

## CHAPTER 4

# Cost Accumulation, Tracing, and Allocation

### LEARNING OBJECTIVES

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

- 1 Identify cost objects and cost drivers.
- 2 Distinguish direct costs from indirect costs.
- 3 Allocate indirect costs to cost objects.
- 4 Select appropriate cost drivers for allocating indirect costs.
- 5 Allocate costs to solve timing problems.
- 6 Explain the benefits and detriments of allocating pooled costs.
- 7 Allocate joint product costs.
- 8 Recognize the effects of cost allocation on employee motivation.
- 9 Allocate service department costs to operating departments (Appendix).

### CHAPTER OPENING

What does it cost? This is one of the questions most frequently asked by business managers. Managers must have reliable cost estimates to price products, evaluate performance, control operations, and prepare financial statements. As this discussion implies, managers need to know the cost of many different things. The things we are trying to determine the cost of are commonly called **cost objects**. For example, if we are trying to determine the cost of operating a department, that department is the cost object. Cost objects may be products, processes, departments, services, activities, and so on. This chapter explains techniques managerial accountants use to determine the cost of a variety of cost objects.

## The Curious Accountant

A former patient of a California hospital complained about being charged \$7 for a single aspirin tablet. After all, an entire bottle of 100 aspirins can be purchased at the local pharmacy store for around \$2.

Can you think of any reasons, other than shameless profiteering, that a hospital would need to charge \$7 for an aspirin? Remember that the hospital is not just selling the aspirin; it is also delivering it to the patient. (Answer on page 159.)



## LO 1

Identify cost objects and cost drivers.



## DETERMINE THE COST OF COST OBJECTS

Accountants use **cost accumulation** to determine the cost of a particular object. Suppose the Atlanta Braves advertising manager wants to promote a Tuesday night ball game by offering free baseball caps to all children who attend. What would be the promotion cost? The team's accountant must *accumulate* many individual costs and add them together. For simplicity consider only three cost components: (1) the cost of the caps, (2) the cost of advertising the promotion, and (3) the cost of an employee to work on the promotion.

Cost accumulation begins with identifying the cost objects. The primary cost object is the cost of the promotion. Three secondary cost objects are (1) the cost of caps, (2) the cost of advertising, and (3) the cost of labor. The costs of the secondary cost objects are combined to determine the cost of the primary cost object.

Determining the costs of the secondary cost objects requires identifying what *drives* those costs. A **cost driver** has a *cause-and-effect* relationship with a cost object. For example, the *number of caps* (cost driver) has an effect on the *cost of caps* (cost object). The *number of advertisements* is a cost driver for the *advertising cost* (cost object); the *number of labor hours* worked is a cost driver for the *labor cost* (cost object). Using the following assumptions about unit costs and cost drivers, the accumulated cost of the primary cost object (cost of the cap promotion) is:

Cost Object	Cost Per Unit	×	Cost Driver	=	Total Cost of Object
Cost of caps	\$2.50	×	4,000 Caps	=	\$10,000
Cost of advertising	\$100.00	×	50 Advertisements	=	5,000
Cost of labor	\$8.00	×	100 Hours	=	800
Cost of cap promotion					<u>\$15,800</u>

The Atlanta Braves should run the promotion if management expects it to produce additional revenues exceeding \$15,800.

### Estimated versus Actual Cost

The accumulated cost of the promotion—\$15,800—is an *estimate*. Management cannot know *actual* costs and revenues until after running the promotion. While actual information is more accurate, it is not relevant for deciding whether to run the promotion because the decision must be made before the actual cost is known. Managers must accept a degree of inaccuracy in exchange for the relevance of timely information. Many business decisions are based on estimated rather than actual costs.

Managers use cost estimates to set prices, bid on contracts, evaluate proposals, distribute resources, plan production, and set goals. Certain circumstances, however, require actual cost data. For example, published financial reports and managerial performance evaluations use actual cost data. Managers frequently accumulate both estimated and actual cost data for the same cost object. For example, companies use cost estimates to establish goals and use actual costs to evaluate management performance in meeting those goals. The following discussion provides a number of business examples that use estimated data, actual data, or a combination of both.

## ASSIGNMENT OF COSTS TO OBJECTS IN A RETAIL BUSINESS



Exhibit 4.1 displays the January income statement for In Style, Inc. (ISI), a retail clothing store. ISI subdivides its operations into women's, men's, and children's departments. To encourage the departmental managers to maximize sales, ISI began

paying the manager of each department a bonus based on a percentage of departmental sales revenue.

Although the bonus incentive increased sales revenue, it also provoked negative consequences. The departmental managers began to argue over floor space; each manager wanted more space to display merchandise. The managers reduced prices; they increased sales commissions. In the drive to maximize sales, the managers ignored the need to control costs. To improve the situation, the store manager decided to base future bonuses on each department's contribution to profitability rather than its sales revenue.

## IDENTIFYING DIRECT AND INDIRECT COSTS

The new bonus strategy requires determining the cost of operating each department. Each department is a separate *cost object*. Assigning costs to the departments (cost objects) requires **cost tracing** and **cost allocation**. *Direct costs* can be easily traced to a cost object. *Indirect costs* cannot be easily traced to a cost object. Whether or not a cost is easily traceable requires *cost/benefit analysis*.

Some of ISI's costs can be easily traced to the cost objects (specific departments). The cost of goods sold is an example of an easily traced cost. Price tags on merchandise can be coded so cash register scanners capture the departmental code for each sale. The cost of goods sold is not only easily traceable but also very useful information. Companies need cost of goods sold information for financial reporting (income statement and balance sheet) and for management decisions (determining inventory reorder points, pricing strategies, and cost control). Because the cost of tracing *cost of goods sold* is small relative to the benefits obtained, cost of goods sold is a *direct cost*.

In contrast, the cost of supplies (shopping bags, sales slips, pens, staples, price tags) used by each department is much more difficult to trace. How could the number of staples used to seal shopping bags be traced to any particular department? The sales staff could count the number of staples used, but doing so would be silly for the benefits obtained. Although tracing the cost of supplies to each department may be possible, it is not worth the effort of doing so. The cost of supplies is therefore an *indirect cost*. Indirect costs are also called **overhead costs**.

Direct and indirect costs can be described as follows:

**Direct costs** can be traced to cost objects in a *cost-effective* manner.  
**Indirect costs** cannot be traced to objects in a *cost-effective* manner.

By analyzing the accounting records, ISI's accountant classified the costs from the income statement in Exhibit 4.1 as direct or indirect, as shown in Exhibit 4.2. The next paragraph explains the classifications.

All figures represent January costs. Items 1 through 4 are direct costs, traceable to the cost objects in a cost-effective manner. Cost of goods sold is traced to departments at the point of sale using cash register scanners. Sales commissions are based on a percentage of departmental sales and are therefore easy to trace to the departments. Departmental managers' salaries are also easily traceable to the departments. Equipment, furniture, and fixtures are tagged with department codes that permit tracing depreciation charges directly to specific departments. Items 5 through 8 are incurred on behalf of the company as a whole and are therefore not directly traceable to a specific department.

LO 2

Distinguish direct costs from indirect costs.

### EXHIBIT 4.1

#### Income Statement

#### IN STYLE, INC.

#### Income Statement

For the Month Ended January 31

Sales	\$360,000
Cost of goods sold	(216,000)
Gross margin	144,000
Sales commissions	(18,000)
Dept. managers' salaries	(12,000)
Store manager's salary	(9,360)
Depreciation	(16,000)
Rental fee for store	(18,400)
Utilities	(2,300)
Advertising	(7,200)
Supplies	(900)
Net income	<u>\$ 59,840</u>

**EXHIBIT 4.2****Income Statement Classification of Costs**

Cost Item	Direct Costs			Indirect Costs
	Women's	Men's	Children's	
1. Cost of goods sold—\$216,000	\$120,000	\$58,000	\$38,000	
2. Sales commissions—\$18,000	9,500	5,500	3,000	
3. Dept. managers' salaries—\$12,000	5,000	4,200	2,800	
4. Depreciation—\$16,000	7,000	5,000	4,000	
5. Store manager's salary				\$ 9,360
6. Rental fee for store				18,400
7. Utilities				2,300
8. Advertising				7,200
9. Supplies				900
Totals	<u>\$141,500</u>	<u>\$72,700</u>	<u>\$47,800</u>	<u>\$38,160</u>

Although Item 9 could be traced to specific departments, the cost of doing so would exceed the benefits. The cost of supplies is therefore also classified as indirect.

### Cost Classifications—Independent and Context Sensitive

Whether a cost is direct or indirect is independent of whether it is fixed or variable. In the ISI example, both cost of goods sold and the cost of supplies vary relative to sales volume (both are variable costs), but cost of goods sold is direct and the cost of supplies is indirect. Furthermore, the cost of rent and the cost of depreciation are both fixed relative to sales volume, but the cost of rent is indirect and the cost of depreciation is direct. In fact, the very same cost can be classified as direct or indirect, depending on the cost object. The store manager's salary is not directly traceable to a specific department, but it is traceable to a particular store. As these examples demonstrate, cost classification depends on the context in which the costs occur.

## ALLOCATING INDIRECT COSTS TO OBJECTS

### LO 3

Allocate indirect costs to cost objects.

**Common costs** support multiple cost objects, but cannot be directly traced to any specific object. In the case of In Style, Inc., the cost of renting the store (common cost) supports the women's, men's, and children's departments (cost objects). The departmental managers may shirk responsibility for the rental cost by claiming that others higher up the chain of command are responsible. Responsibility can be motivated at the departmental level by assigning (*allocating*) a portion of the total rental cost to each department.

To accomplish appropriate motivation, authority must accompany responsibility. In other words, the departmental managers should be held responsible for a portion of rental cost only if they are able to exercise some degree of control over that cost. For example, if managers are assigned a certain amount of the rental cost for each square foot of space they use, they should have the authority to establish the size of the space used by their departments. **Controllable costs** are costs that can be influenced by a manager's decisions and actions. The controllability concept is discussed in more detail in Chapter 9.

**Cost allocation** involves dividing a total cost into parts and assigning the parts to designated cost objects. How should ISI allocate the \$38,160 of indirect costs to each of the three departments? First, identify a cost driver for each cost to be allocated. For example, there is a cause-and-effect relationship between store size and rent cost;

## REALITY BYTES

How does **Southwest Airlines** know the cost of flying a passenger from Houston, Texas, to Los Angeles, California? The fact is that Southwest does not know the actual cost of flying particular passengers anywhere. There are many indirect costs associated with flying passengers. Some of these include the cost of planes, fuel, pilots, office buildings, and ground personnel. Indeed, besides insignificant food and beverage costs, there are few costs that could be traced directly to customers. Southwest and other airlines are forced to use allocation and averaging to determine the estimated cost of providing transportation services to customers. Estimated rather than actual cost is used for decision-making purposes.

Consider that in its 2008 annual report Southwest reported the average operating expenses of flying one passenger one mile (called a *passenger mile*) were 10.2¢. However, this number was based on 103.3 billion “available passenger miles.” In 2008 Southwest operated at 71.2 percent of capacity, not 100 percent, so it was only able to charge passengers for 73.5 billion passenger miles. Thus, its average operating expenses were closer to 14.4¢ for each mile for which they were able to charge. Had they operated at a higher capacity, their average costs would have been lower.



the larger the building, the higher the rent cost. This relationship suggests that the more floor space a department occupies, the more rent cost that department should bear. To illustrate, assume ISI’s store capacity is 23,000 square feet and the women’s, men’s, and children’s departments occupy 12,000, 7,000, and 4,000 square feet, respectively. ISI can achieve a rational allocation of the rent cost using the following two-step process.<sup>1</sup>

**Step 1.** Compute the *allocation rate* by dividing the *total cost to be allocated* (\$18,400 rental fee) by the *cost driver* (23,000 square feet of store space). *The cost driver is also called the allocation base.* This computation produces the **allocation rate**, as follows:

$$\begin{array}{rclcl} \text{Total cost to be allocated} & \div & \text{Cost driver (allocation base)} & = & \text{Allocation rate} \\ \$18,400 \text{ rental fee} & \div & 23,000 \text{ square feet} & = & \$0.80 \text{ per} \\ & & & & \text{square foot} \end{array}$$

**Step 2.** Multiply the *allocation rate* by the *weight of the cost driver* (weight of the base) to determine the allocation *per cost object*, as follows:

Cost Object	Allocation Rate	×	Number of Square Feet	=	Allocation per Cost Object
Women’s department	\$0.80	×	12,000	=	\$ 9,600
Men’s department	0.80	×	7,000	=	5,600
Children’s department	0.80	×	4,000	=	3,200
Total			<u>23,000</u>		<u>\$18,400</u>

<sup>1</sup>Other mathematical approaches achieve the same result. This text consistently uses the two-step method described here. Specifically, the text determines allocations by (1) computing a *rate* and (2) multiplying the *rate* by the *weight of the base* (cost driver).

It is also plausible to presume utilities cost is related to the amount of floor space a department occupies. Larger departments will consume more heating, lighting, air conditioning, and so on than smaller departments. Floor space is a reasonable cost driver for utility cost. Based on square footage, ISI can allocate utility cost to each department as follows:

**Step 1.** Compute the allocation rate by dividing the total cost to be allocated (\$2,300 utility cost) by the cost driver (23,000 square feet of store space):

$$\text{Total cost to be allocated} \div \text{Cost driver} = \text{Allocation rate}$$

$$\text{\$2,300 utility cost} \div \text{23,000 square feet} = \text{\$0.10 per square foot}$$

**Step 2.** Multiply the *allocation rate* by the *weight of the cost driver* to determine the allocation *per cost object*:

Cost Object	Allocation Rate	×	Number of Square Feet	=	Allocation per Cost Object
Women's department	\$0.10	×	12,000	=	\$1,200
Men's department	0.10	×	7,000	=	700
Children's department	0.10	×	4,000	=	400
Total			<u>23,000</u>		<u>\$2,300</u>

### CHECK YOURSELF 4.1

HealthCare, Inc., wants to estimate the cost of operating the three departments (Dermatology, Gynecology, and Pediatrics) that serve patients in its Health Center. Each department performed the following number of patient treatments during the most recent year of operation: Dermatology, 2,600; Gynecology, 3,500; and Pediatrics, 6,200. The annual salary of the Health Center's program administrator is \$172,200. How much of the salary cost should HealthCare allocate to the Pediatrics Department?

#### Answer

**Step 1** Compute the *allocation rate*.

$$\text{Total cost to be allocated} \div \text{Cost driver (patient treatments)} = \text{Allocation rate}$$

$$\text{\$172,200 salary cost} \div (\text{2,600} + \text{3,500} + \text{6,200}) = \text{\$14 per patient treatment}$$

**Step 2** Multiply the *allocation rate* by the *weight of the cost driver* (weight of the base) to determine the allocation *per cost object*.

Cost Object	Allocation Rate	×	No. of Treatments	=	Allocation per Cost Object
Pediatrics department	\$14	×	6,200	=	\$86,800

## SELECTING A COST DRIVER

Companies can frequently identify more than one cost driver for a particular indirect cost. For example, ISI's shopping bag cost is related to both the *number of sales transactions* and the *volume of sales dollars*. As either of these potential cost drivers increases, shopping bag usage also increases. The most useful cost driver is the one with the strongest cause-and-effect relationship.

### LO 4

Select appropriate cost drivers for allocating indirect costs.

Consider shopping bag usage for T-shirts sold in the children’s department versus T-shirts sold in the men’s department. Assume ISI studied T-shirt sales during the first week of June and found the following:

Department	Children’s	Men’s
Number of sales transactions	120	92
Volume of sales dollars	\$1,440	\$1,612

Given that every sales transaction uses a shopping bag, the children’s department uses far more shopping bags than the men’s department even though it has a lower volume of sales dollars. A reasonable explanation for this circumstance is that children’s T-shirts sell for less than men’s T-shirts. The number of sales transactions is the better cost driver because it has a stronger cause-and-effect relationship with shopping bag usage than does the volume of sales dollars. Should ISI therefore use the number of sales transactions to allocate supply cost to the departments? Not necessarily.

