3. What percentage completion figure would result in increasing the reported net operating income by $62,500 over the net operating income that would be reported if the 25% figure were used?
4. Do you think Carol Lee should go along with the request to alter estimates of the percentage completion? Why or why not?

CASE 4–20 Second Department—Weighted-Average Method [LO2, LO3, LO4]

eXcel

Durall Company manufactures a plastic gasket that is used in automobile engines. The gaskets go through three processing departments: Mixing, Forming, and Stamping. The company's accountant (who is very inexperienced) has prepared a summary of production and costs for the Forming Department for October as follows:

Forming Department costs:	
Work in process inventory, October 1, 8,000 units:	
materials 100% complete; conversion 7/8 complete	$ 22,420*
Costs transferred in from the Mixing Department	81,480
Material added during October (added when processing is 50% complete in the Forming Department)	27,600
Conversion costs added during October	96,900
Total departmental costs	$228,400
Forming Department costs assigned to:	
Units completed and transferred to the Stamping Department, 100,000 units at $2.284 each	$228,400
Work in process inventory, October 31, 5,000 units:	
conversion 2/5 complete	—
Total departmental costs assigned	$228,400

*Consists of cost transferred in, $8,820; materials cost, $3,400; and conversion costs, $10,200.

After mulling over the data above, Durall's president commented, "I can't understand what's happening here. Despite a concentrated effort at cost reduction, our unit cost actually went up in the Forming Department last month. With that kind of performance, year-end bonuses are out of the question for the people in that department."

The company uses the weighted-average method in its process costing.

Required:

1. Prepare a report for the Forming Department for October showing how much cost should have been assigned to the units completed and transferred to the Stamping Department and to the ending work in process inventory.
2. Explain to the president why the unit cost appearing on the report prepared by the accountant is so high.

Appendix 4A: FIFO Method

The FIFO method of process costing differs from the weighted-average method in two ways: (1) the computation of equivalent units, and (2) the way in which costs of beginning inventory are treated. The FIFO method is generally considered more accurate than the weighted-average method, but it is more complex. The complexity is not a problem for computers, but the FIFO method is a little more difficult to understand and to learn than the weighted-average method.

LEARNING OBJECTIVE 6
Compute the equivalent units of production using the FIFO method.

Equivalent Units—FIFO Method

The computation of equivalent units under the FIFO method differs from the computation under the weighted-average method in two ways.

First, the "units transferred out" is divided into two parts. One part consists of the units from the beginning inventory that were completed and transferred out, and the other part consists of the units that were both *started* and *completed* during the current period.

Second, full consideration is given to the amount of work expended during the current period on units in the *beginning* work in process inventory as well as on units in the ending inventory. Thus, under the FIFO method, both beginning and ending inventories are converted to an equivalent units basis. For the beginning inventory, the equivalent units represent the work done to *complete* the units; for the ending inventory, the equivalent units represent the work done to bring the units to a stage of partial completion at the end of the period (the same as with the weighted-average method).

The formula for computing the equivalent units of production under the FIFO method is more complex than under the weighted-average method:

FIFO Method
(a separate calculation is made for each cost category in each processing department)

$$\begin{aligned}\text{Equivalent units of production} = {} & \text{Equivalent units to complete beginning work in process inventory*} \\ & + \text{Units started and completed during the period} \\ & + \text{Equivalent units in ending work in process inventory}\end{aligned}$$

$$\text{*Equivalent units to complete beginning work in process inventory} = \text{Units in beginning work in process inventory} \times \left(100\% - \text{Percentage completion of beginning work in process inventory}\right)$$

Or, the equivalent units of production can also be determined as follows:

$$\begin{aligned}\text{Equivalent units of production} = {} & \text{Units transferred out} \\ & + \text{Equivalent units in ending work in process inventory} \\ & - \text{Equivalent units in beginning work in process inventory}\end{aligned}$$

To illustrate the FIFO method, refer again to the data for the Shaping and Milling Department at Double Diamond Skis. The department completed and transferred 4,800 units to the Graphics Application Department during May. Because 200 of these units came from the beginning inventory, the Shaping and Milling Department must have started and completed 4,600 units during May. The 200 units in the beginning inventory were 55% complete with respect to materials and only 30% complete with respect to conversion costs when the month started. Thus, to complete these units the department must have added another 45% of materials costs (100% − 55% = 45%) and another 70% of conversion costs (100% − 30% = 70%). Following this line of reasoning, the equivalent units for the department for May would be computed as shown in Exhibit 4A–1.

Comparison of Equivalent Units of Production under the Weighted-Average and FIFO Methods

Stop at this point and compare the data in Exhibit 4A–1 with the data in Exhibit 4–5 in the chapter, which shows the computation of equivalent units under the weighted-average method. Also refer to Exhibit 4A–2, which compares the two methods.

The essential difference between the two methods is that the weighted-average method blends work and costs from the prior period with work and costs in the current

	Materials	Conversion
To complete beginning work in process:		
Materials: 200 units × (100% − 55%)*	90	
Conversion: 200 units × (100% − 30%)*		140
Units started and completed during the period	4,600†	4,600†
Ending work in process:		
Materials: 400 units × 40% complete	160	
Conversion: 400 units × 25% complete		100
Equivalent units of production	4,850	4,840

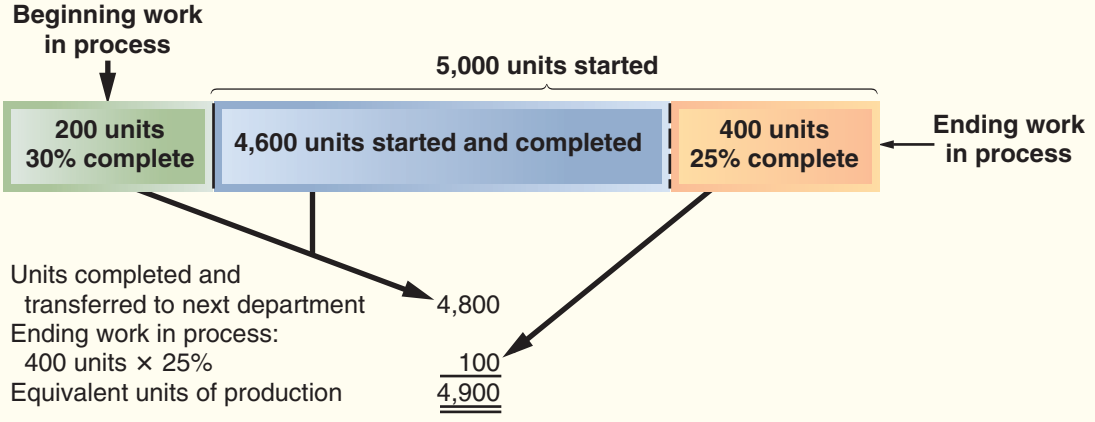
*This is the work needed to complete the units in beginning inventory.
†5,000 units started − 400 units in ending work in process = 4,600 units started and completed. This can also be computed as 4,800 units completed and transferred to the next department − 200 units in beginning work in process inventory. The FIFO method assumes that the units in beginning inventory are finished first.

EXHIBIT 4A–1
Equivalent Units of Production: FIFO Method

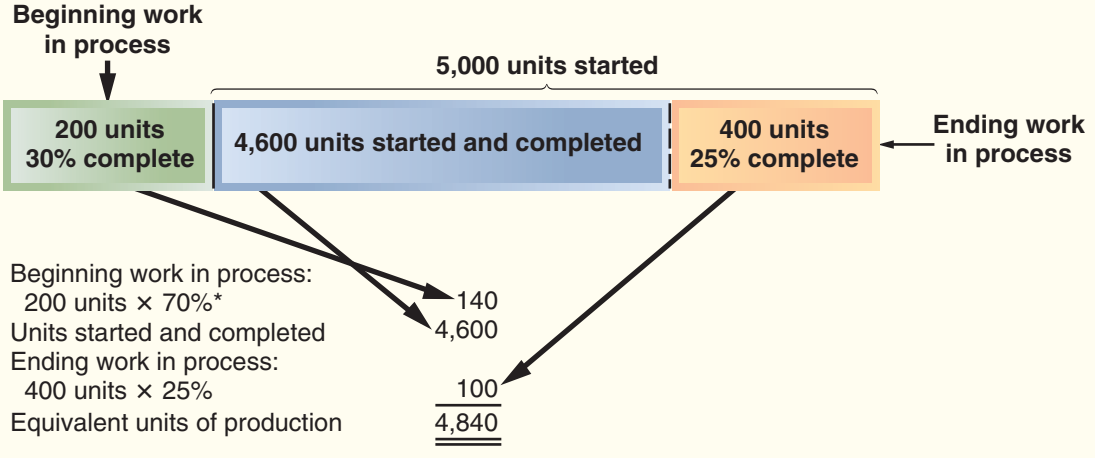
Double Diamond Skis
Shaping and Milling Department
Conversion Costs

EXHIBIT 4A–2
Visual Perspective of Equivalent Units of Production

Weighted-Average Method



FIFO Method



* 100% – 30% = 70%. This 70% represents the work needed to complete the units in the beginning inventory.

period, whereas the FIFO method separates the two periods. To see this more clearly, consider the following reconciliation of the two calculations of equivalent units:

Shaping and Milling Department	Materials	Conversion
Equivalent units—weighted-average method	4,960	4,900
Less equivalent units in beginning inventory:		
200 units × 55%	110	
200 units × 30%		60
Equivalent units of production—FIFO method	4,850	4,840

From the above, it is evident that the FIFO method removes the equivalent units that were already in beginning inventory from the equivalent units as defined using the weighted-average method. Thus, the FIFO method isolates the equivalent units that are due to work performed during the current period. The weighted-average method blends together the equivalent units already in beginning inventory with the equivalent units that are due to work performed in the current period.

