CHAPTER 5

Cost Management in an Automated Business Environment

ABC, ABM, and TQM

LEARNING OBJECTIVES

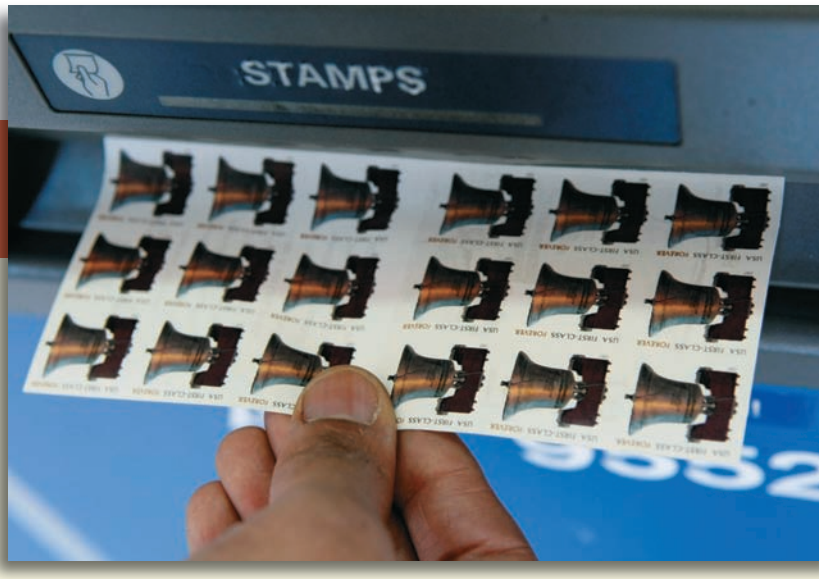
After you have mastered the material in this chapter you will be able to:

1. Explain how activity-based costing improves accuracy in determining the cost of products and services.
2. Identify cost centers and cost drivers in an activity-based costing system.
3. Use activity-based costing to calculate costs of products and services.
4. Identify the components of quality costs.
5. Prepare and interpret quality cost reports.

CHAPTER OPENING

Worldwide growth in capitalism has fostered an increasingly competitive global business environment. Companies have responded by using technology to increase productivity. Management accountants have worked with engineers to more accurately measure and control costs. They have eliminated many nonvalue-added activities and have employed quality control procedures that reduce costs and enhance customer satisfaction. These innovative business practices have enabled companies to eliminate unprofitable products and to promote products that maximize profitability. This chapter focuses on newer and emerging business practices employed by world-class companies.

The Curious Accountant



A vendor incurs a cost when it allows customers to pay using a credit or debit card. Credit card companies, such as **American Express**, charge the vendor either a fixed fee or a percentage of the transaction amount. For example, when the **United States Postal Service (USPS)** allows a customer to pay for $100 of stamps using a credit card, the USPS receives less than $100 from the credit card company, perhaps $97. The actual discount rate the credit card company charges depends on its agreement with the individual vendor. Large customers such as the USPS usually get better rates than smaller customers. Considering that total revenues at the USPS were $74.9 billion in 2008 and that $38.2 billion of these were from first-class mail, the costs of allowing customers to use debit and credit cards to pay for postage can be high.

Most companies that accept credit cards as payment do so believing that customers will spend more money using "plastic" than if forced to pay cash. Also, a company's competitors may be accepting credit cards, leaving the company little choice. However, the USPS has a virtual monopoly on many types of mail services in the United States, so why is it willing to allow customers to pay with credit cards? Why not make everyone pay with cash or checks?

Now consider this: Another large government agency, the **Internal Revenue Service (IRS)** will not accept debit or credit card payments unless the taxpayer pays the credit card fee. If the USPS does not require a surcharge for credit card users, why does the IRS? (Answers on page 215.)

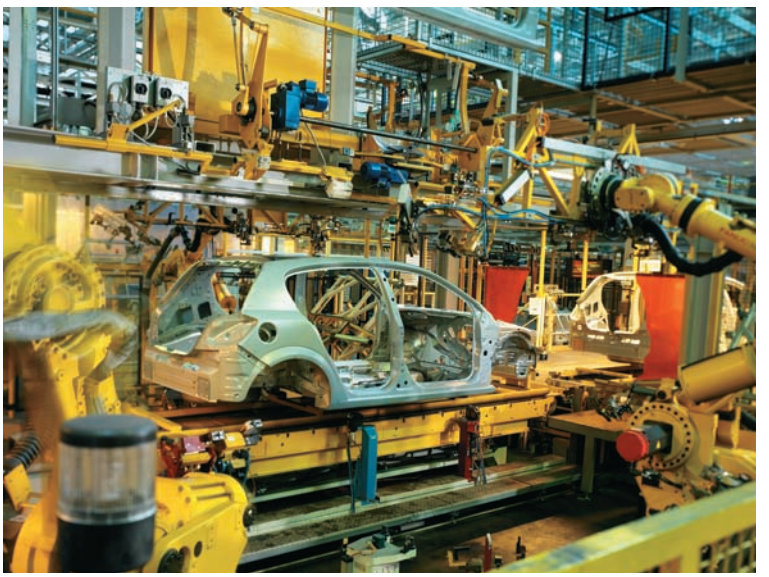
DEVELOPMENT OF A SINGLE COMPANYWIDE COST DRIVER

LO 1

Explain how activity-based costing improves accuracy in determining the cost of products and services.

When accountants first developed cost systems, manufacturing processes were labor intensive. Indirect manufacturing costs were relatively minor and highly correlated with labor use; products that used large amounts of labor consumed large amounts of overhead. This link made the number of labor hours a suitable cost driver for allocating overhead costs.

To illustrate, suppose during an eight-hour day Friedman Company production employees worked on two jobs, Job 1 for two hours and Job 2 for six hours. Friedman consumed utilities of $120 during the day. How much of the $120 should the company assign to each job? Friedman cannot trace the utility cost directly to a specific job, but the job that required more labor likely consumed more of the utility cost. The longer employees work the more heat, lights, and water they use. Allocating the utility cost to the two jobs based on *direct labor hours* produces rational results. Friedman could allocate the utility cost at $15 per hour ($120 ÷ 8 hours). It could assign Job 1 $30 of the utility cost ($15 per hour × 2 hours), and Job 2 the remaining $90 ($15 × 6 hours).



In addition to utilities, direct labor drives many other indirect costs. Consider the depreciation cost of tools employees use while working on production jobs. The more time employees work, the more they use the tools. Direct labor hours could be an effective cost driver (allocation base) for allocating tool depreciation costs. The same logic applies to supervisory salaries, production supplies, factory rent expense, and other overhead costs. Many companies applied this reasoning to justify using direct labor hours as the *sole base* for establishing a **companywide allocation rate.** These companies then allocated all overhead costs to their products or other cost objects using the single labor-based, companywide overhead rate. Even though using one base to allocate all overhead costs inaccurately measured some cost objects, in the labor intensive environment that spawned companywide allocation rates, overhead costs were relatively small compared to the costs of labor and materials. Allocation inaccuracies were relatively insignificant in amount.

Automation has changed the nature of manufacturing processes. The number of direct labor hours is no longer an effective allocation base in many modern manufacturing companies. Machines have replaced most human workers. Because they operate technically complex equipment, the remaining workers are highly skilled and not easily replaced. Companies resist laying off these trained workers when production declines. Neither do companies add employees when production increases. Adjusting production volume merely requires turning additional machines on or off. In such circumstances, direct labor is not related to production volume. Direct labor is therefore not an effective base for allocating overhead costs. Former labor-intensive companies that adopt automation usually must develop more sophisticated ways to allocate overhead costs.

When companies replace people with machines, overhead costs such as machinery depreciation and power usage become greater in proportion to total manufacturing costs. In highly automated companies, overhead costs may be greater than direct labor and direct materials costs combined. Although misallocating minor overhead amounts does little harm, misallocating major costs destroys the usefulness of accounting information and leads to poor decisions. Managers must consider how automation affects overhead cost allocation.

Effects of Automation on Selecting a Cost Driver

In an automated manufacturing environment, robots and sophisticated machinery, rather than human labor, transform raw materials into finished goods. To illustrate the effect of these changes on selecting a cost driver, return to the previous Friedman Company example. Suppose Friedman automates the production process for Job 2, replacing most labor with four hours of machine processing and reducing the number of direct labor hours required from six to one. Assume the new machinery acquired increases utility consumption and depreciation charges, raising daily overhead costs from $120 to $420. Because Job 1 requires two hours of direct labor and Job 2 now requires one hour of direct labor, Friedman's companywide allocation rate increases to $140 per direct labor hour ($420 ÷ 3 hours). The company would allocate $280 ($140 × 2 hours) of the total overhead cost to Job 1 and $140 ($140 × 1 hour) to Job 2. The pre- and postautomation allocations are compared here.

Product	Preautomation Cost Distribution	Postautomation Cost Distribution
Job 1	$ 30	$280
Job 2	90	140
Total	$120	$420

Using direct labor hours as the cost driver after automating production of Job 2 distorts the overhead cost allocation. Although Friedman did not change the production process for Job 1 at all, Job 1 received a $250 ($280 − $30) increase in its share of allocated overhead cost. This increase should have been assigned to Job 2 because automating production of Job 2 caused overhead costs to increase. The decrease in direct labor hours for Job 2 causes the distortion. Prior to automation, Job 2 used six of eight total direct labor hours and was therefore allocated 75 percent (6 ÷ 8) of the overhead cost. After automation, Job 2 consumed only one of three total direct labor hours, reducing its overhead allocation to only 33 percent of the total. These changes in the allocation base, coupled with the increase in total overhead cost, caused the postautomation overhead cost allocation for Job 1 to be significantly overstated and for Job 2 to be significantly understated.

One way to solve the misallocation problem is to find a more suitable volume-based cost driver. For example, Friedman could allocate utility costs using machine hours instead of direct labor hours. This text illustrated using different **volume-based cost drivers** (such as material dollars and direct labor hours) in Chapter 4. Unfortunately, automated production processes often generate costs which have no cause-and-effect relationship with volume-based cost drivers. Many companies have therefore adopted **activity-based cost drivers** to improve the accuracy of indirect cost allocations. To illustrate, consider the case of Carver Soup Company.

Activity-Based Cost Drivers

Carver Soup Company (CSC) produces batches of vegetable and tomato soup. Each time CSC switches production from vegetable soup to tomato soup or vice versa, it incurs certain costs. For example, production workers must clean the mixing, blending, and cooking equipment. They must change settings on the equipment to the specifications for the particular soup to be processed. CSC must test each batch for quality to ensure the recipe has been correctly followed. Because these costs are incurred for each new batch, they are called **start-up,** or **setup, costs.** CSC plans to make 180 batches of each type of soup during the coming year. The following table summarizes expected production information:

	Vegetable	Tomato	Total
Number of cans	954,000	234,000	1,188,000
Number of setups	180	180	360

CSC expects each setup will cost $264, for total expected setup costs of $95,040 ($264 × 360 setups). Using number of cans as the cost driver (volume-based driver) produces an allocation rate of $0.08 per can ($95,040 ÷ 1,188,000 cans). Multiplying the allocation rate by the weight of the base (number of cans) produces the following setup cost allocation:

Product	Allocation Rate	×	Number of Cans Produced	=	Allocated Setup Cost
Vegetable	$0.08	×	954,000	=	$76,320
Tomato	0.08	×	234,000	=	18,720

As expected, the volume-based (number of cans) allocation rate assigns more cost to the high-volume vegetable soup product. However, assigning more setup cost to the vegetable soup makes little sense. Since both products require the *same number* of setups, the setup cost should be distributed equally between them. The volume-based cost driver *overcosts* the high-volume product (vegetable soup) and *undercosts* the low-volume product (tomato soup).

Setup costs are driven by the number of times CSC employees perform the setup activities. The more setups employees undertake, the greater the total setup cost. An *activity-based cost driver* (number of setups) provides a more accurate allocation base for setup costs. Using the allocation rate of $264 ($95,040 ÷ 360 setups) per setup assigns the same amount of setup cost to each product, as follows:

Product	Allocation Rate	×	Number of Setups	=	Allocated Setup Cost
Vegetable	$264	×	180	=	$47,520
Tomato	264	×	180	=	47,520

Activity-Based Cost Drivers Enhance Relevance

The *activity-based cost driver* produces a better allocation because it distributes the *relevant* costs to the appropriate products. If CSC were to stop producing tomato soup, it could *avoid* spending $47,520 for 180 setups (assuming CSC could eliminate labor, supplies, and other resources used in the setup process). *Avoidable costs are relevant* to decision making. The inaccurate volume-based product cost data could mislead a manager into making a poor decision. Suppose a company specializing in setup activities offered to provide CSC 180 tomato soup setups for $40,000. A manager relying on the volume-based allocated cost of $18,720 would reject the $40,000 offer to outsource as too costly. In fact, CSC should accept the offer because it could avoid $47,520 of cost if the outside company performs the setup activity. In a highly automated environment in which companies produce many different products at varying volume levels, it is little wonder that many companies have turned to activity-based costing to improve the accuracy of cost allocations and the effectiveness of decisions.

CHECK YOURSELF 5.1

Professional Training Services, Inc. (PTSI), offers professional exam review courses for both the certified public accountant (CPA) and the certified management accountant (CMA) exams. Many more students take the CPA review courses than the CMA review courses. PTSI uses the same size and number of classrooms to teach both courses; its CMA courses simply have more empty seats. PTSI is trying to determine the cost of offering the two courses. The company's accountant has decided to allocate classroom rental cost based on the number of students enrolled in the courses. Explain why this allocation base will likely result in an inappropriate assignment of cost to the two cost objects. Identify a more appropriate allocation base.

Answer Using the number of students as the allocation base will assign more of the rental cost to the CPA review courses because those courses have higher enrollments. This allocation is inappropriate because the number of classrooms, not the number of students, drives the amount of rental cost. Since both courses require the same number of classrooms, the rental cost should be allocated equally between them. Several allocation bases would produce an equal allocation, such as the number of classrooms, the number of courses, or a 50/50 percentage split.

ACTIVITY-BASED COSTING

LO 2

Identify cost centers and cost drivers in an activity-based costing system.

A company that allocates indirect costs using **activity-based costing (ABC)** follows a two-stage process. In the first stage, costs are assigned to pools based on the activities that cause the costs to be incurred. In the second stage, the costs in the activity cost pools are allocated to products using a variety of cost drivers. The first step in developing an ABC system is to identify essential activities and the costs of performing those activities.

A business undertakes **activities** to accomplish its mission. Typical activities include acquiring raw materials, transforming raw materials into finished products, and delivering products to customers. These broadly defined activities can be divided into subcategories. For example, the activity of acquiring raw materials involves separate subcategory activities such as identifying suppliers, obtaining price quotations, evaluating materials specifications, completing purchase orders, and receiving purchased materials. Each of these subcategories can be subdivided into yet more detailed activities. For instance, identifying suppliers may include such activities as reviewing advertisements, searching Internet sites, and obtaining recommendations from business associates. Further subdivisions are possible. Companies perform thousands of activities.

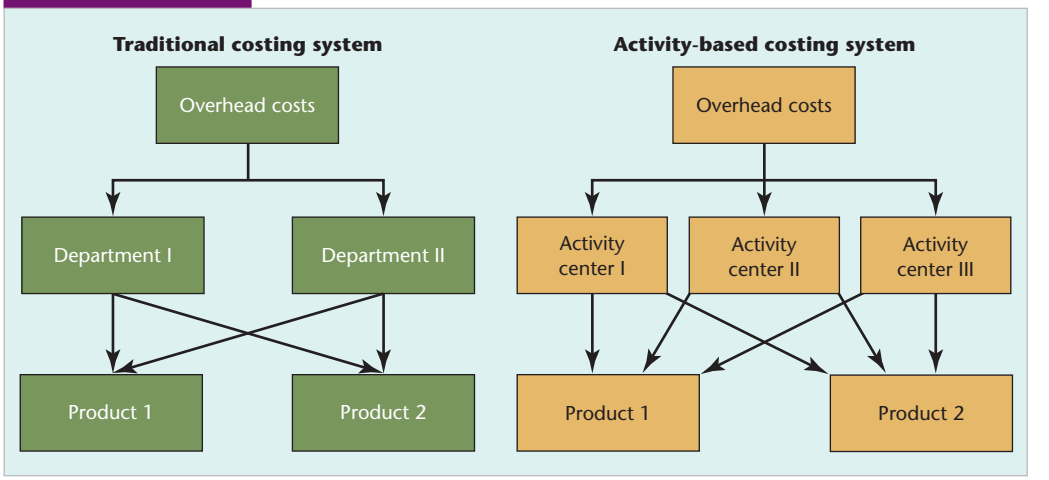
Identifying Activity Centers

Maintaining separate cost records for thousands of activities is expensive. To reduce record-keeping costs, companies group related activities into hubs called **activity centers.** The overhead costs of these related activities are combined into a cost pool for each activity center. Because the activities assigned to each center are related, a business can obtain rational cost allocations using a common cost driver for an entire cost pool. Determining the optimal number of activity centers requires *cost/benefit analysis.* Companies will incur the higher record-keeping costs for additional activity centers only to the extent that the additional accuracy improves decision making.