The *availability of information* also influences cost driver selection. While the number of sales transactions is the more accurate cost driver, ISI could not use this allocation base unless it maintains records of the number of sales transactions per department. If the store tracks the volume of sales dollars but not the number of transactions, it must use dollar volume even if the number of transactions is the better cost driver. For ISI, sales volume in dollars appears to be the best *available* cost driver for allocating supply cost.

Assuming that sales volume for the women’s, men’s, and children’s departments was \$190,000, \$110,000, and \$60,000, respectively, ISI can allocate the supplies cost as follows:

**Step 1.** Compute the allocation rate by dividing the total cost to be allocated (\$900 supplies cost) by the cost driver (\$360,000 total sales volume):

$$\begin{aligned} \text{Total cost to be allocated} \div \text{Cost driver} &= \text{Allocation rate} \\ \$900 \text{ supplies cost} \div \$360,000 \text{ sales volume} &= \$0.0025 \text{ per sales dollar} \end{aligned}$$

**Step 2.** Multiply the allocation rate by the weight of the cost driver to determine the allocation per cost object:

Cost Object	Allocation Rate	×	Sales Volume	=	Allocation per Cost Object
Women’s department	\$0.0025	×	\$190,000	=	\$475
Men’s department	0.0025	×	110,000	=	275
Children’s department	0.0025	×	60,000	=	150
Total			<u>\$360,000</u>		<u>\$900</u>

ISI believes sales volume is also the appropriate allocation base for advertising cost. The sales generated in each department were likely influenced by the general advertising campaign. ISI can allocate advertising cost as follows:

**Step 1.** Compute the allocation rate by dividing the total cost to be allocated (\$7,200 advertising cost) by the cost driver (\$360,000 total sales volume):

$$\begin{aligned} \text{Total cost to be allocated} \div \text{Cost driver} &= \text{Allocation rate} \\ \$7,200 \text{ advertising cost} \div \$360,000 \text{ sales volume} &= \$0.02 \text{ per sales dollar} \end{aligned}$$



**Step 2.** Multiply the allocation rate by the weight of the cost driver to determine the allocation per cost object:

Cost Object	Allocation Rate	×	Sales Volume	=	Allocation per Cost Object
Women's department	\$0.02	×	\$190,000	=	\$3,800
Men's department	0.02	×	110,000	=	2,200
Children's department	0.02	×	<u>60,000</u>	=	<u>1,200</u>
Total			<u>\$360,000</u>		<u>\$7,200</u>

There is no strong cause-and-effect relationship between the store manager's salary and the departments. ISI pays the store manager the same salary regardless of sales level, square footage of store space, number of labor hours, or any other identifiable variable. Because no plausible cost driver exists, ISI must allocate the store manager's salary arbitrarily. Here the manager's salary is simply divided equally among the departments as follows:

**Step 1.** Compute the allocation rate by dividing the total cost to be allocated (\$9,360 manager's monthly salary) by the allocation base (number of departments):

$$\text{Total cost to be allocated} \div \text{Cost driver} = \text{Allocation rate}$$

$$\text{\$9,360 store manager's salary} \div \text{3 departments} = \text{\$3,120 per department}$$

**Step 2.** Multiply the allocation rate by the weight of the cost driver to determine the allocation per cost object:

Cost Object	Allocation Rate	×	Number of Departments	=	Allocation per Cost Object
Women's department	\$3,120	×	1	=	\$3,120
Men's department	3,120	×	1	=	3,120
Children's department	3,120	×	<u>1</u>	=	<u>3,120</u>
Total			<u>3</u>		<u>\$9,360</u>

As the allocation of the store manager's salary demonstrates, many allocations are arbitrary or based on a weak relationship between the allocated cost and the allocation base (cost driver). Managers must use care when making decisions using allocated costs.

## Behavioral Implications

Using the indirect cost allocations just discussed, Exhibit 4.4 shows the profit each department generated in January. ISI paid the three departmental managers bonuses based on each department's contribution to profitability. The store manager noticed an immediate change in the behavior of the departmental managers. For example, the manager of the women's department offered to give up 1,000 square feet of floor space because she believed reducing the selection of available products would not reduce sales significantly. Customers would simply buy different brands. Although sales would not decline dramatically, rent and utility cost allocations to the women's department would decline, increasing the profitability of the department.

## Answers to The Curious Accountant

When we compare the cost that a hospital charges for an aspirin to the price we pay for an aspirin, we are probably not considering the full cost that we

incur to purchase aspirin. If someone asks you what you pay for an aspirin, you would probably take the price of a bottle, say \$2, and divide it by the number of pills in the bottle, say 100. This would suggest their cost is \$0.02 each. Now, consider what it cost to buy the aspirins when all costs are considered. First, there is your time to drive to the store; what do you get paid per hour? Then, there is the cost of operating your automobile. You get the idea; in reality, the cost of an aspirin, from a business perspective, is much more than just the cost of the pills themselves.

Exhibit 4.3 shows the income statement of Hospital Corporation of America (HCA) for three recent years. HCA claims to be “. . . one of the leading health care services companies in the United States.” In 2008 it operated 271 facilities in 20 states and England. As you can see, while it generated over \$28 billion in revenue, it also incurred a lot of expenses. Look at its first two expense categories. Although it incurred \$4.6 billion in supplies expenses, it incurred almost two and a half times this amount in compensation expense. In other words, it cost a lot more to have someone deliver the aspirin to your bed than the aspirin itself costs.

In 2008 HCA earned \$673 million from its \$28.4 billion in revenues. This is a return on sales percentage of 2.4 percent ( $\$673 \div \$28.4$ ). Therefore, on a \$7 aspirin, HCA would earn 17 cents of profit, which is still not a bad profit for selling one aspirin. As a comparison, in 2008, Walgreens return on sales was 3.7 percent.

### EXHIBIT 4.3

<b>HCA, INC.</b>			
Consolidated Income Statements			
for the Years Ended December 31, 2008, 2007, and 2006			
(Dollars in millions, except per share amounts)			
	2008	2007	2006
Revenues	\$28,374	\$26,858	\$25,477
Salaries and benefits	11,440	10,714	10,409
Supplies	4,620	4,395	4,322
Other operating expenses	4,554	4,241	4,056
Provision for doubtful accounts	3,409	3,130	2,660
Gains on investments		(8)	(243)
Equity in earnings of affiliates	(223)	(206)	(197)
Depreciation and amortization	1,416	1,426	1,391
Interest expense	2,021	2,215	955
Gains on sales of facilities	(97)	(471)	(205)
Transaction costs			442
Impairment of long-lived assets	64	24	24
Total expenses	<u>27,204</u>	<u>25,460</u>	<u>23,614</u>
Income before minority interests and income taxes	1,170	1,398	1,863
Minority interests in earnings of consolidated entities	229	208	201
Income before income taxes	941	1,190	1,662
Provision for income taxes	268	316	626
Net income	<u>\$ 673</u>	<u>\$ 874</u>	<u>\$ 1,036</u>

**EXHIBIT 4.4****Profit Analysis by Department**

	Department			Total
	Women's	Men's	Children's	
Sales	\$190,000	\$110,000	\$60,000	\$360,000
Cost of goods sold	(120,000)	(58,000)	(38,000)	(216,000)
Sales commissions	(9,500)	(5,500)	(3,000)	(18,000)
Dept. managers' salary	(5,000)	(4,200)	(2,800)	(12,000)
Depreciation	(7,000)	(5,000)	(4,000)	(16,000)
Store manager's salary	(3,120)	(3,120)	(3,120)	(9,360)
Rental fee for store	(9,600)	(5,600)	(3,200)	(18,400)
Utilities	(1,200)	(700)	(400)	(2,300)
Advertising	(3,800)	(2,200)	(1,200)	(7,200)
Supplies	(475)	(275)	(150)	(900)
Departmental profit	<u>\$ 30,305</u>	<u>\$ 25,405</u>	<u>\$ 4,130</u>	<u>\$ 59,840</u>

In contrast, the manager of the children's department wanted the extra space. He believed the children's department was losing sales because it did not have enough floor space to display a competitive variety of merchandise. Customers came to the store to shop at the women's department, but they did not come specifically for children's wear. With additional space, the children's department could carry items that would draw customers to the store specifically to buy children's clothing. He believed the extra space would increase sales enough to cover the additional rent and utility cost allocations.

The store manager was pleased with the emphasis on profitability that resulted from tracing and assigning costs to specific departments.

## EFFECTS OF COST BEHAVIOR ON SELECTING THE MOST APPROPRIATE COST DRIVER

### LO 4

Select appropriate cost drivers for allocating indirect costs.

As previously mentioned, indirect costs may exhibit variable or fixed cost behavior patterns. Failing to consider the effects of cost behavior when allocating indirect costs can lead to significant distortions in product cost measurement. We examine the critical relationships between cost behavior and cost allocation in the next section of the text.

### Using Volume Measures to Allocate Variable Overhead Costs

A *causal relationship* exists between variable overhead product costs (indirect materials, indirect labor, inspection costs, utilities, etc.) and the volume of production. For example, the cost of indirect materials such as glue, staples, screws, nails, and varnish will increase or decrease in proportion to the number of desks a furniture manufacturing company makes. *Volume measures are good cost drivers* for allocating variable overhead costs.

Volume can be expressed by such measures as the number of units produced, the number of labor hours worked, or the amount of *direct* materials used in production. Given the variety of possible volume measures, how does management identify the most appropriate cost driver (allocation base) for assigning particular overhead costs? Consider the case of Filmier Furniture Company.

### Using Units as the Cost Driver

During the most recent year, Filmier Furniture Company produced 4,000 chairs and 1,000 desks. It incurred \$60,000 of *indirect materials* cost during the period. How much of this cost should Filmier allocate to chairs versus desks? Using number of units as the cost driver produces the following allocation:

**Step 1.** Compute the allocation rate.

$$\text{Total cost to be allocated} \div \text{Cost driver} = \text{Allocation rate}$$

$$\text{\$60,000 indirect materials cost} \div \text{5,000 units} = \text{\$12 per unit}$$

**Step 2.** Multiply the allocation rate by the weight of the cost driver to determine the allocation per cost object.

Product	Allocation Rate	×	Number of Units Produced	=	Allocated Cost
Desks	\$12	×	1,000	=	\$12,000
Chairs	12	×	4,000	=	48,000
Total			<u>5,000</u>	=	<u>\$60,000</u>

### Using Direct Labor Hours as the Cost Driver

Using the number of units as the cost driver assigns an *equal amount* (\$12) of indirect materials cost to each piece of furniture. However, if Filmier uses more indirect materials to make a desk than to make a chair, assigning the same amount of indirect materials cost to each is inaccurate. Assume Filmier incurs the following direct costs to make chairs and desks:

	Desks	Chairs	Total
Direct labor hours	3,500 hrs.	2,500 hrs.	6,000 hrs.
Direct materials cost	\$1,000,000	\$500,000	\$1,500,000

Both direct labor hours and direct materials cost are volume measures that indicate Filmier uses more indirect materials to make a desk than a chair. It makes sense that the amount of direct labor used is related to the amount of indirect materials used. Because production workers use materials to make furniture, it is plausible to assume that the more hours they work, the more materials they use. Using this reasoning, Filmier could assign the indirect materials cost to the chairs and desks as follows:

**Step 1.** Compute the allocation rate.

$$\text{Total cost to be allocated} \div \text{Cost driver} = \text{Allocation rate}$$

$$\text{\$60,000 indirect materials cost} \div \text{6,000 hours} = \text{\$10 per hour}$$

**Step 2.** Multiply the allocation rate by the weight of the cost driver.

Product	Allocation Rate	×	Number of Labor Hours	=	Allocated Cost
Desks	\$10.00	×	3,500	=	\$35,000
Chairs	10.00	×	<u>2,500</u>	=	<u>25,000</u>
Total			<u>6,000</u>	=	<u>\$60,000</u>

Basing the allocation on labor hours rather than number of units assigns a significantly larger portion of the indirect materials cost to desks (\$35,000 versus \$12,000). Is this allocation more accurate? Suppose the desks, but not the chairs, require elaborate,

labor-intensive carvings. A significant portion of the labor is then not related to consuming indirect materials (glue, staples, screws, nails, and varnish). It would therefore be inappropriate to allocate the indirect materials cost based on direct labor hours.

**Using Direct Material Dollars as the Cost Driver**

If labor hours is an inappropriate allocation base, Filmier can consider direct material usage, measured in material dollars, as the allocation base. It is likely that the more lumber (direct material) Filmier uses, the more glue, nails, and so forth (indirect materials) it uses. It is reasonable to presume direct materials usage drives indirect materials usage. Using direct materials dollars as the cost driver for indirect materials produces the following allocation:

**Step 1.** Compute the allocation rate.

$$\begin{array}{rcl} \text{Total cost to be allocated} \div & \text{Cost driver} & = \text{Allocation rate} \\ \$60,000 \text{ indirect} & \div & \$1,500,000 \text{ direct} \\ \text{materials cost} & & \text{material dollars} = \$0.04 \text{ per direct} \\ & & \text{material dollar} \end{array}$$

**Step 2.** Multiply the allocation rate by the weight of the cost driver.

Product	Allocation Rate	×	Number of Direct Material Dollars	=	Allocated Cost
Desks	\$0.04	×	\$1,000,000	=	\$40,000
Chairs	0.04	×	500,000	=	20,000
Total			<u>\$1,500,000</u>	=	<u>\$60,000</u>

**Selecting the Best Cost Driver**

Which of the three volume-based cost drivers (units, labor hours, or direct material dollars) results in the most accurate allocation of the overhead cost? Management must use judgment to decide. In this case, direct material dollars appears to have the most convincing relationship to indirect materials usage. If the cost Filmier was allocating were fringe benefits, however, direct labor hours would be a more appropriate cost driver. If the cost Filmier was allocating were machine maintenance cost, a different volume-based cost driver, machine hours, would be an appropriate base. The most accurate allocations of indirect costs may actually require using multiple cost drivers.



## ✓ CHECK YOURSELF 4.2

Boston Boat Company builds custom sailboats for customers. During the current accounting period, the company built five different-sized boats that ranged in cost from \$35,000 to \$185,000. The company's manufacturing overhead cost for the period was \$118,000. Would you recommend using the number of units (boats) or direct labor hours as the base for allocating the overhead cost to the five boats? Why?

**Answer** Using the number of units as the allocation base would assign the same amount of overhead cost to each boat. Since larger boats require more overhead cost (supplies, utilities, equipment, etc.) than smaller boats, there is no logical link between the number of boats and the amount of overhead cost required to build a particular boat. In contrast, there is a logical link between direct labor hours used and overhead cost incurred. The more labor used, the more supplies, utilities, equipment, and so on used. Since larger boats require more direct labor than smaller boats, using direct labor hours as the allocation base would allocate more overhead cost to larger boats and less overhead cost to smaller boats, producing a logical overhead allocation. Therefore, Boston should use direct labor hours as the allocation base.

## Allocating Fixed Overhead Costs

Fixed costs present a different cost allocation problem. By definition, the volume of production does not drive fixed costs. Suppose Lednicky Bottling Company rents its manufacturing facility for \$28,000 per year. The rental cost is fixed regardless of how much product Lednicky bottles. However, Lednicky may still use a volume-based cost driver as the allocation base. The object of allocating fixed costs to products is to distribute a *rational share* of the overhead cost to each product. Selecting an allocation base that spreads total overhead cost equally over total production often produces a rational distribution. For example, assume Lednicky produced 2,000,000 bottles of apple juice during 2011. If it sold 1,800,000 bottles of the juice during 2011, how much of the \$28,000 of rental cost should Lednicky allocate to ending inventory and how much to cost of goods sold? A rational allocation follows:



**Step 1.** Compute the allocation rate.

$$\text{Total cost to be allocated} \div \text{Allocation base (cost driver)} = \text{Allocation rate}$$

$$\text{\$28,000 rental cost} \div \text{2,000,000 units} = \text{\$0.014 per bottle of juice}$$

Because the base (number of units) used to allocate the cost does not drive the cost, it is sometimes called an *allocation base* instead of a *cost driver*. However, many managers use the term cost driver in conjunction with fixed cost even though that usage is technically inaccurate. The terms allocation base and cost driver are frequently used interchangeably.