Cost per Equivalent Unit—FIFO Method

LEARNING OBJECTIVE 7
Compute the cost per equivalent unit using the FIFO method.

In the FIFO method, the cost per equivalent unit is computed as follows:

FIFO Method
(a separate calculation is made for each cost category in each processing department)

$$\text{Cost per equivalent unit} = \frac{\text{Cost added during the period}}{\text{Equivalent units of production}}$$

Unlike the weighted-average method, in the FIFO method the cost per equivalent unit is based only on the costs incurred in the department in the current period.

The costs per equivalent unit for materials and for conversion are computed below for the Shaping and Milling Department for May:

Shaping and Milling Department
Costs per Equivalent Unit—FIFO method

	Materials	Conversion
Cost added during the period (a)	$368,600	$350,900
Equivalent units of production (b)	4,850	4,840
Cost per equivalent unit (a) ÷ (b)	$76.00	$72.50

Applying Costs—FIFO Method

LEARNING OBJECTIVE 8
Assign costs to units using the FIFO method.

The costs per equivalent unit are used to value units in ending inventory and units that are transferred to the next department. For example, each unit transferred out of the Shaping and Milling Department to the Graphics Application Department will carry with it a cost of $148.50—$76.00 for materials cost and $72.50 for conversion cost. Because 4,800 units were transferred out in May to the next department, the total cost assigned to those units would be $712,800 (4,800 units × $148.50 per unit).

A complete accounting of the costs of both ending work in process inventory and the units transferred out appears on the next page. It is more complicated than the weighted-average method. This is because the cost of the units transferred out consists of three separate components: (1) the cost of beginning work in process inventory; (2) the cost to complete the units in beginning work in process inventory; and (3) the cost of units started and completed during the period.

Shaping and Milling Department
Costs of Ending Work in Process Inventory and Units Transferred Out—FIFO Method

	Materials	Conversion	Total
Ending work in process inventory:			
Equivalent units of production (see Exhibit 4A–1) (a)	160	100	
Cost per equivalent unit (see page 170) (b)	$76.00	$72.50	
Cost of ending work in process inventory (a) × (b)	$12,160	$7,250	$19,410
Units transferred out:			
Cost in beginning work in process inventory	$9,600	$5,575	$15,175
Cost to complete the units in beginning work in process inventory:			
Equivalent units of production required to complete the units in beginning inventory (see Exhibit 4A–1) (a)	90	140	
Cost per equivalent unit (see page 170) (b)	$76.00	$72.50	
Cost to complete the units in beginning inventory (a) × (b)	$6,840	$10,150	$16,990
Cost of units started and completed this period:			
Units started and completed this period (see Exhibit 4A–1) (a)	4,600	4,600	
Cost per equivalent unit (see page 170) (b)	$76.00	$72.50	
Cost of units started and completed this period (a) × (b)	$349,600	$333,500	$683,100
Total cost of units transferred out			$715,265

Again, note that the cost of the units transferred out consists of three distinct components—the cost of beginning work in process inventory, the cost to complete the units in beginning inventory, and the cost of units started and completed during the period. This is a major difference between the weighted-average and FIFO methods.

Cost Reconciliation Report—FIFO Method

LEARNING OBJECTIVE 9
Prepare a cost reconciliation report using the FIFO method.

The costs assigned to ending work in process inventory and to the units transferred out reconcile with the costs we started with in Exhibit 4–7 as shown below:

Shaping and Milling Department
Cost Reconciliation

Costs to be accounted for:	
Cost of beginning work in process inventory (Exhibit 4–7)	$ 15,175
Costs added to production during the period (Exhibit 4–7)	719,500
Total cost to be accounted for	$734,675
Costs accounted for as follows:	
Cost of ending work in process inventory (see above)	$ 19,410
Cost of units transferred out (see above)	715,265
Total cost accounted for	$734,675

The $715,265 cost of the units transferred to the next department, Graphics Application, will be accounted for in that department as "costs transferred in." As in the weighted-average method, this cost will be treated in the process costing system as just another category of costs, like materials or conversion costs. The only difference is that the costs transferred in will always be 100% complete with respect to the work done in

the Graphics Applications Department. Costs are passed on from one department to the next in this fashion, until they reach the last processing department, Finishing and Pairing. When the products are completed in this last department, their costs are transferred to finished goods.

A Comparison of Costing Methods

In most situations, the weighted-average and FIFO methods will produce very similar unit costs. If there never are any ending inventories, the two methods will produce identical results. The reason for this is that without any ending inventories, no costs can be carried forward into the next period and the weighted-average method will base unit costs on just the current period's costs—just as in the FIFO method. If there *are* ending inventories, either erratic input prices or erratic production levels would also be required to generate much of a difference in unit costs under the two methods. This is because the weighted-average method will blend the unit costs from the prior period with the unit costs of the current period. Unless these unit costs differ greatly, the blending will not make much difference.

Nevertheless, from the standpoint of cost control, the FIFO method is superior to the weighted-average method. Current performance should be evaluated based on costs of the current period only but the weighted-average method mixes costs of the current period with costs of the prior period. Thus, under the weighted-average method, the manager's apparent performance in the current period is influenced by what happened in the prior period. This problem does not arise under the FIFO method because the FIFO method makes a clear distinction between costs of prior periods and costs incurred during the current period. For the same reason, the FIFO method also provides more up-to-date cost data for decision-making purposes.

On the other hand, the weighted-average method is simpler to apply than the FIFO method, but computers can handle the additional calculations with ease once they have been appropriately programmed.

Appendix 4A Exercises and Problems

All applicable exercises and problems are available with McGraw-Hill's *Connect™ Accounting*.

EXERCISE 4A–1 Computation of Equivalent Units—FIFO Method [LO6]

Refer to the data for Lindex Company in Exercise 4–2.

Required:

Compute the equivalent units of production for October assuming that the company uses the FIFO method for accounting for units and costs.

EXERCISE 4A–2 Cost per Equivalent Unit—FIFO Method [LO7]

Resprin Company uses the FIFO method in its process costing system. Data for the Assembly Department for May appear below:

	Materials	Labor	Overhead
Cost added during May	$82,560	$52,920	$132,300
Equivalent units of production	16,000	14,000	14,000

Required:

Compute the cost per equivalent unit for materials, for labor, for overhead, and in total.

EXERCISE 4A–3 Applying Costs to Units—FIFO Method [LO8]

Data concerning a recent period's activity in the Mixing Department, the first processing department in a company that uses process costing, appear below:

	Materials	Conversion
Cost of work in process inventory at the beginning of the period	$2,700	$380
Equivalent units of production in the ending work in process inventory	800	200
Equivalent units of production required to complete the beginning work in process inventory	400	700
Cost per equivalent unit for the period	$4.40	$1.30

A total of 8,000 units were completed and transferred to the next processing department during the period. Beginning work in process inventory consisted of 1,000 units and ending work in process inventory consisted of 2,000 units.

Required:

Using the FIFO method, compute the cost of the units transferred to the next department during the period and the cost of ending work in process inventory.

EXERCISE 4A–4 Cost Reconciliation Report—FIFO Method [LO9]

Kippinger Baking Corporation uses a process costing system in its large-scale baking operations. The Mixing Department is one of the company's processing departments. In the Mixing Department in August, the cost of beginning work in process inventory was $4,230, the cost of ending work in process inventory was $3,870, and the cost added to production was $46,320.