Comparing ABC with Traditional Cost Allocation

How do ABC systems differ from traditional allocation systems? Traditional allocation systems pool costs by departments, then allocate departmental cost pools to cost objects using volume-based cost drivers. In contrast, ABC systems pool costs

EXHIBIT 5.1



by activity centers, then allocate activity center cost pools to cost objects using a variety of volume- and activity-based cost drivers. ABC systems use many more activity centers than the number of departments in a traditional allocation system. As a result, ABC improves cost tracing by using more cause-and-effect relationships in assigning indirect costs to numerous activity centers. Exhibit 5.1 illustrates the primary differences between a traditional two-stage allocation system and an ABC system.

Types of Production Activities

Many companies organize activities into four hierarchical categories to improve cost tracing. These categories are (1) unit-level activities, (2) batch-level activities, (3) product-level activities, and (4) facility-level activities.[1] The overhead costs in each category are pooled and allocated to products based on how the products benefit from the activities. *The primary objective is to trace the cost of performing activities to the products that are causing the activities to be performed.* To illustrate, consider the overhead costs incurred by Unterman Shirt Company.

Unterman has two product lines, dress shirts and casual shirts. The company expects to incur overhead costs of $5,730,000 in the course of producing 680,000 dress shirts and 120,000 casual shirts during 2011. Currently, Unterman assigns an equal amount of overhead to each shirt, simply dividing the total expected overhead cost by the total expected production ($5,730,000 ÷ 800,000 units = $7.16 per shirt, rounded). Each type of shirt requires approximately the same amount of direct materials, $8.20 per shirt, and the same amount of direct labor, $6.80 per shirt. The total cost per shirt is $22.16 ($7.16 + $8.20 + $6.80). Unterman sells shirts for $31 each, yielding a gross margin of $8.84 per shirt ($31 − $22.16).

Bob Unterman, president and owner of the company, believes the direct materials and direct labor costs are reasonable, but the overhead costs must not be the same for both product lines. Mr. Unterman hired a consultant, Rebecca Lynch, to trace the overhead costs. Ms. Lynch decided to use an *activity-based cost* system. She identified the activities necessary to make shirts and classified them into the following four activity cost centers.

Unit-Level Activity Center

Unit-level activities occur each time a unit of product is made. For example, for every shirt made, Unterman incurs inspection costs, machine-related utility costs, and costs

[1]The types of costs in each category will be in Chapter 6.

for production supplies. Total unit-level cost increases with every shirt made and decreases with reductions in production volume. Some costs behave so much like unit-level costs that they may be accounted for as unit-level even though they are not strictly unit-level. For example, suppose Unterman employees lubricate production machinery after every eight hours of continuous operation. Although Unterman does not incur lubrication cost for each shirt produced, the cost behavior pattern is so closely tied to production levels that it may be accounted for as a unit-level cost.

Ms. Lynch identified the following unit-level overhead costs: (1) $300,000 for machine-related utilities, (2) $50,000 for machine maintenance, (3) $450,000 for indirect labor and indirect materials, (4) $200,000 for inspection and quality control, and (5) $296,000 for miscellaneous unit-level costs. She assigned these costs into a single *unit-level activity center* overhead cost pool of $1,296,000. This assignment illustrates the first stage of the two-stage ABC allocation system. Of the total $5,730,000 overhead cost, Ms. Lynch has allocated $1,296,000 to one of the four activity centers. The remaining overhead cost is allocated among the three other activity centers.

The second-stage cost assignment involves allocating the $1,296,000 unit-level cost pool between the two product lines. Because unit-level costs are incurred each time a shirt is produced, they should be allocated using a base correlated to production levels. Ms. Lynch chose direct labor hours as the allocation base. Past performance indicates the dress shirts will require 272,000 direct labor hours and the casual shirts will require 48,000 direct labor hours. Based on this information, Ms. Lynch allocated the unit-level overhead costs and computed the cost per unit as shown in Exhibit 5.2.

EXHIBIT 5.2

Allocation of Unit-Level Overhead Costs

	Product Lines		
	Dress Shirts	Casual Shirts	Total
Number of direct labor hours (a)	272,000	48,000	320,000
Cost per labor hour ($1,296,000 ÷ 320,000 hours) (b)	$4.05	$4.05	NA
Total allocated overhead cost (c = a × b)	$1,101,600	$194,400	$1,296,000
Number of shirts (d)	680,000	120,000	800,000
Cost per shirt (c ÷ d)	$1.62	$1.62	NA

The unit-level costs exhibit a variable cost behavior pattern. Total cost varies in direct proportion to the number of units produced. Cost per unit is constant. Because production volume does not affect the unit-level overhead cost, the pricing of shirts should not be affected by the fact that the company makes more dress shirts than casual shirts.

Batch-Level Activity Center

Batch-level activities relate to producing groups of products. Batch-level costs are fixed regardless of the number of units produced in a single batch. For example, the costs of setting up machinery to cut fabric for a certain size shirt remain unchanged regardless of the number of shirts cut at that particular machine setting. Similarly, the cost of a first-item batch test is the same whether 200 or 2,000 shirts are made in the batch. Materials handling costs are also commonly classified as batch-level because materials are usually transferred from one department to another in batches. For example, all of the size small casual shirts are cut in the sizing department, then the entire batch of cut fabric is transferred in one operation to the sewing department. The cost of materials handling is the same regardless of whether the batch load is large or small.

Because total batch costs depend on the number of batches produced, more batch costs should be allocated to products that require more batches. Ms. Lynch identified $690,000 of total batch-level overhead costs and assigned this amount to a batch-level cost pool.

For the second-stage allocation, Ms. Lynch determined that the casual-shirt line requires considerably more setups than the dress-shirt line because the casual shirts are subject to frequent style changes. Because customers buy limited amounts of items with short shelf lives, Unterman must produce casual shirts in small batches. Ms. Lynch decided more of the batch-level costs should be allocated to the casual-shirt line than to the dress-shirt line. She chose number of setups as the most rational allocation base. Since casual shirts require 1,280 setups and dress shirts require 1,020 setups, Ms. Lynch allocated the batch-level costs as shown in Exhibit 5.3.

EXHIBIT 5.3

Allocation of Batch-Level Overhead Costs

	Product Lines		
	Dress Shirts	Casual Shirts	Total
Number of setups performed (a)	1,020	1,280	2,300
Cost per setup ($690,000 ÷ 2,300 setups) (b)	$300	$300	NA
Total allocated overhead cost (c = a × b)	$306,000	$384,000	$690,000
Number of shirts (d)	680,000	120,000	800,000
Cost per shirt (c ÷ d)	$0.45	$3.20	NA

ABC demonstrates that the per shirt batch-level cost for casual shirts ($3.20 per shirt) is considerably more than for dress shirts ($0.45). One reason is that the casual-shirt line incurs more batch-level costs ($384,000 versus $306,000). The other is that Unterman produces far fewer casual shirts than dress shirts (120,000 units versus 680,000). Because batch-level costs are fixed relative to the number of units in a particular batch, the cost per unit is greater the smaller the batch. For example, if setup costs are $300, the setup cost per unit for a batch of 100 units is $3 ($300 ÷ 100 units). For a batch of only 10 units, however, the setup cost per unit is $30 ($300 ÷ 10 units). When batch-level costs are significant, companies should pursue high-volume products. Low-volume products are more expensive to make because the fixed costs must be spread over fewer units. To the extent that cost affects pricing, Unterman should charge more for casual shirts than dress shirts.

Product-Level Activity Center

Product-level activities support specific products or product lines. Examples include raw materials inventory holding costs; engineering development costs; and legal fees for patents, copyrights, trademarks, and brand names. Unterman Shirt Company positions itself as a fashion leader. It incurs extensive design costs to ensure that it remains a trendsetter. The company also incurs engineering costs to continually improve the quality of materials used in its shirts and legal fees to protect its brand names. After reviewing Unterman's operations, Ms. Lynch concluded she could trace $1,800,000 of the total overhead cost to the product-level activity center.

The second-stage allocation requires dividing these activities between the dress-shirt line and the casual-shirt line. Interviews with fashion design staff disclosed that they spend more time on casual shirts because of the frequent style changes. Similarly, the engineers spend more of their time developing new fabric, buttons, and zippers for casual shirts. The materials used in dress shirts are fairly stable. Although engineers spend some time improving the quality of dress-shirt materials, they devote far more

EXHIBIT 5.4

Allocation of Product-Level Overhead Costs

	Product Lines		
	Dress Shirts	Casual Shirts	Total
Percent of product-level activity utilization (a)	30%	70%	100%
Total allocated overhead cost (b = a × $1,800,000)	$540,000	$1,260,000	$1,800,000
Total units produced (c)	680,000	120,000	800,000
Cost per unit (b ÷ c)	$0.79*	$10.50	NA

*Rounded to the nearest whole cent.

time to the more unusual materials used in the casual shirts. Similarly, the legal department spends more time developing and protecting patents, trademarks, and brand names for the casual-shirt line. Ms. Lynch concluded that 70 percent of the product-level cost pool applied to casual shirts and 30 percent to dress shirts. She allocated product-level costs to the two product lines as shown in Exhibit 5.4.

Product-level costs are frequently distributed unevenly among different product lines. Unterman Shirt Company incurs substantially more costs to sustain its casual-shirt line than its dress-shirt line. Using a single companywide overhead rate in such circumstances distorts cost measurements. Distorted product cost measurements can lead to negative consequences such as irrational pricing policies and rewards for inappropriate decisions. Activity-based costing reduces measurement distortions by more accurately tracing costs to the products that cause their incurrence.

Facility-Level Activity Center

Facility-level activities benefit the production process as a whole and are not related to any specific product, batch, or unit of production. For example, insuring the manufacturing facility against fire losses does not benefit any particular product or product line. Facility-level costs include depreciation on the manufacturing plant, security, landscaping, plant maintenance, general utilities, and property taxes. For Unterman Shirt Company, Ms. Lynch identified $1,944,000 of facility-level overhead costs. Because no cause-and-effect relationship exists between these facility-level manufacturing costs and the two product lines, she must allocate these costs arbitrarily. Basing the arbitrary allocation on the total number of units produced, Ms. Lynch allocated 85 percent (680,000 ÷ 800,000) of the facility-level cost pool to the dress-shirt line and 15 percent (120,000 ÷ 800,000) to the casual-shirt line as shown in Exhibit 5.5.

EXHIBIT 5.5

Allocation of Facility-Level Overhead Costs

	Product Lines		
	Dress Shirts	Casual Shirts	Total
Percent of total units (a)	85%	15%	100%
Total allocated overhead cost (b = a × $1,944,000)	$1,652,400	$291,600	$1,944,000
Total units produced (c)	680,000	120,000	800,000
Cost per unit (b ÷ c)	$2.43	$2.43	NA

Classification of Activities Not Limited to Four Categories

The number of activity centers a business uses depends on cost/benefit analysis. The four categories illustrated for Unterman Shirt Company represent a useful starting point. Any of the four categories could be further subdivided into more detailed activity centers. Unterman could establish an activity cost center for unit-level labor-related activities and a different activity center for unit-level machine-related activities. Identifying all potential activity centers in a real-world company can be daunting. Paulette Bennett describes the process used in the Material Control Department at Compumotor, Inc., as follows:

> Recognizing that ordinarily the two biggest problems with an ABC project are knowing where to start and how deep to go, we began by analyzing the activities that take place in our procurement process. As the old saying goes, to find the biggest alligators you usually have to wade into the weeds; therefore, we started by writing down all the procurement activities. Creating a real world picture of costs by activity was our aim. But had we used our initial list we would have designed a spreadsheet so large that no human could ever have emerged alive at the other end.[2]

Ms. Bennett's abbreviated list still included 83 separate activities. The list represented the activity centers for only one department of a very large company. Although the Unterman example used only four categories, the real-world equivalent is far more complex.

CHECK YOURSELF 5.2

Under what circumstances would the number of units produced be an inappropriate allocation base for batch-level costs?

Answer Using the number of units produced as the allocation base would allocate more of the batch-level costs to high-volume products and less of the costs to low-volume products. Since batch-level costs are normally related to the number of batches rather than the number of units made in each batch, allocation of batch-level costs based on units produced would result in poor product cost estimates; the costing system would overcost high-volume products and undercost low-volume products. It would be appropriate to use the number of units produced only when each batch consists of the same number of product units. Even under these circumstances, the number of units merely serves as a proxy for the number of batches. It would still be more appropriate to use the number of batches to allocate batch-level costs.

Context-Sensitive Classification of Activities

Particular activities could fall into any of the four hierarchical categories. For example, inspecting each individual item produced is a unit-level activity. Inspecting the first item of each batch to ensure the setup was correct is a batch-level activity. Inspecting a specific product line is a product-level activity. Finally, inspecting the factory building is a facility-level activity. To properly classify activities, you must learn to analyze the context within which they occur.

Selecting Cost Drivers

Activity-based costing uses both *volume-based* cost drivers and *activity-based* cost drivers. Volume-based drivers are appropriate for indirect costs that increase or decrease relative to the volume of activity. Using cost drivers such as units, direct labor hours, or

[2]Paulette Bennett, "ABM and the Procurement Cost Model," *Management Accounting,* March 1996, pp. 28–32.

machine hours is appropriate for unit-level activities. The flaw in traditional costing systems is that they use a volume-based measure (usually direct labor hours) to allocate all indirect costs. In contrast, the more sophisticated ABC approach uses activity drivers such as number of setups or percentage of utilization for overhead costs that are not influenced by volume. ABC improves the accuracy of allocations by using a combination of volume- and activity-based cost drivers.

USING ABC INFORMATION TO TRACE COSTS TO PRODUCT LINES

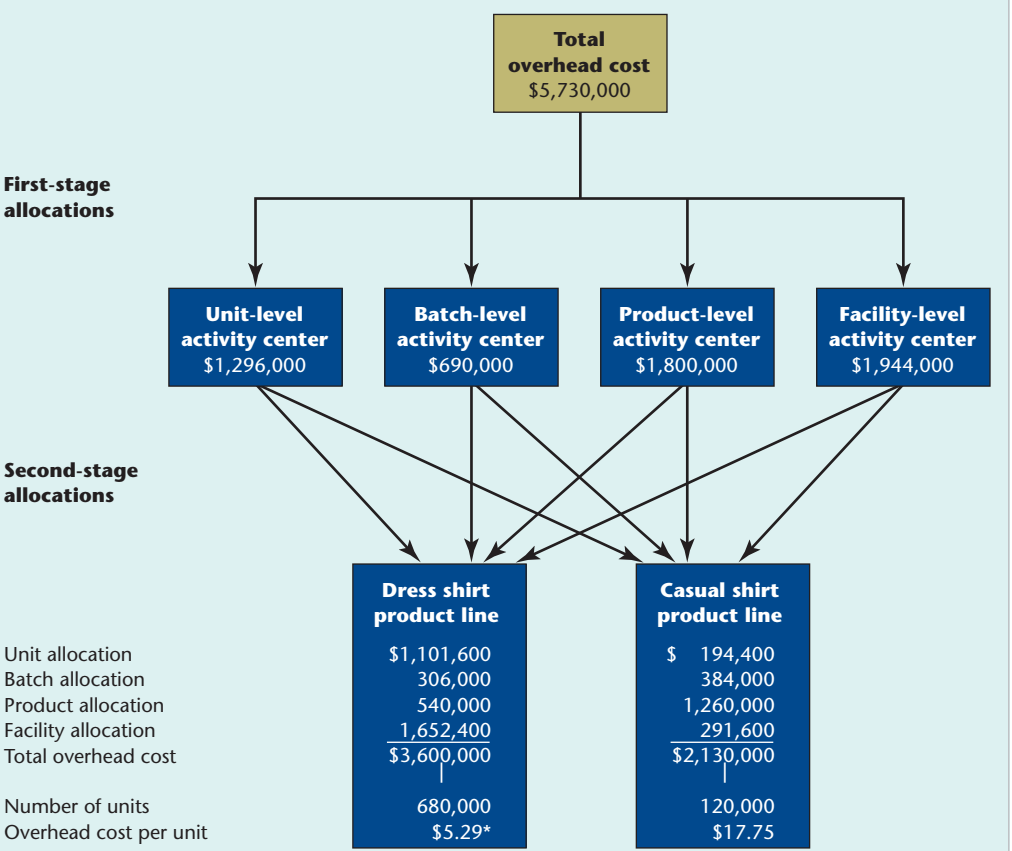
LO 3

Use activity-based costing to calculate costs of products and services.