**Step 2.** Multiply the allocation rate by the weight of the cost driver.

Financial Statement Item	Allocation Rate	×	Number of Bottles	=	Allocated Cost
Inventory	\$0.014	×	200,000	=	\$ 2,800
Cost of goods sold	0.014	×	1,800,000	=	25,200

Using number of units as the allocation base assigns equal amounts of the rental cost to each unit of product. Equal allocation is appropriate so long as the units are homogeneous. If the units are not identical, however, Lednicky may need to choose a different allocation base to rationally distribute the rental cost. For example, if some of the bottles are significantly larger than others, Lednicky may find using some physical measure, like liters of direct material used, to be a more appropriate allocation base. Whether an indirect cost is fixed or variable, selecting the most appropriate allocation base requires sound reasoning and judgment.

## ALLOCATING COSTS TO SOLVE TIMING PROBLEMS

### LO 5

Allocate costs to solve timing problems.

Under certain circumstances products may be made before or after the costs associated with making them have been incurred. Suppose, for example, premiums for an annual insurance policy are paid in March. The insurance cost benefits the products made in the months before and after March as well as those produced in March. Allocation can be used to spread the insurance cost over products made during the entire accounting period rather than charging the total cost only to products made in March.

Monthly fluctuations in production volume complicate fixed cost allocations. To illustrate, assume Grave Manufacturing pays its production supervisor a monthly salary of \$3,000. Furthermore, assume Grave makes 800 units of product in January and 1,875 in February. How much salary cost should Grave assign to the products made in January and February, respectively? The allocation seems simple. Just divide the \$3,000 monthly salary cost by the number of units of product made each month as follows:

$$\text{January} \quad \$3,000 \div 800 \text{ units} = \$3.75 \text{ cost per unit}$$

$$\text{February} \quad \$3,000 \div 1,875 \text{ units} = \$1.60 \text{ cost per unit}$$

If Grave Manufacturing based a cost-plus pricing decision on these results, it would price products made in January significantly higher than products made in February. It is likely such price fluctuations would puzzle and drive away customers. Grave needs an allocation base that will spread the annual salary cost evenly over annual production. A timing problem exists, however, because Grave must allocate the salary cost before the end of the year. In order to price its products, Grave needs to know the allocated amount before the actual cost information is available. Grave can manage the timing problem by using estimated rather than actual costs.

Grave Manufacturing can *estimate* the annual cost of the supervisor's salary (indirect labor) as \$36,000 ( $\$3,000 \times 12$  months). The *actual* cost of indirect labor may differ because the supervisor might receive a pay raise or be replaced with a person who earns less. Based on current information, however, \$36,000 is a reasonable estimate of the annual indirect labor cost. Grave must also estimate total annual production volume. Suppose Grave produced 18,000 units last year and expects no significant change in the current year. It can allocate indirect labor cost for January and February as follows:

**Step 1.** Compute the allocation rate.

$$\text{Total cost to be allocated} \div \text{Allocation base} = \text{Allocation rate} \\ \text{(cost driver)}$$

$$\$36,000 \div 18,000 \text{ units} = \$2.00 \text{ per unit}$$

**Step 2.** Multiply the rate by the weight of the base (number of units per month) to determine how much of the salary cost to allocate to each month's production.

Month	Allocation Rate	×	Number of Units Produced	=	Allocation per Month
January	\$2.00	×	800	=	\$1,600
February	2.00	×	1,875	=	3,750

Grave Manufacturing will add these indirect cost allocations to other product costs to determine the total estimated product cost to use in cost-plus pricing or other managerial decisions.

Because the overhead allocation rate is determined *before* actual cost and volume data are available, it is called the **predetermined overhead rate**. Companies use predetermined overhead rates for product costing estimates and pricing decisions during a year, but they must use actual costs in published year-end financial statements. If necessary, companies adjust their accounting records at year-end when they have used estimated data on an interim basis. The procedures for making such adjustments are discussed in a later chapter.

## AGGREGATING AND DISAGGREGATING INDIVIDUAL COSTS INTO COST POOLS

Allocating *individually* every single indirect cost a company incurs would be tedious and not particularly useful relative to the benefit obtained. Instead, companies frequently accumulate many individual costs into a single **cost pool**. The total of the pooled cost is then allocated to the cost objects. For example, a company may accumulate costs for gas, water, electricity, and telephone service into a single utilities cost pool. It would then allocate the total cost in the utilities cost pool to the cost objects rather than individually allocating each of the four types of utility costs.

How far should pooling costs go? Why not pool utility costs with indirect labor costs? If the forces driving the utility costs are different from the forces driving the labor costs, pooling the costs will likely reduce the reliability of any associated cost allocations. To promote accuracy, pooling should be limited to costs with common cost drivers.

Costs that have been pooled for one purpose may require disaggregation for a different purpose. Suppose all overhead costs are pooled for the purpose of determining the cost of making a product. Further, suppose that making the product requires two processes that are performed in different departments. A cutting department makes heavy use of machinery to cut raw materials into product parts. An assembly department uses human labor to assemble the parts into a finished product. Now suppose the objective changes from determining the cost of making the product to determining the cost of operating each department. Under these circumstances, it may be necessary to disaggregate the total overhead cost into smaller pools such as a utility cost pool, an indirect labor cost pool, and so on so that different drivers can be used to allocate these costs to the two departments.

### LO 6

Explain the benefits and detriments of allocating pooled costs.

## ALLOCATING JOINT COSTS

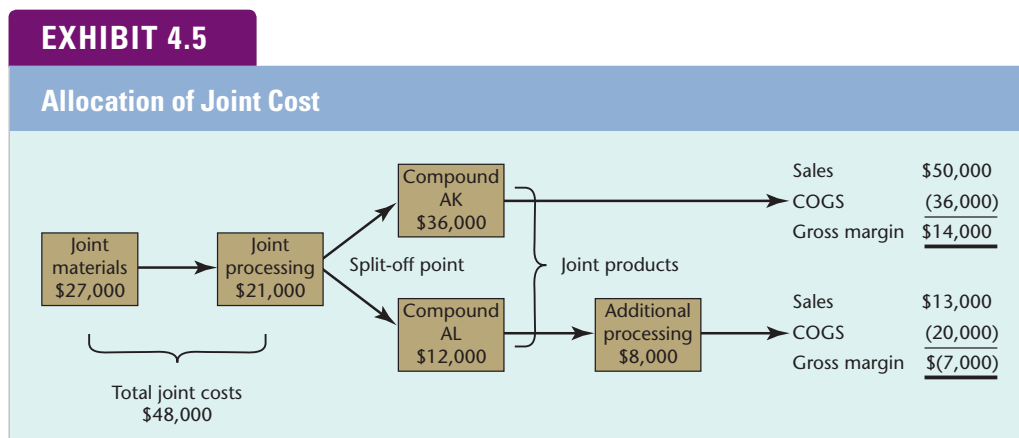
**Joint costs** are common costs incurred in the process of making two or more **joint products**. The cost of raw milk is a joint cost of producing the joint products cream, whole milk, 2 percent milk, and skim milk. Joint costs include not only materials costs but also the labor and overhead costs of converting the materials into separate products. The point in the production process at which products become separate and identifiable is the **split-off point**. For financial reporting of inventory and cost of goods sold, companies must allocate the joint costs to the separate joint products. Some joint products require additional processing after the split-off point. Any additional materials, labor, or overhead costs incurred after the split-off point are assigned to the specific products to which they relate.

To illustrate, assume Westar Chemical Company produces from common raw materials the joint products Compound AK and Compound AL. Compound AL requires further processing before Westar can sell it. The diagram in Exhibit 4.5 illustrates the joint product costs.

### LO 7

Allocate joint product costs.





The joint costs of producing a batch of the two compounds are \$48,000, representing \$27,000 of materials cost and \$21,000 of processing cost. A batch results in 3,000 gallons of Compound AK and 1,000 gallons of Compound AL. Westar allocates joint costs to the products based on the number of gallons produced, as follows:

**Step 1.** Compute the allocation rate.

$$\text{Total cost to be allocated} \div \text{Allocation base} = \text{Allocation rate}$$

$$\text{\$48,000 joint costs} \div \text{4,000 gallons} = \text{\$12 per gallon}$$

**Step 2.** Multiply the allocation rate by the weight of the base.

Joint Product	Allocation Rate	×	Number of Gallons Produced	=	Allocated Cost
Compound AK	\$12	×	3,000	=	\$36,000
Compound AL	12	×	1,000	=	12,000

Westar sells 3,000 gallons of Compound AK for \$50,000, and 1,000 gallons of Compound AL for \$13,000. Exhibit 4.5 shows the gross margins for each product using the joint cost allocations computed above.

### Relative Sales Value as the Allocation Base

Because Compound AL shows a \$7,000 loss, a manager might mistakenly conclude that Westar should stop making and selling this product. If Westar stops making Compound AL, the total joint cost (\$48,000) would be assigned to Compound AK and total gross margin would decline as shown below.

		With Compound AL	Without Compound AL
Sales	\$63,000	(\$50,000 + \$13,000)	\$50,000
Cost of goods sold	<u>(56,000)</u>	(\$36,000 + \$20,000)	<u>(48,000)</u>
Gross margin	<u>\$ 7,000</u>		<u>\$ 2,000</u>

To avoid the appearance that a product such as Compound AL is producing losses, many companies allocate joint cost to products based on the relative sales value of each product at the split-off point. Westar Chemical would allocate all of the joint costs to Compound AK because Compound AL has no market value at the split-off point. The resulting gross margins follow.

	Compound AK	Compound AL
Sales	\$50,000	\$13,000
Cost of goods sold	<u>(48,000)</u>	<u>(8,000)</u>
Gross margin	<u>\$ 2,000</u>	<u>\$ 5,000</u>

Westar's total profit on the joint products is \$7,000 whether it allocates the joint costs using gallons or relative market value. However, using market value as the allocation base produces a positive gross margin for both products, reducing the likelihood that a manager will mistakenly eliminate a product that is contributing to profitability.



### CHECK YOURSELF 4.3

What are some logical split-off points for a meat processing company engaged in butchering beef?

**Answer** The first logical split-off point occurs when processing separates the hide (used to produce leather) from the carcass. Other split-off points occur as further processing produces different cuts of meat (T-bone and New York strip steaks, various roasts, chops, ground chuck, etc.).

## COST ALLOCATION: THE HUMAN FACTOR

Cost allocations significantly affect individuals. They may influence managers' performance evaluations and compensation. They may dictate the amount of resources various departments, divisions, and other organizational subunits receive. Control over resources usually offers managers prestige and influence over organization operations. The following scenario illustrates the emotional impact and perceptions of fairness of cost allocation decisions.

LO 8

Recognize the effects of cost allocation on employee motivation.

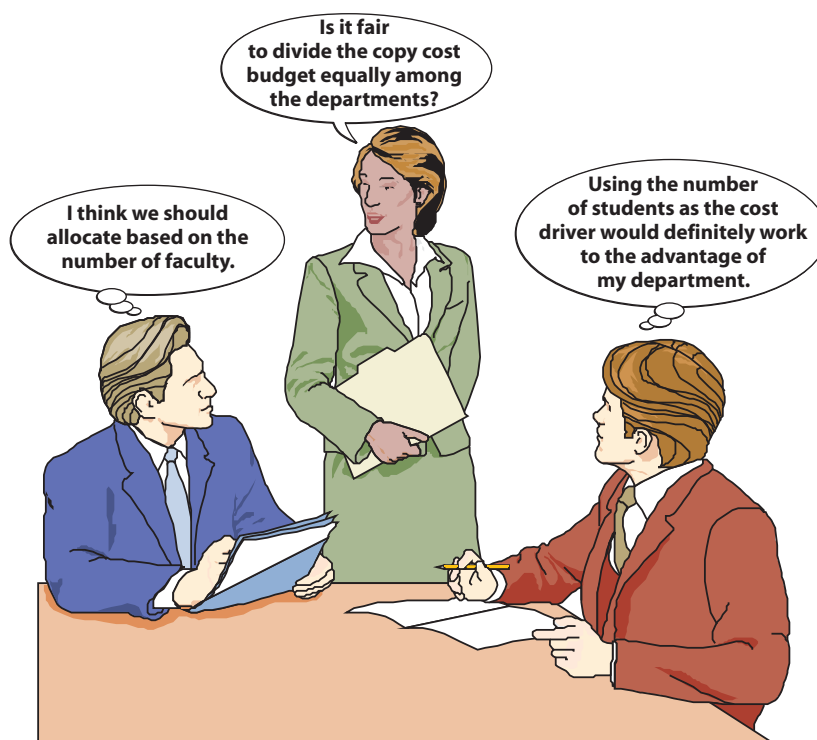
### Using Cost Allocations in a Budgeting Decision

Sharon Southport, dean of the School of Business at a major state university, is in dire need of a budgeting plan. Because of cuts in state funding, the money available to the School of Business for copying costs next year will be reduced substantially. Dean Southport supervises four departments: management, marketing, finance, and accounting. The Dean knows the individual department chairpersons will be unhappy and frustrated with the deep cuts they face.

### Using Cost Drivers to Make Allocations

To address the allocation of copying resources, Dean Southport decided to meet with the department chairs. She explained that the total budgeted for copying costs will be \$36,000. Based on past usage, department allocations would be as follows: \$12,000 for management, \$10,000 for accounting, \$8,000 for finance, and \$6,000 for marketing.

Dr. Bill Thompson, the management department chair, immediately protested that his department could not operate on a \$12,000 budget for copy costs. Management has more faculty members than any other department. Dr. Thompson argued that copy costs are directly related to the number of faculty members, so copy funds should be allocated based on the number of faculty members. Dr. Thompson suggested that number of faculty members rather than past usage should be used as the allocation base.



Since the School of Business has 72 faculty members (29 in management, 16 in accounting, 12 in finance, and 15 in marketing), the allocation should be as follows:

**Step 1.** Compute the allocation rate.

$$\begin{array}{rclcl} \text{Total cost to be allocated} & \div & \text{Cost driver} & = & \text{Allocation rate} \\ \$36,000 & \div & 72 & = & \$500 \text{ per faculty member} \end{array}$$

**Step 2.** Multiply the rate by the weight of the driver (the number of faculty per department) to determine the allocation per object (department).

Department	Allocation Rate	×	Number of Faculty	=	Allocation per Department	Allocation Based on Past Usage
Management	\$500	×	29		\$14,500	\$12,000
Accounting	500	×	16		8,000	10,000
Finance	500	×	12		6,000	8,000
Marketing	500	×	15		7,500	6,000
Total					<u>\$36,000</u>	<u>\$36,000</u>

Seeing these figures, Dr. Bob Smethers, chair of the accounting department, questioned the accuracy of using the number of faculty members as the cost driver. Dr. Smethers suggested the number of *students* rather than the number of *faculty members* drives the cost of copying. He argued that most copying results from duplicating syllabi, exams, and handouts. The accounting department teaches mass sections of introductory accounting that have extremely high student/teacher ratios. Because his department teaches more students, it spends more on copying costs even though it has fewer faculty members. Dr. Smethers recomputed the copy cost allocation as follows:

**Step 1.** Compute the allocation rate based on number of students. University records indicate that the School of Business taught 1,200 students during the most recent academic year. The allocation rate (copy cost per student) follows.

**Total cost to be allocated ÷ Cost driver = Allocation rate**

$$\$36,000 \div 1,200 = \$30 \text{ per student}$$

**Step 2.** Multiply the rate by the weight of the driver (number of students taught by each department) to determine the allocation per object (department).

Department	Allocation Rate	×	Number of Students	=	Allocation per Department	Allocation Based on Past Usage
Management	\$30	×	330	=	\$ 9,900	\$12,000
Accounting	30	×	360	=	10,800	10,000
Finance	30	×	290	=	8,700	8,000
Marketing	30	×	220	=	6,600	6,000
Total					<u>\$36,000</u>	<u>\$36,000</u>

## Choosing the Best Cost Driver

Dr. Thompson objected vigorously to using the number of students as the cost driver. He continued to argue that the size of the faculty is a more appropriate allocation base. The chair of the finance department sided with Dr. Smethers, the chair of the marketing department kept quiet, and the dean had to settle the dispute.

