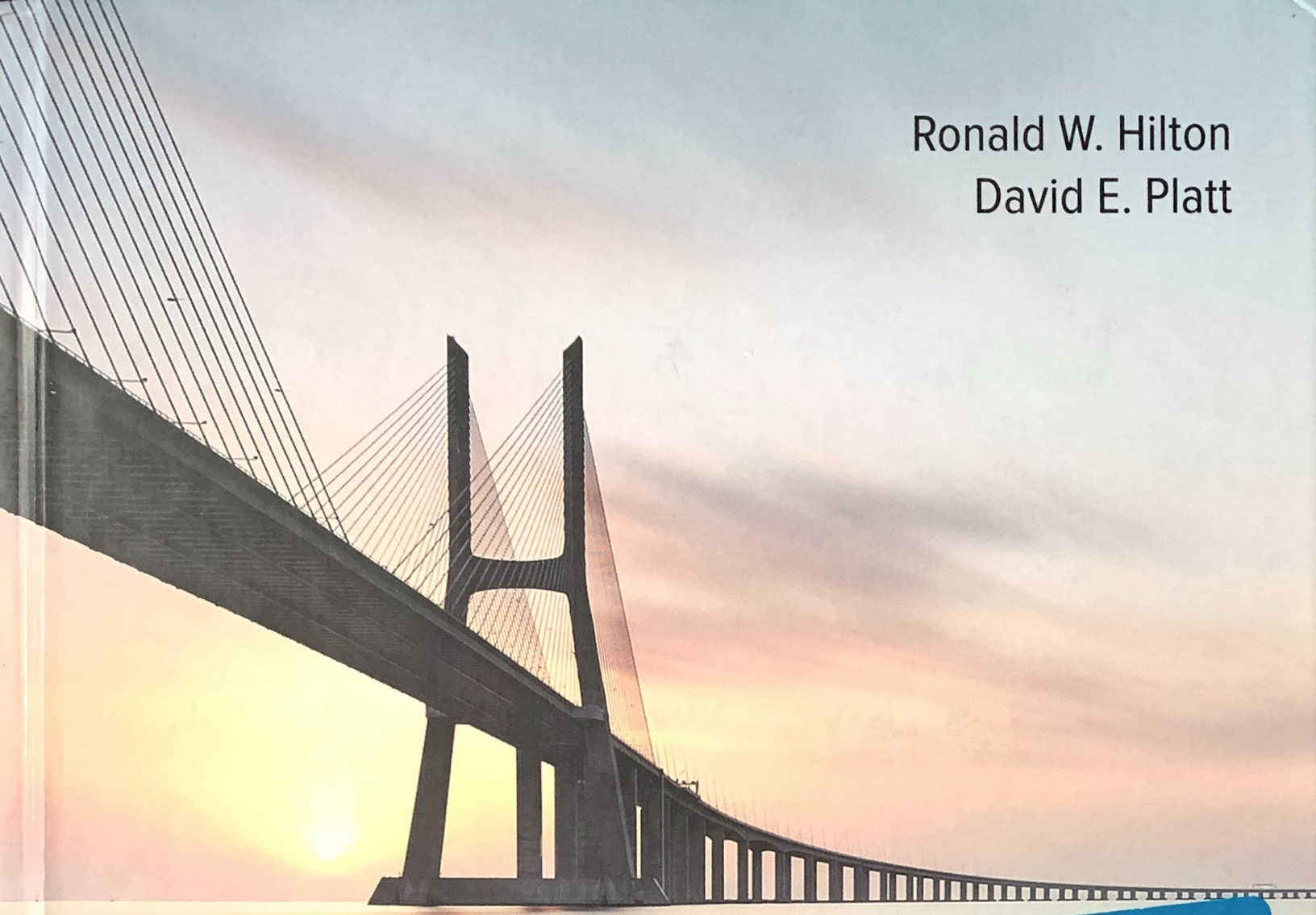


Ronald W. Hilton
David E. Platt

Managerial

Creating Value in a Dynam

Mc Graw Hill Education

Solution to Review Problem

1.

	Box C52	Box W29
Purchasing, storage, and material handling	$8,000 (20% × $40,000)	$7,000 (20% × $35,000)
Engineering and product design	200 (10 × $20/hr.)	500 (25 × $20/hr.)
Machine setup costs	140 (2 × $70/run)	280 (4 × $70/run)
Machine depreciation and maintenance	72 (24 × $3/hr.)	60 (20 × $3/hr.)
Factory depreciation, taxes, insurance, and utilities	48 (24 × $2/hr.)	40 (20 × $2/hr.)
Other manufacturing overhead costs	36 (24 × $1.50/hr.)	30 (20 × $1.50/hr.)
Total overhead assigned to production order	$8,496	$7,910

2. Overhead cost: Box C52 = $0.4248 per box $\left(\frac{\$8,496}{20,000}\right)$; Box W29 = $0.79 per box $\left(\frac{\$7,910}{10,000}\right)$

3. Computations based on a single predetermined overhead rate based on direct-labor hours:

   a. $\frac{\text{Total budgeted overhead}}{\text{Total budgeted direct-labor hours}} = \frac{\$1,020,000}{4,000} = \$255/\text{hr.}$

   b. Total overhead assigned to each order:

   Box C52 order: 42 direct-labor hours × $255/hr. = $10,710

   Box W29 order: 21 direct-labor hours × $255/hr. = $5,355

   c. Overhead cost per box:

   Box C52: $10,710 ÷ 20,000 = $.5355 per box

   Box W29: $5,355 ÷ 10,000 = $.5355 per box

4. The widely differing overhead costs are assigned as a result of the inherent inaccuracy of the single, volume-based overhead rate. The relative usage of direct labor by the two production orders does not reflect their relative usage of other manufacturing support services.