Exhibit 5.6 summarizes the ABC allocations Ms. Lynch prepared. Mr. Unterman was shocked to learn that overhead costs for casual shirts are virtually three times those for dress shirts. Exhibit 5.7 compares the per-unit gross margins for the two product lines using the traditional cost system and using the ABC system. Recall that direct materials and direct labor costs for dress and casual shirts are $8.20 and $6.80, respectively. The difference in the margins is attributable to the overhead allocation. Using a traditional companywide overhead rate allocates an equal amount of overhead to each shirt ($5,730,000 ÷ 800,000 units = $7.16 per shirt). In contrast, the ABC approach assigns $5.29 to each dress shirt and $17.75 to each casual shirt. Total overhead cost is $5,730,000 under both approaches. It is the *allocation* of rather than the *amount* of the overhead cost that differs. ABC shows that making a casual

EXHIBIT 5.6

ABC Overhead Cost Allocation



*Rounded to the nearest whole cent.

EXHIBIT 5.7

Gross Margins Using Traditional Versus ABC Costing

	Gross Margins Traditional System		Gross Margins ABC Costing	
	Dress Shirts	Casual Shirts	Dress Shirts	Casual Shirts
Sales price	$31.00	$31.00	$31.00	$31.00
Cost of goods sold				
Materials cost	(8.20)	(8.20)	(8.20)	(8.20)
Labor cost	(6.80)	(6.80)	(6.80)	(6.80)
Overhead	(7.16)	(7.16)	(5.29)	(17.75)
Gross margin	$ 8.84	$ 8.84	$10.71	$ (1.75)

shirt costs more than making a dress shirt. After reviewing the data in Exhibit 5.7, Mr. Unterman realized the company was incurring losses on the casual-shirt line. What options does he have?

Under- and Overcosting

In using the single companywide overhead rate, Unterman Shirt Company has undercosted its casual line and priced the shirts below cost. The obvious response to the ABC gross margin data in Exhibit 5.7 is to raise the price of casual shirts. Unfortunately, the market may not cooperate. If other companies are selling casual shirts at prices near $31, customers may buy from Unterman's competitors instead of paying a higher price for Unterman's shirts. In a market-driven economy, raising prices may not be a viable option. Unterman may have to adopt a target-pricing strategy.

Target pricing starts with determining the price customers are willing to pay. The company then attempts to produce the product at a low enough cost to sell it at the price customers demand. Exhibits 5.3 and 5.4 indicate that batch-level and product-level costs are significantly higher for casual shirts than for dress shirts. Unterman may be too fashion conscious with respect to casual shirts. Perhaps the company should reduce fashion design costs by focusing on a few traditional styles instead of maintaining a trendsetting position. Also, following established trends is less risky than setting new ones. Retail customers may have more confidence in the marketability of traditional casual shirts, which could lead them to place larger orders, enabling Unterman to reduce its per-unit batch costs.

The single companywide overhead rate not only undercosts the casual-shirt line but also overcosts the dress-shirt line. To the extent that the overhead cost affects the selling price, the dress-shirt line is overpriced. Overpricing places the dress shirt business at a competitive disadvantage which can have a snowball effect. If volume declines because of lost market share, sales revenue will decrease and Unterman's fixed costs will be spread over fewer units, resulting in a higher cost per unit. Higher costs encourage price increases, which further aggravate the competitive disadvantage. It is as important for Unterman to consider reducing the sales price of dress shirts as it is to raise the sales price of casual shirts.

Downstream Costs and Upstream Costs

The preceding paragraph analyzed only product costs. Businesses incur **upstream costs** before—and **downstream costs** after—goods are manufactured. Either upstream or downstream costs may be relevant to product elimination decisions. For example, suppose Unterman pays sales representatives a $2 commission for each shirt sold.

Answers to The Curious Accountant

The USPS commissioned **Coopers & Lybrand (C&L)** (now Pricewaterhouse-Coopers), a large accounting firm, to conduct activity-based costing (ABC) studies of its key revenue collection processes. C&L developed an ABC model for USPS's existing cash and check revenue collection and a similar ABC model for debit and credit card activities. The ABC model identified costs associated with unit, batch, and product activities. *Unit-level activity* was defined as the acceptance and processing of a payment by item. *Batch-level activities* involved the closeout at the end of the day, consolidation, and supervisory review. *Product-level activities* included maintenance for bank accounts and deposit reconciliation for the cash and checks model and terminal maintenance and training for the credit and debit card system. A comparison of the cost of the two activity models revealed that a significant cost savings could be achieved in the long term by implementing a debit and credit card system. Some examples of expected cost savings included a decrease in the per-unit transaction cost due to the fact that credit card customers tend to spend more per transaction than do cash customers. In addition, the cost of activities associated with the collection of bad debts falls to virtually zero when debit or credit cards are used and the cost of cash management activities declines. Funds are collected earlier (no check collection float occurs), thereby reducing the need for financing and the resultant interest cost.

Payments received by the IRS are very different from those received by the USPS. The USPS experiences billions of payment transactions each year, many of which are for relatively small amounts; for example, a customer may pay to send one package priority mail for $5.70. The IRS receives fewer payments than the USPS, but most of these payments are for significantly larger amounts. Also, while the USPS has over 36,000 post offices processing payments, the IRS has less than a dozen payment processing centers. In ABC costing terms, the IRS has fewer unit-level activities and batch-level activities associated with processing payments than does the USPS, so the financial analysis used by the USPS is not relevant to the IRS. There is another very good reason the IRS does not accept credit card payments unless the taxpayer pays a surcharge; Congress passed a law stipulating this condition.

Source: Terrel L. Carter, Ali M. Sedghat, and Thomas D. Williams, "How ABC Changed the Post Office," *Management Accounting,* February 1998, pp. 28–36; and the USPS 2008 Annual Report.

Although sales commissions are selling, not product, costs, they are relevant to deciding whether to eliminate the casual-shirt line. Unterman can avoid the commission expense if it sells no casual shirts. Including the sales commission increases the total avoidable cost to $32.32 ($30.32 product costs + $2.00 sales commissions) which is more than the $31 sales price. Unterman would therefore be more profitable if it abandoned the casual-shirt line. Management must also consider upstream costs such as those for research and development. To continue in business, companies must sell products at prices that exceed the *total* cost to develop, make, and sell them.

Employee Attitudes and the Availability of Data

Activity-based costing can lead management to implement cost-cutting measures, including product and product line eliminations, that can result in the loss of jobs. Employees are therefore sometimes uncooperative with management efforts to adopt an ABC system. Companies must help employees recognize that ABC and other **strategic cost management** techniques frequently result in redirecting workers rather than displacing them. Ultimately, jobs depend on the employer's competitive health. The implementation of an ABC system is more likely to succeed when both managers and rank-and-file employees are convinced their own well-being is tied to the company's well-being.

Even when employees cooperate, implementing an ABC system can be difficult. Frequently, the accounting system is not collecting some of the needed data. For example, suppose a manager wants to allocate inspection costs based on the number of hours job inspections take. Inspectors may not record the time spent on individual jobs. Basing the allocation on inspection hours requires inspectors to begin keeping more detailed time records. The accuracy of the allocation then depends on how conscientiously inspectors complete their time reports. Obtaining employee support and accurate data are two of the more challenging obstacles to successfully implementing ABC.

TOTAL QUALITY MANAGEMENT

LO 4

Identify the components of quality costs.

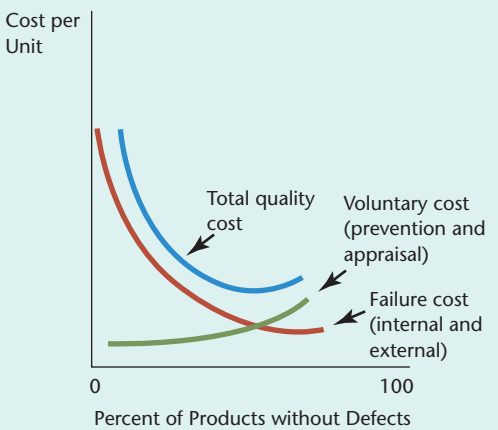
Quality is key to a company's ability to obtain and retain customers. What does *quality* mean? It does not always mean the best. A spoon made of silver is of higher quality than a spoon made of plastic, but customers are perfectly willing to use plastic spoons at fast-food restaurants. **Quality** represents the degree to which products or services *conform* to design specifications. The costs companies incur to ensure quality conformance can be classified into four categories: prevention, appraisal, internal failure, and external failure.

Companies incur **prevention costs** to avoid nonconforming products. They incur **appraisal costs** to identify nonconforming products produced in spite of prevention cost expenditures. **Failure costs** result from correcting defects in nonconforming products produced. **Internal failure costs** pertain to correcting defects before goods reach customers; **external failure costs** result from delivering defective goods to customers.

Because prevention and appraisal costs are a function of managerial discretion, they are often called **voluntary costs.** Management chooses how much to spend on these voluntary costs. In contrast, management does not directly control failure costs. The cost of dissatisfied customers may not be measurable, much less controllable. Even though failure costs may not be directly controllable, they are related to voluntary costs. When management spends additional funds on prevention and appraisal controls, failure costs tend to decline. As the level of control increases, quality conformance increases, reducing failure costs. When control activities are reduced, quality conformance decreases and failure cost increases. *Voluntary costs and failure costs move in opposite directions.*

EXHIBIT 5.8

Relationships Among Components of Quality Cost



Minimizing Total Quality Cost

Total quality control cost is the sum of voluntary costs plus failure costs. Because voluntary costs and failure costs are negatively correlated, the minimum amount of *total* quality cost is located at the point on a graph where the marginal voluntary expenditures equal the marginal savings on failure cost as shown in Exhibit 5.8.

Exhibit 5.8 indicates that the minimum total quality cost per unit occurs at quality level of less than 100 percent. At very low levels of quality assurance, significant failure costs outweigh any cost savings available by avoiding voluntary costs. In contrast, extremely high levels of quality assurance result in voluntary cost expenditures that are not offset by failure cost savings. Although the goal of zero defects is appealing, it is not a cost-effective strategy. Realistic managers seek to minimize total quality cost rather than to eliminate all defects.

CHECK YOURSELF 5.3

Is it wiser to spend money on preventing defects or on correcting failures?

Answer The answer depends on where a company's product falls on the "total quality cost" line (see Exhibit 5.8). If the product falls left of the cost minimization point, spending more on preventing defects would produce proportionately greater failure cost savings. In other words, a company would spend less in total by reducing failure costs through increasing prevention costs. Under these circumstances, it would be wise to incur prevention costs. On the other hand, if the product falls right of the cost minimization point line, the company would spend more to prevent additional defects than it would save by reducing failure costs. Under these circumstances, it makes more sense to pay the failure costs than attempt to avoid them by incurring prevention costs.

FOCUS ON INTERNATIONAL ISSUES

GLOBAL CONSEQUENCES OF EXTERNAL FAILURE COSTS

In late September 2009, Toyota Motor Company announced that it would be conducting a recall related to problems with floor mats in several models of Toyota and Lexus model cars and trucks. In some cases the floor mats had moved, preventing the vehicle's accelerator from moving properly. As an immediate solution, Toyota asked drivers of the affected vehicles to remove the driver's side floor mat, but the company said it would replace the accelerator pedals in the vehicles to prevent the floor mats from causing them to get stuck. The company estimated that 3.8 million vehicles had been sold with the mats under suspicion. A few months later, in February 2010, the company announced further recalls for additional vehicles with faulty accelerator pedals and braking systems.

These are examples of an *external failure cost* since the product made it into costumers' hands before the defect was found. Toyota did not immediately say how much this product failure was estimated to cost the company, but some analysts projected the costs of these recalls, along with lost sales, to be $1.5 to $2.0 billion. First, there is the cost of notifying all affected customers of the potential risk and advising them of what to do. This includes the obvious costs of printing and mailing, but also the costs of lawyers and public-relations consultants. Then there is the replacement cost of the new accelerator pedals. Since some individuals had already been injured and killed in cars that were alleged to have the defects, there will certainly be the costs of lawsuits and settlements. Finally, there is the cost of the potential damage to the company's reputation. Product recalls are nothing unusual in the automobile industry; cars are complex products with thousands of parts. However, Toyota, and particularly its Lexus brand, have reputations for being among the highest quality vehicles. A company can lose its reputation for quality a lot more quickly that it can be developed.

It may cost a little more to make sure your products are made correctly in the first place, but in the long run it is often cheaper than paying the external failure costs.

Quality Cost Reports

LO 5

Prepare and interpret quality cost reports.

Managing quality costs to achieve the highest level of customer satisfaction is known as **total quality management (TQM).** Accountants support TQM by preparing a **quality cost report,** which typically lists the company's quality costs and analyzes horizontally each item as a percentage of the total cost. Data are normally displayed for two or more accounting periods to disclose the effects of changes over time. Exhibit 5.9 shows a quality cost report for Unterman Shirt Company. The company's accountant prepared the report to assess the effects of a quality control campaign the company recently initiated. Review Exhibit 5.9. What is Unterman's quality control strategy? Is it succeeding?

Exhibit 5.9 indicates Unterman is seeking to control quality costs by focusing on appraisal activities. The total expenditures for prevention activities remained unchanged, but expenditures for appraisal activities increased significantly. The results of this strategy are apparent in the failure cost data. Internal failure costs increased significantly while external failure costs decreased dramatically. The strategy succeeded in lowering total quality costs. The report suggests, however, that more improvement is possible. Notice that 86.13 percent (appraisal 19.63 percent + internal failure 39.01 percent + external failure 27.49 percent) of total quality costs is spent on finding and correcting mistakes. The adage "an ounce of prevention is worth a pound of cure," applied to Unterman, implies spending more on prevention could perhaps eliminate many of the appraisal and failure costs.

EXHIBIT 5.9

Quality Cost Report for Unterman Shirt Company

	2013		2012	
	Amount	Percentage*	Amount	Percentage*
Prevention costs				
Product design	$ 50,000	6.54%	$ 52,000	6.60%
Preventive equipment (depreciation)	7,000	0.92	7,000	0.89
Training costs	27,000	3.53	25,000	3.17
Promotion and awards	22,000	2.88	22,000	2.79
Total prevention	106,000	13.87	106,000	13.45
Appraisal costs				
Inventory inspection	75,000	9.82	25,000	3.17
Reliability testing	43,000	5.63	15,000	1.90
Testing equipment (depreciation)	20,000	2.62	12,000	1.52
Supplies	12,000	1.57	8,000	1.02
Total appraisal	150,000	19.63	60,000	7.61
Internal failure costs				
Scrap	90,000	11.78	40,000	5.08
Repair and rework	140,000	18.32	110,000	13.96
Downtime	38,000	4.97	20,000	2.54
Reinspection	30,000	3.93	12,000	1.52
Total internal failure	298,000	39.01	182,000	23.10
External failure costs				
Warranty repairs and replacement	120,000	15.71	260,000	32.99
Freight	20,000	2.62	50,000	6.35
Customer relations	40,000	5.24	60,000	7.61
Restocking and packaging	30,000	3.93	70,000	8.88
Total external failure	210,000	27.49	440,000	55.84
Grand total	$764,000	100.00%	$788,000	100.00%

*Percentages do not add exactly because of rounding.

REALITY BYTES

Improving the quality of a product can increase its costs. Are the benefits of the higher quality worth the higher costs? In other words, are companies that spend money to improve the quality of their products rewarded with higher profit margins? This is a difficult question to answer empirically because, among other things, there is not always a definitive, objective measure of the quality of competing products or services.

Nevertheless, we can make some general comparisons based on objective data available for automobile manufactures. Every year **JD Power and Associates** releases reports on various aspects of quality among auto manufacturers, including the *Vehicle Dependability Study (VDS)*. This study surveys owners who have had their cars for three years, asking what problems they have experienced related to their vehicles' dependability. According to the company, "the study finds that the frequency and severity of component replacement has a potentially strong impact on customer loyalty intentions."