Dean Southport recognized that the views of the chairpersons were influenced by self-interest. The allocation base affects the amount of resources available to each department. Furthermore, the dean recognized that the size of the faculty does drive some of the copying costs. For example, the cost of copying manuscripts that faculty submit for publication relates to faculty size. The more articles faculty submit, the higher the copying cost. Nevertheless, the dean decided the number of students has the most significant impact on copying costs. She also wanted to encourage faculty members to minimize the impact of funding cuts on student services. Dean Southport therefore decided to allocate copying costs based on the number of students taught by each department. Dr. Thompson stormed angrily out of the meeting. The dean developed a budget by assigning the available funds to each department using the number of students as the allocation base.

## Controlling Emotions

Dr. Thompson's behavior may relieve his frustration but it doesn't indicate clear thinking. Dean Southport recognized that Dr. Thompson's contention that copy costs were related to faculty size had some merit. Had Dr. Thompson offered a compromise rather than an emotional outburst, he might have increased his department's share of the funds. Perhaps a portion of the allocation could have been based on the number of faculty members with the balance allocated based on the number of students. Had Dr. Thompson controlled his anger, the others might have agreed to compromise. Technical expertise in computing numbers is of little use without the interpersonal skills to persuade others. Accountants may provide numerical measurements, but they should never forget the impact of their reports on the people in the organization.

## A Look Back



Managers need to know the costs of products, processes, departments, activities, and so on. The target for which accountants attempt to determine cost is a *cost object*. Knowing the cost of specific objects enables management to control costs, evaluate performance, and price products. *Direct costs* can be cost-effectively traced to a cost object. *Indirect costs* cannot be easily traced to designated cost objects.

The same cost can be direct or indirect, depending on the cost object to which it is traced. For example, the salary of a Burger King restaurant manager can be directly traced to a particular store but cannot be traced to particular food items made and sold in the store. Classifying a cost as direct or indirect is independent of whether the cost behaves as fixed or variable; it is also independent of whether the cost is relevant to a given decision. A direct cost could be either fixed or variable or either relevant or irrelevant, depending on the context and the designated cost object.

Indirect costs are assigned to cost objects using *cost allocation*. Allocation divides an indirect cost into parts and distributes the parts among the relevant cost objects. Companies frequently allocate costs to cost objects in proportion to the *cost drivers* that cause the cost to be incurred. The first step in allocating an indirect cost is to determine the allocation rate by dividing the total cost to be allocated by the chosen cost driver. The next step is to multiply the allocation rate by the amount of the cost driver for a particular object. The result is the amount of indirect cost to assign to the cost object.

A particular indirect cost may be related to more than one driver. The best cost driver is the one that most accurately reflects the amount of the resource used by the cost object. Objects that consume the most resources should be allocated a proportionately greater share of the costs. If no suitable cost driver exists, companies may use arbitrary allocations such as dividing a total cost equally among cost objects.

Cost allocations have behavioral implications. Using inappropriate cost drivers can distort allocations and lead managers to make choices that are detrimental to the company's profitability.

The joint costs incurred in the process of making two or more products are allocated among the products at the *split-off point*, the point at which products become separate and identifiable. The allocation base can be the products' relative sales values or some quantity measure of the amount of each product made. If one of the joint products requires additional processing costs to bring it to market, only these additional processing costs are relevant to a decision about whether to undertake further processing. The allocated joint costs are not relevant because they will be incurred whether or not the joint product is processed after the split-off point. By-products share common costs with other products but have an insignificant market value relative to their joint products.



## A Look Forward

The failure to accurately allocate indirect costs to cost objects can result in misinformation that impairs decision making. The next chapter explains how increased use of automation in production has caused distortion in allocations determined using traditional approaches. The chapter introduces the allocation of indirect costs using more recently developed activity-based costing and explains how activity-based management can improve efficiency and productivity. Finally, the chapter introduces total quality management, a strategy that seeks to minimize the costs of conforming to a designated standard of quality.

## APPENDIX

### Allocating Service Center Costs

Most organizations establish departments responsible for accomplishing specific tasks. Departments that are assigned tasks leading to the accomplishment of the primary objectives of the organization are called **operating departments**. Those that provide support to operating departments are called **service departments**. For example, the department of

#### LO 9

Allocate service department costs to operating departments.

accounting at a university is classified as an operating department because its faculty perform the university's primary functions of teaching, research, and service. In contrast, the maintenance department is classified as a service department because its employees provide janitorial services that support primary university functions. Professors are more likely to be motivated to perform university functions when facilities are clean, but the university's primary purpose is not to clean buildings. Similarly, the lending department in a bank is an operating department and the personnel department is a service department. The bank is in the business of making loans. Hiring employees is a secondary function that assists the lending activity.

The costs to produce a product (or a service) include both operating and service department costs. Therefore, service department costs must somehow be allocated to the products produced (or services provided). Service department costs are frequently distributed to products through a two-stage allocation process. First-stage allocations involve the distribution of costs from service center cost pools to operating department cost pools. In the second stage, costs in the operating cost pools are allocated to products. Three different approaches can be used to allocate costs in the first stage of the two-stage costing process: the *direct method*, the *step method*, and the *reciprocal method*.

## Direct Method

The **direct method** is the simplest allocation approach. It allocates service department costs directly to operating department cost pools. To illustrate, assume that Candler & Associates is a law firm that desires to determine the cost of handling each case. The firm has two operating departments, one that represents clients in civil suits and the other that defends clients in criminal cases. The two operating departments are supported by two service departments, personnel and secretarial support. Candler uses a two-stage allocation system to allocate the service centers' costs to the firm's legal cases. In the first stage, the costs to operate each service department are accumulated in separate cost pools. For example, the costs to operate the personnel department are \$80,000 in salary, \$18,000 in office rental, \$12,000 in depreciation, \$3,000 in supplies, and \$4,000 in miscellaneous costs. These costs are added together in a single services department cost pool amounting to \$117,000. Similarly, the costs incurred by the secretarial department are accumulated in a cost pool. We assume that this cost pool contains \$156,800 of accumulated costs. The amounts in these cost pools are then allocated to the operating departments' cost pools. The appropriate allocations are described in the following paragraphs.

Assume that Candler's accountant decides that the number of attorneys working in the two operating departments constitutes a rational cost driver for the allocation of the personnel department cost pool and that the number of request forms submitted to the secretarial department constitutes a rational cost driver for the allocation of costs accumulated in the secretarial department cost pool. The total number of attorneys working in the two operating departments is 18, 11 in the civil department and 7 in the criminal department. The secretarial department received 980 work request forms with 380 from the civil department and 600 from the criminal department. Using these cost drivers as the allocation bases, the accountant made the following first-stage allocations.

## Determination of Allocation Rates

$$\frac{\text{Allocation rate for personnel department cost pool}}{\text{department cost pool}} = \frac{\$117,000}{18} = \$6,500 \text{ per attorney}$$

$$\frac{\text{Allocation rate for secretarial department cost pool}}{\text{department cost pool}} = \frac{\$156,800}{980} = \$160 \text{ per request form}$$

**EXHIBIT 4.6****First-Stage Allocations for Candler & Associates—Direct Method**

<b>Allocated Service Department Overhead</b>	<b>Allocation Rate</b>	<b>×</b>	<b>Weight of Base</b>	<b>=</b>	<b>Civil Department</b>	<b>Criminal Department</b>	<b>Total Service Department Cost Pool</b>
Personnel	\$6,500	×	11 attorneys	=	\$ 71,500		
	6,500	×	7 attorneys	=		\$ 45,500	
Total cost of personnel department							\$117,000
Secretarial	160	×	380 requests	=	60,800		
	160	×	600 requests	=		96,000	
Total cost of secretarial department							156,800
Total of cost pools after allocation					132,300	141,500	\$273,800
Other operating department overhead costs					785,100	464,788	
Total of operating department overhead cost pools					<u>\$917,400</u>	<u>\$606,288</u>	

The accountant then multiplied these rates by the weight of the base to determine the amount of each service cost pool to allocate to each operating department cost pool. The appropriate computations are shown in Exhibit 4.6.

As indicated, the allocated service department costs are pooled with other operating department overhead costs to form the operating department cost pools. In the second stage of the costing process, the costs in the operating department cost pools are allocated to the firm's products (cases). To illustrate second-stage allocations, assume that Candler allocates the operating department overhead cost pools on the basis of billable hours. Furthermore, assume that the civil department expects to bill 30,580 hours to its clients and the criminal department expects to bill 25,262 hours. Based on this information, the following predetermined overhead rates are used to allocate operating department cost pools to particular cases.

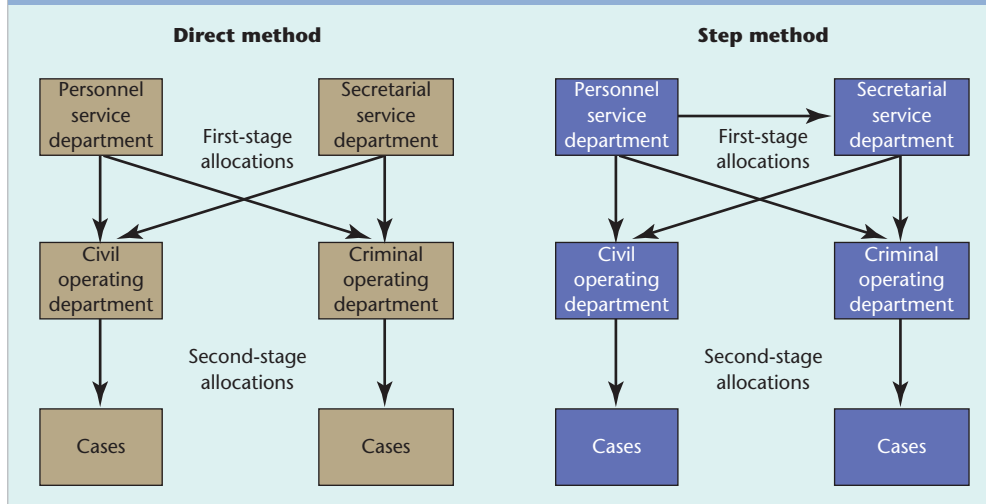
$$\text{Predetermined overhead rate for the civil department} = \frac{\$917,400}{30,580} = \$30 \text{ per billable hour}$$

$$\text{Predetermined overhead rate for the criminal department} = \frac{\$606,288}{25,262} = \$24 \text{ per billable hour}$$

These rates are used to calculate the amount of operating department cost pools to include in the determination of the cost to litigate specific cases. For example, a case in the civil department that required 300 billable hours of legal service is allocated \$9,000 (300 hours × \$30 predetermined overhead rate) of overhead cost. Assuming that the direct costs to litigate the case amounted to \$25,000, the total cost of this particular case is \$34,000 (\$25,000 direct cost + \$9,000 allocated overhead). This accumulated cost figure could be used as a guide to determine the charge to the client or the profitability of the case.

### Step Method

The direct method of allocating service center costs fails to consider the fact that service departments render assistance to other service departments. A service that is performed by one service department for the benefit of another service department is called an **interdepartmental service**. To illustrate this, we return to the case of Candler & Associates. Suppose that Candler's personnel department works with the employees in the secretarial department as well as the attorneys in the civil and criminal operating departments. Under these circumstances, Candler needs a cost approach that recognizes the

**EXHIBIT 4.7****Comparison of Direct and Step Allocation Methods**

interdepartmental service activity. One such approach is known as the **step method**. The primary difference between the direct method and the step method is depicted graphically in Exhibit 4.7. Focus your attention on the first stage of the allocation process. Notice that the step method includes one additional allocation, specifically from the personnel department cost pool to the secretarial department cost pool. The direct method ignores this interdepartmental service cost allocation. Indeed, the direct method derives its name from the fact that it allocates costs only from service cost pools to operating cost pools.

The fact that the direct method ignores the effect of interdepartmental services may cause distortions in the measurement of cost objects. The primary purpose of the step method is to avoid such distortions, thereby improving the accuracy of product costing. To illustrate this point, consider Candler & Associates. First, note that the interdepartmental portion of the personnel department cost is, in fact, a cost of providing secretarial services. In other words, the personnel service costs could be reduced if the personnel department did not provide service to the secretarial staff. Accordingly, the cost of providing personnel support to the secretarial staff should be included in the secretarial cost pool. Under the direct method, however, the interdepartmental service cost is allocated between the civil and criminal operating departments. This is not a problem in and of itself because the cost of secretarial service is also allocated between the civil and criminal operating departments. Unfortunately, the base used to allocate personnel costs to the operating departments (i.e., number of attorneys) distributes more cost to the civil department than to the criminal department. This is unfortunate because the criminal department uses more secretarial service than the civil department does. In other words, more secretarial cost (i.e., interdepartmental personnel cost) is being allocated to the civil department although the criminal department uses more secretarial services. This means that ultimately the cost to litigate civil cases will be overstated and the cost to litigate criminal cases will be understated.

The step method corrects this distortion by distributing the interdepartmental personnel department cost to the secretarial department cost pool before it is allocated to the operating departments. Because the secretarial cost pool is allocated on the basis of requests for secretarial service, more of the interdepartmental cost will be allocated to the criminal operating department. To validate this result, assume that the personnel department cost pool is allocated to the secretarial department cost pool and the two



operating department cost pools on the basis of the number of employees in each department. In addition to the 18 attorneys in the firm, assume that two employees work in the secretarial department. Accordingly, the allocation rate for the personnel cost pool is calculated as follows.

$$\text{Allocation rate for personnel department cost pool} = \frac{\$117,000}{20} = \$5,850 \text{ per employee}$$

Based on this rate, the first step in the allocation process distributes the personnel department cost pool as indicated here.

Personnel Cost Pool Allocated to	Allocation Rate		Weight of Base		Allocated Cost
Secretarial	\$5,850	×	2 employees	=	\$ 11,700
Civil	5,850	×	11 employees	=	64,350
Criminal	5,850	×	7 employees	=	40,950
Total			<u>20 employees</u>		<u>\$117,000</u>

The result of the distribution of personnel department costs is shown as the Step 1 allocation in Exhibit 4.8. The \$11,700 interdepartmental personnel department cost allocated to the secretarial department cost pool is added to the \$156,800 existing balance in that cost pool (See Exhibit 4.8). The result is the accumulation of secretarial cost of \$168,500. The second step in the costing process allocates this cost pool to the operating departments. Recall that the secretarial cost pool is allocated on the basis of number of work request forms submitted. Furthermore, recall that 980 request forms were submitted to the secretarial department (380 from the civil department and 600 from the criminal department). Accordingly, the allocation rate for the secretarial department cost pool is computed as follows.

$$\text{Allocation rate for secretarial department cost pool} = \frac{\$168,500}{980} = \$171.93878 \text{ per request form}$$

Based on this rate, the second step in the allocation process distributes the secretarial cost pool as indicated here.

Secretarial Cost Pool Allocated to	Allocation Rate		Weight of Base		Allocated Cost
Civil	\$171.93878	×	380 requests	=	\$ 65,337
Criminal	171.93878	×	600 requests	=	103,163
Total			<u>980 requests</u>		<u>\$168,500</u>

The result of this allocation is shown as the Step 2 allocation in Exhibit 4.8. Notice that the final cost pools for the operating departments reflect the expected shift in the cost distribution between the two departments. Specifically, the cost pool in the criminal department is higher and the cost pool in the civil department is lower than the comparable cost pool amounts computed under the direct method (see Exhibit 4.6 for the appropriate comparison). This distribution of cost is consistent with the fact that more of the interdepartmental service cost should be assigned to the criminal

**EXHIBIT 4.8****First-Stage Allocations for Candler & Associates—Step Method**

	<b>Personnel Cost Pool</b>		<b>Secretarial Cost Pool</b>		<b>Civil Department</b>		<b>Criminal Department</b>
Cost to be allocated	\$117,000		\$156,800				
Step 1 allocation	(117,000)	=	11,700	+	\$ 64,350	+	\$ 40,950
Step 2 allocation			(168,500)	=	65,337	+	103,163
Total in cost pool after allocation	<u>\$ 0</u>		<u>\$ 0</u>		129,687		144,113
Other operating department overhead costs					785,100		464,788
Total of operating department overhead cost pool					<u>\$914,787</u>		<u>\$608,901</u>

department because it uses more secretarial services than does the civil department. Accordingly, the step method of allocation more accurately reflects the manner in which the two operating departments consume resources.