Required:

Prepare a cost reconciliation report for the Mixing Department for August.

EXERCISE 4A–5 Equivalent Units—FIFO Method [LO6]

Refer to the data for Gulf Fisheries, Inc., in Exercise 4–12.

Required:

Compute the equivalent units for May for the Cleaning Department, assuming that the company uses the FIFO method of accounting for units.

EXERCISE 4A–6 Equivalent Units—FIFO Method [LO6]

Refer to the data for Societe Clemeau in Exercise 4–10.

Required:

1. Compute the number of kilograms of cement completed and transferred out of the Mixing Department during May.
2. Compute the equivalent units of production for materials and for conversion for May.

EXERCISE 4A–7 Equivalent Units and Cost per Equivalent Unit—FIFO Method [LO6, LO7]

Refer to the data for Kalox, Inc., in Exercise 4–6.

Required:

Assume that the company uses the FIFO method of accounting for units and costs.

1. Compute the equivalent units for May's activity for the first processing department.
2. Determine the costs per equivalent unit for May.

EXERCISE 4A–8 Computation of Equivalent Units—FIFO Method [LO6]

QualCon, Inc., produces wine bottles for vintners in a process that starts in the Melt and Mold Department. Data concerning that department's operations in the most recent period appear below:

Beginning work in process:	
Units in process	400
Stage of completion with respect to materials	75%
Stage of completion with respect to conversion	25%
Units started into production during the month	42,600
Units completed and transferred out	42,500
Ending work in process:	
Units in process	500
Stage of completion with respect to materials	80%
Stage of completion with respect to conversion	30%

Required:

QualCon uses the FIFO method in its process costing system. Compute the equivalent units of production for the period for the Melt and Mold Department.

EXERCISE 4A–9 Equivalent Units; Applying Costs—FIFO Method [LO6, LO7, LO8]

Krollon Company uses the FIFO method in its process costing system. The following data are for the most recent month of operations in one of the company's processing departments:

Units in beginning inventory	400		
Units started into production	4,300		
Units in ending inventory	300		
Units transferred to the next department	4,400		
		Materials	Conversion
Percentage completion of beginning inventory		70%	30%
Percentage completion of ending inventory		80%	40%

According to the company's costing system, the cost of beginning inventory was $7,886, of which $4,897 was for materials and the remainder was for conversion cost. The costs added during the month amounted to $181,652. The costs per equivalent unit for the month were:

	Materials	Conversion
Cost per equivalent unit	$18.20	$23.25

Required:

1. Compute the total cost per equivalent unit for the month.
2. Compute the equivalent units of material and of conversion costs in the ending inventory.
3. Compute the equivalent units of material and of conversion costs that were required to complete the beginning inventory.
4. Determine the number of units started and completed during the month.
5. Determine the costs of ending inventory and units transferred out.

PROBLEM 4A–10 Equivalent Units; Applying Costs—FIFO Method [LO6, LO7, LO8, LO9]

Reutter Company manufactures a single product and uses process costing. The company's product goes through two processing departments, Etching and Wiring. The following activity was recorded in the Etching Department during July:

Production data:	
Units in process, July 1: materials 60% complete; conversion 30% complete	60,000
Units started into production	510,000
Units in process, July 31: materials 80% complete; conversion 40% complete	70,000
Cost data:	
Work in process inventory, July 1:	
Materials cost	$27,000
Conversion cost	$13,000
Cost added during July:	
Materials cost	$468,000
Conversion cost	$357,000

Materials are added at several stages during the etching process. The company uses the FIFO method.

Required:

1. Determine the equivalent units for July for the Etching Department.
2. Compute the costs per equivalent unit for July for the Etching Department.
3. Determine the total cost of ending work in process inventory and the total cost of units transferred to the next process for the Etching Department in July.
4. Prepare a cost reconciliation report for the Etching Department for July.

PROBLEM 4A–11 Equivalent Units, Cost per Equivalent Unit, Applying Costs—FIFO Method [LO6, LO7, LO8, LO9]

Refer to the data for the Mixing Department in Honeybutter, Inc., in Problem 4–14. Assume that the company uses the FIFO method rather than the weighted-average method in its process costing system.

Required:

1. Determine the equivalent units for June for the Mixing Department.
2. Compute the costs per equivalent unit for June for the Mixing Department.
3. Determine the total cost of ending work in process inventory and the total cost of units transferred to the next process for the Mixing Department in June.
4. Prepare a cost reconciliation report for the Mixing Department for June.

CASE 4A–12 Second Department—FIFO Method [LO6, LO7, LO8]

Refer to the data for Durall Company in Case 4–20. Assume that the company uses the FIFO method in its process costing system.

Required:

1. Prepare a report for the Forming Department for October showing how much cost should have been assigned to the units completed and transferred to the Stamping Department and to the ending work in process inventory.
2. Assume that in order to remain competitive, the company undertook a major cost-cutting program during October. Would the effects of this cost-cutting program tend to show up more under the weighted-average method or under the FIFO method? Explain your answer.

Appendix 4B: Service Department Allocations

Most large organizations have both *operating departments* and *service departments.* The central purposes of the organization are carried out in the operating departments. In contrast, service departments do not directly engage in operating activities. Instead, they provide services or assistance to the operating departments. Examples of operating departments include the Surgery Department at Mt. Sinai Hospital, the Geography Department at the University of Washington, the Marketing Department at Allstate Insurance Company, and production departments at manufacturers such as Mitsubishi, Hewlett-Packard, and Michelin. In process costing, the processing departments are all operating departments. Examples of service departments include Cafeteria, Internal Auditing, Human Resources, Cost Accounting, and Purchasing.

The overhead costs of operating departments commonly include allocations of costs from the service departments. To the extent that service department costs are classified as production costs, they should be included in unit product costs and thus, must be allocated to operating departments in a process costing system.

Three approaches are used to allocate the costs of service departments to other departments: the direct method, the step-down method, and the reciprocal method. These three methods are discussed in the following sections. However, before getting into the details of these methods, we will discuss *interdepartmental services.*

Interdepartmental Services Many service departments provide services to each other, as well as to operating departments. For example, the Cafeteria Department provides meals for all employees, including those assigned to other service departments, as well as to employees of the operating departments. In turn, the Cafeteria Department may receive services from other service departments, such as from Custodial Services or from Personnel. Services provided between service departments are known as *interdepartmental* or *reciprocal services.*

Direct Method

LEARNING OBJECTIVE 10
Allocate service department costs to operating departments using the direct method.

The *direct method* is the simplest of the three cost allocation methods. It ignores the services provided by a service department to other service departments (e.g., interdepartmental services) and allocates all service department costs directly to operating departments. Even if a service department (such as Personnel) provides a large amount of service to another service department (such as the cafeteria), no allocations are made between the two departments. Rather, all costs are allocated *directly* to the operating departments, bypassing the other service departments; hence, the term *direct method.*

For an example of the direct method, consider Mountain View Hospital, which has two service departments and two operating departments as shown below. The hospital allocates its Hospital Administration costs on the basis of employee-hours and its Custodial Services costs on the basis of square feet occupied.

	Service Departments		Operating Departments		
	Hospital Administration	Custodial Services	Laboratory	Patient Care	Total
Departmental costs before allocation	$360,000	$90,000	$261,000	$689,000	$1,400,000
Employee hours	12,000	6,000	18,000	30,000	66,000
Space occupied—square feet	10,000	200	5,000	45,000	60,200

EXHIBIT 4B–1
Direct Method of Allocation

	Service Departments		Operating Departments		
	Hospital Administration	Custodial Services	Laboratory	Patient Care	Total
Departmental costs before allocation	$360,000	$90,000	$261,000	$689,000	$1,400,000
Allocation:					
Hospital Administration costs ($^{18}/_{48}$, $^{30}/_{48}$)*	(360,000)		135,000	225,000	
Custodial Services costs ($^{5}/_{50}$, $^{45}/_{50}$)†		(90,000)	9,000	81,000	
Total cost after allocation	$ 0	$ 0	$405,000	$995,000	$1,400,000

*Based on the employee-hours in the two operating departments, which are 18,000 hours + 30,000 hours = 48,000 hours.
†Based on the square feet occupied by the two operating departments, which is 5,000 square feet + 45,000 square feet = 50,000 square feet.