Key Terms

For each term's definition refer to the indicated page, or turn to the glossary at the end of the text.

activity analysis, 187
activity-based costing (ABC) system, 172
activity-based management (ABM), 186
activity cost pool, 172
activity dictionary, 186
batch-level activity, 173
bill of activities, 186
consumption ratio, 181
cost driver, 183
cost hierarchy, 173
customer-profitability analysis, 189
customer profitability profile, 191
facility-(or general-operations) level activity, 173
kaizen costing, 189
non-value-added activities, 187
non-value-added costs, 187
pool rate, 175
process, 188
process value analysis (PVA), 188
product-sustaining-level activity, 173
storyboarding, 185
two-dimensional ABC model, 186
unit-level activity, 173
volume-based (or through-put-based) costing system, 171

Review Questions

5–1. Briefly explain how a traditional, volume-based product-costing system operates.

5–2. Why was Patio Grill Company's management being misled by the traditional product-costing system? What mistakes were being made?

5–3. Explain how an activity-based costing system operates.

5–4. What are cost drivers? What is their role in an activity-based costing system?

5–5. List and briefly describe the four broad categories of activities identified in stage one of an activity-based costing system.

5–6. How can an activity-based costing system alleviate the problems Patio Grill Company's management was having under its traditional, volume-based product-costing system?

5–7. Why do product-costing systems based on a single, volume-based cost driver tend to overcost high-volume products? What undesirable strategic effects can such distortion of product costs have?

5–8. How is the distinction between direct and indirect costs handled differently under volume-based versus activity-based costing systems?

5–9. Explain the concept of a *pool rate* in activity-based costing. (Refer to Exhibit 5-6.)

5–10. Briefly explain two factors that tend to result in product cost distortion under traditional, volume-based product-costing systems.

5–11. List three factors that are important in selecting cost drivers for an ABC system.

5–12. What is the role of *activity dictionary* in an ABC project?

5–13. Explain why a new product-costing system may be needed when line managers suggest that an apparently profitable product be dropped.

5–14. Explain why a manufacturer with diverse product lines may benefit from an ABC system.

5–15. Are activity-based costing systems appropriate for the service industry? Explain.

5–16. Explain why maintaining their medical-services provider network is treated as a product-sustaining-level activity by Blue Cross Blue Shield.

5–17. How could the administration at Immunity Medical Center's Primary Care Unit use the information developed by the TDABC project team?

5–18. Explain a key difference in the interpretation of the ABC data in Exhibit 5-7 (Patio Grill Company) and the TDABC data in Exhibit 5-16 (Immunity Medical Center).

5–19. Explain the concept of *two-dimensional ABC*. Support your explanation with a diagram.

5–20. What is meant by the term *activity analysis?* Give three criteria for determining whether an activity adds value.

5–21. Distinguish between an activity's trigger and its root cause. Give an example of each.

5–22. What is meant by customer-profitability analysis? Give an example of an activity that might be performed more commonly for one customer than for another.

5–23. Explain the relationship between customer profitability analysis and activity-based costing.

5–24. What is a customer profitability profile?

5–25. Describe the use of practical capacity in a TDABC system.

Exercises

All applicable Exercises are available in Connect.

connect

Exercise 5–26
Volume-Based Cost Driver versus ABC
(LO 5-1, 5-2, 5-4)

Tioga Company manufactures sophisticated lenses and mirrors used in large optical telescopes. The company is now preparing its annual profit plan. As part of its analysis of the profitability of individual products, the controller estimates the amount of overhead that should be allocated to the individual product lines from the following information.

	Lenses	Mirrors
Units produced	25	25
Material moves per product line	5	15
Direct-labor hours per unit	200	200

The total budgeted material-handling cost is $50,000.

Required:

1. Under a costing system that allocates overhead on the basis of direct-labor hours, the material-handling costs allocated to one lens would be what amount?
2. Answer the same question as in requirement (1), but for mirrors.
3. Under activity-based costing (ABC), the material-handling costs allocated to one lens would be what amount? The cost driver for the material-handling activity is the number of material moves.
4. Answer the same question as in requirement (3), but for mirrors.

(CMA, adapted)

Exercise 5–27
Activity-Based Costing; Quality Control Costs
(LO 5-1, 5-2, 5-4)

Urban Elite Cosmetics has used a traditional cost accounting system to apply quality-control costs uniformly to all products at a rate of 14.5 percent of direct-labor cost. Monthly direct-labor cost for Satin Sheen makeup is $27,500. In an attempt to more equitably distribute quality-control costs, management is considering activity-based costing. The monthly data shown in the following chart have been gathered for Satin Sheen makeup.

Activity Cost Pool	Cost Driver	Pool Rates	Quantity of Driver for Satin Sheen
Incoming material inspection	Type of material	$11.50 per type	12 types
In-process inspection	Number of units	.14 per unit	17,500 units
Product certification	Per order	77.00 per order	25 orders

Required:

1. Calculate the monthly quality-control cost to be assigned to the Satin Sheen product line under each of the following product-costing systems. (Round to the nearest dollar.)
   a. Traditional system, which assigns overhead on the basis of direct-labor cost.
   b. Activity-based costing.
2. Does the traditional product-costing system overcost or undercost the Satin Sheen product line with respect to quality-control costs? By what amount?