The preceding illustration considered a simple two-stage allocation process with only two service departments and two operating departments. In large organizations, the costing process may be significantly more complex. Interdepartmental cost allocations may involve several service departments. For example, a personnel department may provide service to a secretarial department that provides service to an engineering department that provides service to the accounting department that provides service to several operating departments. In addition, general overhead costs may be allocated to both service and operating departments before costs are allocated from service to operating departments. For example, general utility costs may be pooled together and allocated to service and operating departments on the basis of square footage of floor space. These allocated utility costs are then redistributed to other service departments and to operating departments in a sequence of step-down allocations. The step-down process usually begins with the cost pool that represents resources used by the largest number of departments. This constitutes the first step in the costing process. The second step proceeds with allocations from the cost pool that represents resources used by the second largest number of departments and so on, until all overhead costs have been allocated to the operating departments. Accordingly, the first stage of a two-stage costing process may include many allocations (steps) before all costs have been distributed to the operating departments. Regardless of how many allocations are included in the first stage, the second stage begins when costs are allocated from the operating departments to the organization's products.

### Reciprocal Method

Note that the step method is limited to one-way interdepartmental relationships. In practice, many departments have two-way working relationships. For example, the personnel department may provide services to the secretarial department and receive services from it. Two-way associations in which departments provide and receive services from one another are called **reciprocal relationships**. Allocations that recognize reciprocal relationships require complex mathematical manipulation involving the use of simultaneous linear equations. The resultant cost distributions are difficult to interpret. Furthermore, the results attained with the **reciprocal method** are not significantly different from those attained through the step method. As a result, the reciprocal method is rarely used in practice.



A step-by-step audio-narrated series of slides is provided on the text website at [www.mhhe.com/edmonds2011](http://www.mhhe.com/edmonds2011).



### SELF-STUDY REVIEW PROBLEM

New budget constraints have pressured Body Perfect Gym to control costs. The owner of the gym, Mr. Ripple, has notified division managers that their job performance evaluations will be highly influenced by their ability to minimize costs. The gym has three divisions: weight lifting, aerobics, and spinning. The owner has formulated a report showing how much it cost to operate each of the three divisions last year. In preparing the report, Mr. Ripple identified several indirect costs that must be allocated among the divisions. These indirect costs are \$4,200 of laundry expense, \$48,000 of supplies, \$350,000 of office rent, \$50,000 of janitorial services, and \$120,000 for administrative salaries. To provide a reasonably accurate cost allocation, Mr. Ripple has identified several potential cost drivers. These drivers and their association with each division follow.

Cost Driver	Weight Lifting	Aerobics	Spinning	Total
Number of participants	26	16	14	56
Number of instructors	10	8	6	24
Square feet of gym space	12,000	6,000	7,000	25,000
Number of staff	2	2	1	5

#### Required

- Identify the appropriate cost objects.
- Identify the most appropriate cost driver for each indirect cost, and compute the allocation rate for assigning each indirect cost to the cost objects.
- Determine the amount of supplies expense that should be allocated to each of the three divisions.
- The spinning manager wants to use the number of staff rather than the number of instructors as the allocation base for the supplies expense. Explain why the spinning manager would take this position.
- Identify two cost drivers other than your choice for Requirement *b* that could be used to allocate the cost of the administrative salaries to the three divisions.

#### Solution to Requirement a

The objective is to determine the cost of operating each division. Therefore, the cost objects are the three divisions (weight lifting, aerobics, and spinning).

#### Solution to Requirement b

The costs, appropriate cost drivers, and allocation rates for assigning the costs to the departments follow:

Cost	Base	Computation	Allocation Rate
Laundry expense	Number of participants	\$ 4,200 ÷ 56	\$75 per participant
Supplies	Number of instructors	48,000 ÷ 24	\$2,000 per instructor
Office rent	Square feet	350,000 ÷ 25,000	\$14 per square foot
Janitorial service	Square feet	50,000 ÷ 25,000	\$2 per square foot
Administrative salaries	Number of divisions	120,000 ÷ 3	\$40,000 per division

There are other logical cost drivers. For example, the cost of supplies could be allocated based on the number of staff. It is also logical to use a combination of cost drivers. For example, the allocation for the cost of supplies could be based on the combined number of instructors and staff. For this problem, we assumed that Mr. Ripple chose the number of instructors as the base for allocating supplies expense.

**Solution to Requirement c**

Department	Cost to Be Allocated	Allocation Rate	×	Weight of Base	=	Amount Allocated
Weight lifting	Supplies	\$2,000	×	10	=	\$20,000
Aerobics	Supplies	2,000	×	8	=	16,000
Spinning	Supplies	2,000	×	6	=	12,000
Total						<u>\$48,000</u>

**Solution to Requirement d**

If the number of staff were used as the allocation base, the allocation rate for supplies would be as follows:

$$\$48,000 \div 5 \text{ staff} = \$9,600 \text{ per staff member}$$

Using this rate, the total cost of supplies would be allocated among the three divisions as follows:

Department	Cost to Be Allocated	Allocation Rate	×	Weight of Base	=	Amount Allocated
Weight lifting	Supplies	\$9,600	×	2	=	\$19,200
Aerobics	Supplies	9,600	×	2	=	19,200
Spinning	Supplies	9,600	×	1	=	9,600
Total						<u>\$48,000</u>

By using the number of staff as the allocation base instead of the number of instructors, the amount of overhead cost allocated to the spinning division falls from \$12,000 to \$9,600. Since managers are evaluated based on minimizing costs, it is clearly in the spinning manager's self-interest to use the number of staff as the allocation base.

**Solution to Requirement e**

Among other possibilities, bases for allocating the administrative salaries include the number of participants, the number of lessons, or the number of instructors.

**KEY TERMS**

allocation 153	cost pools 165	overhead costs 153
allocation base 155	cost tracing 153	predetermined
allocation rate 155	direct cost 153	overhead rate 165
common costs 154	direct method 171	reciprocal method 175
controllable costs 154	indirect cost 153	reciprocal relationships 175
cost accumulation 152	interdepartmental service 172	service departments 170
cost allocation 153	joint costs 165	split-off point 165
cost driver 152	joint products 165	step method 173
cost objects 150	operating departments 170	

**QUESTIONS**

1. What is a cost object? Identify four different cost objects in which an accountant would be interested.
2. Why is cost accumulation imprecise?
3. If the cost object is a manufactured product, what are the three major cost categories to accumulate?
4. What is a direct cost? What criteria are used to determine whether a cost is a direct cost?
5. Why are the terms *direct cost* and *indirect cost* independent of the terms *fixed cost* and *variable cost*? Give an example to illustrate.

6. Give an example of why the statement, “All direct costs are avoidable,” is incorrect.
7. What are the important factors in determining the appropriate cost driver to use in allocating a cost?
8. How is an allocation rate determined? How is an allocation made?
9. In a manufacturing environment, which costs are direct and which are indirect in product costing?
10. Why are some manufacturing costs not directly traceable to products?
11. What is the objective of allocating indirect manufacturing overhead costs to the product?
12. On January 31, the managers of Integra, Inc., seek to determine the cost of producing their product during January for product pricing and control purposes. The company can easily determine the costs of direct materials and direct labor used in January production, but many fixed indirect costs are not affected by the level of production activity and have not yet been incurred. The managers can reasonably estimate the overhead costs for the year based on the fixed indirect costs incurred in past periods. Assume the managers decide to allocate an equal amount of these estimated costs to the products produced each month. Explain why this practice may not provide a reasonable estimate of product costs in January.
13. Respond to the following statement: “The allocation base chosen is unimportant. What is important in product costing is that overhead costs be assigned to production in a specific period by an allocation process.”
14. Larry Kwang insists that the costs of his school’s fund-raising project should be determined after the project is complete. He argues that only after the project is complete can its costs be determined accurately and that it is a waste of time to try to estimate future costs. Georgia Sundum counters that waiting until the project is complete will not provide timely information for planning expenditures. How would you arbitrate this discussion? Explain the trade-offs between accuracy and timeliness.
15. What are the three methods used for allocating service center costs? How do the methods differ? (Appendix)



## MULTIPLE-CHOICE QUESTIONS

Multiple-choice questions are provided on the text website at [www.mhhe.com/edmonds2011](http://www.mhhe.com/edmonds2011).

## EXERCISES—SERIES A

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

### LO 3

#### Exercise 4-1A *Allocating costs between divisions*

Sims Services Company (SSC) has 50 employees, 38 of whom are assigned to Division A and 12 to Division B. SSC incurred \$296,000 of fringe benefits cost during 2011.

#### Required

Determine the amount of the fringe benefits cost to be allocated to Division A and to Division B.

### LO 2

#### Exercise 4-2A *Direct versus indirect costs*

Jeelani Construction Company is composed of two divisions: (1) Home Construction and (2) Commercial Construction. The Home Construction Division is in the process of building 12 houses and the Commercial Construction Division is working on three projects. Cost items of the company follow:

- Company president’s salary
- Depreciation on crane used in commercial construction
- Depreciation on home office building
- Salary of corporate office manager
- Wages of workers assigned to a specific construction project
- Supplies used by the Commercial Construction Division



Labor on a particular house  
 Salary of the supervisor of commercial construction projects  
 Supplies, such as glue and nails, used by the Home Construction Division  
 Cost of building permits  
 Materials used in commercial construction project  
 Depreciation on home building equipment (small tools such as hammers or saws)

**Required**

- Identify each cost as being a direct or indirect cost assuming the cost objects are the individual products (houses or projects).
- Identify each cost as being a direct or indirect cost, assuming the cost objects are the two divisions.
- Identify each cost as being a direct or indirect cost assuming the cost object is Jeelani Construction Company as a whole.

**Exercise 4-3A** *Allocating overhead cost among products***LO 3, 4**

Dew Hats Corporation manufactures three different models of hats: Vogue, Beauty, and Glamour. Dew expects to incur \$576,000 of overhead cost during the next fiscal year. Other budget information follows.

	Vogue	Beauty	Glamour	Total
Direct labor hours	2,000	4,000	6,000	12,000
Machine hours	1,200	1,400	1,400	4,000

**Required**

- Use direct labor hours as the cost driver to compute the allocation rate and the budgeted overhead cost for each product.
- Use machine hours as the cost driver to compute the allocation rate and the budgeted overhead cost for each product.
- Describe a set of circumstances where it would be more appropriate to use direct labor hours as the allocation base.
- Describe a set of circumstances where it would be more appropriate to use machine hours as the allocation base.

**Exercise 4-4A** *Allocating overhead costs among products***LO 3, 4**

Nevin Company makes three products in its factory: plastic cups, plastic tablecloths, and plastic bottles. The expected overhead costs for the next fiscal year include the following.

Factory manager's salary	\$260,000
Factory utility cost	121,000
Factory supplies	<u>56,000</u>
Total overhead costs	<u>\$437,000</u>

Nevin uses machine hours as the cost driver to allocate overhead costs. Budgeted machine hours for the products are as follows:

Cups	420 Hours
Tablecloths	740
Bottles	<u>1,140</u>
Total machine hours	<u>2,300</u>

**Required**

- Allocate the budgeted overhead costs to the products.
- Provide a possible explanation as to why Nevin chose machine hours, instead of labor hours, as the allocation base.

**LO 3, 4****Exercise 4-5A** *Allocating costs among products*

Deka Construction Company expects to build three new homes during a specific accounting period. The estimated direct materials and labor costs are as follows.

Expected Costs	Home 1	Home 2	Home 3
Direct labor	\$60,000	\$ 90,000	\$170,000
Direct materials	90,000	130,000	180,000

Assume Deka needs to allocate two major overhead costs (\$40,000 of employee fringe benefits and \$20,000 of indirect materials costs) among the three jobs.

**Required**

Choose an appropriate cost driver for each of the overhead costs and determine the total cost of each house.

**LO 3, 5****Exercise 4-6A** *Allocating to smooth cost over varying levels of production*

Production workers for Nabors Manufacturing Company provided 280 hours of labor in January and 500 hours in February. Nabors expects to use 4,000 hours of labor during the year. The rental fee for the manufacturing facility is \$8,000 per month.

**Required**

Explain why allocation is needed. Based on this information, how much of the rental cost should be allocated to the products made in January and to those made in February?

**LO 3, 5****Exercise 4-7A** *Allocating to solve a timing problem*

Production workers for Bianco Manufacturing Company provided 3,600 hours of labor in January and 1,900 hours in February. The company, whose operation is labor intensive, expects to use 32,000 hours of labor during the year. Bianco paid a \$96,000 annual premium on July 1 of the prior year for an insurance policy that covers the manufacturing facility for the following 12 months.

**Required**

Explain why allocation is needed. Based on this information, how much of the insurance cost should be allocated to the products made in January and to those made in February?

**LO 3, 5****Exercise 4-8A** *Allocating to solve a timing problem*

Stevens Air is a large airline company that pays a customer relations representative \$4,000 per month. The representative, who processed 1,000 customer complaints in January and 1,300 complaints in February, is expected to process 24,000 customer complaints during 2012.

**Required**

- Determine the total cost of processing customer complaints in January and in February.
- Explain why allocating the cost of the customer relations representative would or would not be relevant to decision making.

**LO 3, 5****Exercise 4-9A** *Allocating overhead cost to accomplish smoothing*

Woods Corporation expects to incur indirect overhead costs of \$60,000 per month and direct manufacturing costs of \$11 per unit. The expected production activity for the first four months of 2012 is as follows.

	January	February	March	April
Estimated production in units	4,000	7,000	3,000	6,000

**Required**

- Calculate a predetermined overhead rate based on the number of units of product expected to be made during the first four months of the year.
- Allocate overhead costs to each month using the overhead rate computed in Requirement *a*.
- Calculate the total cost per unit for each month using the overhead allocated in Requirement *b*.

**Exercise 4-10A** *Pooling overhead cost***LO 3, 5, 6**

Jasti Manufacturing Company produced 1,000 units of inventory in January 2011. It expects to produce an additional 8,400 units during the remaining 11 months of the year. In other words, total production for 2011 is estimated to be 9,600 units. Direct materials and direct labor costs are \$64 and \$52 per unit, respectively. Jasti Company expects to incur the following manufacturing overhead costs during the 2011 accounting period.

Production supplies	\$ 4,800
Supervisor salary	192,000
Depreciation on equipment	144,000
Utilities	36,000
Rental fee on manufacturing facilities	96,000

**Required**

- Combine the individual overhead costs into a cost pool and calculate a predetermined overhead rate assuming the cost driver is number of units.
- Determine the cost of the 1,200 units of product made in January.
- Is the cost computed in Requirement *a* actual or estimated? Could Jasti improve accuracy by waiting until December to determine the cost of products? Identify two reasons that a manager would want to know the cost of products in January. Discuss the relationship between accuracy and relevance as it pertains to this problem.

**Exercise 4-11A** *How the allocation of fixed cost affects a pricing decision***LO 3, 5**

Mallett Manufacturing Co. expects to make 30,000 chairs during the 2011 accounting period. The company made 3,200 chairs in January. Materials and labor costs for January were \$16,000 and \$24,000, respectively. Mallett produced 2,500 chairs in February. Material and labor costs for February were \$8,000 and \$12,000, respectively. The company paid the \$240,000 annual rental fee on its manufacturing facility on January 1, 2011.

**Required**

Assuming that Mallett desires to sell its chairs for cost plus 40 percent of cost, what price should be charged for the chairs produced in January and February?

**Exercise 4-12A** *Allocating joint product cost***LO 3, 7**

Turley Chemical Company makes three products, B7, K6, and X9, which are joint products from the same materials. In a standard batch of 300,000 pounds of raw materials, the company generates 70,000 pounds of B7, 150,000 pounds of K6, and 80,000 pounds of X9. A standard batch costs \$2,400,000 to produce. The sales prices per pound are \$6, \$10, and \$16 for B7, K6, and X9, respectively.

**Required**

- Allocate the joint product cost among the three final products using weight as the allocation base.
- Allocate the joint product cost among the three final products using market value as the allocation base.

**Exercise 4-13A** *Human factor***LO 8**

Dearman Clinics provides medical care in three departments: internal medicine (IM), pediatrics (PD), and obstetrics gynecology (OB). The estimated costs to run each department follow:

	IM	PD	OB
Physicians	\$400,000	\$300,000	\$200,000
Nurses	80,000	120,000	160,000



Dearman expects to incur \$450,000 of indirect (overhead) costs in the next fiscal year.