On March 19, JD Power released its 2009 VDS, which looked at the reliability of 2006 model cars. Although Buick came in first as an overall brand-name winner, other GM brands, including Saab, Hummer, Pontiac, and Saturn, came in well below average. Toyota and Lexus, a division of Toyota, were close to Buick at the top of the dependability rankings. Toyota and Lexus are usually near the top of JD Power's VDS as well as its Initial Quality Study, which is based on a survey of owners of new cars. Ford and its Lincoln, Mercury, and Jaguar divisions were also ranked as being above average in the 2009 VDS.

What about these companies' comparative profitability? The table below shows return on assets ratios for the 2008 and 2007 fiscal years of Toyota, Ford, and GM. Although 2008 was not a good year for car manufacturers in general, due to the economic recession, the data show that, generally, car companies with better quality had better financial results. It would certainly be an oversimplification to attribute all of Toyota's financial success to its higher quality evaluations. However, many experts in the automotive business believe Toyota's reputation for building high-quality vehicles has been a significant contributor to its success.

Return on Assets Ratios

	2008	2007
Toyota	(1.4)%	5.3%
Ford	(5.9)	(1.0)
GM	(33.9)	(26.0)

Source: jdpower.com

These data are for years prior to Toyota's recalls for faulty accelerator and braking systems that occurred in late 2009 and early 2010. These widespread recalls had an immediate, negative, effect on the company's sales, and a positive effect on Ford's sales. It is a lot easier to lose customers due to quality problems than it was to attract them in the first place.

A Look Back <<

Many traditional cost systems used direct labor hours as the sole base for allocating overhead costs. Labor hours served as an effective *companywide allocation base* because labor was highly correlated with overhead cost incurrence. It made sense to assign more overhead to cost objects that required more labor. Because direct labor was related to production volume, it was frequently called a *volume-based cost driver.* Other volume-based cost drivers included machine hours, number of units, and labor dollars. Companywide, volume-based cost drivers were never perfect measures of overhead consumption. However, misallocation was not a serious problem because overhead

costs were relatively small. If a manager misallocated an insignificant cost, it did not matter.

Automation has changed the nature of the manufacturing process. This change may cause significant distortions in the allocation of overhead costs when the allocation base is a companywide, volume-based cost driver. There are two primary reasons for distortions. First, in an automated environment, the same amount of labor (e.g., flipping a switch) may produce a large or a small volume of products. Under these circumstances, labor use is not related to the incurrence of overhead and is not a rational allocation base. Second, the distortions may be significant because overhead costs are much higher relative to the cost of labor and materials. For example, when robots replace people in the production process, depreciation becomes a larger portion of total product cost and labor becomes a smaller portion of the total.

To improve the accuracy of allocations, managerial accountants began to study the wide array of activities required to make a product. Such activities may include acquiring raw materials, materials handling and storage activities, product design activities, legal activities, and traditional production labor activities. Various measures of these activities can be used as bases for numerous overhead allocations related to determining product cost. Using activity measures to allocate overhead costs has become known as *activity-based costing (ABC)*. In an ABC system, costs are allocated in a two-stage process. First, activities are organized into *activity centers* and the related costs of performing these activities are combined into *cost pools*. Second, the pooled costs are allocated to designated cost objects using activity-based cost drivers. Implementing ABC is most likely to succeed when employees understand that it will positively affect their fate and that of the company. Without employee cooperation, collecting data necessary for the system's success may be difficult.

Many ABC systems begin by organizing activities into one of four categories. Total *unit-level activity cost* increases each time a unit of product is made and decreases when production volume declines. Unit-level activity costs can be allocated with a base correlated to the level of production (volume-based cost drivers). *Batch-level activities* are related to producing groups of products. Their costs are fixed regardless of the number of units in a batch. Batch-level costs are assigned so that the products requiring the most batches are assigned the most batch costs. *Product-level activities* support a specific product or product line. Product-level costs are frequently assigned to products based on the product's percentage use of product-level activities. *Facility-level activities* are performed for the benefit of the production process as a whole. The allocation of these costs is often arbitrary.

Accurate allocations prevent the distortions of overcosted or undercosted products. Over-costing can cause a product line to be overpriced. Overpriced products may cause a company to lose market share, and the decline in sales revenue will cause profits to fall. When products are underpriced, revenue is less than it could be, and profitability suffers.

Product costs are frequently distinguished from upstream and downstream costs. *Upstream costs* result from activities that occur *before* goods are manufactured. Examples include research and development, product design, and legal work. *Downstream costs* result from activities that occur *after* goods are manufactured. Examples of downstream costs include selling and administrative expenses. Upstream and downstream costs affect pricing decisions and product elimination decisions.

>> A Look Forward

The next chapter introduces the concept of cost relevance. Applying the concepts you have learned to real-world business problems can be challenging. Frequently, so much data is available that it is difficult to distinguish important from useless information. The next chapter will help you learn to identify information that is relevant in a variety of short-term decision-making scenarios including special offers, outsourcing, segment elimination, and asset replacement.

A step-by-step audio-narrated series of slides is provided on the text website at www.mhhe.com/edmonds2011.

SELF-STUDY REVIEW PROBLEM

Adventure Luggage Company makes two types of airline carry-on bags. One bag type designed to meet mass-market needs is constructed of durable polyester. The other bag type aimed at the high-end luxury market is made of genuine leather. Sales of the polyester bag have declined recently because of stiff price competition. Indeed, Adventure would have to sell this bag at less than production cost to match the competition. Adventure's president suspects that something is wrong with how the company estimates the bag's cost. He has asked the company's accountant to investigate that possibility. The accountant gathered the following information relevant to estimating the cost of the company's two bag types.

Both bags require the same amount of direct labor. The leather bags have significantly higher materials costs, and they require more inspections and rework because of higher quality standards. Since the leather bags are produced in smaller batches of different colors, they require significantly more setups. Finally, the leather bags generate more legal costs due to patents and more promotion costs because Adventure advertises them more aggressively. Specific cost and activity data follow.

	Polyester Bags	Leather Bags
Per unit direct materials cost	$30	$90
Per unit direct labor cost	2 hours @ $14 per hour	2 hours @ $14 per hour
Annual sales volume	7,000 units	3,000 units

Total annual overhead costs are $872,000. Adventure currently allocates overhead costs using a traditional costing system based on direct labor hours.

To reassess the overhead allocation policy and the resulting product cost estimates, the accountant subdivided the overhead into four categories and gathered information about these cost categories and the activities that caused the company to incur the costs. These data follow.

			Amount of Cost Driver		
Category	Estimated Cost	Cost Driver	Polyester	Leather	Total
Unit level	$480,000	Number of machine hours	20,000	60,000	80,000
Batch level	190,000	Number of machine setups	1,500	3,500	5,000
Product level	152,000	Number of inspections	200	600	800
Facility level	50,000	Equal percentage	50%	50%	100%
Total	$872,000				

Required

a. Determine the total cost and cost per unit for each product line, assuming that Adventure allocates overhead costs to each product line using direct labor hours as a companywide allocation base. Also determine the combined cost of the two product lines.

b. Determine the total cost and cost per unit for each product line, assuming that Adventure allocates overhead costs using an ABC system. Determine the combined cost of the two product lines.

c. Explain why the total combined cost computed in Requirements *a* and *b* is the same. Given that the combined cost is the same using either system, why is an ABC system with many different allocation rates better than a traditional system with a single companywide overhead rate?

Solution to Requirement a

Predetermined Overhead Rate

Polyester		Leather		
2 hr. × 7,000 units 14,000 direct labor hours	+	2 hr. × 3,000 units 6,000 direct labor hours	=	20,000 hours

Allocation rate = $872,000 ÷ 20,000 hours = $43.60 per direct labor hour

Allocated Overhead Costs

Type of Bag	Allocation Rate	×	Number of Hours	=	Allocated Cost
Polyester	$43.60	×	14,000	=	$610,400
Leather	43.60	×	6,000	=	261,600
Total			20,000		$872,000

Total Cost of Each Product Line and Combined Cost

Type of Bag	Direct Materials*	+	Direct Labor†	+	Allocated Overhead	=	Total
Polyester	$210,000	+	$196,000	+	$610,400	=	$1,016,400
Leather	270,000	+	84,000	+	261,600	=	615,600
Total	$480,000	+	$280,000	+	$872,000	=	$1,632,000

*Direct materials
Polyester $30 × 7,000 units = $210,000
Leather $90 × 3,000 units = $270,000

†Direct labor
Polyester $14 × 14,000 hours = $196,000
Leather $14 × 6,000 hours = $84,000

Cost per Unit Computations Using Traditional Cost System

Type of Bag	Total Cost	÷	Units	=	Cost per Unit
Polyester	$1,016,400	÷	7,000	=	$145.20
Leather	615,600	÷	3,000	=	205.20
Total	$1,632,000				

Solution to Requirement b

Overhead Cost Allocation Using ABC

	Unit	Batch	Product	Facility	Total
Cost pool	$480,000	$190,000	$152,000	$50,000	$872,000
÷ Cost drivers	Number of machine hours	Number of setups	Number of inspections	Equally	
	80,000	5,000	800	50%	
= Rate	$6 per machine hour	$38 per setup	$190 per inspection	$25,000	

Overhead Allocation for Polyester Bags

	Unit	Batch	Product	Facility	Total
Weight	20,000	1,500	200	1	
× Rate	$ 6	$ 38	$ 190	$25,000	
Allocation	$120,000	$57,000	$38,000	$25,000	$240,000

Overhead Allocation for Leather Bags

	Unit	Batch	Product	Facility	Total
Weight	60,000	3,500	600	1	
× Rate	$ 6	$ 38	$ 190	$25,000	
Allocation	$360,000	$133,000	$114,000	$25,000	$632,000

Total Cost of Each Product Line and Combined Cost

Type of Bag	Direct Materials	+	Direct Labor	+	Allocated Overhead	=	Total
Polyester	$210,000	+	$196,000	+	$240,000	=	$ 646,000
Leather	270,000	+	84,000	+	632,000	=	986,000
Total	$480,000	+	$280,000	+	$872,000	=	$1,632,000

Cost per Unit Computations Under ABC System

Type of Bag	Total Cost	÷	Units	=	Cost per Unit
Polyester	$ 646,000	÷	7,000	=	$ 92.29
Leather	986,000	÷	3,000	=	328.67
Total	$1,632,000				

Solution to Requirement c

The allocation method (ABC versus traditional costing) does not affect the total amount of cost to be allocated. Therefore, the total cost is the same using either method. However, the allocation method (ABC versus traditional costing) does affect the cost assigned to each product line. Since the ABC system more accurately traces costs to the products that cause the costs to be incurred, it provides a more accurate estimate of the true cost of making the products. The difference in the cost per unit using ABC versus traditional costing is significant. For example, the cost of the polyester bag was determined to be $145.20 using the traditional allocation method and $92.29 using ABC. This difference could have led Adventure to overprice the polyester bag, thereby causing the decline in sales volume. To the extent that ABC is more accurate, using it will improve pricing and other strategic decisions that significantly affect profitability.

KEY TERMS

Activities 207
Activity-based cost drivers 205
Activity-based costing (ABC) 207
Activity centers 207
Appraisal costs 216
Batch-level activities 209
Companywide allocation rate 204
Downstream costs 214
External failure costs 216
Facility-level activities 211
Failure costs 216
Internal failure costs 216
Prevention costs 216
Product-level activities 210
Quality 216
Quality cost report 218
Start-up (setup) costs 205
Strategic cost management 216
Target pricing 214
Total quality management (TQM) 218
Unit-level activities 208
Upstream costs 214
Volume-based cost drivers 205
Voluntary costs 216

QUESTIONS

1. Why did traditional costing systems base allocations on a single companywide cost driver?
2. Why are labor hours ineffective as a companywide allocation base in many industries today?
3. What is the difference between volume-based cost drivers and activity-based cost drivers?
4. Why do activity-based cost drivers provide more accurate allocations of overhead in an automated manufacturing environment?

5. When would it be appropriate to use volume-based cost drivers in an activity-based costing system?
6. Martinez Manufacturing makes two products, one of which is produced at a significantly higher volume than the other. The low-volume product consumes more of the company's engineering resources because it is technologically complex. Even so, the company's cost accountant chose to allocate engineering department costs based on the number of units produced. How could selecting this allocation base affect a decision about outsourcing engineering services for the low-volume product?
7. Briefly describe the activity-based costing allocation process.
8. Tom Rehr made the following comment: "Facility-level costs should not be allocated to products because they are irrelevant for decision-making purposes." Do you agree or disagree with this statement? Justify your response.
9. To facilitate cost tracing, a company's activities can be subdivided into four hierarchical categories. What are these four categories? Describe them and give at least two examples of each category.
10. Beth Nelson, who owns and runs a small sporting goods store, buys most of her merchandise directly from manufacturers. Ms. Nelson was shocked at the $7.50 charge for a container of three ping-pong balls. She found it hard to believe that it could have cost more than $1.00 to make the balls. When she complained to Jim Wilson, the marketing manager of the manufacturing company, he tried to explain that the cost also included companywide overhead costs. How could companywide overhead affect the cost of ping-pong balls?
11. If each patient in a hospital is considered a cost object, what are examples of unit-, batch-, product- and facility-level costs that would be allocated to this object using an activity-based costing system?
12. Milken Manufacturing has three product lines. The company's new accountant, Marvin LaSance, is responsible for allocating facility-level costs to these product lines. Mr. LaSance is finding the allocation assignment a daunting task. He knows there have been disagreements among the product managers over the allocation of facility costs, and he fears being asked to defend his method of allocation. Why would the allocation of facility-level costs be subject to disagreements?
13. Why would machine hours be an inappropriate allocation base for batch-level costs?
14. Alisa Kamuf's company has reported losses from operations for several years. Industry standards indicate that prices are normally set at 30 percent above manufacturing cost, which Ms. Kamuf has done. Assuming that her other costs are in line with industry norms, how could she continue to lose money while her competitors earn a profit?
15. Issacs Corporation produces two lines of pocket knives. The Arrowsmith product line involves very complex engineering designs; the Starscore product line involves relatively simple designs. Since its introduction, the low-volume Arrowsmith products have gained market share at the expense of the high-volume Starscore products. This pattern of sales has been accompanied by an overall decline in company profits. Why may the existing cost system be inadequate?
16. What is the relationship between activity-based management and just-in-time inventory?

MULTIPLE-CHOICE QUESTIONS

Multiple-choice questions are provided on the text website at www.mhhe.com/edmonds2011.

EXERCISES—SERIES A

All applicable Exercises in Series A are available with McGraw-Hill's *Connect Accounting*.

LO 3

Exercise 5-1A *Classifying the costs of unit-, batch-, product-, or facility-level activities*

Humphrey Manufacturing is developing an activity-based costing system to improve overhead cost allocation. One of the first steps in developing the system is to classify the costs of performing production activities into activity cost pools.

Required

Using your knowledge of the four categories of activities, classify the cost of each activity in the following list into unit-, batch-, product-, or facility-level cost pools.

Cost Activity	Cost Pool
a. Engineering product design	
b. Supplies	
c. Wages of maintenance staff	
d. Labeling and packaging	
e. Plant security	
f. Ordering materials for a specific type of product	
g. Wages of workers moving units of work between work stations	
h. Factorywide electricity	
i. Salary of a manager in charge of a product line	
j. Sales commissions	

Exercise 5-2A *Identifying appropriate cost drivers* LO 2

Required

Provide at least one example of an appropriate cost driver (allocation base) for each of the following activities.

a. Maintenance is performed on manufacturing equipment.
b. Sales commissions are paid.
c. Direct labor is used to change machine configurations.
d. Production equipment is set up for new production runs.
e. Engineering drawings are produced for design changes.
f. Purchase orders are issued.
g. Products are labeled, packaged, and shipped.
h. Machinists are trained on new computer-controlled machinery.
i. Lighting is used for production facilities.
j. Materials are unloaded and stored for production.

Exercise 5-3A *Classifying costs and identifying the appropriate cost driver* LO 2, 3

Fairfield Manufacturing incurred the following costs during 2011 to produce its high-quality precision instruments. The company used an activity-based costing system and identified the following activities.

1. Inspection of each batch produced.
2. Salaries of receiving clerks.
3. Setup for each batch produced.
4. Insurance on production facilities.
5. Depreciation on manufacturing equipment.
6. Materials handling.
7. Inventory storage.