The direct method of allocating the hospital's service department costs to the operating departments is shown in Exhibit 4B–1. Several things should be noted in this exhibit. First, the employee-hours of the Hospital Administration Department and the Custodial Services Department are ignored when allocating the costs of Hospital Administration using the direct method. *Under the direct method, any of the allocation base attributable to the service departments themselves is ignored; only the amount of the allocation base attributable to the operating departments is used in the allocation.* Note that the same rule is used when allocating the costs of the Custodial Services Department. Even though the Hospital Administration and Custodial Services departments occupy some space, this is ignored when the Custodial Services costs are allocated. Finally, note that after all allocations have been completed, all of the service department costs are contained in the two operating departments.

Although the direct method is simple, it is less accurate than the other methods because it ignores interdepartmental services.

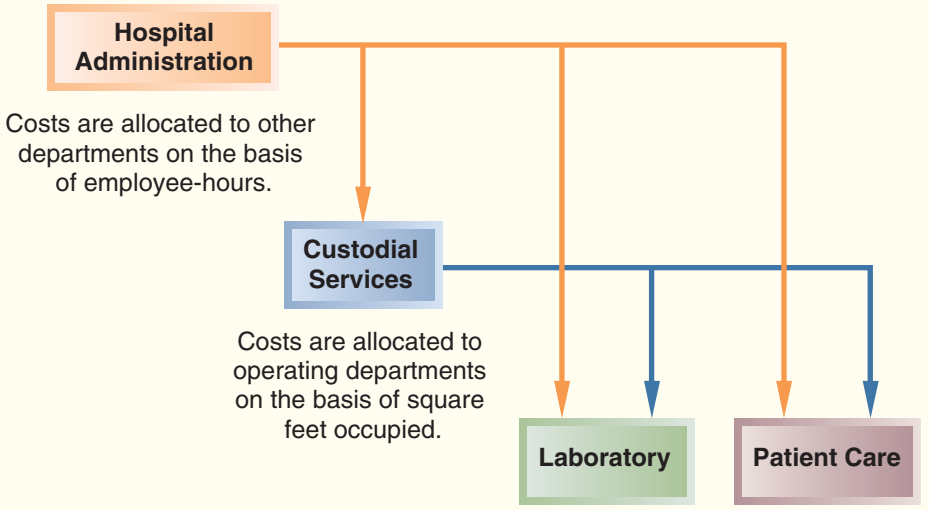
Step-Down Method

LEARNING OBJECTIVE 11
Allocate service department costs to operating departments using the step-down method.

Unlike the direct method, the *step-down method* provides for allocation of a service department's costs to other service departments, as well as to operating departments. The step-down method is sequential. The sequence typically begins with the department that provides the greatest amount of service to other service departments. After its costs have been allocated, the process continues, step by step, ending with the department that provides the least amount of services to other service departments. This step procedure is illustrated in Exhibit 4B–2.

Exhibit 4B–3 shows the details of the step-down method. Note the following three key points about these allocations. First, under Allocation in Exhibit 4B–3, you see two allocations, or steps. In the first step, the costs of Hospital Administration are allocated to another service department (Custodial Services) as well as to the operating departments. In contrast to the direct method, the allocation base for Hospital Administration costs now includes the employee-hours for Custodial Services as well as for the operating departments. However, the allocation base still excludes the employee-hours for Hospital Administration itself. *In both the direct and step-down methods, any amount of the allocation base attributable to the service department whose cost is being allocated is always ignored.* Second, looking again at Exhibit 4B–3, note that in the second step under the Allocation heading, the cost of Custodial Services is allocated to the two operating departments, and none of the cost is allocated to Hospital Administration even though Hospital Administration occupies space in the building. *In the step-down method,*

EXHIBIT 4B–2
Graphic Illustration—Step-Down Method



any amount of the allocation base that is attributable to a service department whose cost has already been allocated is ignored. After a service department's costs have been allocated, costs of other service departments are not reallocated back to it. Third, note that the cost of Custodial Services allocated to other departments in the second step ($130,000) in Exhibit 4B–3 includes the costs of Hospital Administration that were allocated to Custodial Services in the first step in Exhibit 4B–3.

Reciprocal Method

The *reciprocal method* gives full recognition to interdepartmental services. Under the step-down method only partial recognition of interdepartmental services is possible. The step-down method always allocates costs forward—never backward. The reciprocal method, by contrast, allocates service department costs in *both* directions. Thus, because Custodial Services in the prior example provides services for Hospital Administration, part of Custodial Services' costs will be allocated *back* to Hospital Administration if the reciprocal method is used. At the same time, part of Hospital Administration's costs will be allocated *forward* to Custodial Services. Reciprocal allocation requires the use of simultaneous linear equations and is beyond the scope of this book. Examples of the reciprocal method can be found in more advanced cost accounting texts.

EXHIBIT 4B–3
Step-Down Method of Allocation

	Service Departments		Operating Departments		
	Hospital Administration	Custodial Services	Laboratory	Patient Care	Total
Departmental costs before allocation	$360,000	$ 90,000	$261,000	$ 689,000	$1,400,000
Allocation:					
Hospital Administration costs (6/54, 18/54, 30/54)* . . .	(360,000)	40,000	120,000	200,000	
Custodial Services costs (5/50, 45/50)†		(130,000)	13,000	117,000	
Total cost after allocation	$ 0	$ 0	$394,000	$1,006,000	$1,400,000

*Based on the employee-hours in Custodial Services and the two operating departments, which are 6,000 hours + 18,000 hours + 30,000 hours = 54,000 hours.
†As in Exhibit 4B–1, this allocation is based on the square feet occupied by the two operating departments.

Appendix 4B Exercises and Problems

All applicable exercises and problems are available with McGraw-Hill's *Connect™ Accounting*.

EXERCISE 4B–1 Direct Method [LO10]

Ignatius College has provided the following data to be used in its service department cost allocations:

	Service Departments		Operating Departments	
	Administration	Physical Plant Services	Undergraduate Programs	Graduate Programs
Departmental costs before allocations	$2,070,000	$720,000	$23,650,000	$2,980,000
Student credit-hours			40,000	5,000
Space occupied in square feet	30,000	5,000	250,000	50,000

Required:

Using the direct method, allocate the costs of the service departments to the two operating departments. Allocate the costs of the Administration Department on the basis of student credit-hours and the costs of the Physical Plant Services Department on the basis of space occupied.

EXERCISE 4B–2 Step-Down Method [LO11]

University District Co-op, a whole foods grocery and coffee shop, has provided the following data to be used in its service department cost allocations:

	Service Departments		Operating Departments	
	Administration	Building Services	Groceries	Coffee Shop
Departmental costs before allocations	$200,000	$60,000	$3,860,000	$340,000
Employee-hours	480	320	2,720	160
Space occupied in square feet	800	1,200	9,500	500

Required:

Using the step-down method, allocate the costs of the service departments to the two operating departments. Allocate the costs of the Administration Department first on the basis of employee-hours and then the costs of the Building Services Department on the basis of space occupied.

EXERCISE 4B–3 Step-Down Method [LO11]

Arbon Company has three service departments and two operating departments. Selected data concerning the five departments are presented below:

	Service Departments			Operating Departments		
	Administrative	Janitorial	Equipment Maintenance	Prep	Finishing	Total
Costs	$84,000	$67,800	$36,000	$256,100	$498,600	$942,500
Number of employees	80	60	240	600	300	1,280
Square feet of space occupied	3,000	12,000	10,000	20,000	70,000	115,000
Machine-hours				10,000	30,000	40,000

The company allocates service department costs by the step-down method in the following order: Administrative (number of employees), Janitorial (space occupied), and Equipment Maintenance (machine-hours).

Required:
Using the step-down method, allocate the service department costs to the operating departments.

EXERCISE 4B–4 Direct Method [LO10]
Refer to the data for Arbon Company in Exercise 4B–3.

Required:
Assuming that the company uses the direct method rather than the step-down method to allocate service department costs, how much cost would be assigned to each operating department?

eXcel

PROBLEM 4B–5 Step-Down Method [LO11]
Pleasant View Hospital has three service departments—Food Services, Administrative Services, and X-ray Services. The costs of these departments are allocated by the step-down method, using the allocation bases and in the order shown below:

Service Department	Costs Incurred	Base for Allocation
Food Services	Variable	Meals served
	Fixed	Peak-period needs
Administrative Services	Variable	Files processed
	Fixed	10% X-ray Services, 20% Outpatient Clinic, 30% OB Care, and 40% General Hospital
X-ray Services	Variable	X-rays taken
	Fixed	Peak-period needs

Estimated cost and operating data for all departments in the hospital for the forthcoming month are presented in the following table:

	Food Services	Admin. Services	X-Ray Services	Outpatient Clinic	OB Care	General Hospital	Total
Variable costs	$ 73,150	$ 6,800	$38,100	$11,700	$ 14,850	$ 53,400	$198,000
Fixed costs	48,000	33,040	59,520	26,958	99,738	344,744	612,000
Total costs	$121,150	$39,840	$97,620	$38,658	$114,588	$398,144	$810,000
Meals served		1,000	500		7,000	30,000	38,500
Percent of peak-period Food Services needs		2%	1%		17%	80%	100%
Files processed			1,500	3,000	900	12,000	17,400
X-rays taken				1,200	350	8,400	9,950
Percent of peak-period X-ray Services needs				13%	3%	84%	100%

All billing in the hospital is done through the Outpatient Clinic, OB Care, or General Hospital. The hospital's administrator wants the costs of the three service departments allocated to these three billing centers.

