, where X = annual fleet miles

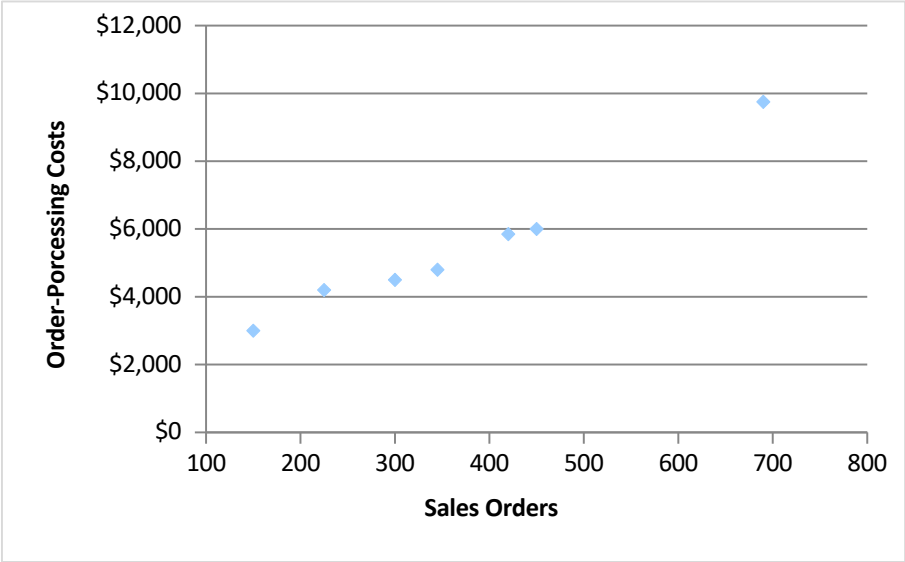
Topic: Scatter Diagrams and High-Low Cost Estimation
LO: 3

6. Assume the Paul's Custom Print Shop has the following information on the number of sales orders received and order-processing costs.

Month	Sales Orders	Order-Processing Costs
Jan	450	$6,000
Feb	225	4,200
Mar	690	9,750
Apr	420	5,850
May	345	4,800
Jun	150	3,000
Jul	300	4,500

Plot the data on a scatter diagram. Using the information from representative high- and low- volume months, and develop a cost-estimating equation for monthly production costs.

Answer:



Variable costs = ($9,750 – $3,000) / (690 – 150) = $12.50 per sales order

Fixed costs = $9,750 – ($12.50 x 690) = $1,125 *or* $3,000 – ($12.50 x 150) = $1,125

Monthly order processing costs = $1,125 + $12.50X, where X = sales orders

Topic: Cost Classification Hierarchy
LO: 5

7. Cooper and Kaplan developed the framework used to classify manufacturing activities. List the four categories of activities and provide an example of each activity level.

Answer:
Unit level:

- Cost of raw materials
- Cost of inserting a component
- Utilities cost of operating equipment
- Costs of packaging
- Sales commissions

Batch level:

- Cost of processing a sales order
- Cost of issuing and tracking a work order
- Cost of equipment set-up
- Cost of moving batches between workstations
- Cost of inspection

Product level:

- Cost of product development
- Cost of product marketing such as advertising
- Cost of specialized equipment
- Cost of maintaining specialized equipment

Facility level:

- Cost of maintaining general faculties such as buildings and grounds
- Cost of nonspecialized equipment
- Cost of maintaining nonspecialized equipment
- Cost of real property taxes
- Cost of general advertising
- Cost of general administration salaries

Topic: Cost Behavior
LO: 1

8. Classify each of the following costs as variable, fixed, mixed, or step by writing an X under one of the following headings (Sales volume is the cost driver).

	Variable	Fixed	Mixed	Step
1. Total selling and administrative costs				
2. Salaries of supervisors (each supervisor is in charge of five production employees)				
3. Raw materials used in production				
4. Power consumption in a restaurant				
5. Cost of goods sold in a restaurant				
6. Salaries of employees who handle 20 claims per month				
7. Pulpwood in a paper mill				
8. Salaries of two secretaries in the corporate office				
9. Total current manufacturing costs				
10. The cost of an automobile rented on the basis of a daily charge plus $0.50 per mile				

Answer:

	Variable	Fixed	Mixed	Step
1. Total selling and administrative costs			X	
2. Salaries of supervisors (each supervisor is in charge of five production employees)				X
3. Raw materials used in production	X			
4. Power consumption in a restaurant			X	
5. Cost of goods sold in a restaurant	X			
6. Salaries of employees who handle 20 claims per month				X
7. Pulpwood in a paper mill	X			
8. Salaries of two secretaries in the corporate office		X		
9. Total current manufacturing costs			X	
10. The cost of an automobile rented on the basis of a daily charge plus $0.50 per mile			X	

Topic: Committed and Discretionary Fixed Costs
LO: 2

9. Identify each of the following costs as fixed-committed or fixed-discretionary by writing an "X" under one of the following headings:

	Fixed Committed	Fixed Discretionary
1. Cost of entertainment at the company awards banquet		
2. Research and development staff salaries		
3. Cost of placing an ad in a corporate magazine		
4. Rent on an exhibition at a trade show		
5. Depreciation on manufacturing equipment		
6. Depreciation on the corporate jet		
7. Interest on bonds payable		
8. Exclusivity fee paid by a franchise		
9. Corporate charitable contributions		
10. Employee training workshops		

Answer:

	Fixed Committed	Fixed Discretionary
1. Cost of entertainment at the company awards banquet		X
2. Research and development staff salaries		X
3. Cost of placing an ad in a corporate magazine		X
4. Rent on an exhibition at a trade show		X
5. Depreciation on manufacturing equipment	X	
6. Depreciation on the corporate jet	X	
7. Interest on bonds payable	X	
8. Exclusivity fee paid by a franchise	X	
9. Corporate charitable contributions		X
10. Employee training workshops		X

Topic: High-Low Method
LO: 3
10. Andrea Company manufactures and sells specialty items. The following representative direct labor-hours and production costs are provided for a four-month period:

Month	Hrs. Direct Labor	Production Costs
January	1,500	$ 22,500
February	2,000	26,250
March	3,500	40,500
April	2,000	22,500
Total	9,000	$111,750

a = fixed production costs per month
b = variable production costs per direct labor hour
n = number of months
X = direct labor-hours per month
Y = total monthly production costs

Using the symbols above, indicate the cost estimation equation based on number of direct labor hours per month, and calculate total monthly production costs for May using the high-low method, assuming the direct labor hours for May are expected to be 2,250.

Answer:
Y = a + bX
b = ($40,500 – $22,500) / (3,500 – 1,500) = $9.00 variable production cost per direct labor hour
a = $40,500 – ($9.00 x 3,500) = $9,000 or $22,500 – ($9.00 x 1,500) = $9,000
Y = $9,000 + $9.00X

Total Production Costs for May = $9,000 + ($9.00 x 2,250) = $29,250

Topic: Cost Behavior
LO: 1
11. The Johnson Furniture Company has the following information available regarding costs at various levels of monthly production:

Production volume (units)	8,000 Units	11,000 Units
Direct materials	$35,000	$50,000
Direct labor	33,000	45,000
Indirect materials	10,500	15,000
Supervisors' salaries	6,000	6,000
Depreciation on plant and equipment	5,000	5,000
Maintenance	16,000	22,000
Utilities	7,500	10,500
Insurance on plant and equipment	800	800
Property taxes on plant and equipment	1,000	1,000
Total	$114,800	$155,300

Identify each of the costs above as being variable, fixed, or mixed.

Answer:

	Variable	Fixed	Mixed
Direct materials	X		
Direct labor	X		
Indirect materials	X		
Supervisors' salaries		X	
Depreciation on plant and equipment		X	
Maintenance			X
Utilities			X
Insurance on plant and equipment		X	
Property taxes on plant and equipment		X	

Topic: Cost Estimation Using the High-Low Method
LO: 3

12. The Johnson Furniture Company has the following information available regarding costs at various levels of monthly production:

Production volume (units)	8,000 Units	11,000 Units
Direct materials	$35,000	$50,000
Direct labor	33,000	45,000
Indirect materials	10,500	15,000
Supervisors' salaries	6,000	6,000
Depreciation on plant and equipment	5,000	5,000
Maintenance	16,000	22,000
Utilities	7,500	10,500
Insurance on plant and equipment	800	800
Property taxes on plant and equipment	1,000	1,000
Total	$114,800	$155,300

Develop an equation for total monthly production costs using the high-low method of cost estimation, and predict total costs for a monthly production volume of 18,000 units.