(CMA, adapted)

Exercise 5–28
Cost Drivers; Activity Cost Pools
(LO 5-2, 5-3, 5-6)

Kentaro Corporation manufactures Digital Video Recorders (DVRs) in its Tokyo plant. The following costs are budgeted for January. (Yen is the Japanese monetary unit.)

Raw materials and components	2,950,000 yen
Insurance, plant	600,000
Electricity, machinery	120,000
Electricity, light	60,000
Engineering design	610,000
Depreciation, plant	700,000
Depreciation, machinery	1,400,000
Custodial wages, plant	40,000
Equipment maintenance, wages	150,000
Equipment maintenance, parts	30,000
Setup wages	40,000
Inspection of finished goods	30,000
Property taxes	120,000
Natural gas, heating	30,000

Required: Divide these costs into activity cost pools, and identify a cost driver for assigning each pool of costs to products. Calculate the total cost in each activity cost pool.

Exercise 5–29
Categorizing Activity Cost Pools
(LO 5-2, 5-3)

Refer to the information given in the preceding exercise. For each of the activity cost pools identified, indicate whether it represents a unit-level, batch-level, product-sustaining-level, or facility-level activity.

Exercise 5–30
Activity-Based Costing in a Government Agency; Use of Internet
(LO 5-2, 5-7, 5-10)

Visit the website of a city, state, or Canadian province of your choosing (e.g., the City of Charlotte, N.C., www.charmeck.org).

Required: Read about the services offered to the public by this governmental unit. Then discuss how activity-based costing could be used effectively by the governmental unit to determine the cost of providing these services.

Exercise 5–31
Distortion of Product Costs
(LO 5-2, 5-5)

Wheelco, Inc. manufactures automobile and truck wheels. The company produces four basic, high-volume wheels used by each of the large automobile and pickup truck manufacturers. Wheelco also has two specialty wheel lines. These are fancy, complicated wheels used in expensive sports cars.

Lately, Wheelco's profits have been declining. Foreign competitors have been undercutting Wheelco's prices in three of its bread-and-butter product lines, and Wheelco's sales volume and market share have declined. In contrast, Wheelco's specialty wheels have been selling steadily, although in relatively small numbers, in spite of three recent price increases. At a recent staff meeting, Wheelco's president made the following remarks: "Our profits are going down the tubes, folks. It costs us 29 dollars to manufacture our A22 wheel. That's our best seller, with a volume last year of 17,000 units. But our chief competitor is selling basically the same wheel for 27 bucks. I don't see how they can do it. I think it's just one more example of foreign dumping. I'm going to write my senator about it! Thank goodness for our specialty wheels. I think we've got to get our salespeople to push those wheels more and more. Take the D52 model, for example. It's a complicated thing to make, and we don't sell many. But look at the profit margin. Those wheels cost us 49 dollars to make, and we're selling them for 105 bucks each."

Required: What do you think is behind the problems faced by Wheelco? Comment on the president's remarks. Do you think his strategy is a good one? What do you recommend, and why?

Exercise 5–32
Key Features of Activity-Based Costing
(LO 5-2, 5-5, 5-7)

Refer to the description given for Wheelco, Inc. in the preceding exercise. Suppose the firm's president has decided to implement an activity-based costing system.

Required:

1. List and briefly describe the key features that Wheelco's new product-costing system should have.
2. What impact will the new system be likely to have on the company's situation?
3. What strategic options would you expect to be suggested by the product-costing results from the new system?

Exercise 5–33
Winery; Classification of Activities
(LO 5-2, 5-3, 5-7)

Finger Lakes Winery is a small, family-run operation in upstate New York. The winery produces two varieties of wine: riesling and chardonnay. Among the activities engaged in by the winery are the following:

1.	*Trimming:*	At the end of a growing season, the vines are trimmed, which helps prepare them for the next harvest.
2.	*Tying:*	The vines are tied onto wires to help protect them from the cold. (This also occurs at the end of the season.)
3.	*Hilling:*	Dirt is piled up around the roots to help protect them from frost.
4.	*Conditioning:*	After the snow melts in the spring, dirt is leveled back from the roots.
5.	*Untying:*	The vines are untied from the wires to allow them freedom to grow during the spring and summer months.
6.	*Chemical spraying:*	The vines are sprayed in the spring to protect them from disease and insects.
7.	*Harvesting:*	All of the grapes of both varieties are picked by hand to minimize damage.
8.	*Stemming and crushing:*	Batches of grapes are hand-loaded into a machine, which gently removes the stems and mildly crushes them.
9.	*Pressing:*	After removal from the stemmer/crusher, the juice runs freely from the grapes.
10.	*Filtering:*	The grapes are crushed mechanically to render more juice from them.
11.	*Fermentation:*	The riesling grape juice is placed in stainless steel tanks for fermentation. The chardonnay grape juice undergoes a two-stage fermentation process in oak barrels.
12.	*Aging:*	The riesling wines are aged in the stainless steel tanks for approximately a year. The chardonnays are aged in the oak barrels for about two years.
13.	*Bottling:*	A machine bottles the wine and corks the bottles.
14.	*Labeling:*	Each bottle is manually labeled with the name of the vintner, vintage, and variety.
15.	*Packing:*	The bottles are manually packed in 12-bottle cases.
16.	*Case labeling:*	The cases are hand-stamped with the same information that the bottles received.
17.	*Shipping:*	The wine is shipped to wine distributors and retailers, mainly in central New York. Generally, about 100 cases are shipped at a time.
18.	*Maintenance on buildings:*	This is done during the slow winter months.
19.	*Maintenance on equipment:*	This is done when needed, and on a routine basis for preventive maintenance.