Required:
Prepare the cost allocation desired by the hospital administrator. Include under each billing center the direct costs of the center as well as the costs allocated from the service departments.

eXcel

PROBLEM 4B–6 Step-Down Method versus Direct Method; Predetermined Overhead Rates [LO10, LO11]
Petah, Ltd., of Tel Aviv, Israel, has budgeted costs in its various departments as follows for the coming year:

Factory Administration	₪ 540,000
Custodial Services	137,520
Personnel	57,680
Maintenance	90,400
Stamping—overhead	752,600
Assembly—overhead	351,800
Total overhead cost	₪1,930,000

The Israeli currency is the shekel, denoted by ₪. The company allocates service department costs to other departments, *in the order listed below.*

	Number of Employees	Total Labor-Hours	Square Meters of Space Occupied	Direct Labor-Hours	Machine-Hours
Factory Administration	22	—	5,000	—	—
Custodial Services	8	6,000	2,000	—	—
Personnel	10	10,000	3,000	—	—
Maintenance	50	44,000	10,000	—	—
Stamping—overhead	80	60,000	70,000	40,000	140,000
Assembly—overhead	120	180,000	20,000	160,000	20,000
	290	300,000	110,000	200,000	160,000

Stamping and Assembly are operating departments; the other departments are service departments. Factory Administration is allocated on the basis of labor-hours; Custodial Services on the basis of square meters occupied; Personnel on the basis of number of employees; and Maintenance on the basis of machine-hours.

Required:

1. Allocate service department costs to consuming departments by the step-down method. Then compute predetermined overhead rates in the operating departments, using a machine-hours basis in Stamping and a direct labor-hours basis in Assembly.
2. Repeat (1) above, this time using the direct method. Again, compute predetermined overhead rates in Stamping and Assembly.
3. Assume that the company doesn't bother with allocating service department costs but simply computes a single plantwide overhead rate based on total overhead costs (both service department and operating department costs) divided by total direct labor-hours. Compute the plantwide overhead rate.
4. Suppose a job requires machine and labor time as follows:

	Machine-Hours	Direct Labor-Hours
Stamping Department	190	25
Assembly Department	10	75
Total hours	200	100

   Using the overhead rates computed in (1), (2), and (3) above, compute the amount of overhead cost that would be assigned to the job if the overhead rates were developed using the step-down method, the direct method, and the plantwide method. (Round allocations to the nearest whole shekel.)

CASE 4B–7 Step-Down Method versus Direct Method [LO10, LO11]

"I can't understand what's happening here," said Mike Holt, president of Severson Products, Inc. "We always seem to bid too high on jobs that require a lot of labor time in the Finishing Department, and we always seem to get every job we bid on that requires a lot of machine time in the Milling Department. Yet we don't seem to be making much money on those Milling Department jobs. I wonder if the problem is in our overhead rates."

Severson Products manufactures high-quality wood products to customers' specifications. Some jobs take a large amount of machine work in the Milling Department, and other jobs take a large amount of hand finishing work in the Finishing Department. In addition to the Milling and Finishing departments, the company has three service departments. The costs of these service departments are allocated to other departments *in the order listed on the following page.* (For each service department, use the most appropriate allocation base.)

	Total Labor-Hours	Square Feet of Space Occupied	Number of Employees	Machine-Hours	Direct Labor-Hours
Cafeteria	16,000	12,000	25		
Custodial Services	9,000	3,000	40		
Machinery Maintenance	15,000	10,000	60		
Milling	30,000	40,000	100	160,000	20,000
Finishing	100,000	20,000	300	40,000	70,000
	170,000	85,000	525	200,000	90,000

Budgeted overhead costs in each department for the current year are as follows:

Cafeteria	$ 320,000*
Custodial Services	65,400
Machinery Maintenance	93,600
Milling	416,000
Finishing	166,000
Total budgeted cost	$1,061,000

*This represents the amount of cost subsidized by the company.

Because of its simplicity, the company has always used the direct method to allocate service department costs to the two operating departments.

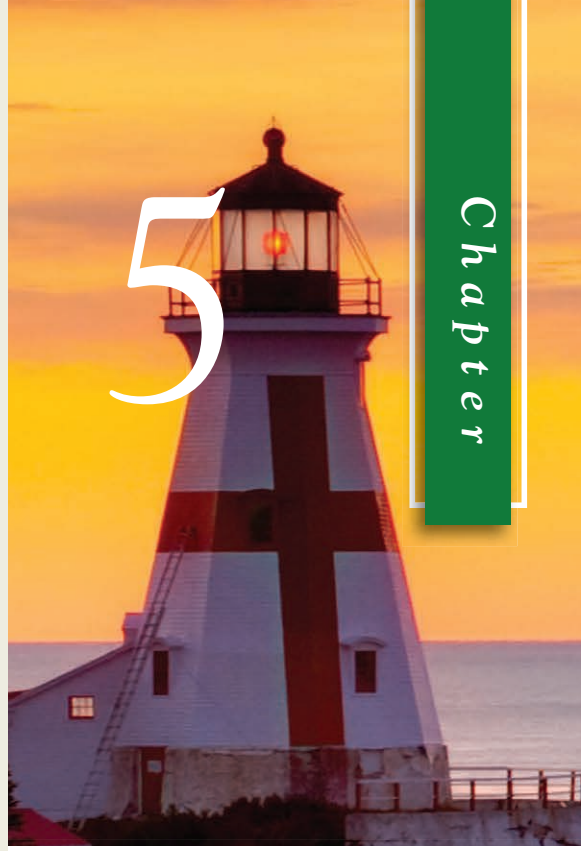
Required:

1. Using the step-down method, allocate service department costs to the consuming departments. Then compute predetermined overhead rates in the operating departments for the current year using machine-hours as the allocation base in the Milling Department and direct labor-hours as the allocation base in the Finishing Department.
2. Repeat (1) above, this time using the direct method. Again compute predetermined overhead rates in the Milling and Finishing Departments.
3. Assume that during the current year the company bids on a job that requires machine and labor time as follows:

	Machine-Hours	Direct Labor-Hours
Milling Department	2,000	1,600
Finishing Department	800	13,000
Total hours	2,800	14,600

a. Determine the amount of overhead that would be assigned to the job if the company used the overhead rates developed in (1) above. Then determine the amount of overhead that would be assigned to the job if the company used the overhead rates developed in (2) above.

b. Explain to the president why the step-down method provides a better basis for computing predetermined overhead rates than the direct method.



Cost-Volume-Profit Relationships

Moreno Turns Around the Los Angeles Angels

BUSINESS FOCUS

When Arturo Moreno bought Major League Baseball's Los Angeles Angels in 2003, the team was drawing 2.3 million fans and losing $5.5 million per year. Moreno immediately cut prices to attract more fans and increase profits. In his first spring training game, he reduced the price of selected tickets from $12 to $6. By increasing attendance, Moreno understood that he would sell more food and souvenirs. He dropped the price of draft beer by $2 and cut the price of baseball caps from $20 to $7.

The Angels now consistently draw about 3.4 million fans per year. This growth in attendance helped double stadium sponsorship revenue to $26 million, and it motivated the Fox Sports Network to pay the Angels $500 million to broadcast all of its games for the next ten years. Since Moreno bought the Angels, annual revenues have jumped from $127 million to $212 million, and the team's operating loss of $5.5 million has been transformed to a profit of $10.3 million. ■

Source: Matthew Craft, "Moreno's Math," *Forbes*, May 11, 2009, pp. 84–87.