Required

a. Classify each activity as a unit-level, batch-level, product-level, or facility-level activity.
b. Identify an appropriate cost driver (allocation base) for each activity.

Exercise 5-4A *Context-sensitive nature of activity classification* LO 3

Required

Describe a set of circumstances in which the cost of painting could be classified as a unit-level, a batch-level, a product-level, or a facility-level cost.

LO 3

Exercise 5-5A *Context-sensitive nature of activity classification*

Wayne Company makes two types of circuit boards. One is a high-caliber board designed to accomplish the most demanding tasks; the other is a low-caliber board designed to provide limited service at an affordable price. During its most recent accounting period, Wayne incurred $170,000 of inspection cost. When Wayne recently established an activity-based costing system, its activities were classified into four categories. Categories and appropriate cost drivers follow.

	Direct Labor Hours	Number of Batches	Number of Inspectors	Number of Square Feet
High caliber	3,000	20	3	30,000
Low caliber	14,000	20	2	70,000
Total	17,000	40	5	100,000

Required

Allocate the inspection cost between the two products assuming that it is driven by (a) unit-level activities, (b) batch-level activities, (c) product-level activities, or (d) facility-level activities. Note that each allocation represents a separate alternative. In other words, the $170,000 of inspection cost will be allocated four times, once for each cost driver.

LO 2, 3

Exercise 5-6A *Computing overhead rates based on different cost drivers*

Roebuck Industries produces two electronic decoders, P and Q. Decoder P is more sophisticated and requires more programming and testing than does Decoder Q. Because of these product differences, the company wants to use activity-based costing to allocate overhead costs. It has identified four activity pools. Relevant information follows.

Activity Pools	Cost Pool Total	Cost Driver
Repair and maintenance on assembly machine	$ 50,000	Number of units produced
Programming cost	84,000	Number of programming hours
Software inspections	6,000	Number of inspections
Product testing	8,000	Number of tests
Total overhead cost	$148,000	

Expected activity for each product follows.

	Number of Units	Number of Programming Hours	Number of Inspections	Number of Tests
Decoder P	20,000	2,000	190	1,400
Decoder Q	30,000	1,500	60	1,100
Total	50,000	3,500	250	2,500

Required

a. Compute the overhead rate for each activity pool.

b. Determine the overhead cost allocated to each product.

LO 1, 3

Exercise 5-7A *Comparing an ABC system with a traditional costing system*

Use the information in Exercise 5-6A to complete the following requirements. Assume that before shifting to activity-based costing, Roebuck Industries allocated all overhead costs based on direct labor hours. Direct labor data pertaining to the two decoders follow.

	Direct Labor Hours
Decoder P	15,000
Decoder Q	22,000
Total	37,000

Required

a. Compute the amount of overhead cost allocated to each type of decoder when using direct labor hours as the allocation base.

b. Determine the cost per unit for overhead when using direct labor hours as the allocation base and when using ABC.

c. Explain why the per unit overhead cost is lower for the high-volume product when using ABC.

Exercise 5-8A *Allocating costs with different cost drivers* LO 1, 3

Wykle Company produces commercial gardening equipment. Since production is highly automated, the company allocates its overhead costs to product lines using activity-based costing. The costs and cost drivers associated with the four overhead activity cost pools follow.

	Activities			
	Unit Level	**Batch Level**	**Product Level**	**Facility Level**
Cost	$50,000	$20,000	$10,000	$120,000
Cost driver	2,000 labor hrs.	40 setups	Percentage of use	12,000 units

Production of 800 sets of cutting shears, one of the company's 20 products, took 200 labor hours and 6 setups and consumed 15 percent of the product-sustaining activities.

Required

a. Had the company used labor hours as a companywide allocation base, how much overhead would it have allocated to the cutting shears?

b. How much overhead is allocated to the cutting shears using activity-based costing?

c. Compute the overhead cost per unit for cutting shears using first activity-based costing and then using direct labor hours for allocation if 800 units are produced. If direct product costs are $100 and the product is priced at 30 percent above cost (rounded to the nearest whole dollar), for what price would the product sell under each allocation system?

d. Assuming that activity-based costing provides a more accurate estimate of cost, indicate whether the cutting shears would be over- or underpriced if direct labor hours are used as an allocation base. Explain how over- or undercosting can affect Wykle's profitability.

e. Comment on the validity of using the allocated facility-level cost in the pricing decision. Should other costs be considered in a cost-plus pricing decision? If so, which ones? What costs would you include if you were trying to decide whether to accept a special order?

Exercise 5-9A *Allocating costs with different cost drivers* LO 2, 3

Swartz Publishing identified the following overhead activities, their respective costs, and their cost drivers to produce the three types of textbooks the company publishes.

		Type of Textbook		
Activity (Cost)	**Cost Driver**	**Deluxe**	**Moderate**	**Economy**
Machine maintenance ($240,000)	Number of machine hours	250	750	1,000
Setups ($420,000)	Number of setups	30	15	5
Packing ($108,000)	Number of cartons	10	30	50
Photo development ($336,000)	Number of pictures	4,000	2,000	1,000

Deluxe textbooks are made with the finest-quality paper, six-color printing, and many photographs. Moderate texts are made with three colors and a few photographs spread throughout each chapter. Economy books are printed in black and white and include pictures only in chapter openings.

Required

a. Swartz currently allocates all overhead costs based on machine hours. The company produced the following number of books during the prior year.

Deluxe	Moderate	Economy
50,000	150,000	200,000

Determine the overhead cost per book for each book type.

b. Determine the overhead cost per book, assuming that the volume-based allocation system described in Requirement *a* is replaced with an activity-based costing system.

c. Explain why the per-unit overhead costs determined in Requirements *a* and *b* differ.

LO 3

Exercise 5-10A *Computing product cost with given activity allocation rates*

Gamble Manufacturing produces two modems, one for laptop computers and the other for desktop computers. The production process is automated, and the company has found activity-based costing useful in assigning overhead costs to its products. The company has identified five major activities involved in producing the modems.

Activity	Allocation Base	Allocation Rate
Materials receiving & handling	Cost of material	2% of material cost
Production setup	Number of setups	$100.00 per setup
Assembly	Number of parts	$5.00 per part
Quality inspection	Inspection time	$1.50 per minute
Packing and shipping	Number of orders	$10.00 per order

Activity measures for the two kinds of modems follow.

	Labor Cost	Material Cost	Number of Setups	Number of Parts	Inspection Time	Number of Orders
Laptops	$1,260	$6,000	30	42	7,200 min.	65
Desktops	1,150	7,500	12	24	5,100 min.	20

Required

a. Compute the cost per unit of laptop and desktop modems, assuming that Gamble made 300 units of each type of modem.

b. Explain why laptop modems cost more to make even though they have less material cost and are smaller than desktop modems.

LO 3

Exercise 5-11A *Allocating facility-level costs and a product elimination decision*

Jacob Boards produces two kinds of skateboards. Selected unit data for the two boards for the last quarter follow.

	Basco Boards	Shimano Boards
Production costs		
Direct materials	$27	$36
Direct labor	$39	$51
Allocated overhead	$15	$18
Total units produced and sold	4,000	8,000
Total sales revenue	$336,000	$888,000

Jacob allocates production overhead using activity-based costing. It allocates delivery expense and sales commissions, which amount to $54,000 per quarter, to the two products equally.

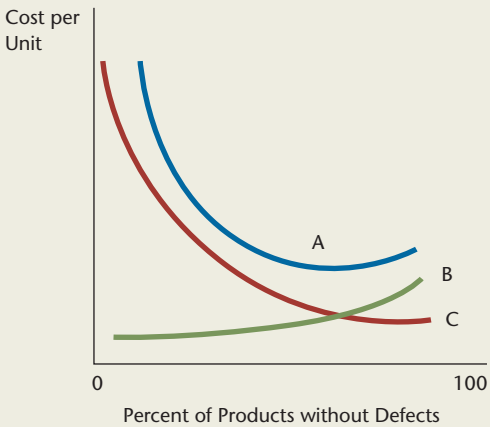
Required

a. Compute the net profit for each product.

b. Assuming that the overhead allocation for Basco boards includes $12,000 of facility-level costs, would you advise Jacob to eliminate these boards? (*Hint:* Consider the method used to allocate the delivery and selling expense.)

Exercise 5-12A *Quality cost components and relationships*

LO 4



Required

The preceding graph depicts the relationships among the components of total quality cost.

a. Label the lines identified as A, B, and C.

b. Explain the relationships depicted in the graph.

PROBLEMS—SERIES A

All applicable Problems in Series A are available with McGraw-Hill's *Connect Accounting.*

Problem 5-13A *Comparing an ABC system with a traditional costing system*

LO 1, 3

Peck Electronics produces video games in three market categories, commercial, home, and miniature. Peck has traditionally allocated overhead costs to the three products using the company-wide allocation base of direct labor hours. The company recently implemented an ABC system when it installed computer-controlled assembly stations that rendered the traditional costing system ineffective. In implementing the ABC system, the company identified the following activity cost pools and cost drivers.

Category	Total Pooled Cost	Types of Costs	Cost Driver
Unit	$720,000	Indirect labor wages, supplies, depreciation, machine maintenance	Machine hours
Batch	388,800	Materials handling, inventory storage, labor for setups, packaging, labeling and shipping, scheduling	Number of production orders
Product	211,200	Research and development	Time spent by research department
Facility	600,000	Rent, utilities, maintenance, admin. salaries, security	Square footage

CHECK FIGURES
b. Cost per unit:
Commercial: $58.90
Home: $50.21
Miniature: $79.47

Additional data for each of the product lines follow.

	Commercial	Home	Miniature	Total
Direct materials cost	$36.00/unit	$24.00/unit	$30.00/unit	—
Direct labor cost	$14.40/hour	$14.40/hour	$18.00/hour	—
Number of labor hours	6,000	12,000	2,000	20,000
Number of machine hours	10,000	45,000	25,000	80,000
Number of production orders	200	2,000	800	3,000
Research and development time	10%	20%	70%	100%
Number of units	15,000	45,000	14,000	74,000
Square footage	20,000	50,000	30,000	100,000

Required

a. Determine the total cost and cost per unit for each product line, assuming that overhead costs are allocated to each product line using direct labor hours as a companywide allocation base. Also determine the combined cost of all three product lines.

b. Determine the total cost and cost per unit for each product line, assuming that an ABC system is used to allocate overhead costs. Determine the combined cost of all three product lines.

c. Explain why the combined total cost computed in Requirements *a* and *b* is the same amount. Given that the combined cost is the same using either allocation method, why is an ABC system with many different allocation rates more accurate than a traditional system with a single companywide overhead rate?

LO 1, 3

Problem 5-14A *Effect of automation on overhead allocation*

CHECK FIGURES
b. Allocated costs:
Seasonal: $6,000
All-purpose: $84,000

Hewitt Rug Company makes two types of rugs, seasonal and all-purpose. Both types of rugs are hand-made, but the seasonal rugs require significantly more labor because of their decorative designs. The annual number of rugs made and the labor hours required to make each type of rug follow.

	Seasonal	All-Purpose	Totals
Number of rugs	1,200	2,800	4,000
Number of direct labor hours	120,000	168,000	288,000

Required

a. Assume that annual overhead costs total $72,000. Select the appropriate cost driver and determine the amount of overhead to allocate to each type of rug.

b. Hewitt automates the seasonal rug line resulting in a dramatic decline in labor usage, to make 1,200 rugs in only 12,000 hours. Hewitt continues to make the all-purpose rugs the same way as before. The number of rugs made and the labor hours required to make them after automation follow.

	Seasonal	All-Purpose	Totals
Number of rugs	1,200	2,800	4,000
Number of direct labor hours	12,000	168,000	180,000

Overhead costs are expected to increase to $90,000 as a result of the automation. Allocate the increased overhead cost to the two types of rugs using direct labor hours as the allocation base and comment on the appropriateness of the allocation.

LO 1, 3

Problem 5-15A *Using activity-based costing to improve allocation accuracy*

CHECK FIGURES
c. All-purpose: $13,759.20
Seasonal: $14,960.70

This problem is an extension of Problem 5-14A, which must be completed first.
Hewitt's accounting staff has disaggregated the $90,000 of overhead costs into the following items.

(1) Inspection costs	$ 32,000
(2) Setup costs	21,600
(3) Engineering costs	32,000
(4) Legal costs related to products	12,000
(5) Materials movement cost per batch	4,800
(6) Salaries of production supervisors	80,000
(7) Fringe benefit costs	16,000
(8) Utilities costs	8,000
(9) Plant manager's salary	48,000
(10) Depreciation on production equipment	72,000
(11) Depreciation on building	16,000
(12) Miscellaneous costs	10,000
(13) Indirect materials costs	5,600
(14) Production employee incentive costs	2,000
Total	$360,000

Required

a. Each of Hewitt's rug lines operates as a department. The all-purpose department occupies 6,000 square feet of floor space, and the seasonal department occupies 12,000 square feet of space. Comment on the validity of allocating the overhead costs by square footage.

b. Assume that the following additional information is available.

(1) Rugs are individually inspected.

(2) Hewitt incurs setup costs each time a new style of seasonal rug is produced. The seasonal rugs were altered nine times during the year. The manual equipment for all-purpose rugs is reset twice each year to ensure accurate weaving. The setup for the technical equipment used to weave seasonal rugs requires more highly skilled workers, but the all-purpose rugs require more manual equipment, thereby resulting in a *per setup* charge that is roughly equal for both types of rugs. Hewitt undertook 22 setups during the year, 18 of which applied to seasonal rugs and 4 that applied to all-purpose rugs.

(3) Ninety percent of the product-level costs can be traced to producing seasonal rugs.

(4) Six supervisors oversee the production of all-purpose rugs. Because seasonal rugs are made in an automated department, only two production supervisors are needed.

(5) Each rug requires an equal amount of indirect materials.

(6) Costs associated with production activities are assigned to six activity cost pools: (1) labor-related activities, (2) unit-level activities, (3) batch-level activities, (4) product-level supervisory activities, (5) other product-level activities, and (6) facility-level activities.

Organize the $360,000 of overhead costs into activity center cost pools and allocate the costs to the two types of rugs.

c. Assuming that 90 seasonal and 240 all-purpose rugs were made in January, determine the overhead costs that would be assigned to each of the two rug types for the month of January.

Problem 5-16A *Using activity-based costing to improve allocation accuracy*

LO 1, 3

CHECK FIGURES

a. Cost per student:
Computer-Assisted: $327
Classroom: $237

Soloman Academy, is a profit-oriented education business. Soloman provides remedial training for high school students who have fallen behind in their classroom studies. It charges its students $500 per course. During the previous year, Soloman provided instruction for 1,000 students. The income statement for the company follows.

Revenue	$ 400,000
Cost of instructors	(170,000)
Overhead costs	(85,000)
Net income	$ 145,000

The company president, Susan Doubleday, indicated in a discussion with the accountant, Merrill Archer, that she was extremely pleased with the growth in the area of computer-assisted

instruction. She observed that this department served 200 students using only two part-time instructors. In contrast, the classroom-based instructional department required 32 instructors to teach 800 students. Ms. Doubleday noted that the per-student cost of instruction was dramatically lower for the computer-assisted department. She based her conclusion on the following information.

Soloman pays its part-time instructors an average of $5,000 per year. The total cost of instruction and the cost per student are computed as follows.

Type of Instruction	Computer-Assisted	Classroom
Number of instructors (a)	2	32
Number of students (b)	200	800
Total cost (c = a × $5,000)	$10,000	$160,000
Cost per student (c ÷ b)	$50	$200

Assuming that overhead costs were distributed equally across the student population, Ms. Doubleday concluded that the cost of instructors was the critical variable in the company's capacity to generate profits. Based on her analysis, her strategic plan called for heavily increased use of computer-assisted instruction.

Mr. Archer was not so sure that computer-assisted instruction should be stressed. After attending a seminar on activity-based costing (ABC), he believed that the allocation of overhead cost could be more closely traced to the different types of learning activities. To facilitate an activity-based analysis, he developed the following information about the costs associated with computer-assisted versus classroom instructional activities. He identified $48,000 of overhead costs that were directly traceable to computer-assisted activities, including the costs of computer hardware, software, and technical assistance. He believed the remaining $37,000 of overhead costs should be allocated to the two instructional activities based on the number of students enrolled in each program.

Required

a. Based on the preceding information, determine the total cost and the cost per student to provide courses through computer-assisted instruction versus classroom instruction.

b. Comment on the validity of stressing growth in the area of computer-assisted instruction.