Answer:
Variable costs = ($155,300 – $114,800) / (11,000 – 8,000) = $13.50 per unit
Fixed costs = $114,800 – $13.50(8,000) = $6,800 *or* $155,300 – $13.50(11,000) = $6,800
Total monthly production costs = $6,800 + $13.50(No. of Units)
Total monthly production costs for 18,000 units = $6,800 + $13.50(18,000) = $249,800

Topic: Cost Estimation Using the High-Low Method
LO: 3

13. The Bright School Logo Products Company needs to predict the labor cost in producing specialty coffee mugs. The following production information is available:

Year	Production Volume	Labor Hours	Labor Dollars
2012	1,250	850	$6,375
2013	1,700	975	8,775
2014	1,200	750	9,000
2015	3,075	1,500	16,875
2016	1,600	950	12,825
2017	1,400	875	13,125

Wage rates have steadily increased since 2012; however, management expects no further increases in 2018.

a. Select the appropriate independent variable for estimating labor cost. Explain the reason for your selection.

b. Develop an equation to predict for 2018 the labor cost of producing specialty mugs. Use the high-low method.

Answer:

a. In periods of changing prices, unadjusted cost data should not be used as the dependent variable. Assuming that the technology has not changed, labor-hours used in coffee mug production can be substituted for labor-dollars in developing the estimating equation:

b. Total labor hours = a constant + b(Number of mugs produced)

Using labor hours:
b = (1,500 – 750) / (3,075 – 1,200) = 0.40 labor hours per coffee mug.
a = 1,500 – (0.40 x 3,075) = 270 fixed labor hours per year.
Total labor hours = 270 + 0.40(Number of mugs produced)

The wage rate for 2018 is the same as 2017.
For 2017, $13,125 / 875 = $15
Total labor costs = $15 x [Total Labor Hours] = $15 x [270 + 0.40 x (No. of Mugs produced)]

Topic: Estimating Fixed and Variable Cost Components
LO: 3

14. The Timber Products manufactures small tables. The overhead incurred in manufacturing the tables has both a fixed component and a variable component. The company's management wishes to explain variable overhead as a percentage of direct labor costs. Management has obtained the following cost data pertaining to the production of the small tables:

Units Produced	Direct Labor Costs	Overhead Costs
150	$1,900	$1,200
200	$2,500	$1,350
500	$4,500	$2,700
300	$2,700	$1,450
50	$1,500	$1,050

Compute the fixed and variable components of the overhead costs using the high-low method.

Answer:
b = ($2,700 – $1,050) / ($4,500 – $1,500) = 55%; Variable overhead is 55% of Direct Labor Costs.
a = $2,700 – (0.55 x $4,500) = $225 fixed overhead costs
Overhead costs = $225 + (0.55 x Direct Labor Cost)

Topic: Estimating Fixed and Variable Cost Components
LO: 3

15. The following data was obtained from the books of the Delta Home Painting Company:

Month	Overhead Costs	Direct Labor Hours
January	$1,200	300
February	1,875	400
March	900	250
April	2,125	450
May	550	100

Compute the fixed and variable components of the monthly overhead costs using the high-low method.

Answer:
b = ($2,125 – $550) / (450 – 100) = $4.50 per Direct Labor Hour (DLH)
a = $2,125 – ($4.50 x 450) = $100 *or* $550 – ($4.50 x 100) = $100

Total Overhead Cost = $100 + $4.50(DLH)

Topic: Cost Estimation Using the High-Low Method
LO: 3

16. The Perry Products Company needs to predict the labor cost in producing made-to-order mugs. The following production information is available:

Year	Mugs Produced	Labor-Hours	Labor Cost
2012	1,150	850	$ 8,400
2013	1,600	975	$ 9,000
2014	1,100	800	$ 7,900
2015	2,100	1,150	$10,700
2016	1,500	950	$ 9,700
2017	1,300	875	$ 9,900

a. Select the appropriate independent variable for estimating labor cost. Explain the reason for your selection.

b. Develop an equation for labor costs using the high-low method of cost estimation, and predict total costs for an annual usage of 2,500 labor hours.

Answer:

a. The independent variable should be labor hours. Labor-hours has the most logical causal relationship with labor cost.

b. Variable costs = ($10,700 – $7,900) / (1,150 – 800) = $8.00 per labor hour.
Fixed costs = $10,700 – ($8.00 x 1,150) = $1,500 per month
Total annual labor cost = $1,500 + ($8.00 x (No. labor hours))
Total costs for 2,500 labor hours = $1,500 + ($8.00 x 2,500) = $21,500

Essay Questions

Topic: Least-Squares Regression
LO: 3

1. Your company has just performed a least-squares regression analysis of the monthly costs of manufacturing a new product. What are some considerations that should be made before making a decision based on the results of this analysis?