LEARNING OBJECTIVES

After studying Chapter 5, you should be able to:

- **LO1** Explain how changes in activity affect contribution margin and net operating income.
- **LO2** Prepare and interpret a cost-volume-profit (CVP) graph and a profit graph.
- **LO3** Use the contribution margin ratio (CM ratio) to compute changes in contribution margin and net operating income resulting from changes in sales volume.
- **LO4** Show the effects on net operating income of changes in variable costs, fixed costs, selling price, and volume.
- **LO5** Determine the level of sales needed to achieve a desired target profit.
- **LO6** Determine the break-even point.
- **LO7** Compute the margin of safety and explain its significance.
- **LO8** Compute the degree of operating leverage at a particular level of sales and explain how it can be used to predict changes in net operating income.
- **LO9** Compute the break-even point for a multiproduct company and explain the effects of shifts in the sales mix on contribution margin and the break-even point.

Cost-volume-profit (CVP) analysis is a powerful tool that helps managers understand the relationships among cost, volume, and profit. CVP analysis focuses on how profits are affected by the following five factors:

1. Selling prices.
2. Sales volume.
3. Unit variable costs.
4. Total fixed costs.
5. Mix of products sold.

Because CVP analysis helps managers understand how profits are affected by these key factors, it is a vital tool in many business decisions. These decisions include what products and services to offer, what prices to charge, what marketing strategy to use, and what cost structure to maintain. To help understand the role of CVP analysis in business decisions, consider the case of Acoustic Concepts, Inc., a company founded by Prem Narayan.

MANAGERIAL ACCOUNTING IN ACTION

The Issue

Prem, who was a graduate student in engineering at the time, started Acoustic Concepts to market a radical new speaker he had designed for automobile sound systems. The speaker, called the Sonic Blaster, uses an advanced microprocessor and proprietary software to boost amplification to awesome levels. Prem contracted with a Taiwanese electronics manufacturer to produce the speaker. With seed money provided by his family, Prem placed an order with the manufacturer and ran advertisements in auto magazines.

The Sonic Blaster was an almost immediate success, and sales grew to the point that Prem moved the company's headquarters out of his apartment and into rented quarters in a nearby industrial park. He also hired a receptionist, an accountant, a sales manager, and a small sales staff to sell the speakers to retail stores. The accountant, Bob Luchinni, had worked for several small companies where he had acted as a business advisor as well as accountant and bookkeeper. The following discussion occurred soon after Bob was hired:

Prem: Bob, I've got a lot of questions about the company's finances that I hope you can help answer.

Bob: We're in great shape. The loan from your family will be paid off within a few months.

Prem: I know, but I am worried about the risks I've taken on by expanding operations. What would happen if a competitor entered the market and our sales slipped? How far could sales drop without putting us into the red? Another question I've been trying to resolve is how much our sales would have to increase to justify the big marketing campaign the sales staff is pushing for.

Bob: Marketing always wants more money for advertising.

Prem: And they are always pushing me to drop the selling price on the speaker. I agree with them that a lower price will boost our sales volume, but I'm not sure the increased volume will offset the loss in revenue from the lower price.

Bob: It sounds like these questions are all related in some way to the relationships among our selling prices, our costs, and our volume. I shouldn't have a problem coming up with some answers.

Prem: Can we meet again in a couple of days to see what you have come up with?

Bob: Sounds good. By then I'll have some preliminary answers for you as well as a model you can use for answering similar questions in the future.

The Basics of Cost-Volume-Profit (CVP) Analysis

Bob Luchinni's preparation for his forthcoming meeting with Prem begins with the contribution income statement. The contribution income statement emphasizes the behavior of costs and therefore is extremely helpful to managers in judging the impact on profits

of changes in selling price, cost, or volume. Bob will base his analysis on the following contribution income statement he prepared last month:

Acoustic Concepts, Inc.
Contribution Income Statement
For the Month of June

	Total	Per Unit
Sales (400 speakers)	$100,000	$250
Variable expenses	60,000	150
Contribution margin	40,000	$100
Fixed expenses	35,000	
Net operating income	$ 5,000	

Notice that sales, variable expenses, and contribution margin are expressed on a per unit basis as well as in total on this contribution income statement. The per unit figures will be very helpful to Bob in some of his calculations. Note that this contribution income statement has been prepared for management's use inside the company and would not ordinarily be made available to those outside the company.

Contribution Margin

LEARNING OBJECTIVE 1
Explain how changes in activity affect contribution margin and net operating income.

Contribution margin is the amount remaining from sales revenue after variable expenses have been deducted. Thus, it is the amount available to cover fixed expenses and then to provide profits for the period. Notice the sequence here—contribution margin is used *first* to cover the fixed expenses, and then whatever remains goes toward profits. If the contribution margin is not sufficient to cover the fixed expenses, then a loss occurs for the period. To illustrate with an extreme example, assume that Acoustic Concepts sells only one speaker during a particular month. The company's income statement would appear as follows:

Contribution Income Statement
Sales of 1 Speaker

	Total	Per Unit
Sales (1 speaker)	$ 250	$250
Variable expenses	150	150
Contribution margin	100	$100
Fixed expenses	35,000	
Net operating loss	$(34,900)	

For each additional speaker the company sells during the month, $100 more in contribution margin becomes available to help cover the fixed expenses. If a second speaker is sold, for example, then the total contribution margin will increase by $100 (to a total of $200) and the company's loss will decrease by $100, to $34,800:

Contribution Income Statement
Sales of 2 Speakers

	Total	Per Unit
Sales (2 speakers)	$ 500	$250
Variable expenses	300	150
Contribution margin	200	$100
Fixed expenses	35,000	
Net operating loss	$(34,800)	

If enough speakers can be sold to generate $35,000 in contribution margin, then all of the fixed expenses will be covered and the company will *break even* for the month—that is, it will show neither profit nor loss but just cover all of its costs. To reach the break-even point, the company will have to sell 350 speakers in a month because each speaker sold yields $100 in contribution margin:

Contribution Income Statement
Sales of 350 Speakers

	Total	Per Unit
Sales (350 speakers)	$87,500	$250
Variable expenses	52,500	150
Contribution margin	35,000	$100
Fixed expenses	35,000	
Net operating income	$ 0	

Computation of the break-even point is discussed in detail later in the chapter; for the moment, note that the **break-even point** is the level of sales at which profit is zero.

Once the break-even point has been reached, net operating income will increase by the amount of the unit contribution margin for each additional unit sold. For example, if 351 speakers are sold in a month, then the net operating income for the month will be $100 because the company will have sold 1 speaker more than the number needed to break even:

Contribution Income Statement
Sales of 351 Speakers

	Total	Per Unit
Sales (351 speakers)	$87,750	$250
Variable expenses	52,650	150
Contribution margin	35,100	$100
Fixed expenses	35,000	
Net operating income	$ 100	

If 352 speakers are sold (2 speakers above the break-even point), the net operating income for the month will be $200. If 353 speakers are sold (3 speakers above the break-even point), the net operating income for the month will be $300, and so forth. To estimate the profit at any sales volume above the break-even point, multiply the number of units sold in excess of the break-even point by the unit contribution margin. The result represents the anticipated profits for the period. Or, to estimate the effect of a planned increase in sales on profits, simply multiply the increase in units sold by the unit contribution margin. The result will be the expected increase in profits. To illustrate, if Acoustic Concepts is currently selling 400 speakers per month and plans to increase sales to 425 speakers per month, the anticipated impact on profits can be computed as follows:

Increased number of speakers to be sold	25
Contribution margin per speaker	× $100
Increase in net operating income	$2,500

These calculations can be verified as follows:

	Sales Volume			
	400 Speakers	425 Speakers	Difference (25 Speakers)	Per Unit
Sales (@ $250 per speaker)	$100,000	$106,250	$6,250	$250
Variable expenses (@ $150 per speaker)	60,000	63,750	3,750	150
Contribution margin	40,000	42,500	2,500	$100
Fixed expenses	35,000	35,000	0	
Net operating income	$ 5,000	$ 7,500	$2,500	

To summarize, if sales are zero, the company's loss would equal its fixed expenses. Each unit that is sold reduces the loss by the amount of the unit contribution margin. Once the break-even point has been reached, each additional unit sold increases the company's profit by the amount of the unit contribution margin.

CVP Relationships in Equation Form

The contribution format income statement can be expressed in equation form as follows:

$$\text{Profit} = (\text{Sales} - \text{Variable expenses}) - \text{Fixed expenses}$$

For brevity, we use the term *profit* to stand for net operating income in equations.