Required: Classify each of the activities listed as a unit-, batch-, product-sustaining-, or facility-level activity.

Exercise 5–34
United Technologies; Classification of Activities
(LO 5-2, 5-3, 5-7)

United Technologies Corporation implemented activity-based costing in two of its subsidiaries: Otis Elevator Company and Carrier Corporation. The following table shows 27 activities and eight accounts identified at Carrier, along with the classification determined by the ABC project team.[12]

Name of Activity or Account	Classification by Activity level
Acquiring material	Batch
Inspecting incoming materials	Batch
Moving materials	Batch
Planning production	Batch
Processing special orders	Batch
Processing supplier invoices	Batch
Receiving material	Batch
Scheduling production	Batch
Inspecting production processes	Batch
Processing purchase orders	Batch
Building occupancy	Facility
Depreciation	Facility
General management	Facility
Maintaining facilities	Facility
Managing the environment	Facility
Assuring quality	Product Sustaining
Expediting	Product Sustaining
Maintaining tools and dies	Product Sustaining
Maintaining/improving production processes	Product Sustaining
Managing human resources	Product Sustaining
Managing waste disposal	Product Sustaining
Processing payroll	Product Sustaining
Processing production information	Product Sustaining
Providing product cost	Product Sustaining
Setting manufacturing methods	Product Sustaining
Supervising production	Product Sustaining
Sustaining accounting	Product Sustaining
Maintaining production equipment	Product Sustaining
Direct-labor allowances	Unit
Direct-labor fringes	Unit
Utilities (equipment)	Unit
Overtime (hourly)	Unit
Rework	Unit
Shift differential	Unit
Spoilage	Unit

Required: Choose two activities or accounts from each of the four classifications and explain why you agree or disagree with the ABC project team's classification.

Exercise 5–35
ABC; Selling Costs
(LO 5-2, 5-4)

Redwood Company sells craft kits and supplies to retail outlets and through its catalog. Some of the items are manufactured by Redwood, while others are purchased for resale. For the products it manufactures, the company currently bases its selling prices on a product-costing system that accounts for direct material, direct labor, and the associated overhead costs. In addition to these product costs, Redwood incurs substantial selling costs, and Roger Jackson, controller, has suggested that these selling costs should be included in the product pricing structure.

[12]Robert Adams and Ray Carter, "United Technologies' Activity-Based Accounting Is a Catalyst for Success," *As Easy as ABC* 18, p 4. In the table, we have adjusted the nomenclature of United Technologies to match that used in this textbook. Specifically, United Technologies uses the term "*structural*-level activity" where we use "*facility*-level activity," and they shorten "*product-sustaining*-level activity to simply "*sustaining*-level activity."

After studying the costs incurred over the past two years for one of its products, skeins of knitting yarn, Jackson has selected four categories of selling costs and chosen cost drivers for each of these costs. The selling costs actually incurred during the past year and the cost drivers are as follows:

Cost Category	Amount	Cost Driver
Sales commissions	$ 675,000	Boxes of yarn sold to retail stores
Catalogs	295,400	Catalogs distributed
Cost of catalog sales	105,000	Skeins sold through catalog
Credit and collection	60,000	Number of retail orders
Total selling costs	$1,135,400	

The knitting yarn is sold to retail outlets in boxes, each containing 12 skeins of yarn. The sale of partial boxes is not permitted. Commissions are paid on sales to retail outlets but not on catalog sales. The cost of catalog sales includes telephone costs and the wages of personnel who take the catalog orders. Jackson believes that the selling costs vary significantly with the size of the order. Order sizes are divided into three categories as follows:

Order Size	Catalog Sales	Retail Sales
Small	1–10 skeins	1–10 boxes
Medium	11–20 skeins	11–20 boxes
Large	Over 20 skeins	Over 20 boxes

An analysis of the previous year's records produced the following statistics.

	Order Size			
	Small	Medium	Large	Total
Retail sales in boxes (12 skeins per box)	2,000	45,000	178,000	225,000
Catalog sales in skeins	79,000	52,000	44,000	175,000
Number of retail orders	485	2,415	3,100	6,000
Catalogs distributed	254,300	211,300	125,200	590,800

Required:

1. Prepare a schedule showing Redwood Company's total selling cost for each order size and the per-skein selling cost within each order size.
2. Explain how the analysis of the selling costs for skeins of knitting yarn is likely to impact future pricing and product decisions at Redwood Company.

(CMA, adapted)

Exercise 5–36
Classification of Activities in a University; Cost Drivers
(LO 5-2, 5-3, 5-6, 5-7, 5-10)

As a group, discuss the activities of your college or university (e.g., admission, registration, etc.). List as many activities as you can.

Required: Make a presentation to your class that includes the following:

1. Your list of activities.
2. The classification of each activity (e.g., unit level).
3. An appropriate cost driver for each activity.

Exercise 5–37
Non-Value-Added Costs
(LO 5-8)

Non-value-added costs occur in nonmanufacturing organizations, just as they do in manufacturing firms.

Required: Identify four potential non-value-added costs in (1) an airline, (2) a bank, and (3) a hotel.

Exercise 5–38
Design Your Own Production Process; Non-Value-Added Costs
(LO 5-8)

Since you have always wanted to be an entrepreneur, invent your own product and describe at least five steps used in its production.

Required: Explain how you would go about identifying non-value-added costs in the production process.

b. Registering vehicles at a county motor vehicle office.
c. Picking oranges.
d. Inspecting computer components in an electronics firm.