**Required**

- Name four allocation bases that could be used to assign the overhead cost to each department.
- Assume the manager of each department is permitted to recommend how the overhead cost should be allocated to the departments. Which of the allocation bases named in Requirement *a* is the manager of OB most likely to recommend? Explain why. What argument may the manager of OB use to justify his choice of the allocation base?
- Which of the allocation bases would result in the fairest allocation of the overhead cost from the perspective of the company president?
- Explain how classifying overhead costs into separate pools could improve the fairness of the allocation of the overhead costs.

**Appendix****LO 3, 9****Exercise 4-14A** *Allocating a service center cost to operating departments*

Fowler Corporation's computer services department assists two operating departments in using the company's information system effectively. The annual cost of computer services is \$360,000. The production department employs 22 employees, and the sales department employs 18 employees. Fowler uses the number of employees as the cost driver for allocating the cost of computer services to operating departments.

**Required**

Allocate the cost of computer services to operating departments.

**LO 3, 9****Exercise 4-15A** *Allocating costs of service centers to operating departments—step method*

Hardy Health Care Center, Inc., has three clinics servicing the Seattle metropolitan area. The company's legal services department supports the clinics. Moreover, its computer services department supports all of the clinics and the legal services department. The annual cost of operating the legal services department is \$217,000. The annual cost of operating the computer services department is \$450,000. The company uses the number of patients served as the cost driver for allocating the cost of legal services and the number of computer workstations as the cost driver for allocating the cost of computer services. Other relevant information follows:

	Number of Patients	Number of Workstations
Hoover clinic	6,000	15
Eastwood clinic	4,200	16
Gardendale clinic	5,800	12
Legal services		7
Computer services		10

**Required**

- Allocate the cost of computer services to all of the clinics and the legal services department.
- After allocating the cost of computer services, allocate the cost of legal services to the three clinics.
- Compute the total allocated cost of service centers for each clinic.

**LO 3, 9****Exercise 4-16A** *Allocating costs of service centers to operating departments—direct method*

Jooste Trust Corporation has two service departments: actuary and economic analysis. Jooste also has three operating departments: annuity, fund management, and employee benefit services. The annual costs of operating the service departments are \$440,000 for actuary and \$720,000 for economic analysis. Jooste uses the direct method to allocate service center costs to operating departments. Other relevant data follow:

	Operating Costs*	Revenue
Annuity	\$500,000	\$ 840,000
Fund management	900,000	1,260,000
Employee benefit services	600,000	1,100,000

\*The operating costs are measured before allocating service center costs.

**Required**

- Use operating costs as the cost driver for allocating service center costs to operating departments.
- Use revenue as the cost driver for allocating service center costs to operating departments.

**PROBLEMS—SERIES A**

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

**Problem 4-17A** *Cost accumulation and allocation*

Singh Manufacturing Company makes two different products, M and N. The company's two departments are named after the products; for example, Product M is made in Department M. Singh's accountant has identified the following annual costs associated with these two products.

**LO 1, 2, 3, 4, 5****CHECK FIGURE**

(c) N: \$531.65

<b>Financial data</b>	
Salary of vice president of production division	\$180,000
Salary of supervisor Department M	76,000
Salary of supervisor Department N	56,000
Direct materials cost Department M	300,000
Direct materials cost Department N	420,000
Direct labor cost Department M	240,000
Direct labor cost Department N	680,000
Direct utilities cost Department M	120,000
Direct utilities cost Department N	24,000
General factorywide utilities	36,000
Production supplies	36,000
Fringe benefits	138,000
Depreciation	720,000
<b>Nonfinancial data</b>	
Machine hours Department M	5,000
Machine hours Department N	1,000

**Required**

- Identify the costs that are (1) direct costs of Department M, (2) direct costs of Department N, and (3) indirect costs.
- Select the appropriate cost drivers for the indirect costs and allocate these costs to Departments M and N.
- Determine the total estimated cost of the products made in Departments M and N. Assume that Singh produced 2,000 units of Product M and 4,000 units of Product N during the year. If Singh prices its products at cost plus 40 percent of cost, what price per unit must it charge for Product M and for Product N?

**LO 1, 3, 4****Problem 4-18A** *Selecting an appropriate cost driver (What is the base?)*

The Vest School of Vocational Technology has organized the school training programs into three departments. Each department provides training in a different area as follows: nursing assistant, dental hygiene, and office technology. The school's owner, Wilma Vest, wants to know how much it costs to operate each of the three departments. To accumulate the total cost for each department, the accountant has identified several indirect costs that must be allocated to each. These costs are \$10,080 of phone expense, \$2,016 of office supplies, \$720,000 of office rent, \$144,000 of janitorial services, and \$150,000 of salary paid to the dean of students. To provide a reasonably accurate allocation of costs, the accountant has identified several possible cost drivers. These drivers and their association with each department follow.

Cost Driver	Department 1	Department 2	Department 3
Number of telephones	28	32	52
Number of faculty members	20	16	12
Square footage of office space	28,800	16,800	12,000
Number of secretaries	2	2	2

**Required**

- Identify the appropriate cost objects.
- Identify the appropriate cost driver for each indirect cost and compute the allocation rate for assigning each indirect cost to the cost objects.
- Determine the amount of telephone expense that should be allocated to each of the three departments.
- Determine the amount of supplies expense that should be allocated to Department 3.
- Determine the amount of office rent that should be allocated to Department 2.
- Determine the amount of janitorial services cost that should be allocated to Department 1.
- Identify two cost drivers not listed here that could be used to allocate the cost of the dean's salary to the three departments.

**LO 1, 2****Problem 4-19A** *Cost allocation in a service industry***CHECK FIGURE**

b. To NY: \$802

Kirby Airlines is a small airline that occasionally carries overload shipments for the overnight delivery company Never-Fail, Inc. Never-Fail is a multimillion-dollar company started by Jack Never immediately after he failed to finish his first accounting course. The company's motto is "We Never-Fail to Deliver Your Package on Time." When Never-Fail has more freight than it can deliver, it pays Kirby to carry the excess. Kirby contracts with independent pilots to fly its planes on a per-trip basis. Kirby recently purchased an airplane that cost the company \$5,500,000. The plane has an estimated useful life of 25,000,000 miles and a zero salvage value. During the first week in January, Kirby flew two trips. The first trip was a round trip flight from Chicago to San Francisco, for which Kirby paid \$350 for the pilot and \$300 for fuel. The second flight was a round trip from Chicago to New York. For this trip, it paid \$300 for the pilot and \$150 for fuel. The round trip between Chicago and San Francisco is approximately 4,400 miles and the round trip between Chicago and New York is 1,600 miles.

**Required**

- Identify the direct and indirect costs that Kirby incurs for each trip.
- Determine the total cost of each trip.
- In addition to depreciation, identify three other indirect costs that may need to be allocated to determine the cost of each trip.

**LO 1, 3, 4****Problem 4-20A** *Cost allocation in a manufacturing company***CHECK FIGURE**

d. Feb.: \$7,200

Hunt Manufacturing Company makes tents that it sells directly to camping enthusiasts through a mail-order marketing program. The company pays a quality control expert \$72,000 per year to inspect completed tents before they are shipped to customers. Assume that the company completed 1,600 tents in January and 1,200 tents in February. For the entire year, the company expects to produce 12,000 tents.

**Required**

- Explain how changes in the cost driver (number of tents inspected) affect the total amount of fixed inspection cost.
- Explain how changes in the cost driver (number of tents inspected) affect the amount of fixed inspection cost per unit.
- If the cost objective is to determine the cost per tent, is the expert's salary a direct or an indirect cost?
- How much of the expert's salary should be allocated to tents produced in January and February?

**Problem 4-21A** *Fairness and cost pool allocations***LO 1, 4, 6, 8****excel**

Daniel Manufacturing Company uses two departments to make its products. Department I is a cutting department that is machine intensive and uses very few employees. Machines cut and form parts and then place the finished parts on a conveyor belt that carries them to Department II where they are assembled into finished goods. The assembly department is labor intensive and requires many workers to assemble parts into finished goods. The company's manufacturing facility incurs two significant overhead costs: employee fringe benefits and utility costs. The annual costs of fringe benefits are \$252,000 and utility costs are \$180,000. The typical consumption patterns for the two departments are as follows.

	Department I	Department II	Total
Machine hours used	16,000	4,000	20,000
Direct labor hours used	5,000	13,000	18,000

The supervisor of each department receives a bonus based on how well the department controls costs. The company's current policy requires using a single allocation base (machine hours or labor hours) to allocate the total overhead cost of \$432,000.

**Required**

- Assume that you are the supervisor of Department I. Choose the allocation base that would minimize your department's share of the total overhead cost. Calculate the amount of overhead that would be allocated to both departments using the base that you selected.
- Assume that you are the supervisor of Department II. Choose the allocation base that would minimize your department's share of the total overhead cost. Calculate the amount of overhead that would be allocated to both departments using the base that you selected.
- Assume that you are the plant manager and have the authority to change the company's overhead allocation policy. Formulate an overhead allocation policy that would be fair to the supervisors of both Department I and Department II. Compute the overhead allocations for each department using your policy.
- Explain why it is necessary to disaggregate the overhead cost pool in order to accomplish fairness.

**Problem 4-22A** *Allocation to accomplish smoothing***LO 1, 3, 5****CHECK FIGURES**

O'Hara Corporation estimated its overhead costs would be \$24,000 per month except for January when it pays the \$72,000 annual insurance premium on the manufacturing facility. Accordingly, the January overhead costs were expected to be \$96,000 (\$72,000 + \$24,000). The company expected to use 7,000 direct labor hours per month except during July, August, and September when the company expected 9,000 hours of direct labor each month to build inventories for high demand that normally occurs during the Christmas season. The company's actual direct labor hours were the same as the estimated hours. The company made 3,500 units of product in each month except July, August, and September in which it produced 4,500 units each month. Direct labor costs were \$24 per unit, and direct materials costs were \$10 per unit.

a. \$4

c. March: \$42

**Required**

- Calculate a predetermined overhead rate based on direct labor hours.
- Determine the total allocated overhead cost for January, March, and August.

- c. Determine the cost per unit of product for January, March, and August.
- d. Determine the selling price for the product, assuming that the company desires to earn a gross margin of \$20 per unit.

**LO 1, 3, 5****CHECK FIGURES**

- a. Cost/unit for EZRecords: \$200
- b. Cost/unit for ProOffice: \$220

**LO 1, 6****Problem 4-23A Allocating indirect costs between products**

Erin Tarver is considering expanding her business. She plans to hire a salesperson to cover trade shows. Because of compensation, travel expenses, and booth rental, fixed costs for a trade show are expected to be \$12,000. The booth will be open 30 hours during the trade show. Ms. Tarver also plans to add a new product line, ProOffice, which will cost \$180 per package. She will continue to sell the existing product, EZRecords, which costs \$100 per package. Ms. Tarver believes that the salesperson will spend approximately 20 hours selling EZRecords and 10 hours marketing ProOffice.

**Required**

- a. Determine the estimated total cost and cost per unit of each product, assuming that the salesperson is able to sell 80 units of EZRecords and 50 units of ProOffice.
- b. Determine the estimated total cost and cost per unit of each product, assuming that the salesperson is able to sell 200 units of EZRecords and 100 units of ProOffice.
- c. Explain why the cost per unit figures calculated in Requirement *a* are different from the amounts calculated in Requirement *b*. Also explain how the differences in estimated cost per unit will affect pricing decisions.

**Problem 4-24A Cost Pools**

Richter Department Stores, Inc. has three departments: women's, men's, and children's. The following are the indirect costs related to its operations:

Medical insurance  
Salaries of secretaries  
Water bill  
Vacation pay  
Sewer bill  
Staples  
Natural gas bill  
Pens  
Ink cartridges  
Payroll taxes  
Paper rolls for cash registers

**Required**

- a. Organize the costs in the following three pools: indirect materials, indirect labor, and indirect utilities, assuming that each department is a cost object.
- b. Identify an appropriate cost driver for each pool.
- c. Explain why accountants use cost pools.

**LO 3, 7****Problem 4-25A Allocating joint product cost**

Koch Chicken Corporation processes and packages chicken for grocery stores. It purchases chickens from farmers and processes them into two different products: chicken drumsticks and chicken steak. From a standard batch of 12,000 pounds of raw chicken that costs \$7,000, the company produces two parts: 2,800 pounds of drumsticks and 4,200 pounds of breast for a processing cost of \$2,450. The chicken breast is further processed into 3,200 pounds of steak for a processing cost of \$2,000. The market price of drumsticks per pound is \$1.00 and the market price per pound of chicken steak is \$3.40. If Koch decided to sell chicken breast instead of chicken steak, the price per pound would be \$2.00.

**Required**

- a. Allocate the joint cost to the joint products, drumsticks and breasts, using weight as the allocation base. Calculate the net income for each product. Since the drumsticks are producing a net loss, should that product line be eliminated?

**CHECK FIGURES**

- a. GM for drumsticks: \$(980)
- b. Total cost of breasts: \$7,087.50

- b. Reallocate the joint cost to the joint products, drumsticks and breasts, using relative market values as the allocation base. Calculate the net income for each product. Compare the total net income (drumsticks + breasts) computed in Requirement *b* with that computed in Requirement *a* above. Explain why the total amount is the same. Comment on which allocation base (weight or market value) is more appropriate.
- c. Should Koch further process chicken breasts into chicken steak?

## Appendix

### Problem 4-26A *Allocating service center costs—step method and direct method*

**LO 3, 9**

**eXcel**

Romero Information Services, Inc., has two service departments: human resources and billing. Romero's operating departments, organized according to the special industry each department serves, are health care, retail, and legal services. The billing department supports only the three operating departments, but the human resources department supports all operating departments and the billing department. Other relevant information follows.

#### CHECK FIGURES

- a. Allocated cost from Billing to Retail: \$558,000
- b. Allocated cost from HR to LS: \$240,000

	Human Resources	Billing	Health Care	Retail	Legal Services
Number of employees	20	50	190	140	120
Annual cost*	\$900,000	\$1,710,000	\$6,000,000	\$4,800,000	\$2,800,000
Annual revenue	—	—	\$9,000,000	\$6,200,000	\$4,800,000

\*This is the operating cost before allocating service department costs.

## Required

- a. Allocate service department costs to operating departments, assuming that Romero adopts the step method. The company uses the number of employees as the base for allocating human resources department costs and department annual revenue as the base for allocating the billing department costs.
- b. Allocate service department costs to operating departments, assuming that Romero adopts the direct method. The company uses the number of employees as the base for allocating the human resources department costs and department annual revenue as the base for allocating the billing department costs.
- c. Compute the total allocated cost of service centers for each operating department using each allocation method.

## EXERCISES—SERIES B

### Exercise 4-1B *Allocating costs between divisions*

**LO 1, 3**

Smith and Warren, LLP, has three departments: auditing, tax, and information systems. The departments occupy 2,500 square feet, 1,500 square feet, and 1,000 square feet of office space, respectively. The firm pays \$6,000 per month to rent its offices.

## Required

How much monthly rent cost should Smith and Warren allocate to each department?

### Exercise 4-2B *Direct versus indirect costs*

**LO 2**

Kenta and Associates, LLP, is an accounting firm that provides two major types of professional services: (1) tax services as provided by the tax department and (2) auditing services as provided by the audit department. Each department has numerous clients. Engagement with each individual client is a separate service (i.e., product) and each department has several engagements in each period. Cost items of the firm follow:

Secretarial labor supporting both departments

Professional labor for an audit engagement

Depreciation of computers used in the audit department

Salary of the partner in charge of the tax department  
 Travel expenditures for an audit engagement  
 Salary of the partner in charge of the audit department  
 Salary of the managing partner of the firm  
 Cost of office supplies such as paper, pencils, erasers, etc.  
 Depreciation of computers used in the tax department  
 License fees of the firm  
 Professional labor for a tax engagement

**Required**

- Identify each cost as being a direct or indirect cost assuming the cost objects are the individual engagements (audit engagements or tax engagements).
- Identify each cost as being a direct or indirect cost assuming the cost objects are the two departments.
- Identify each cost as being a direct or indirect cost assuming the cost object is Kenta and Associates, LLP, as a whole.