When a company has only a *single* product, as at Acoustic Concepts, we can further refine the equation as follows:

$$\text{Sales} = \text{Selling price per unit} \times \text{Quantity sold} = P \times Q$$

$$\text{Variable expenses} = \text{Variable expenses per unit} \times \text{Quantity sold} = V \times Q$$

$$\text{Profit} = (P \times Q - V \times Q) - \text{Fixed expenses}$$

We can do all of the calculations of the previous section using this simple equation. For example, on the previous page we computed that the net operating income (profit) at sales of 351 speakers would be $100. We can arrive at the same conclusion using the above equation as follows:

$$\text{Profit} = (P \times Q - V \times Q) - \text{Fixed expenses}$$

$$\begin{aligned}\text{Profit} &= (\$250 \times 351 - \$150 \times 351) - \$35{,}000 \\ &= (\$250 - \$150) \times 351 - \$35{,}000 \\ &= (\$100) \times 351 - \$35{,}000 \\ &= \$35{,}100 - \$35{,}000 = \$100\end{aligned}$$

It is often useful to express the simple profit equation in terms of the unit contribution margin (Unit CM) as follows:

$$\text{Unit CM} = \text{Selling price per unit} - \text{Variable expenses per unit} = P - V$$

$$\text{Profit} = (P \times Q - V \times Q) - \text{Fixed expenses}$$

$$\text{Profit} = (P - V) \times Q - \text{Fixed expenses}$$

$$\text{Profit} = \text{Unit CM} \times Q - \text{Fixed expenses}$$

We could also have used this equation to determine the profit at sales of 351 speakers as follows:

$$\begin{aligned}\text{Profit} &= \text{Unit CM} \times Q - \text{Fixed expenses}\\ &= \$100 \times 351 - \$35{,}000\\ &= \$35{,}100 - \$35{,}000 = \$100\end{aligned}$$

For those who are comfortable with algebra, the quickest and easiest approach to solving the problems in this chapter may be to use the simple profit equation in one of its forms.

CVP Relationships in Graphic Form

LEARNING OBJECTIVE 2
Prepare and interpret a cost-volume-profit (CVP) graph and a profit graph.

The relationships among revenue, cost, profit, and volume are illustrated on a **cost-volume-profit (CVP) graph.** A CVP graph highlights CVP relationships over wide ranges of activity. To help explain his analysis to Prem Narayan, Bob Luchinni prepared a CVP graph for Acoustic Concepts.

Preparing the CVP Graph

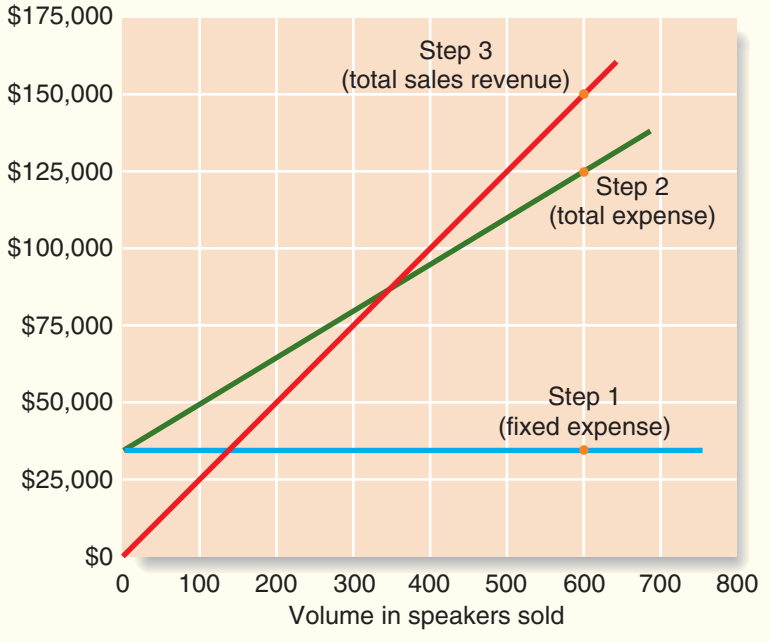
In a CVP graph (sometimes called a *break-even chart*), unit volume is represented on the horizontal (*X*) axis and dollars on the vertical (*Y*) axis. Preparing a CVP graph involves the three steps depicted in Exhibit 5–1:

1. Draw a line parallel to the volume axis to represent total fixed expense. For Acoustic Concepts, total fixed expenses are $35,000.
2. Choose some volume of unit sales and plot the point representing total expense (fixed and variable) at the sales volume you have selected. In Exhibit 5–1, Bob Luchinni chose a volume of 600 speakers. Total expense at that sales volume is:

Fixed expense	$ 35,000
Variable expense (600 speakers × $150 per speaker)	90,000
Total expense	$125,000

After the point has been plotted, draw a line through it back to the point where the fixed expense line intersects the dollars axis.

EXHIBIT 5–1
Preparing the CVP Graph



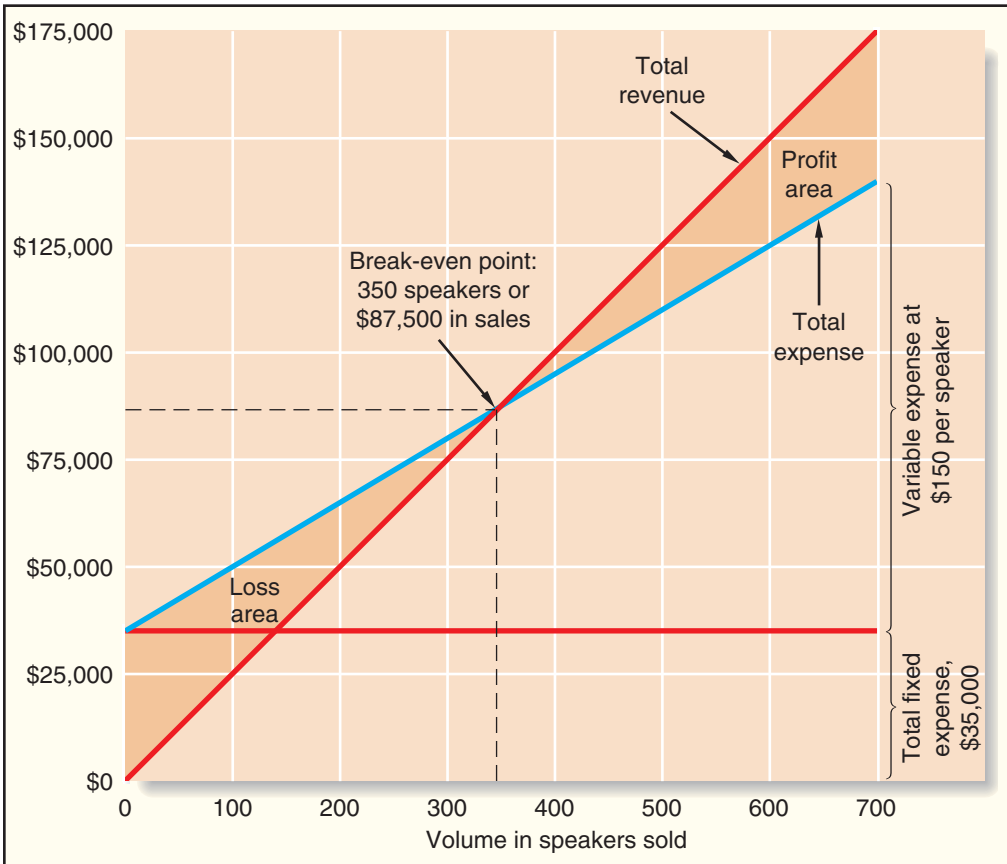


EXHIBIT 5–2
The Completed CVP Graph

3. Again choose some sales volume and plot the point representing total sales dollars at the activity level you have selected. In Exhibit 5–1, Bob Luchinni again chose a volume of 600 speakers. Sales at that volume total $150,000 (600 speakers × $250 per speaker). Draw a line through this point back to the origin.

The interpretation of the completed CVP graph is given in Exhibit 5–2. The anticipated profit or loss at any given level of sales is measured by the vertical distance between the total revenue line (sales) and the total expense line (variable expense plus fixed expense).

The break-even point is where the total revenue and total expense lines cross. The break-even point of 350 speakers in Exhibit 5–2 agrees with the break-even point computed earlier.

As discussed earlier, when sales are below the break-even point—in this case, 350 units—the company suffers a loss. Note that the loss (represented by the vertical distance between the total expense and total revenue lines) gets bigger as sales decline. When sales are above the break-even point, the company earns a profit and the size of the profit (represented by the vertical distance between the total revenue and total expense lines) increases as sales increase.