6–13. What is an *outlier?* List some possible causes of outliers. How should outliers be handled in cost estimation?

6–14. Explain the cost estimation problem caused by allocated and discretionary costs.

6–15. Describe the visual-fit method of cost estimation. What are the main strengths and weaknesses of this method?

6–16. What is the chief drawback of the high-low method of cost estimation? What problem could an outlier cause if the high-low method were used?

6–17. Explain the meaning of the term *least squares* in the least-squares regression method of cost estimation.

6–18. Use an equation to express a least-squares regression line. Interpret each term in the equation.

6–19. Distinguish between *simple regression* and *multiple regression.*

6–20. List several possible cost drivers that could be used by a cruise line such as Carnival.

6–21. Briefly describe two methods that can be used to evaluate a particular least-squares regression line.

Exercises

All applicable Exercises are available in Connect. connect

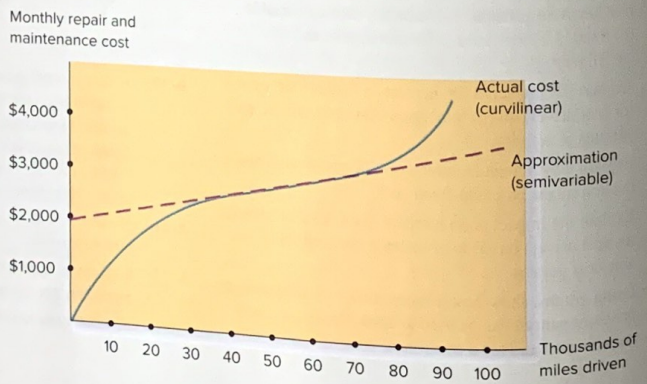
Exercise 6–22
Graphing Cost Behavior Patterns; Hospital
(LO 6-1, 6-2)

Draw a graph of the cost behavior for each of the following costs incurred by the Mountain Summit Hospital. The hospital measures monthly activity in patient days. Label both axes and the cost line in each graph.

1. The cost of food varies in proportion to the number of patient days of activity. In January, the hospital provided 3,000 patient days of care, and food costs amounted to $24,000.
2. The cost of salaries and fringe benefits for the administrative staff totals $12,000 per month.
3. The hospital's laboratory costs include two components: (*a*) $40,000 per month for compensation of personnel and depreciation on equipment and (*b*) $10 per patient day for chemicals and other materials used in performing the tests.
4. The cost of utilities depends on how many wards the hospital needs to use during a particular month. During months with activity under 2,000 patient days of care, two wards are used, resulting in utility costs of $10,000. During months with greater than 2,000 patient days of care, three wards are used, and utility costs total $15,000.
5. Many of the hospital's nurses are part-time employees. As a result, the hours of nursing care provided can be easily adjusted to the amount required at any particular time. The cost of wages and fringe benefits for nurses is approximately $2,500 for each block of 200 patient days of care provided during a month. For example, nursing costs total $2,500 for 1 to 200 patient days, $5,000 for 201 to 400 patient days, $7,500 for 401 to 600 patient days, and so forth.

Exercise 6–23
Approximating a Curvilinear Cost; Public School District
(LO 6-1, 6-2, 6-3)

The behavior of the annual maintenance and repair cost in the Bus Transportation Department of the Summerset Public School District is shown by the solid line in the following graph. The dashed line depicts a semivariable-cost approximation of the department's repair and maintenance cost.



Required:

1. What is the actual (curvilinear) and estimated (semivariable) cost shown by the graph for each of the following activity levels?

	Actual	Estimated
a. 20,000 miles		
b. 40,000 miles		
c. 60,000 miles		
d. 90,000 miles		

2. How good an approximation does the semivariable-cost pattern provide if the department's relevant range is 40,000 to 60,000 miles per month? What if the relevant range is 20,000 to 90,000 miles per month?

Exercise 6–24
Behavior of Fixed and Variable Costs; Television Station
(LO 6-1, 6-2)

WMEJ is an independent television station run by a major state university. The station's broadcast hours vary during the year depending on whether the university is in session. The station's production-crew and supervisory costs are as follows for July and September.

Cost Item	Cost Behavior	Cost Amount	Broadcast Hours during Month
Production crew	Variable		
July		$4,875	390
September		8,000	640
Supervisory employees	Fixed		
July		5,000	390
September		5,000	640

Required:

1. Compute the cost per broadcast hour during July and September for each of these cost items.
2. What will be the total amount incurred for each of these costs during December, when the station's activity will be 420 broadcast hours?
3. What will be the cost per broadcast hour in December for each of the cost items?

Exercise 6–25
Estimating Cost Behavior; High-Low Method
(LO 6-1, 6-2, 6-5)

Jonathan Macintosh is a highly successful Pennsylvania orchardman who has formed his own company to produce and package applesauce. Apples can be stored for several months in cold storage, so applesauce production is relatively uniform throughout the year. The recently hired controller for the firm is about to apply the high-low method in estimating the company's energy cost behavior. The following costs were incurred during the past 12 months:

Month	Pints of Applesauce Produced	Energy Cost
January	35, 000	$23,400
February	21,000	22,100
March	22,000	22,000
April	24,000	22,450
May	30,000	22,900
June	32,000	23,350
July	40,000	28,000
August	30,000	22,800
September	30,000	23,000
October	28,000	22,700
November	41,000	24,100
December	39,000	24,950

Required:

1. Use the high-low method to estimate the company's energy cost behavior and express it in equation form.
2. Predict the energy cost for a month in which 26,000 pints of applesauce are produced.