**LO 3, 5****Exercise 4-3B** *Allocating overhead costs among products*

Diat Company manufactures three different sizes of automobile sunscreens: large, medium, and small. Diat expects to incur \$480,000 of overhead costs during the next fiscal year. Other budget information for the coming year follows:

	Large	Medium	Small	Total
Direct labor hours	2,500	5,000	4,500	12,000
Machine hours	700	1,300	1,000	3,000

**Required**

- Use direct labor hours as the cost driver to compute the allocation rate and the budgeted overhead cost for each product.
- Use machine hours as the cost driver to compute the allocation rate and the budgeted overhead cost for each product.
- Describe a set of circumstances where it would be more appropriate to use direct labor hours as the allocation base.
- Describe a set of circumstances where it would be more appropriate to use machine hours as the allocation base.

**LO 3, 4****Exercise 4-4B** *Allocating overhead costs among products*

Yunan Company makes three models of jump drives in its factory: J512, J1G, and J4G. The expected overhead costs for the next fiscal year are as follows:

Payroll for factory managers	\$100,000
Factory maintenance costs	45,000
Factory insurance	<u>23,000</u>
Total overhead costs	<u>\$168,000</u>

Yunan uses labor hours as the cost driver to allocate overhead cost. Budgeted labor hours for the products are as follows:

J512	1,000 hours
J1G	650
J4G	<u>450</u>
Total labor hours	<u>2,100</u>

**Required**

- Allocate the budgeted overhead costs to the products.
- Provide a possible explanation as to why Yunan chose labor hours, instead of machine hours, as the allocation base.

**Exercise 4-5B** *Allocating costs among products***LO 3, 4**

Blotski Company makes household plastic bags in three different sizes: Snack, Sandwich, and Storage. The estimated direct materials and direct labor costs are as follows.

Expected Costs	Snack	Sandwich	Storage
Direct materials	\$112,000	\$188,000	\$300,000
Direct labor	60,000	116,000	224,000

Blotski allocates two major overhead costs among the three products: \$36,000 of indirect labor cost for workers who move various materials and products to different stations in the factory and \$28,000 of employee pension costs.

**Required**

Determine the total cost of each product.

**Exercise 4-6B** *Allocating indirect cost over varying levels of production***LO 3, 5**

Denver Company's annual factory depreciation is \$108,000. Denver estimated it would operate the factory a total of 2,400 hours this year. The factory operated 200 hours in November and 150 hours in December.

**Required**

Why would Denver need to allocate factory depreciation cost? How much depreciation cost should Denver allocate to products made in November and those made in December?

**Exercise 4-7B** *Allocating indirect cost over varying levels of production***LO 3, 5**

On January 1, Glaze Corporation paid the annual royalty of \$720,000 for rights to use patented technology to make batteries for laptop computers. Glaze plans to use the patented technology to produce five different models of batteries. Glaze uses machine hours as a common cost driver and plans to operate its machines 48,000 hours in the coming year. The company used 3,000 machine hours in June and 3,600 hours in July.

**Required**

Why would Glaze need to allocate the annual royalty payment rather than simply assign it in total to January production? How much of the royalty cost should Glaze allocate to products made in June and those made in July?

**Exercise 4-8B** *Allocating a fixed cost***LO 3, 5**

Last year, Sean Tapper bought an automobile for \$24,000 to use in his taxi business. He expected to drive the vehicle for 140,000 miles before disposing of it for \$3,000. Sean drove 3,200 miles this week and 2,800 miles last week.

**Required**

- Determine the total cost of vehicle depreciation this week and last week.
- Explain why allocating the vehicle cost would or would not be relevant to decision making.

**Exercise 4-9B** *Allocating overhead cost to accomplish smoothing***LO 3, 5**

In 2012, Pingtung Corporation incurred direct manufacturing costs of \$35 per unit and manufacturing overhead costs of \$175,000. The production activity for the four quarters of 2012 follows:

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Number of units produced	3,300	2,700	4,500	2,000



**Required**

- Calculate a predetermined overhead rate based on the number of units produced during the year.
- Allocate overhead costs to each quarter using the overhead rate computed in Requirement *a*.
- Using the overhead allocation determined in Requirement *b*, calculate the total cost per unit for each quarter.

**LO 3, 5, 6****Exercise 4-10B Pooling overhead cost**

Rosen Manufacturing Company produced 500 units of inventory in January 2011. The company expects to produce an additional 5,500 units of inventory during the remaining 11 months of the year, for total estimated production of 6,000 units in 2011. Direct materials and direct labor costs are \$70 and \$82 per unit, respectively. Rosen expects to incur the following manufacturing overhead costs during the 2011 accounting period:

Indirect materials	\$ 6,800
Depreciation on equipment	24,000
Utilities cost	10,200
Salaries of plant manager and staff	96,800
Rental fee on manufacturing facilities	19,000

**Required**

- Combine the individual overhead costs into a cost pool and calculate a predetermined overhead rate assuming the cost driver is number of units.
- Determine the estimated cost of the 500 units of product made in January.
- Is the cost computed in Requirement *a* actual or estimated? Could Rosen improve accuracy by waiting until December to determine the cost of products? Identify two reasons that a manager would want to know the cost of products in January. Discuss the relationship between accuracy and relevance as it pertains to this problem.

**LO 3, 5****Exercise 4-11B How fixed cost allocation affects a pricing decision**

Neumann Manufacturing Company expects to make 30,000 travel sewing kits during 2012. In January, the company made 1,800 kits. Materials and labor costs for January were \$7,200 and \$9,000, respectively. In February, Neumann produced 2,200 kits. Material and labor costs for February were \$8,800 and \$11,000, respectively. The company paid \$69,000 for annual factory insurance on January 10, 2012. Ignore other manufacturing overhead costs.

**Required**

Assuming that Neumann desires to sell its sewing kits for cost plus 20 percent of cost, what price should it charge for the kits produced in January and February?

**LO 3, 6****Exercise 4-12B Allocating joint product cost**

Pannier Food Corporation makes two products from soybeans: cooking oil and cattle feed. From a standard batch of 100,000 pounds of soybeans, Pannier produces 20,000 pounds of cooking oil and 80,000 pounds of cattle feed. Producing a standard batch costs \$10,000. The sales prices per pound are \$1.00 for cooking oil and \$0.75 for cattle feed.

**Required**

- Allocate the joint product cost to the two products using weight as the allocation base.
- Allocate the joint product cost to the two products using market value as the allocation base.

**LO 8****Exercise 4-13B Human factor**

Duddley Company builds custom sailboats. Duddley currently has three boats under construction. The estimated costs to complete each boat are shown below.

	Boat 1	Boat 2	Boat 3
Direct materials	\$25,000	\$32,000	\$12,000
Direct labor	22,000	20,000	14,000

Duddley expects to incur \$48,000 of indirect (overhead) costs in the process of making the boats.

**Required**

- Based on the information provided, name four allocation bases that could be used to assign the overhead costs to each boat.
- Assume that the production manager of each boat is permitted to recommend how the overhead costs should be allocated to the boats. Which of the allocation bases named in Requirement *a* is the manager of Boat 2 most likely to recommend? Explain why. What argument may the manager of Boat 2 use to justify his choice of the allocation base?
- Which of the allocation bases would result in the fairer allocation of the overhead costs from the perspective of the company president?
- Explain how classifying overhead costs into separate pools could improve the fairness of the allocation of the overhead costs.

**Appendix****Exercise 4-14B** *Allocating a service center cost to operating departments***LO 3, 9**

The administrative department of Andrews Consulting, LLC, provides office administration and professional support to its two operating departments. Annual administrative costs are \$540,000. In 2010, the hours chargeable to clients generated by the information services department and the financial planning department were 24,000 and 36,000, respectively. Andrews uses chargeable hours as the cost driver for allocating administrative costs to operating departments.

**Required**

Allocate the administrative costs to the two operating departments.

**Exercise 4-15B** *Allocating service centers' costs to operating departments—step method***LO 3, 9**

Shepard Consulting, LLP, has three operating departments: tax, estate planning, and small business. The company's internal accounting and maintenance departments support the operating departments. Moreover, the maintenance department also supports the internal accounting department. Other relevant information follows:

	Annual Cost*	Square Feet	Operating Revenue
Tax	\$5,000,000	8,000	\$8,000,000
Estate planning	2,000,000	2,000	3,500,000
Small business	3,000,000	4,000	6,500,000
Internal accounting	690,000	1,000	0
Maintenance	450,000	1,000	0

\*The annual cost figures do not include costs allocated from service departments.

Shepard allocates its maintenance cost based on the square footage of each department's office space. The firm allocates the internal accounting cost based on each department's operating revenue.

**Required**

- Allocate the maintenance cost to the operating and internal accounting departments.
- After allocating the maintenance cost, allocate the internal accounting cost to the three operating departments.
- Compute the total allocated cost of the service departments for each operating department.

**Exercise 4-16B** *Allocating service centers' costs to operating departments—direct method***LO 3, 9**

Quebec Corporation, a book publisher, has two service departments: editing and typesetting. Quebec also has three operating departments: children's fiction, youth fiction, and adult fiction. The annual costs of operating the editing department are \$240,000 and of operating the

typesetting department are \$210,000. Quebec uses the direct method to allocate service center costs to operating departments. Other relevant data follow.

	Number of Pages	Number of Hours
Children	15,000	5,000
Youth	10,000	8,000
Adult	5,000	7,000

### Required

- Allocate the service center costs to the operating departments using the number of pages as the cost driver.
- Allocate the service center costs to the operating departments using the number of hours as the cost driver.

## PROBLEMS—SERIES B

### LO 1, 2, 3, 4, 5

### Problem 4-17B *Cost accumulation and allocation*

Otto Tools Company has two production departments in its manufacturing facilities. Home tools specializes in hand tools for individual home users, and professional tools makes sophisticated tools for professional maintenance workers. Otto's accountant has identified the following annual costs associated with these two products:

Financial data	
Salary of vice president of production	\$150,000
Salary of manager, home tools	54,000
Salary of manager, professional tools	43,500
Direct materials cost, home tools	300,000
Direct materials cost, professional tools	375,000
Direct labor cost, home tools	336,000
Direct labor cost, professional tools	414,000
Direct utilities cost, home tools	75,000
Direct utilities cost, professional tools	30,000
General factorywide utilities	31,500
Production supplies	40,500
Fringe benefits	150,000
Depreciation	360,000
Nonfinancial data	
Machine hours, home tools	4,000
Machine hours, professional tools	2,000

### Required

- Identify the costs that are the (1) direct costs of home tools, (2) direct costs of professional tools, and (3) indirect costs.
- Select the appropriate cost drivers and allocate the indirect costs to home tools and to professional tools.
- Assume that each department makes only a single product. Home tools produces its Deluxe Drill for home use, and professional tools produces the Professional Drill. The company made 30,000 units of Deluxe Drill and 20,000 units of Professional Drill during the year. Determine the total estimated cost of the products made in each department. If Otto prices its products at cost plus 30 percent of cost, what price per unit must it charge for the Deluxe Drill and the Professional Drill?

**Problem 4-18B** *Selecting an appropriate cost driver (What is the base?)***LO 1, 3, 4**

Letterman Research Institute has three departments: biology, chemistry, and physics. The institute's controller wants to estimate the cost of operating each department. He has identified several indirect costs that must be allocated to each department including \$11,200 of phone expense, \$2,400 of office supplies, \$1,120,000 of office rent, \$150,000 of janitorial services, and \$150,000 of salary paid to the director. To provide a reasonably accurate allocation of costs, the controller identified several possible cost drivers. These drivers and their association with each department follow.

Cost Driver	Biology	Chemistry	Physics
Number of telephones	10	14	16
Number of researchers	8	10	12
Square footage of office space	8,000	8,000	12,000
Number of secretaries	1	1	1

**Required**

- Identify the appropriate cost objects.
- Identify the appropriate cost driver for each indirect cost, and compute the allocation rate for assigning each indirect cost to the cost objects.
- Determine the amount of telephone expense that should be allocated to each of the three departments.
- Determine the amount of supplies expense that should be allocated to the physics department.
- Determine the amount of office rent cost that should be allocated to the chemistry department.
- Determine the amount of janitorial services cost that should be allocated to the biology department.
- Identify two cost drivers not listed here that could be used to allocate the cost of the director's salary to the three departments.

**Problem 4-19B** *Cost allocation in a service industry***LO 1, 2**

Cook, Newton, and Associates provides legal services for its local community. In addition to its regular attorneys, the firm hires some part-time attorneys to handle small cases. Two secretaries assist all part-time attorneys exclusively. In 2010, the firm paid \$48,000 for the two secretaries who worked a total of 4,000 hours. Moreover, the firm paid Jean Sutton \$60 per hour and Eric Veasy \$50 per hour for their part-time legal services.

In August 2010, Ms. Sutton completed a case that took her 60 hours. Mr. Veasy finished a case on which he worked 30 hours. The firm also paid a private investigator to uncover relevant facts. The investigation fees cost \$1,000 for Ms. Sutton's case and \$750 for Mr. Veasy's case. Ms. Sutton used 30 hours of secretarial assistance, and Mr. Veasy used 40 hours.

**Required**

- Identify the direct and indirect costs incurred in each case completed in August 2010.
- Determine the total cost of each case.
- In addition to secretaries' salaries, identify three other indirect costs that may need to be allocated to determine the cost of the cases.

**Problem 4-20B** *Cost allocation in a manufacturing company***LO 1, 3, 4**

Solid Door Corporation makes a particular type of door. The labor cost is \$90 per door and the material cost is \$160 per door. Solid rents a factory building for \$60,000 a month. Solid plans to produce 24,000 doors annually. In March and April, it made 2,000 and 3,000 doors, respectively.



**Required**

- Explain how changes in the cost driver (number of doors made) affect the total amount of fixed rental cost.
- Explain how changes in the cost driver (number of doors made) affect the fixed rental cost per unit.
- If the cost objective is to determine the cost per door, is the factory rent a direct or an indirect cost?
- How much of the factory rent should be allocated to doors produced in March and April?

**LO 1, 4, 6, 8****Problem 4-21B** *Fairness and cost pool allocations*

Pettway Furniture Company has two production departments. The parts department uses automated machinery to make parts; as a result, it uses very few employees. The assembly department is labor intensive because workers manually assemble parts into finished furniture. Employee fringe benefits and utility costs are the two major overhead costs of the company's production division. The fringe benefits and utility costs for the year are \$300,000 and \$144,000, respectively. The typical consumption patterns for the two departments follow.

	Parts	Assembly	Total
Machine hours used	26,000	\$ 4,000	30,000
Direct labor hours used	3,500	20,500	24,000

The supervisor of each department receives a bonus based on how well the department controls costs. The company's current policy requires using a single activity base (machine hours or labor hours) to allocate the total overhead cost of \$444,000.

**Required**

- Assume that you are the parts department supervisor. Choose the allocation base that would minimize your department's share of the total overhead cost. Calculate the amount of overhead to allocate to both departments using the base that you selected.
- Assume that you are the assembly department supervisor. Choose the allocation base that would minimize your department's share of the total overhead cost. Calculate the amount of overhead to allocate to both departments using the base that you selected.
- Assume that you are the plant manager and that you have the authority to change the company's overhead allocation policy. Formulate an overhead allocation policy that would be fair to the supervisors of both the parts and assembly departments. Compute the overhead allocation for each department using your policy.
- Explain why it is necessary to disaggregate the overhead cost pool in order to accomplish fairness.

**LO 1, 3, 5****Problem 4-22B** *Allocation to accomplish smoothing*

Lagatta Corporation's overhead costs are usually \$24,000 per month. However, the company pays \$54,000 of real estate tax on the factory facility in March. Thus, the overhead costs for March increase to \$78,000. The company normally uses 5,000 direct labor hours per month except for August, September, and October, in which the company requires 9,000 hours of direct labor per month to build inventories for high demand in the Christmas season. Last year, the company's actual direct labor hours were the same as usual. The company made 5,000 units of product in each month except August, September, and October in which it produced 9,000 units per month. Direct labor costs were \$8 per unit; direct materials costs were \$7 per unit.

**Required**

- Calculate a predetermined overhead rate based on direct labor hours.
- Determine the total allocated overhead cost for the months of March, August, and December.