LO 1

Problem 5-17A *Key activity-based costing concepts*

Friar Paint Company makes paint in many different colors; it charges the same price for all of its paint regardless of the color. Recently, Friar's chief competitor cut the price of its white paint, which normally outsells any other color by a margin of 4 to 1. Friar's marketing manager requested permission to match the competitor's price. When Phillip Keaton, Friar's president, discussed the matter with Candice Smalley, the chief accountant, he was told that the competitor's price was below Friar's cost. Mr. Keaton responded, "If that's the case, then there is something wrong with our accounting system. I know the competition wouldn't sell below cost. Prepare a report showing me how you determine our paint cost and get back to me as soon as possible."

The next day, Ms. Smalley returned to Mr. Keaton's office and began by saying, "Determining the cost per gallon is a pretty simple computation. It includes $1.10 of labor, $3.10 of materials, and $4.00 of overhead for a total cost of $8.20 per gallon. The problem is that the competition is selling the stuff for $7.99 per gallon. They've got to be losing money."

Mr. Keaton then asked Ms. Smalley how she determined the overhead cost. She replied, "We take total overhead cost and divide it by total labor hours and then assign it to the products based on the direct labor hours required to make the paint." Mr. Keaton then asked what kinds of costs are included in the total overhead cost. Ms. Smalley said, "It includes the depreciation on the building and equipment, the cost of utilities, supervisory salaries, and interest. Just how detailed do you want me to go with this list?"

Mr. Keaton responded, "Keep going, I'll tell you when I've heard enough."

Ms. Smalley continued, "There is the cost of setups. Every time a color is changed, the machines have to be cleaned, the color release valves reset, a trial batch prepared, and color quality tested. Sometimes mistakes occur and the machines must be reset. In addition, purchasing and

handling the color ingredients must be accounted for as well as adjustments in the packaging department to change the paint cans and to mark the boxes to show the color change. Then . . ."

Mr. Keaton interrupted, "I think I've heard enough. We sell so much white paint that we run it through a separate production process. White paint is produced continuously. There are no shutdowns and setups. White uses no color ingredients. So why are these costs being assigned to our white paint production?"

Ms. Smalley replied, "Well, sir, these costs are just a part of the big total that is allocated to all of the paint, no matter what color it happens to be."

Mr. Keaton looked disgusted and said, "As I told you yesterday, Ms. Smalley, something is wrong with our accounting system!"

Required

a. Explain what the terms *overcost* and *undercost* mean. Is Friar's white paint over- or undercosted?

b. Explain what the term *companywide overhead rate* means. Is Friar using a companywide overhead rate?

c. Explain how Friar could improve the accuracy of its overhead cost allocations.

Problem 5-18A *Pricing decisions made with ABC system cost data*

LO 3

eXcel

CHECK FIGURES

a. Cost per unit:
Tennis Racquet: $64.71
Badminton Racquet: $65.67

Morello Sporting Goods Corporation makes two types of racquets, tennis and badminton. The company uses the same facility to make both products even though the processes are quite different. The company has recently converted its cost accounting system to activity-based costing. The following are the cost data that June Searight, the cost accountant, prepared for the third quarter of 2011 (during which Morello made 70,000 tennis racquets and 30,000 badminton racquets).

Direct Cost	Tennis Racquet (TR)	Badminton Racquet (BR)
Direct materials	$18 per unit	$14 per unit
Direct labor	32 per unit	26 per unit

Category	Estimated Cost	Cost Driver	Amount of Cost Driver
Unit level	$ 750,000	Number of inspection hours	TR: 15,000 hours; BR: 10,000 hours
Batch level	250,000	Number of setups	TR: 80 setups; BR: 45 setups
Product level	150,000	Number of TV commercials	TR: 4; BR: 1
Facility level	650,000	Number of machine hours	TR: 30,000 hours; BR: 35,000 hours
Total	$1,800,000		

Inspectors are paid according to the number of actual hours worked, which is determined by the number of racquets inspected. Engineers who set up equipment for both products are paid monthly salaries. TV commercial fees are paid at the beginning of the quarter. Facility-level cost includes depreciation of all production equipment.

Required

a. Compute the cost per unit for each product.

b. If management wants to price badminton racquets 30 percent above cost, what price should the company set?

c. The market price of tennis racquets has declined substantially because of new competitors entering the market. Management asks you to determine the minimum cost of producing tennis racquets in the short term. Provide that information.

Problem 5-19A *Target pricing and target costing with ABC*

LO 3

Heisler Cameras, Inc., manufactures two models of cameras. Model ZM has a zoom lens; Model DS has a fixed lens. Heisler uses an activity-based costing system. The following are the relevant cost data for the previous month.

CHECK FIGURES

a. Cost per unit:
ZM: $124.84
DS: $51.43

Direct Cost per Unit	Model ZM	Model DS
Direct materials	$20	$10
Direct labor	28	12

Category	Estimated Cost	Cost Driver	Use of Cost Driver
Unit level	$ 27,000	Number of units	ZM: 2,400 units; DS: 9,600 units
Batch level	50,000	Number of setups	ZM: 25 setups; DS: 25 setups
Product level	90,000	Number of TV commercials	ZM: 15; DS: 10
Facility level	300,000	Number of machine hours	ZM: 500 hours; DS: 1,000 hours
Total	$467,000		

Heisler's facility has the capacity to operate 4,500 machine hours per month.

Required

a. Compute the cost per unit for each product.

b. The current market price for products comparable to Model ZM is $135 and for DS is $47. If Heisler sold all of its products at the market prices, what was its profit or loss for the previous month?

c. A market expert believes that Heisler can sell as many cameras as it can produce by pricing Model ZM at $130 and Model DS at $45. Heisler would like to use those estimates as its target prices and have a profit margin of 20 percent of target prices. What is the target cost for each product?

d. Is there any way for the company to reach its target costs?

LO 3

eXcel

Problem 5-20A *Cost management with an ABC system*

CHECK FIGURES

b. Cost per unit:
Diamond: $92.40
Gold: $58.83

Fazel Chairs, Inc., makes two types of chairs. Model Diamond is a high-end product designed for professional offices. Model Gold is an economical product designed for family use. Irene Fazel, the president, is worried about cut-throat price competition in the chairs market. Her company suffered a loss last quarter, an unprecedented event in its history. The company's accountant prepared the following cost data for Ms. Fazel.

Direct Cost per Unit	Model Diamond (D)	Model Gold (G)
Direct materials	$20 per unit	$10 per unit
Direct labor	$18/hour × 2 hours production time	$18/hour × 1 hour production time

Category	Estimated Cost	Cost Driver	Use of Cost Driver
Unit level	$ 300,000	Number of units	D: 15,000 units; G: 35,000 units
Batch level	750,000	Number of setups	D: 104 setups; G: 146 setups
Product level	450,000	Number of TV commercials	D: 5; G: 10
Facility level	500,000	Number of machine hours	D: 1,500 hours; G: 3,500 hours
Total	$2,000,000		

The market price for office chairs comparable to Model Diamond is $118 and to Model Gold is $73.

Required

a. Compute the cost per unit for both products.

b. Judson Regland, the chief engineer, told Ms. Fazel that the company is currently making 150 units of Model Diamond per batch and 245 units of Model Gold per batch. He

suggests doubling the batch sizes to cut the number of setups in half, thereby reducing the setup cost by 50 percent. Compute the cost per unit for each product if Ms. Fazel adopts his suggestion.

c. Is there any side effect if Ms. Fazel increases the production batch size by 100 percent?

Problem 5-21A *Assessing a quality control strategy* LO 4, 5

The following quality cost report came from the records of Nelson Company.

	2011		2010	
	Amount	Percentage	Amount	Percentage
Prevention costs				
Engineering and design	$136,000	13.74%	$ 58,000	3.86%
Training and education	34,000	3.43	12,000	0.80
Depreciation on prevention equipment	58,000	5.86	30,000	1.99
Incentives and awards	88,000	8.89	40,000	2.66
Total prevention	316,000	31.92%	140,000	9.31%
Appraisal costs				
Inventory inspection	50,000	5.05	50,000	3.32
Reliability testing	32,000	3.23	30,000	1.99
Testing equipment (depreciation)	22,000	2.22	24,000	1.60
Supplies	14,000	1.41	16,000	1.06
Total appraisal	118,000	11.92%	120,000	7.98%
Internal failure costs				
Scrap	48,000	4.85	80,000	5.32
Repair and rework	98,000	9.90	220,000	14.63
Downtime	24,000	2.42	40,000	2.66
Reinspection	8,000	0.81	24,000	1.60
Total internal failure	178,000	17.98%	364,000	24.20%
External failure cost				
Warranty repairs and replacement	220,000	22.22	520,000	34.57
Freight	48,000	4.85	100,000	6.65
Customer relations	56,000	5.66	120,000	7.98
Restocking and packaging	54,000	5.45	140,000	9.31
Total external failure	378,000	38.18%	880,000	58.51%
Grand total	$990,000	100.00%	$1,504,000	100.00%

Required

a. Explain the strategy that Nelson Company initiated to control its quality costs.

b. Indicate whether the strategy was successful or unsuccessful in reducing quality costs.

c. Explain how the strategy likely affected customer satisfaction.

EXERCISES—SERIES B

Exercise 5-1B *Classifying the costs of unit-, batch-, product-, or facility-level activities* LO 3

Tucker Manufacturing is developing an activity-based costing system to improve overhead cost allocation. One of the first steps in developing the system is to classify the costs of performing production activities into activity cost pools.

Required

Using the four-tier cost hierarchy described in the chapter, classify each of the following costs into unit-level, batch-level, product-level, or facility-level cost pools.

Cost Activity	Cost Pool
a. Wages of assembly line workers	
b. Product design costs	
c. Materials requisition costs for a particular work order	
d. Security guard wages	
e. Lubricant for machines	
f. Parts used to make a particular product	
g. Machine setup cost	
h. Salary of the plant manager's secretary	
i. Factory depreciation	
j. Advertising costs for a particular product	

LO 2

Exercise 5-2B *Identifying appropriate cost drivers*

Required

Provide at least one example of an appropriate cost driver (allocation base) for each of the following activities.

a. Workers count completed goods before moving them to a warehouse.
b. A logistics manager runs a computer program to determine the materials release schedule.
c. Janitors clean the factory floor after workers have left.
d. Mechanics apply lubricant to machines.
e. Engineers design a product production layout.
f. Engineers set up machines to produce a product.
g. The production supervisor completes the paperwork initiating a work order.
h. The production manager prepares materials requisition forms.
i. Workers move materials from the warehouse to the factory floor.
j. Assembly line machines are operated.

LO 2, 3

Exercise 5-3B *Classifying costs and identifying the appropriate cost driver*

Astro Corporation, a furniture manufacturer, uses an activity-based costing system. It has identified the following selected activities:

1. Incurring property taxes on factory buildings.
2. Incurring paint cost for furniture produced.
3. Setting up machines for a particular batch of production.
4. Inspecting wood prior to using it in production.
5. Packaging completed furniture in boxes for shipment.
6. Inspecting completed furniture for quality control.
7. Purchasing TV time to advertise a particular product.

Required

a. Classify each activity as a unit-level, batch-level, product-level, or facility-level activity.
b. Identify an appropriate cost driver (allocation base) for each of the activities.

LO 3

Exercise 5-4B *Understanding the context-sensitive nature of classifying activities*

Required

Describe a set of circumstances in which labor cost could be classified as a unit-level, a batch-level, a product-level, or a facility-level cost.

LO 3

Exercise 5-5B *Understanding the context-sensitive nature of classifying activities*

Mauldin Company makes two types of cell phones. Handy is a thin, pocket-size cell phone that is easy to carry around. Action is a palm-size phone convenient to hold while the user is talking.

During its most recent accounting period, Mauldin incurred $150,000 of quality-control costs. Recently Mauldin established an activity-based costing system, which involved classifying its activities into four categories. The categories and appropriate cost drivers follow.

	Direct Labor Hours	Number of Batches	Number of Engineers	Number of Square Feet
Handy	26,000	38	10	37,000
Action	24,000	22	5	83,000
Totals	50,000	60	15	120,000

Mauldin uses direct labors hours to allocate unit-level activities, number of batches to allocate batch-level activities, number of engineers to allocate product-level activities, and number of square feet to allocate facility-level activities.

Required

Allocate the quality-control cost between the two products, assuming that it is driven by (a) unit-level activities, (b) batch-level activities, (c) product-level activities, and (d) facility-level activities. Note that each allocation represents a separate allocation. In other words, the $300,000 of quality-control costs will be allocated four times, once for each cost driver.

Exercise 5-6B *Computing overhead rates based on different costing drivers* LO 2, 3

Chase Industries produces two surge protectors: VC620 with six outlets and PH630 with eight outlets and two telephone line connections. Because of these product differences, the company plans to use activity-based costing to allocate overhead costs. The company has identified four activity pools. Relevant information follows.

Activity Pools	Cost Pool Total	Cost Driver
Machine setup	$120,000	Number of setups
Machine operation	300,000	Number of machine hours
Quality control	48,000	Number of inspections
Packaging	32,000	Number of units
Total overhead cost	$500,000	

Expected activity for each product follows.

	Number of Setups	Number of Machine Hours	Number of Inspections	Number of Units
VC620	48	1,400	78	25,000
PH630	72	2,600	172	15,000
Total	120	4,000	250	40,000

Required

a. Compute the overhead rate for each activity pool.

b. Determine the overhead cost allocated to each product.

Exercise 5-7B *Comparing an ABC system with a traditional cost system* LO 1, 3

Use the information in Exercise 5-6B to complete the following requirements. Assume that before shifting to activity-based costing, Chase Industries allocated all overhead costs based on direct labor hours. Direct labor data pertaining to the two surge protectors follow.

	Direct Labor Hours
VC620	16,000
PH630	9,000
Total	25,000

Required

a. Compute the amount of overhead cost allocated to each type of surge protector when using direct labor hours as the allocation base.

b. Determine the cost per unit for overhead when using direct labor hours as the allocation base and when using ABC.

c. Explain why the per unit overhead cost is lower for the higher-volume product when using ABC.

LO 1, 2, 3

Exercise 5-8B *Allocating costs with different cost drivers*

Rigsby Sporting Goods, Inc., produces indoor treadmills. The company allocates its overhead costs using activity-based costing. The costs and cost drivers associated with the four overhead activity cost pools follow.

Activities	Unit Level	Batch Level	Product Level	Facility Level
Cost	$500,000	$250,000	$150,000	$450,000
Cost driver	12,500 labor hours	50 setups	Percentage of use	15,000 units

Producing 5,000 units of PFT200, one of the company's five products, took 4,000 labor hours, 25 setups, and consumed 30 percent of the product-sustaining activities.

Required

a. Had the company used labor hours as a companywide allocation base, how much overhead would it have allocated to the 5,000 units of PFT200?

b. How much overhead is allocated to the 5,000 PFT200 units using activity-based costing?

c. Compute the overhead cost per unit for PFT200 using activity-based costing and direct labor hours if 5,000 units are produced. If direct product costs are $120 and PFT200 is priced at 20 percent above cost (rounded to the nearest whole dollar), compute the product's selling price under each allocation system.

d. Assuming that activity-based costing provides a more accurate estimate of cost, indicate whether PFT200 would be over- or underpriced if Rigsby uses direct labor hours as the allocation base. Explain how over- or undercosting can affect Rigsby's profitability.

e. Comment on the validity of using the allocated facility-level costs in the pricing decision. Should other costs be considered in a cost-plus pricing decision? If so, which ones? What costs would you include if you were trying to decide whether to accept a special order?

LO 2, 3

Exercise 5-9B *Allocating costs with different cost drivers*

Talton Shoes Corporation produces three brands of shoes, Brisk, Pro, and Runner. Relevant information about Talton overhead activities, their respective costs, and their cost drivers follows.

Overhead Costs	Cost Driver	Brisk	Pro	Runner
Fringe benefits ($360,000)	Labor hours	10,000	20,000	20,000
Setups ($200,000)	Number of setups	15	25	10
Packing costs ($40,000)	Number of cartons	200	300	300
Quality control ($300,000)	Number of tests	120	200	80

Required

a. Talton currently allocates all overhead costs based on labor hours. The company produced the following numbers of pairs of shoes during the prior year.

Brisk	Pro	Runner
10,000	15,000	20,000

Determine the overhead cost per pair of shoes for each brand.

b. Determine the overhead cost per pair of shoes for each brand, assuming that the volume-based allocation system described in Requirement *a* is replaced with an activity-based costing system.

c. Explain why the per pair overhead costs determined in Requirements *a* and *b* differ.