Exercise 6–26
Estimating Cost Behavior; Visual-Fit Method
(LO 6-1, 6-2, 6-5)

Refer to the data in the preceding exercise.

Required:

1. Draw a scatter diagram and graph the company's energy cost behavior using the visual-fit method.
2. Predict the energy cost for a month in which 26,000 pints of applesauce are produced.
3. What peculiarity is apparent from the scatter diagram? What should the cost analyst do?

Exercise 6–27
Cost Behavior; Use of Internet
(LO 6-2)

Visit the website of one of the following companies, or a different company of your choosing.

Boeing	www.boeing.com
Ford	www.ford.com/us
Honeywell	www.honeywell.com
Levi Strauss	www.levi.com
Dell Inc.	www.dell.com
General Electric	www.ge.com
AOL	www.aol.com
Hertz	www.hertz.com
Lands' End	www.landsend.com
McDonald's	www.mcdonalds.com
Pizza Hut	www.pizzahut.com
U-Haul	www.uhaul.com

Required: Read about the company's products and operations. Then list five costs that the company would incur and explain what type of cost behavior you believe would be appropriate for each of these cost items.

Exercise 6–28
Visual-Fit Method; Veterinary Laboratory
(LO 6-1, 6-2, 6-5)

The Iowa City Veterinary Laboratory performs a variety of diagnostic tests on commercial and domestic animals. The lab has incurred the following costs over the past year.

Month	Diagnostic Tests Completed	Cost
January	3,050	$61,000
February	4,500	74,500
March	7,100	99,000
April	6,200	95,600
May	4,700	74,800
June	5,900	89,000
July	6,000	91,000
August	6,100	90,000
September	5,300	87,000
October	4,900	76,200
November	4,800	78,100
December	5,050	80,700

Required:

1. Plot the data above in a scatter diagram. Assign cost to the vertical axis and the number of diagnostic tests to the horizontal axis. Visually fit a line to the plotted data.
2. Using the visually fit line, estimate the monthly fixed cost and the variable cost per diagnostic test.

Exercise 6–29
Account-Classification Method; Food Processing
(LO 6-1, 6-2, 6-5)

Chillicothe Meat Company produces one of the best sausage products in southern Ohio. The company's controller used the account-classification method to compile the following information.

a. Depreciation schedules revealed that monthly depreciation on buildings and equipment is $19,000.
b. Inspection of several invoices from meat packers indicated that meat costs the company $1.10 per pound of sausage produced.
c. Wage records showed that compensation for production employees costs $.70 per pound of sausage produced.
d. Payroll records showed that supervisory salaries total $10,000 per month.
e. Utility bills revealed that the company incurs utility costs of $4,000 per month plus $.20 per pound of sausage produced.

Required:

1. Classify each cost item as variable, fixed, or semivariable.
2. Write a cost formula to express the cost behavior of the firm's production costs. (Use the formula $Y = a + bX$, where Y denotes production cost and X denotes quantity of sausage produced.)

Exercise 6–30
High-Low Method; Tour Company
(LO 6-1, 6-2, 6-5)

Rio Bus Tours has incurred the following bus maintenance costs during the recent tourist season. (The *real* is Brazil's national monetary unit. On the day this exercise was written, the *real* was equivalent in value to .269 U.S. dollar.)

Month	Miles Traveled by Tour Buses	Cost
November	8,500	11,400 *real*
December	10,600	11,600
January	12,700	11,700
February	15,000	12,000
March	20,000	12,500
April	8,000	11,000

Required:

1. Use the high-low method to estimate the variable cost per tour mile traveled and the fixed cost per month.
2. Develop a formula to express the cost behavior exhibited by the company's maintenance cost.
3. Predict the level of maintenance cost that would be incurred during a month when 22,000 tour miles are driven. (Remember to express your answer in terms of the *real*.)
4. *Build a spreadsheet:* Construct an Excel spreadsheet to solve all of the preceding requirements. Show how the solution will change if the following information changes: in March there were 21,000 miles traveled and the cost was 12,430 *real*.

Exercise 6–31
Work Measurement; Government Agency
(LO 6-2, 6-6)

The State Department of Taxation processes and audits income-tax returns for state residents. The state tax commissioner has recently begun a program of work measurement to help in estimating the costs of running the department. The independent variable used in the program is the number of returns processed. The analysis revealed that the following variable costs are incurred in auditing a typical tax return.

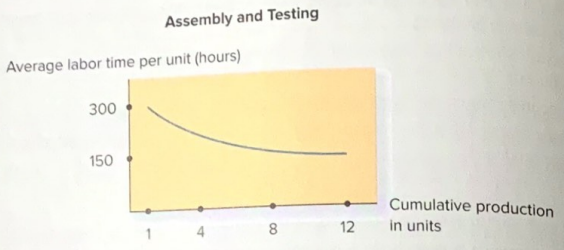
Time spent by clerical employees, 10 hours at $12 per hour
Time spent by tax professional, 20 hours at $25 per hour
Computer time, $50 per audit
Telephone charges, $10 per audit
Postage, $2 per audit

In addition, the department incurs $10,000 of fixed costs each month that are associated with the process of auditing returns.

Required: Draw a graph depicting the monthly costs of auditing state tax returns. Label the horizontal axis "Tax returns audited."