- c. Determine the cost per unit of product for the months of March, August, and December.
- d. Determine the selling price for the product, assuming that the company desires to earn a gross margin of \$7 per unit.

### Problem 4-23B *Allocating indirect cost between products*

LO 1, 3, 5



McCombs Corporation has hired a marketing representative to sell the company's two products: Marvelous and Wonderful. The representative's total salary and fringe benefits are \$10,000 monthly. The product cost is \$90 per unit for Marvelous and \$144 per unit for Wonderful. McCombs expects the representative to spend 48 hours per month marketing Marvelous and 112 hours promoting Wonderful.

#### Required

- a. Determine the estimated total cost and cost per unit, assuming that the representative is able to sell 100 units of Marvelous and 70 units of Wonderful in a month. Allocate indirect cost on the basis of labor hours.
- b. Determine the estimated total cost and cost per unit, assuming that the representative is able to sell 250 units of Marvelous and 140 units of Wonderful. Allocate indirect cost on the basis of labor hours.
- c. Explain why the cost per unit figures calculated in Requirement *a* differ from the amounts calculated in Requirement *b*. Also explain how the differences in estimated cost per unit will affect pricing decisions.

### Problem 4-24B *Cost Pools*

LO 1, 6



Esquire Furniture Company incurred the following costs in the process of making tables and chairs.

Glue	Paint
Supervisor salaries	Water bill
Gas bill	Vacation pay
Payroll taxes	Sewer bill
Cost of nails	Staples
Medical insurance	Electric bill

#### Required

- a. Organize the costs in the following three pools: indirect materials, indirect labor, and indirect utilities.
- b. Identify an appropriate cost driver for each pool.
- c. Explain why accountants use cost pools.

### Problem 4-25B *Allocating joint product cost*

LO 3, 9



Mountain Tea Co. makes two products: a high-grade tea branded Wulong and a low-grade tea branded San Tea for the Asian market. Mountain purchases tea leaves from tea firms in mountainous villages of Taiwan and processes the tea leaves into a high-quality product. The tea leaves are dried and baked in the manufacturing process. Mountain pays farmers \$600 for 900 kilograms of tea leaves. For 900 kilograms of green leaves, the company can produce 100 kilograms of Wulong and 200 kilograms of tea fragments including dried leave stems and broken dried leaves. The cost of this process is \$300 per batch. The tea fragments are packaged into San Tea. The market price for San Tea is \$2.00 per kilogram. The market price is \$20 per kilogram for Wulong. Mountain has an option of taking an additional process to refine the 100 kilograms of Wulong into 30 kilograms of Donding, a prestigious brand. The market price of Donding is \$100 per kilogram. The cost of the additional process is \$250 per batch.

#### Required

- a. Allocate the joint cost to the joint products, Wulong and San Tea, using weight as the allocation base. Calculate the net income for each product. Since the San Tea is sold at a loss, should that product line be eliminated?

- b. Allocate the joint cost to the joint products, Wulong and San Tea, using relative market value as the allocation base. Calculate the net income for each product. Compare the total net income (Wulong + San Tea) computed in Requirement *b* with that computed in Requirement *a* above. Explain why the total amount is the same. Comment on which allocation base (weight or relative market value) is more appropriate.
- c. Should Mountain Tea further process Wulong into Donding?

**Appendix****LO 3, 9****Problem 4-26B** *Allocating service center costs—step method and direct method*

Dunne Corporation has three production departments: forming, assembly, and packaging. The maintenance department supports only the production departments; the computer services department supports all departments including maintenance. Other relevant information follows.

	Forming	Assembly	Packaging	Maintenance	Computer Services
Machine hours	6,000	2,500	1,500	400	0
Number of computers	14	20	11	15	8
Annual cost*	\$450,000	\$800,000	\$250,000	\$100,000	\$90,000

\*This is the annual operating cost before allocating service department costs.

**Required**

- a. Allocate service department costs to operating departments, assuming that Dunne adopts the step method. The company uses the number of computers as the base for allocating the computer services costs and machine hours as the base for allocating the maintenance costs.
- b. Use machine hours as the base for allocating maintenance department costs and the number of computers as the base for allocating computer services cost. Allocate service department costs to operating departments, assuming that Dunne adopts the direct method.
- c. Compute the total allocated cost of service centers for each operating department using each allocation method.

**ANALYZE, THINK, COMMUNICATE****ATC 4-1 Business Applications Case** *Allocating fixed costs at Porsche*

During its fiscal year ending on July 31, 2008, the **Dr. Ing. h. c. F. Porsche AG**, commonly known as “Porsche,” manufactured 105,162 vehicles. During that same year, Porsche recorded depreciation on property, plant and equipment of €281,813,000. (Porsche’s financial information is reported in euros, and € is the symbol for the euro.) For the purposes of this problem, assume that all of the depreciation is related to manufacturing activities.

**Required**

- a. Indicate whether the depreciation charge is a:
  - (1) Product cost, or a general, selling and administrative costs.
  - (2) Fixed or variable cost relative to the volume of production.
  - (3) Direct or indirect if the cost object is the cost of vehicles made in the 2008 fiscal year.
- b. Assume that Porsche incurred depreciation of €23,500,000 during each month of the 2008 fiscal year, but that it produced 10,000 vehicles during February and 7,000 vehicles during March. Based on monthly costs and production levels, what was the average amount of



depreciation cost per vehicle produced during each of these two months, assuming each vehicle was charged the same amount of depreciation?

- c. If Porsche had expected to produce 108,000 vehicles during 2008, and had estimated its annual depreciation costs to be €285,000,000, what would have been its predetermined overhead charge per vehicle for depreciation? Explain the advantage of using this amount to determine the cost of manufacturing a car in February and March versus the amounts you computed in Requirement *b*.
- d. If Porsche's management had estimated the profit per vehicle based on its budgeted production of 108,000 units, would you expect its actual profit per vehicle to be higher or lower than expected? Explain.

#### ATC 4-2 Group Assignment *Selection of the cost driver*

Vulcan College School of Business is divided into three departments: accounting, marketing, and management. Relevant information for each of the departments follows.



Cost Driver	Accounting	Marketing	Management
Number of students	1,400	800	400
Number of classes per semester	64	36	28
Number of professors	20	24	10

Vulcan is a private school that expects each department to generate a profit. It rewards departments for profitability by assigning 20 percent of each department's profits back to that department. Departments have free rein as to how to use these funds. Some departments have used them to supply professors with computer technology. Others have expanded their travel budgets. The practice has been highly successful in motivating the faculty to control costs. The revenues and direct costs for the year 2011 follow:

	Accounting	Marketing	Management
Revenue	\$29,600,000	\$16,600,000	\$8,300,000
Direct costs	24,600,000	13,800,000	6,600,000

Vulcan allocates to the School of Business \$4,492,800 of indirect overhead costs such as administrative salaries and the costs of operating the registrar's office and the bookstore.

#### Required

- a. Divide the class into groups and organize the groups into three sections. Assign each section a department. For example, groups in Section 1 should represent the Accounting Department. Groups in Sections 2 and 3 should represent the Marketing Department and Management Department, respectively. Assume that the dean of the school is planning to assign an equal amount of the college overhead to each department. Have the students in each group prepare a response to the dean's plan. Each group should select a spokesperson who is prepared to answer the following questions.
  - (1) Is your group in favor of or opposed to the allocation plan suggested by the dean?
  - (2) Does the plan suggested by the dean provide a fair allocation? Why?

The instructor should lead a discussion designed to assess the appropriateness of the dean's proposed allocation plan.
- b. Have each group select the cost driver (allocation base) that best serves the self-interest of the department it represents.
- c. Consensus on Requirement *c* should be achieved before completing Requirement *d*. Each group should determine the amount of the indirect cost to be allocated to each department using the cost driver that best serves the self-interest of the department it represents. Have a



spokesperson from each section go to the board and show the income statement that would result for each department.

- d. Discuss the development of a cost driver(s) that would promote fairness rather than self-interest in allocating the indirect costs.

### ATC 4-3 Research Assignment *Using real world data from Pepsi Bottling Group*



Use the 2008 Form 10-K for **Pepsi Bottling Group** to complete the requirements below. Pepsi Bottling Group (PBG) is a separate company from PepsiCo, so do not confuse them. To obtain the Form 10-K you can use either the EDGAR system following the instructions in Appendix A, or it can be found under the “Investor Relations” link on the company’s corporate website at [www.pbg.com](http://www.pbg.com). The company includes its Form 10-K as a part of its 2008 Annual Report, or it can be found separately under “SEC Filings.” Be sure to read carefully the following sections of the document:

*Under “Item 1. Business,” read subsections titled “Introduction,” “Principal Products,” “Raw Materials and Other Supplies,” and “Seasonality.”*

*In the footnotes section of the report, under “Note 2—Summary of Significant Accounting Policies,” read the subsections titled “Advertising and Marketing Costs” and “Shipping and Handling Costs”*

*“Note 4—Balance Sheet Details,” in the footnotes section of the report.*

#### Required

- a. Does PBG consider *shipping and handling costs* and *advertising and marketing costs* to be direct or indirect cost in relation to the manufacturing of its products? Explain.
- b. Assume that when PBG ships orders of bottled drinks each shipment includes several different products such as Pepsi, Lipton tea, and Starbucks Frappuccino. If PBG wanted to allocate the shipping costs among the various products, what would be an appropriate cost driver? Explain the rationale for your choice.
- c. Assume that PBG incurs some advertising costs that cannot be directly traced to a single product such as Pepsi or Diet Pepsi. If PBG wanted to allocate the advertising costs among the various products being advertised jointly, what would be an appropriate way of making this allocation? Explain the rationale for your choice.
- d. As *Note 4* indicates, PBG computes depreciation expense on three separate classes of assets. For which of these classes of assets could its depreciation expense be directly traced to the production of soft drinks? Which class would least likely be traceable to the production of soft drinks? Explain.
- e. Based on PBG’s discussion of the seasonality of its business, should the depreciation of production equipment recorded in a given month be based on the volume of drinks produced that month, or should the depreciation be one-twelfth of the estimated annual depreciation PBG expects to incur? Explain your answer.

### ATC 4-4 Writing Assignment *Selection of the appropriate cost driver*



Bullions Enterprises, Inc. (BEI), makes gold, silver, and bronze medals used to recognize outstanding athletic performance in regional and national sporting events. The per-unit direct costs of producing the medals follow.

	Gold	Silver	Bronze
Direct materials	\$300	\$130	\$ 35
Labor	120	120	120

During 2012, BEI made 1,200 units of each type of medal for a total of 3,600 ( $1,200 \times 3$ ) medals. All medals are created through the same production process, and they are packaged and shipped in identical containers. Indirect overhead costs amounted to \$324,000. BEI currently uses the number of units as the cost driver for the allocation of overhead cost. As a result, BEI allocated \$90 ( $\$324,000 \div 3,600$  units) of overhead cost to each medal produced.

**Required**

The president of the company has questioned the wisdom of assigning the same amount of overhead to each type of medal. He believes that overhead should be assigned on the basis of the cost to produce the medals. In other words, more overhead should be charged to expensive gold medals, less to silver, and even less to bronze. Assume that you are BEI's chief financial officer. Write a memo responding to the president's suggestion.

**ATC 4-5 Ethical Dilemma Allocation to achieve fairness**

The American Acupuncture Association offers continuing professional education courses for its members at its annual meeting. Instructors are paid a fee for each student attending their courses but are charged a fee for overhead costs that is deducted from their compensation. Overhead costs include fees paid to rent instructional equipment such as overhead projectors, provide supplies to participants, and offer refreshments during coffee breaks. The number of courses offered is used as the allocation base for determining the overhead charge. For example, if overhead costs amount to \$5,000 and 25 courses are offered, each course is allocated an overhead charge of \$200 ( $\$5,000 \div 25$  courses). Heidi McCarl, who taught one of the courses, received the following statement with her check in payment for her instructional services.



Instructional fees (20 students $\times$ \$50 per student)	\$1,000
Less: Overhead charge	(200)
Less: Charge for sign language assistant	(240)
Amount due instructor	<u>\$ 560</u>

Although Ms. McCarl was well aware that one of her students was deaf and required a sign language assistant, she was surprised to find that she was required to absorb the cost of this service.

**Required**

- Given that the Americans with Disabilities Act stipulates that the deaf student cannot be charged for the cost of providing sign language, who should be required to pay the cost of sign language services?
- Explain how allocation can be used to promote fairness in distributing service costs to the disabled. Describe two ways to treat the \$240 cost of providing sign language services that improve fairness.

**ATC 4-6 Spreadsheet Assignment Using Excel**

Brook Health Care Center, Inc., has three clinics servicing the Birmingham metropolitan area. The company's legal services department supports the clinics. Moreover, its computer services department supports all of the clinics and the legal services department. The company uses the number of computer workstations as the cost driver for allocating the cost of computer services and the number of patients as the cost driver for allocating the cost of legal services. The annual cost of the Department of Legal Services was \$340,000, and the annual cost of the Department of Computer Services was \$250,000. Other relevant information follows.

	Number of Patients	Number of Workstations
Hoover Clinic	3,100	17
Eastwood Clinic	2,300	13
Gardendale Clinic	2,800	6
Legal Services	0	14

**Required**

- a. Construct a spreadsheet like the following one to allocate the service costs using the step method.

	Computer Services	Legal Services	Hoover Clinic	Eastwood Clinic	Gardendale Clinic
Costs to be allocated	\$250,000	\$340,000			
Step 1 Allocation	(250,000)	70,000	\$ 85,000	\$ 65,000	\$ 30,000
Step 2 Allocation		(410,000)	155,000	115,000	140,000
Total in cost pool after allocation	\$ -	\$ -	\$240,000	\$180,000	\$170,000

Supporting calculations:			driver x rate	driver x rate
a) Cost to be allocated	\$250,000	\$410,000		
Hoover Clinic	17	3,100	\$ 85,000	\$155,000
Eastwood Clinic	13	2,300	65,000	115,000
Gardendale Clinic	6	2,800	30,000	140,000
Legal Services	14		70,000	
b) Total of driver	50	8,200		
Allocation rate a/b	\$ 5,000	\$ 50		

**Spreadsheet Tips**

- The headings in rows 4 and 5 are right aligned. To right align text, choose Format, then Cells, and then click on the tab titled Alignment, and set the horizontal alignment to Right. The shortcut method to right align text is to click on the right align icon in the middle of the second tool bar.
- The supporting calculation section must be completed simultaneously with the allocation table. However, most of the supporting calculations can be completed first. The exception is that the value in cell F13 refers to the sum of cells F6 and F7.

**ATC 4-7 Spreadsheet Assignment Mastering Excel**

Phillips Paints manufactures three types of paint in a joint process: rubberized paint, rust-proofing paint, and aluminum paint. In a standard batch of 500,000 gallons of raw material, the outputs are 240,000 gallons of rubberized paint, 80,000 gallons of rust-proofing paint, and 180,000 gallons of aluminum paint. The production cost of a batch is \$2,700,000. The sales prices per gallon are \$15, \$18, and \$20 for rubberized, rust-proofing, and aluminum paint, respectively.

**Required**

- Construct a spreadsheet to allocate joint costs to the three products using the number of gallons as the allocation base.
- Include formulas in your spreadsheet to calculate the gross margin for each paint.

**COMPREHENSIVE PROBLEM**

Magnificent Modems has excess production capacity and is considering the possibility of making and selling paging equipment. The following estimates are based on a production and sales volume of 1,000 pagers.

Unit-level manufacturing costs are expected to be \$20. Sales commissions will be established at \$1 per unit. The current facility-level costs, including depreciation on manufacturing equipment (\$60,000), rent on the manufacturing facility (\$50,000), depreciation on the administrative equipment (\$12,000), and other fixed administrative expenses (\$71,950), will not be affected by the production of the pagers. The chief accountant has decided to allocate the facility-level costs to the existing product (modems) and to the new product (pagers) on the basis of the number of units of product made (i.e., 5,000 modems and 1,000 pagers).

**Required**

- a. Determine the per-unit cost of making and selling 1,000 pagers.
- b. Assuming the pagers could be sold at a price of \$34 each, should Magnificent make the pagers?
- c. Comment on the validity of using the number of units as an allocation base.