Answer:
First of all, there are some factors relating to the manufacturing of a new product that should be considered. With a new product, data used in the analysis may not be representative of future costs because the process of producing a new product will likely undergo significant changes during the initial year. Also, new products are likely to be initially manufactured at low levels of production due to the preliminary development of the product's market. At low levels of production, variable costs per unit are likely to be higher than they would at normal levels of production. The least-squares regression assumes a linear relationship throughout the entire range. Therefore, results could be questionable for this reason.

In any event, results should be measured against other available knowledge and data for reasonability. The real-world processes generating the data are constantly in a state of change. Consequently, common sense and prior expectations should consistently be applied to the interpretation of any results.

One tool that provides assistance in assessment of the degree to which the regression is well-specified is a scatter diagram. A scatter diagram can provide a visual assessment as to the degree to which the data are arranged in a straight line, and are thus suited for regression analysis. A scatter diagram can also direct attention to "outlier" observations, which represent months that are not necessarily representative of typical months of operations.

Topic: Alternative Cost Estimation Methods
LO: 3

2. Identify the three different cost estimation methods discussed in this course and provide a description of the strengths and weaknesses of each.

Answer:
Scatter Diagrams: Scatter diagrams help identify representative high and low volumes. They are also useful in determining if costs can be reasonably approximated by a straight line. Scatter diagrams are simple to use, but professional judgment is required to draw a representative straight line through the plot of historical data. This method is subjective in nature, and probability intervals cannot be developed.

High-Low Cost Estimation: This method uses data from two time periods to estimate fixed and variable costs. This is a good method to use when data are limited. It is a subjective method, and probability intervals cannot be developed. It is very important that the high and low volumes represent the normal operating conditions of all observations. Again, professional judgment is required to select the appropriate data.

Least-Squares Method: This method uses all available data. It uses a mathematical criterion, which provides for an objective approach to cost estimation. In addition, this method can provide information on how well the cost estimating equation fits the historical cost data and information needed to construct probability intervals for cost estimates. It can also be used to develop equations that are not linear in nature. This method requires more data points than do the high-low or scatter diagram methods.

Topic: Changing Technology and Cost Estimation
LO: 4

3. Briefly explain why changes in technology and prices make cost estimation difficult.

Answer:
Care must be taken to make sure that data used in developing cost estimates are based on the existing technology. When this is not possible, professional judgment is required to make appropriate adjustments. In addition, only data reflecting a single price level should be used in cost estimation. The prices for various cost elements are likely to change at different rates and at different times. Old data should always be used cautiously. If data from different price levels are used, an attempt should be made to restate them to a single price level.

Topic: Difficulties Regarding Cost Estimation
LO: 4

4. Identify some of the areas of concern that make cost estimation difficult.

Answer:
Several items to be wary of when developing cost estimating equations include:

- Data that are not based on normal operating conditions
- Nonlinear relationships between total costs and activity
- Obtaining a high R-squared purely by chance
- Changes in technology and prices
- Matching activity and cost within each observation
- Identifying activity cost drivers

Topic: Changing Cost Structures
LO: 5

5. Describe the changes in composition of total manufacturing costs during the last century, using the three major cost categories: direct materials, direct labor, and manufacturing overhead.

Answer:

1. Direct materials, the cost of primary raw materials converted into finished goods, have increased slightly as organizations purchase components they formerly fabricated.

2. Direct labor, the wages earned by production employees for the time they spend converting raw materials into finished products, has decreased significantly as employees spend less time physically working on products and more time supporting automated production activities.

3. Manufacturing overhead, which includes all manufacturing costs other than direct materials and direct labor, has increased significantly due to automation, product diversity, and product complexity.

Topic: Unit Level Cost Behavior Analysis
LO: 5

6. Describe the unit level approach to cost behavior analysis. Discuss the appropriateness of this approach.

Answer:
The unit level approach to cost analysis assumes changes in an organization's costs are best explained by changes in the number of units or sales dollars (or some other measure of business volume). Because of its relative simplicity, unit level analysis has been widely used and accepted. In many circumstances this approach may provide acceptable results. However, in many other circumstances, this approach may be insufficient to capture the critical drivers of cost. This is especially true in organizations offering multiple products of various complexities, which vary in their consumption of the organization's resources. In these situations, an analysis that includes additional variables for considerations such as the influence of number of batch runs on costs and the influence of the number of products offered on costs would provide more accurate estimation.