Exercise 6–32
Learning Curve; High Technology
(LO 6-1, 6-6)

Weathereye, Inc. manufactures weather satellites. The final assembly and testing of the satellites is a largely manual operation involving dozens of highly trained electronics technicians. The following learning curve has been estimated for the firm's newest satellite model, which is about to enter production.



Required:

1. What will be the average labor time required to assemble and test each satellite when the company has produced four satellites? Eight satellites?
2. What will be the total labor time required to assemble and test all satellites produced if the firm manufactures only four satellites? Eight satellites?
3. How can the learning curve be used in the company's budgeting process? In setting cost standards?

Exercise 6–33
Airline; Least-Squares Regression (Appendix)
(LO 6-1, 6-2, 6-5, 6-8)

Recent monthly costs of providing on-board flight service incurred by Great Plains Airlines are shown in the following table.

Month	Number of Passengers	Cost of On-Board Flight Service
January	16,000	$18,000
February	17,000	18,000
March	16,000	19,000
April	18,000	20,000
May	15,000	18,000
June	17,000	19,000

Required:

1. *Build a spreadsheet:* Construct an Excel spreadsheet and use the Excel commands to perform a least-squares regression. Estimate the cost behavior of the airline's on-board flight service. Express the cost behavior in equation form.
2. Use Excel to calculate and interpret the R^2 value for the regression.

Exercise 6–34
Estimating Cost Behavior by Multiple Methods (Appendix)
(LO 6-1, 6-2, 6-5, 6-8)

Gator Beach Marts, a chain of convenience grocery stores in the Fort Lauderdale area, has store hours that fluctuate from month to month as the tourist trade in the community varies. The utility costs for one of the company's stores are listed below for the past six months.

Month	Total Hours of Operation	Total Utility Cost
January	550	$1,620
February	600	1,700
March	700	1,900
April	500	1,600
May	450	1,350
June	400	1,300

Required:

1. Use the high-low method to estimate the cost behavior for the store's utility costs. Express the cost behavior in formula form ($Y = a + bX$). What is the variable utility cost per hour of operation?
2. Draw a scatter diagram of the store's utility costs. Visually fit a cost line to the plotted data. Estimate the variable utility cost per hour of operation.
3. *Build a spreadsheet:* Construct an Excel spreadsheet and use the Excel commands to perform a least-squares regression. Estimate the cost behavior for the store's utility cost. Express the cost behavior in formula form. What is the variable utility cost per hour of operation?
4. During July, the store will be open 300 hours. Predict the store's total utility cost for July using each of the cost-estimation methods employed in requirements (1), (2), and (3).
5. Use your Excel sheet from requirement (3) to calculate and interpret the R^2 value for the regression.

Problems

All applicable Problems are available in Connect.

connect

Problem 6–35
Cost Behavior Patterns in a Variety of Settings; International Issues
(LO 6-1, 6-2)

For each of the cost items described below, choose the graph (see below) that best represents it.

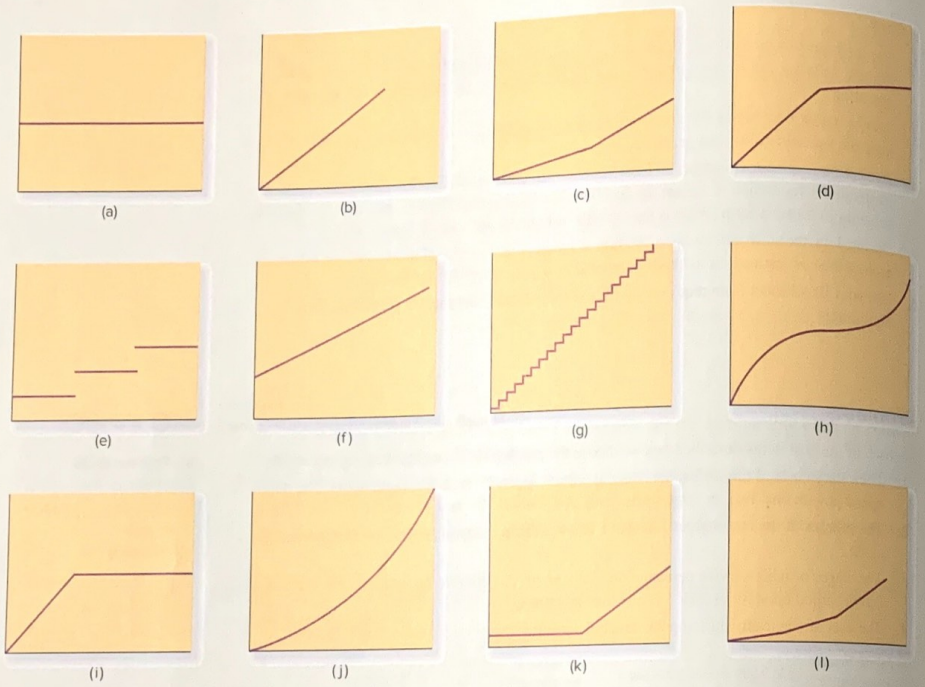
1. The salary costs of the shift supervisors at a truck depot. Each shift is eight hours. The depot operates with one, two, or three shifts at various times of the year.
2. The salaries of the security personnel at a factory. The security guards are on duty around the clock.
3. The wages of table-service personnel in a restaurant. The employees are part-time workers, who can be called upon for as little as two hours at a time.
4. The cost of electricity during peak-demand periods is based on the following schedule.

Up to 9,500 kilowatt-hours (kwh)	$.10 per kwh
Above 9,500 kilowatt-hours	$.13 per kwh

The price schedule is designed to discourage overuse of electricity during periods of peak demand.