Exercise 5-10B *Computing product cost with given activity allocation rates* LO 3

Using automated production processes, Stegall Videos produces two kinds of digital camcorders: N100 for the novice and D200 for the hobbyist. The company has found activity-based costing useful in assigning overhead costs to its products. It has identified the following five major activities involved in producing the camcorders.

Activity	Allocation Base	Allocation Rate
Materials receiving and handling	Cost of materials	3% of materials cost
Production setup	Number of setups	$800 per setup
Assembly	Number of parts	$10 per part
Quality inspection	Inspection time	$25 per minute
Packing and shipping	Number of orders	$80 per order

Activity measures for the two kinds of camcorders follow.

	Labor Cost*	Materials Cost*	Number of Setups	Number of Parts	Inspection Time	Number of Orders
N100	$225,000	$125,000	10	10,000	800 min.	25
D200	150,000	150,000	25	10,000	4,800 min.	50

*Both are direct costs.

Required

a. Compute the cost per unit of N100 and D200, assuming that Stegall made 1,000 units of N100 and 500 units of D200.

b. Explain why the D200 camcorders cost more to make although their direct costs are less than those for the N100 camcorders.

Exercise 5-11B *Allocating facility-level costs and a product elimination decision* LO 3

Adgar Corporation produces two types of juice that it packages in cases of 24 cans per case. Selected per case data for the two products for the last month follow.

	Orange Juice	Tomato Juice
Production costs		
Direct material	$2.25	$1.50
Direct labor	$1.50	$2.25
Allocated overhead	$2.25	$3.00
Total cases produced and sold	25,000	15,000
Total sales revenue	$210,000	$127,500

Adgar allocates production overhead using activity-based costing but allocates monthly packaging expense, which amounted to $60,000 last month, to the two products equally.

Required

a. Compute the net profit for each product.

b. Assuming that the overhead allocation for the tomato juice includes $30,000 of facility-level costs, would you advise Adgar to eliminate this product? (*Hint:* Consider the method used to allocate the monthly packaging expense.)

LO 4

Exercise 5-12B *Applying concepts of quality cost management*

Lucas Weldon, the president of Easeley Industries, Inc., was beaming when he was reviewing the company's quality cost report. After he had implemented a quality-control program for three years, the company's defect rate had declined from 20 percent to 3 percent. Mr. Weldon patted Kenyata Terry, the production manager, on her back and said: "You have done a great job! I plan to reward you for your hard work. However, I want the defects to disappear completely before I promote you to the position of executive vice president. So, zero-defect is going to be your personal goal for the coming year." Ms. Terry responded wearily, "I'm not sure that's really a good idea."

Required

Write a memorandum to the president explaining that zero defect is not a practical policy.

PROBLEMS—SERIES B

LO 1, 3

Problem 5-13B *Comparing an ABC system with a traditional costing system*

Since its inception, Ray Laboratory, has produced a single product, Product S109. With the advent of automation, the company added the technological capability to begin producing a second product, Product N227. Because of the success of Product N227, manufacturing has been shifting toward its production. Sales of Product N227 are now 50 percent of the total annual sales of 20,000 units, and the company is optimistic about the new product's future sales growth. One reason the company is excited about the sales potential of its new product is that the new product's gross profit margin is higher than that of Product S109. Management is thrilled with the new product's initial success but concerned about the company's declining profits since the product's introduction. Suspecting a problem with the company's costing system, management hires you to investigate.

In reviewing the company's records, product specifications, and manufacturing processes, you discover the following information.

1. The company is in an extremely competitive industry in which markups are low and accurate estimates of cost are critical to success.
2. Product N227 has complex parts that require more labor, machine time, setups, and inspections than Product S109.
3. Budgeted costs for direct materials and labor follow.

Direct Cost per Unit	Product S109	Product N227
Direct materials	$25	$25
Direct labor	$10/hour × 2 hours production time	$10/hour × 2.8 hours production time

4. The company presently allocates overhead costs to its products based on direct labor hours. After carefully studying the company's overhead, you identify four different categories of overhead costs. Using your knowledge of this company and similar companies in the same industry, you estimate the total costs for each of these categories and identify the most appropriate cost driver for measuring each product's overhead consumption. Detailed information for each cost category follows.

Category	Estimated Cost	Cost Driver	Use of Cost Driver
Unit level	$ 540,000	Number of machine hours	S109: 20,000 hours; N227: 60,000 hours
Batch level	228,000	Number of machine setups	S109: 1,500; N227: 3,500
Product level	180,000	Number of inspections	S109: 200; N227: 600
Facility level	60,000	Equal percentage for products	S109: 50%; N227: 50%
Total	$1,008,000		

Required

a. Determine the predetermined overhead rate the company is using.
b. Compute the amount of overhead the company assigns to each product using this rate.
c. Determine the cost per unit and total cost of each product when overhead is assigned based on direct labor hours.
d. To remain competitive, the company prices its products at only 20 percent above cost. Compute the price for each product with this markup.
e. Compute the overhead rate for each category of activity.
f. Determine the amount of overhead cost, both in total and per unit, that would be assigned to each product if the company switched to activity-based costing.
g. Assuming that prices are adjusted to reflect activity-based costs, determine the revised price for each product.
h. Based on your results for Requirements *f* and *g*, explain why Product N227 costs more to make than previously apparent and why sales prices therefore need to be adjusted.

Problem 5-14B *Using activity-based costing to improve allocation accuracy* LO 1, 3

Kelvin's Commemoratives makes and sells two types of decorative plates. One plate displays a hand-painted image of Princess Diana; the other plate displays a machine-pressed image of Marilyn Monroe. The Diana plates require 25,000 hours of direct labor to make; the Monroe plates require only 5,000 hours of direct labor. Overhead costs are composed of (1) $210,000 machine-related activity costs including indirect labor, utilities, and depreciation and (2) $150,000 labor-related activity costs including overtime pay, fringe benefits, and payroll taxes.

Required

a. Assuming that Kelvin's uses direct labor hours as the allocation base, determine the amount of the total $240,000 overhead cost that would be allocated to each type of plate.
b. Explain why using direct labor hours may distort the allocation of overhead cost to the two products.
c. Explain how activity-based costing could improve the accuracy of the overhead cost allocation.

Problem 5-15B *Using activity-based costing to improve allocation accuracy* LO 1, 3

This problem is an extension of Problem 5-14B, which must be completed first.
Assume the same data as in Problem 5-14B with the following additional information. The hours of machine time for processing plates are 1,000 for Diana plates and 2,500 for Monroe plates.

Required

a. Establish two activity centers, one for machine-related activities and the second for labor-related activities. Assign the total overhead costs to the two activity centers.
b. Allocate the machine-related overhead costs to each product based on machine hours.
c. Allocate the labor-related overhead costs to each product based on direct labor hours.
d. Draw a diagram that compares the one-stage allocation method used in Problem 5-14B with the two-stage activity-based costing approach used in this problem.

LO 1, 3

Problem 5-16B *Using activity-based costing to improve business decisions*

Wattson CPA and Associates is a local accounting firm specializing in bookkeeping and tax services. The firm has four certified public accountants who supervise 20 clerks. The clerks handle basic bookkeeping jobs and prepare tax return drafts. The CPAs review and approve the bookkeeping jobs and tax returns. Each CPA receives a fixed salary of $7,500 per month; the clerks earn an hourly rate of $18. Because the clerks are paid by the hour and their work hours can be directly traced to individual jobs, their wages are considered direct costs. The CPAs' salaries are not traced to individual jobs and are therefore treated as indirect costs. The firm allocates overhead based on direct labor hours. The following is Wattson's income statement for the previous month.

	Bookkeeping	Tax	Total
Revenues	$70,000	$70,000	$140,000
Direct expenses	(22,500)*	(22,500)*	(45,000)
Indirect supervisory expenses	(15,000)	(15,000)	(30,000)
Net income	$32,500	$32,500	$ 65,000

*1,250 clerical hours were used in each category during the previous month.

Loretta Wattson, CPA and chief executive officer, is not sure that the two operations are equally profitable as the income statement indicates. First, she believes that most of the CPAs' time was spent instructing clerks in tax return preparation. The bookkeeping jobs appear to be routine, and most of the clerks can handle them with little supervision. After attending a recent professional development seminar on activity-based costing (ABC), Ms. Wattson believes that the allocation of indirect costs can be more closely traced to different types of services. To facilitate an activity-based analysis, she asked the CPAs to document their work hours on individual jobs for the last week. The results indicate that, on average, 25 percent of the CPAs' hours was spent supervising bookkeeping activities and the remaining 75 percent was spent supervising tax activities.

Required

a. Based on the preceding information, reconstruct the income statement for bookkeeping services, tax services, and the total, assuming that Wattson revises its allocation of indirect supervisory costs based on ABC.

b. Comment on the results and recommend a new business strategy.

LO 1

Problem 5-17B *Key activity-based costing concepts*

Yoder Boot and Shoe Company makes hand-sewn boots and shoes. Yoder uses a companywide overhead rate based on direct labor hours to allocate indirect manufacturing costs to its products. Making a pair of boots normally requires 2.4 hours of direct labor, and making a pair of shoes requires 1.8 hours. The company's shoe division, facing increased competition from international companies that have access to cheap labor, has responded by automating its shoe production. The reengineering process was expensive, requiring the purchase of manufacturing equipment and the restructuring of the plant layout. In addition, utility and maintenance costs increased significantly for operating the new equipment. Even so, labor costs decreased significantly. Now making a pair of shoes requires only 18 minutes of direct labor. As predicted, the labor savings more than offset the increase in overhead cost, thereby reducing the total cost to make a pair of shoes. The company experienced an unexpected side effect, however; according to the company's accounting records, the cost to make a pair of boots increased although the manufacturing process in the boot division was not affected by the reengineering of the shoe division. In other words, the cost of boots increased although Yoder did not change anything about the way it makes them.

Required

a. Explain why the accounting records reflected an increase in the cost to make a pair of boots.
b. Explain how the companywide overhead rate could result in the underpricing of shoes.
c. Explain how activity-based costing could improve the accuracy of overhead cost allocations.

Problem 5-18B *Pricing decisions made with ABC system cost data* LO 3

Pittman Furniture Corporation makes two types of dining tables, Elegance for formal dining and Comfort for casual dining, at its single factory. With the economy beginning to experience a recession, Justin Pittman, the president, is concerned about whether the company can stay in business as market prices fall. At Mr. Pittman's request, Yamini Sing, the controller, prepared cost data for analysis.

Inspectors are paid according to the number of actual hours worked, determined by the number of tables inspected. Engineers, who set up equipment for both products, are paid monthly salaries. TV commercial fees are paid at the beginning of the quarter.

Direct Cost	Elegance (E)	Comfort (C)
Direct materials	$50 per unit	$30 per unit
Direct labor	$36 per hour × 1.5 hours production time	$36 per hour × 1 hour production time

Category	Estimated Cost	Cost Driver	Use of Cost Driver
Product inspection	$120,000	Number of units	E: 2,500 units; C: 7,500 units
Machine setups	75,000	Number of setups	E: 23 setups; C: 27 setups
Product advertising	210,000	Number of TV commercials	E: 5; C: 9
Facility depreciation	405,000	Number of machine hours	E: 5,000 hours; C: 5,000 hours
Total	$810,000		

Required

a. Compute the cost per unit for each product.
b. If management wants to make 30 percent of cost as a profit margin for Elegance, what price should the company set?
c. The market price of tables in the Comfort class has declined because of the recession. Management asks you to determine the minimum cost of producing Comfort tables in the short term. Provide that information.

Problem 5-19B *Target pricing and target costing with ABC* LO 3

Ricardo Corporation manufactures two models of watches. Model Wonder displays cartoon characters and has simple features designed for kids. Model Marvel has sophisticated features such as dual time zones and an attached calculator. Ricardo's product design team has worked with a cost accountant to prepare a budget for the two products for the next fiscal year as follows.

Direct Cost	Wonder (W)	Marvel (M)
Direct materials	$10 per unit	$20 per unit
Direct labor	$40/hour × 0.3 hour production time	$40/hour × 0.7 hour production time

Category	Estimated Cost	Cost Driver	Use of Cost Driver
Materials handling	$366,000	Number of parts	W: 700,000; M: 520,000
Machine setups	180,000	Number of setups	W: 50; M: 40
Product testing	28,000	Number of units tested	W: 1,000; M: 400
Facility depreciation	360,000	Number of machine hours	W: 3,200; M: 4,000
Total	$934,000		

Wonder watches have 35 parts, and Marvel watches have 65 parts. The budget calls for producing 20,000 units of Wonder and 8,000 units of Marvel. Ricardo tests 5 percent of its products for quality assurance. It sells all its products at market prices.

Required

a. Compute the cost per unit for each product.

b. The current market price for products comparable to Wonder is $43 and for products comparable to Marvel is $115. What will Ricardo's profit or loss for the next year be?

c. Ricardo likes to have a 25 percent profit margin based on the current market price for each product. What is the target cost for each product? What is the total target profit?

d. The president of Ricardo has asked the design team to refine the production design to bring down the product cost. After a series of redesigns, the team recommends a new process that requires purchasing a new machine that costs $400,000 and has five years of useful life and no salvage value. With the new process and the new machine, Ricardo can decrease the number of machine setups to four for each product and cut the cost of materials handling in half. The machine hours used will be 4,500 for Wonder and 6,500 for Marvel. Does this new process enable Ricardo to achieve its target costs?

LO 3

Problem 5-20B *Cost management with an ABC system*

Hayne Corporation manufactures two different coffee makers, Professional for commercial use and Home for family use. Dwight Hayne, the president, recently received complaints from some members of the board of directors about the company's failure to reach the expected profit of $200,000 per month. Mr. Hayne is, therefore, under great pressure to improve the company's bottom line. Under his direction, Alicia Meek, the controller, prepared the following monthly cost data for Mr. Hayne.

Direct Cost	Professional (P)	Home (H)
Direct materials	$25 per unit	$9 per unit
Direct labor	$16 per hour × 0.8 hour production time	$16 per hour × 0.3 hour production time

Category	Estimated Cost	Cost Driver	Use of Cost Driver
Product inspection	$ 60,000	Number of units	P: 15,000 units; H: 45,000 units
Machine setups	15,000	Number of setups	P: 30 setups; H: 45 setups
Product promotion	200,000	Number of TV commercials	P: 10; H: 10
Facility depreciation	295,000	Number of machine hours	P: 7,160 hours; H: 4,640 hours
Total	$570,000		

The market price for coffee makers comparable to Professional is $65 and to Home is $22. The company's administrative expenses amount to $125,000.

Required

a. Compute the cost per unit for both products.

b. Determine the company's profit or loss.

c. Charlie Chen, the marketing manager, recommends that the company implement a focused marketing strategy. He argues that advertisements in trade journals would be more effective for the commercial market than on TV. In addition, the cost of journal ads would be only $21,000. He also proposes sending discount coupons to targeted households to reach a broad market base. The coupons program would cost $72,000. Compute the new cost of each product, assuming that Mr. Hayne replaces TV advertising with Mr. Chen's suggestions.

d. Determine the company's profit or loss using the information in Requirement *c*.

Problem 5-21B *Assessing a quality control strategy*

LO 4, 5

Carl Wallace, the president of Ritch Plastic Company, is a famous cost cutter in the plastics industry. Two years ago, he accepted an offer from Ritch's board of directors to help the company cut costs quickly. In fact, Mr. Wallace's compensation package included a year-end bonus tied to the percentage of cost decrease over the preceding year. On February 12, 2012, Mr. Wallace received comparative financial information for the two preceding years. He was especially interested in the results of his cost-cutting measures on quality control. The quality report shown below was extracted from the company's financial information.

Required

a. Explain the strategy that Mr. Wallace initiated to control Ritch's costs.

b. Indicate whether the strategy was successful or unsuccessful in reducing quality costs.

c. Explain how the strategy will likely affect the company's business in the long term.