5. The cost of sheet metal used to manufacture automobiles.
6. The cost of utilities at a university. For low student enrollments, utility costs increase with enrollment, but at a decreasing rate. For large student enrollments, utility costs increase at an increasing rate.
7. The cost of online back-up storage at a rate of $2.50 per gigabyte, up to 50 gigabytes, beyond which storage is unlimited, at no additional cost.
8. The cost of the nursing staff in a hospital. The staff always has a minimum of nine nurses on duty. Additional nurses are used depending on the number of patients in the hospital. The hospital administrator estimates that this additional nursing staff costs approximately $195 per patient per day.
9. The cost of chartering a private airplane. The cost is $390 per hour for the first three hours of a flight. Then the charge drops to $280 per hour.
10. Under a licensing agreement with a South American import/export company, your firm has begun shipping machine tools to several countries. The terms of the agreement call for an annual licensing fee of $100,000 to be paid to the South American import company if total exports are under $5,000,000. For sales in excess of $5,000,000, an additional licensing fee of 10 percent of sales is due.
11. Your winery exports wine to several Pacific Rim countries. In one nation, you must pay a tariff for every case of wine brought into the country. The tariff schedule is the following:

0 to 5,500 cases per year	$12 per case
5,501 to 11,000 cases per year	$15 per case
Above 11,000 cases per year	$20 per case



Problem 6–36

Cost Behavior and Analysis; High-Low Method

(LO 6-2, 6-5)

2. Variable maintenance cost: $9 per hour

The following selected data were taken from the accounting records of Metcalf Manufacturing. The company uses direct-labor hours as its cost driver for overhead costs.

Month	Direct-Labor Hours	Manufacturing Overhead
January	23,000	$454,000
February	30,000	517,000
March	34,000	586,000
April	26,000	499,500
May	25,000	480,000
June	28,000	515,000

March's costs consisted of machine supplies ($102,000), depreciation ($15,000), and plant maintenance ($469,000). These costs exhibit the following respective behavior: variable, fixed, and semivariable.

The manufacturing overhead figures presented in the preceding table do not include Metcalf's supervisory labor cost, which is step-fixed in nature. For volume levels of less than 15,000 hours, supervisory labor amounts to $45,000. The cost is $90,000 from 15,000–29,999 hours and $135,000 when activity reaches 30,000 hours or more.

Required:

1. Determine the machine supplies cost and depreciation for January.
2. Using the high-low method, analyze Metcalf's plant maintenance cost and calculate the monthly fixed portion and the variable cost per direct-labor hour.
3. Assume that present cost behavior patterns continue into the latter half of the year. Estimate the *total* amount of manufacturing overhead the company can expect in November if 29,500 direct-labor hours are worked.

4. Briefly explain the difference between a fixed cost and a step-fixed cost.
5. Assume that a company has a step-fixed cost. Generally speaking, where on a step should the firm attempt to operate if it desires to achieve a maximum return on its investment?

Problem 6–37

Cost Behavior and Analysis; High-Low Method

(LO 6-2, 6-4, 6-5)

2. Total cost for 1,650 tons: $823,500

Antioch Extraction, which mines ore in Montana, uses a calendar year for both financial-reporting and tax purposes. The following selected costs were incurred in December, the low point of activity, when 1,500 tons of ore were extracted:

Straight-line depreciation	$ 25,000	Royalties	$135,000
Charitable contributions*	11,000	Trucking and hauling	275,000
Mining labor/fringe benefits	345,000		

*Incurred only in December.

Peak activity of 2,600 tons occurred in June, resulting in mining labor/fringe benefit costs of $598,000, royalties of $201,000, and trucking and hauling outlays of $325,000. The trucking and hauling outlays exhibit the following behavior:

Less than 1,500 tons	$250,000
From 1,500–1,899 tons	275,000
From 1,900–2,299 tons	300,000
From 2,300–2,699 tons	325,000

Antioch uses the high-low method to analyze costs.

Required:

1. Classify the five costs listed in terms of their behavior: variable, step-variable, committed fixed, discretionary fixed, step-fixed, or semivariable. Show calculations to support your answers for mining labor/fringe benefits and royalties.
2. Calculate the total cost for next February when 1,650 tons are expected to be extracted.
3. Comment on the cost-effectiveness of hauling 1,500 tons with respect to Antioch's trucking/hauling cost behavior. Can the company's effectiveness be improved? How?
4. Distinguish between committed and discretionary fixed costs. If Antioch were to experience severe economic difficulties, which of the two types of fixed costs should management try to cut? Why?
5. Speculate as to why the company's charitable contribution cost arises only in December.

Problem 6–38

High-Low Method; Fitness Centers

(LO 6-1, 6-2, 6-5)

3. Cost prediction at 590 hours of activity, maintenance cost: $4,995

Nation's Capital Fitness, Inc. operates a chain of fitness centers in the Washington, D.C., area. The firm's controller is accumulating data to be used in preparing its annual profit plan for the coming year. The cost behavior pattern of the firm's equipment maintenance costs must be determined. The accounting staff has suggested the use of an equation, in the form of $Y = a + bX$, for maintenance costs. Data regarding the maintenance hours and costs for last year are as follows:

Month	Hours of Maintenance Service	Maintenance Costs
January	520	$ 4,470
February	490	4,260
March	300	2,820
April	500	4,350
May	310	2,960
June	480	4,200
July	320	3,000
August	400	3,600
September	470	4,050
October	350	3,300
November	340	3,160
December	320	3,030
Total	4,800	$43,200
Average	400	$ 3,600