	2011		2010	
	Amount	Percentage	Amount	Percentage
Prevention costs				
Engineering and design	$ 65,000	6.57%	$ 69,000	7.39%
Training and education	26,000	2.63	76,000	8.14
Depreciation on prevention equipment	15,000	1.51	15,000	1.60
Incentives and awards	20,000	2.02	20,000	2.14
Total prevention	126,000	12.73%	180,000	19.27%
Appraisal costs				
Product and materials inspection	33,000	3.33	73,000	7.82
Reliability testing	27,000	2.73	67,000	7.17
Testing equipment (depreciation)	38,000	3.83	38,000	4.07
Supplies	10,000	1.01	16,000	1.71
Total appraisal	108,000	10.90%	194,000	20.77%
Internal failure costs				
Scrap	52,000	5.25	120,000	12.85
Repair and rework	46,000	4.65	150,000	16.06
Downtime	64,000	6.46	40,000	4.28
Reinspection	8,000	0.81	24,000	2.57
Total internal failure	170,000	17.17%	334,000	35.76%
External failure cost				
Warranty repairs and replacement	347,000	35.05	125,000	13.38
Freight	75,000	7.58	31,000	3.32
Customer relations	45,000	4.55	28,000	3.00
Restocking and packaging	119,000	12.02	42,000	4.50
Total external failure	586,000	59.20%	226,000	24.20%
Grand total	$990,000	100.00%	$934,000	100.00%

ANALYZE, THINK, COMMUNICATE

ATC 5-1 Business Applications Case *Using ABC to improve product pricing*

Drilling Innovations, Inc., produces specialized cutting heads used by companies that drill for oil and natural gas. The company has recently implemented an ABC system for three of its products and is interested in evaluating its effectiveness before converting to an ABC system for all products. To perform this evaluation, the company compiled data for the three products using both the traditional system and the new ABC system. The traditional system used a single driver (machine hours). The ABC system uses a variety of cost drivers related to the activities used to produce the cutting heads. The three products involved in the trial run of the ABC system were GS-157, HS-241, and OS-367. The following data relate to these products; unit data have been rounded to the nearest penny.

Product	Selling Price per Unit	Units Produced	Total Costs Allocated: Traditional Costing	Cost per Unit: Traditional Costing	Total Cost Allocated: ABC	Costs per Unit: ABC
GS-157	$19.30	120,000	$1,600,000	$13.33	$1,500,000	$12.50
HS-241	17.50	90,000	1,100,000	12.22	1,050,000	11.67
OS-367	15.10	40,000	400,000	10.00	550,000	13.75
Totals			$3,100,000		$3,100,000	

Required

a. Determine the gross profit margin for each product produced based on the ABC data [(Selling price − ABC cost per unit) × Units produced].

b. Determine the gross profit margin for each product produced based on the traditional costing data [(Selling price − Traditional cost per unit) × Units produced].

c. Provide an explanation as to why the cost of OS-367 may have increased under the ABC system while the cost of GS-157 decreased.

d. Suggest what action management might take with respect to the discoveries resulting from the ABC versus traditional costing analysis. Assume that Drilling Innovations expects to produce a gross profit margin on each product of at least 30 percent of the selling price.

ATC 5-2 Group Assignment *Using ABC in a service business*

A dialysis clinic provides two types of treatment for its patients. Hemodialysis (HD), an in-house treatment, requires that patients visit the clinic three times each week for dialysis treatments. Peritoneal dialysis (PD) permits patients to self-administer their treatments at home on a daily basis. On average, the clinic serves 102 HD patients and 62 PD patients. A recent development caused clinic administrators to develop a keen interest in cost measurement for the two separate services. Managed care plans such as HMOs began to pay treatment providers a fixed payment per insured participant regardless of the level of services provided by the clinic. With fixed fee revenues, the clinic was forced to control costs to ensure profitability. As a result, knowing the cost to provide HD versus PD services was critically important for the clinic. It needed accurate cost measurements to answer the following questions. Were both services profitable, or was one service carrying the burden of the other service? Should advertising be directed toward acquiring HD or PD patients? Should the clinic eliminate HMO service?

Management suspected the existing cost allocation system was inaccurate in measuring the true cost of providing the respective services; it had been developed in response to Medicare reporting requirements. It allocated costs between HD and PD based on the ratio of cost to charges (RCC). In other words, RCC allocates indirect costs in proportion to revenues. To illustrate, consider the allocation of $883,280 of indirect nursing services costs, which are allocated to the two treatment groups in relation to the revenue generated by each group.

Given that the clinic generated total revenue of $3,006,775, an allocation rate of 0.2937633 per revenue dollar was established ($883,280 ÷ $3,006,775). This rate was multiplied by the proportionate share of revenue generated by each service category to produce the following allocation.

Type of Service	Service Revenue	×	Allocation Rate	=	Allocated Cost
HD	$1,860,287	×	0.2937633	=	$546,484
PD	1,146,488	×	0.2937633	=	336,796
Total	$3,006,775	×	0.2937633	=	$883,280

To better assess the cost of providing each type of service, the clinic initiated an activity-based costing (ABC) system. The ABC approach divided the nursing service cost into four separate cost pools. A separate cost driver (allocation base) was identified for each cost pool. The cost pools and their respective cost drivers follow.

	Total	HD	PD
Nursing services cost pool categories			
RNs	$239,120	?	?
LPNs	404,064	?	?
Nursing administration and support staff	115,168	?	?
Dialysis machine operations (tech. salaries)	124,928	?	?
Total	$883,280	?	?

	Total	HD	PD
Activity cost drivers (corresponding to cost pools)			
Number of RNs	7	5	2
Number of LPNs	19	15	4
Number of treatments (nursing administration)	34,967	14,343	20,624
Number of dialyzer treatments (machine operations)	14,343	14,343	0

Data Source: T. D. West and D. A. West, "Applying ABC to Healthcare," *Management Accounting,* February 1999, pp. 22–33.

Required

a. Organize the class into four sections and divide the sections into groups of four or five students each. Assign Task 1 to the first section of groups, Task 2 to the second section, Task 3 to the third section, and Task 4 to the fourth section.

Group Tasks

(1) Allocate the RN cost pool between the HD and PD service centers.

(2) Allocate the LPN cost pool between the HD and PD service centers.

(3) Allocate the nursing administration and support staff cost pool between the HD and PD service centers.

(4) Allocate the dialysis machine operations cost pool between the HD and PD service centers.

b. Have the class determine the total cost to allocate to the two service centers in the following manner. Select a representative from each section and have the selected person go to the board. Each representative should supply the allocated cost for the cost pool assigned by her respective section. The instructor should total the amounts and compare the ABC cost allocations with those developed through the traditional RCC system.

c. The instructor should lead the class in a discussion that addresses the following questions.

(1) Assuming that the ABC system provides a more accurate measure of cost, which service center (HD or PD) is overcosted by the traditional allocation system and which is undercosted?

(2) What is the potential impact on pricing and profitability for both service centers?

(3) How could management respond to the conditions described in the problem?

ATC 5-3 Research Assignment *Evaluating external failure costs with real world data*


The federal government maintains a website devoted to providing information about product recalls. To complete this assignment you will need to obtain information from this site as follows:

Go to recalls.gov

Click on the Consumer Products tab at the top of the screen

Click on CPSC Recalls—Home

Use the "Find Recalls by" month and year options to look up information about the following recalls that occurred in November 2009:

- Maclaren USA Recalls to Repair Strollers Following Fingertip Amputations, and
- Infant Entrapment and Suffocation Prompts Stork Craft to Recall . . .

Required

For each of these two recalls:

a. Explain why the product was recalled.

b. Who was most responsible for the problem that resulted in the recall?

c. Who will be negatively affected by the faulty product?

d. What are the external failure costs related to the faulty product? Describe the nature of these costs; you will not be able to identify dollar amounts.

e. At what point in the pre-sale process could steps have been taken to prevent the faulty product from being produced and/or sold?

ATC 5-4 Writing Assignment *Assessing a strategy to control quality cost*

Lucy Sawyer, who owns and operates Sawyer Toy Company, is a perfectionist. She believes literally in the "zero-defects" approach to quality control. Her favorite saying is, "You can't spend too much on quality." Even so, in 2010 her company experienced an embarrassing breach of quality that required the national recall of a defective product. She vowed never to repeat the experience and instructed her staff to spend whatever it takes to ensure that products are delivered free of defects in 2011. She was somewhat disappointed with the 2011 year-end quality cost report shown here.

	2010	2011
Prevention costs	$120,000	$ 80,000
Appraisal costs	240,000	430,000
Internal failure costs	140,000	560,000
External failure cost	320,000	210,000
Total	$820,000	$1,280,000

Although external failure costs had declined, they remained much higher than expected. The increased inspections had identified defects that were corrected, thereby avoiding another recall; however, the external failure costs were still too high. Ms. Sawyer responded by saying, "We will have to double our efforts." She authorized hiring additional inspectors and instructed her production supervisors to become more vigilant in identifying and correcting errors.

Required

Assume that you are the chief financial officer (CFO) of Sawyer Toy Company. Ms. Sawyer has asked you to review the company's approach to quality control. Prepare a memo to her that

evaluates the existing approach, and recommend changes in expenditure patterns that can improve profitability as well as increase the effectiveness of the quality control system.

ATC 5-5 Ethical Dilemma *Conflicts between controlling cost and providing social responsibility to patients*

This case examines potential ethical issues faced by the dialysis clinic described in ATC 5-2. It is, however, an independent case that students may study in conjunction with or separately from ATC 5-2. The dialysis clinic provides two types of treatment for its patients. Hemodialysis (HD), an in-house treatment, requires patients to visit the clinic three times each week. Peritoneal dialysis (PD) permits patients to self-administer their treatments at home on a daily basis. The clinic serves a number of HMO patients under a contract that limits collections from the HMO insurer to a fixed amount per patient. As a result, the clinic's profitability is directly related to its ability to control costs. To illustrate, assume that the clinic is paid a fixed annual fee of $15,000 per HMO patient served. Also assume that the current cost to provide health care averages $14,000 a year per patient, resulting in an average profitability of $1,000 per patient ($15,000 − $14,000). Because the revenue base is fixed, the only way the clinic can increase profitability is to lower its average cost of providing services. If the clinic fails to control costs and the average cost of patient care increases, profitability will decline. A recent ABC study suggests that the cost to provide HD service exceeds the amount of revenue generated from providing that service. The clinic is profitable because PD services generate enough profit to more than make up for losses on HD services.

Required

Respond to each potential scenario described here. Each scenario is independent of the others.

a. Suppose that as a result of the ABC analysis, the chief accountant, a certified management accountant (CMA), recommends that the clinic discontinue treating HD patients referred by the HMO provider. Based on this assumption, answer the following questions.

  (1) Assume that the clinic is located in a small town. If it discontinues treating the HD patients, they will be forced to drive 50 miles to the nearest alternative treatment center. Does the clinic have a moral obligation to society to continue to provide HD service although it is not profitable to do so?

  (2) The accountant's recommendation places profitability above the needs of HD patients. Does this recommendation violate any of the standards of ethical conduct described in Chapter 1, Exhibit 1.15?

b. Assume that the clinic continues to treat HD patients referred by HMOs. However, to compensate for the loss incurred on these patients, the clinic raises prices charged to non-HMO patients. Is it fair to require non-HMO patients to subsidize services provided to the HMO patients?

c. Suppose that the clinic administrators respond to the ABC data by cutting costs. The clinic overbooks HMO patients to ensure that downtime is avoided when cancellations occur. It reduces the RN nursing staff and assigns some of the technical work to less-qualified assistants. Ultimately, an overworked, underqualified nurse's aide makes a mistake, and a patient dies. Who is at fault—the HMO, the accountant who conducted the ABC analysis, or the clinic administrators who responded to the ABC information?

ATC 5-6 Spreadsheet Assignment *Using Excel*

Tameron Corporation produces video games in three market categories: commercial, home line, and miniature handheld. Tameron has traditionally allocated overhead costs to the three product categories using the companywide base of direct labor hours. The company recently switched to an ABC system when it installed computer-controlled assembly stations that rendered the traditional costing system ineffective. In implementing the ABC system, the company identified the cost pools and drivers shown in the following spreadsheet. The activity in each of the three product lines appears in rows 3 to 9. The pooled costs are shown in cells E11 to E15.

Required

Construct a spreadsheet like the following one to compute the total cost and cost per unit for each product line. Cells K4 to K9, G12 to I15, E19 to E28, G19 to G28, I19 to I28, and K26 should all be formulas.

Microsoft Excel - ch05-working.xls

Chapter 5 - Working with Excel — Name:

b)

Driver	Commercial	Home Line	Miniature	Total
Labor hours	5,000	11,000	4,000	20,000
Machine hours	13,000	44,000	23,000	80,000
# Production orders	340	1,800	860	3,000
R&D time	15%	18%	67%	100%
Units	14,000	44,000	17,000	75,000
Sq. footage	20,000	50,000	30,000	100,000

Cost type	Pooled Cost	Total Activity	Pool Rate	
Unit level	$ 620,000	80,000	$ 7.75	per mh
Batch level	327,000	3,000	$ 109.00	per order
Product level	185,000	100%	$ 185,000	times %
Facility level	530,000	100,000	$ 5.30	per sq. ft.
	$1,662,000			

Product Cost:	Commercial	Home Line	Miniature	Total
Direct materials cost	$30 $ 420,000	$20 $ 880,000	$25 $ 425,000	
Direct labor cost	12 60,000	12 132,000	15 60,000	
Allocated overhead				
Unit-level	100,750	341,000	178,250	
Batch-level	37,060	196,200	93,740	
Product-level	27,750	33,300	123,950	
Facility-level	106,000	265,000	159,000	
Total cost	$ 751,560	$1,847,500	$1,039,940	$3,639,000
Cost per unit	$ 53.68	$ 41.99	$ 61.17	

Sheet1 / Sheet2 / Sheet3 — Ready — NUM

ATC 5-7 Spreadsheet Assignment *Mastering Excel*

Beasley Company makes three types of exercise machines. Data have been accumulated for four possible overhead drivers. Data for these four possible drivers are shown in rows 3 to 7 of the following spreadsheet.

Required

Construct a spreadsheet that will allocate overhead and calculate unit cost for each of these alternative drivers. A screen capture of the spreadsheet and data follows.

Microsoft Excel - ch05-mastering.xls

Chapter 5 - Mastering Excel — Name:

Possible Drivers	Standard	Deluxe	Grand	Total
1 Unit	10,000	15,000	20,000	45,000
2 Setup	100	500	400	1,000
3 Machine hour	20,000	45,000	60,000	125,000
4 Labor hour	4,000	9,000	16,000	29,000

Determine the effect of different cost drivers on overhead allocated and the resulting cost per unit.
To change the cost driver, insert the appropriate number (1-4) from the list above in cell B15.

Overhead Rate:

$$1 \times \frac{\text{Overhead cost}}{\text{Units}} = \frac{\$500{,}000}{45{,}000} = \$\ 11.11 \text{ per unit}$$

Cost	Standard	Deluxe	Grand	Total
Direct Materials	$ 12,000	$ 36,000	$ 80,000	$ 128,000
Direct Labor	800	4,000	3,200	8,000
Allocated Overhead	111,111	166,667	222,222	500,000
Total	$ 123,911	$ 206,667	$ 305,422	$ 636,000
Cost per unit	$ 12.39	$ 13.78	$ 15.27	

Sheet1 / Sheet2 / Sheet3 — Ready — NUM

Spreadsheet Tips

1. This spreadsheet uses a function called *vertical lookup.* This function can pull the appropriate values from a table. The form of this function is =VLOOKUP (value, table, column#). In this example, the table is in cells B4 to K7. Three examples of the use of VLOOKUP follow.
2. Cell C15 is =VLOOKUP (B15, B4:K7, 2). This function operates by using the one (1) in cell B15 to look up a value in the table. Notice that the table is defined as B4:K7 and that the function is looking up the value in the second column, which is Units.
3. Cell E15 is =VLOOKUP (B15, B4:K7, 10). In this case, the function is looking up the value in the tenth column, which is 45,000. Be sure to count empty columns.
4. Cell E20 is =VLOOKUP (B15, B4:K7, 4)*G15. In this case, the function is looking up the value in the fourth column, which is $10,000. Be sure to count empty columns.
5. Cells I15, G20, and I20 also use the VLOOKUP function.
6. After completing the spreadsheet, you can change the value in cell B15 (1-4) to see the effect of choosing a different driver for overhead.

COMPREHENSIVE PROBLEM

To this point we have assumed the Magnificent Modems produced only one type of modem. Suppose instead we assume the company produces several different kinds of modems. The production process differs for each type of product. Some require more setup time than others, they are produced in different batch sizes, and they require different amounts of indirect labor (supervision). Packaging and delivery to customers also differs for each type of modem. Even so, Magnificent Modems uses a single allocation base (number of units) to allocate overhead costs.

Required

Write a brief memo that explains how Magnificent Modems could benefit from an ABC costing system.