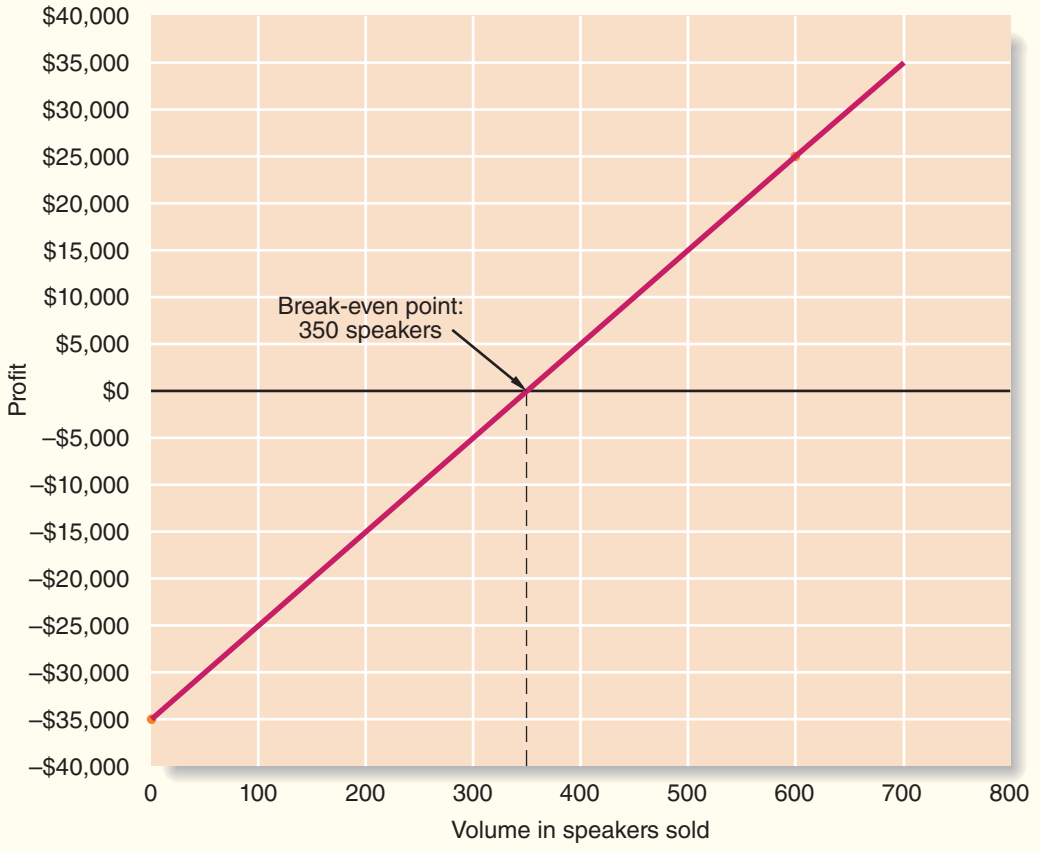
An even simpler form of the CVP graph, which we call a profit graph, is presented in Exhibit 5–3. That graph is based on the following equation:

$$\text{Profit} = \text{Unit CM} \times Q - \text{Fixed expenses}$$

In the case of Acoustic Concepts, the equation can be expressed as:

$$\text{Profit} = \$100 \times Q - \$35{,}000$$

EXHIBIT 5–3
The Profit Graph



Because this is a linear equation, it plots as a single straight line. To plot the line, compute the profit at two different sales volumes, plot the points, and then connect them with a straight line. For example, when the sales volume is zero (i.e., $Q = 0$), the profit is −$35,000 (= $100 × 0 − $35,000). When Q is 600, the profit is $25,000 (= $100 × 600 −$35,000). These two points are plotted in Exhibit 5–3 and a straight line has been drawn through them.

The break-even point on the profit graph is the volume of sales at which profit is zero and is indicated by the dashed line on the graph. Note that the profit steadily increases to the right of the break-even point as the sales volume increases and that the loss becomes steadily worse to the left of the break-even point as the sales volume decreases.

Contribution Margin Ratio (CM Ratio)

LEARNING OBJECTIVE 3
Use the contribution margin ratio (CM ratio) to compute changes in contribution margin and net operating income resulting from changes in sales volume.

In the previous section, we explored how cost-volume-profit relationships can be visualized. In this section, we show how the *contribution margin ratio* can be used in cost-volume-profit calculations. As the first step, we have added a column to Acoustic Concepts' contribution format income statement in which sales revenues, variable expenses, and contribution margin are expressed as a percentage of sales:

	Total	Per Unit	Percent of Sales
Sales (400 speakers)	$100,000	$250	100%
Variable expenses	60,000	150	60%
Contribution margin	40,000	$100	40%
Fixed expenses	35,000		
Net operating income	$ 5,000		

The contribution margin as a percentage of sales is referred to as the **contribution margin ratio (CM ratio).** This ratio is computed as follows:

$$\text{CM ratio} = \frac{\text{Contribution margin}}{\text{Sales}}$$

For Acoustic Concepts, the computations are:

$$\text{CM ratio} = \frac{\text{Total contribution margin}}{\text{Total sales}} = \frac{\$40{,}000}{\$100{,}000} = 40\%$$

In a company such as Acoustic Concepts that has only one product, the CM ratio can also be computed on a per unit basis as follows:

$$\text{CM ratio} = \frac{\text{Unit contribution margin}}{\text{Unit selling price}} = \frac{\$100}{\$250} = 40\%$$

The CM ratio shows how the contribution margin will be affected by a change in total sales. Acoustic Concepts' CM ratio of 40% means that for each dollar increase in sales, total contribution margin will increase by 40 cents ($1 sales × CM ratio of 40%). Net operating income will also increase by 40 cents, assuming that fixed costs are not affected by the increase in sales. Generally, the effect of a change in sales on the contribution margin is expressed in equation form as:

$$\text{Change in contribution margin} = \text{CM ratio} \times \text{Change in sales}$$

As this illustration suggests, *the impact on net operating income of any given dollar change in total sales can be computed by applying the CM ratio to the dollar change.* For example, if Acoustic Concepts plans a $30,000 increase in sales during the coming month, the contribution margin should increase by $12,000 ($30,000 increase in sales × CM ratio of 40%). As we noted above, net operating income will also increase by $12,000 if fixed costs do not change. This is verified by the following table:

	Sales Volume			Percent of Sales
	Present	Expected	Increase	
Sales	$100,000	$130,000	$30,000	100%
Variable expenses	60,000	78,000*	18,000	60%
Contribution margin	40,000	52,000	12,000	40%
Fixed expenses	35,000	35,000	0	
Net operating income	$ 5,000	$ 17,000	$12,000	

*$130,000 expected sales ÷ $250 per unit = 520 units. 520 units × $150 per unit = $78,000.

The relation between profit and the CM ratio can also be expressed using the following equation:

$$\text{Profit} = \text{CM ratio} \times \text{Sales} - \text{Fixed expenses}^{1}$$

For example, at sales of $130,000, the profit is expected to be $17,000 as shown below:

$$\begin{aligned}\text{Profit} &= \text{CM ratio} \times \text{Sales} - \text{Fixed expenses}\\ &= 0.40 \times \$130{,}000 - \$35{,}000\\ &= \$52{,}000 - \$35{,}000 = \$17{,}000\end{aligned}$$

[1] This equation can be derived using the basic profit equation and the definition of the CM ratio as follows:

$$\text{Profit} = (\text{Sales} - \text{Variable expenses}) - \text{Fixed expenses}$$

$$\text{Profit} = \text{Contribution margin} - \text{Fixed expenses}$$

$$\text{Profit} = \frac{\text{Contribution margin}}{\text{Sales}} \times \text{Sales} - \text{Fixed expenses}$$

$$\text{Profit} = \text{CM ratio} \times \text{Sales} - \text{Fixed expenses}$$

Again, if you are comfortable with algebra, this approach will often be quicker and easier than constructing contribution format income statements.

The CM ratio is particularly valuable in situations where the dollar sales of one product must be traded off against the dollar sales of another product. In this situation, products that yield the greatest amount of contribution margin per dollar of sales should be emphasized.

Some Applications of CVP Concepts

LEARNING OBJECTIVE 4
Show the effects on net operating income of changes in variable costs, fixed costs, selling price, and volume.

Bob Luchinni, the accountant at Acoustic Concepts, wanted to demonstrate to the company's president Prem Narayan how the concepts developed on the preceding pages can be used in planning and decision making. Bob gathered the following basic data:

	Per Unit	Percent of Sales
Selling price	$250	100%
Variable expenses	150	60%
Contribution margin	$100	40%

Recall that fixed expenses are $35,000 per month. Bob Luchinni will use these data to show the effects of changes in variable costs, fixed costs, sales price, and sales volume on the company's profitability in a variety of situations.

Before proceeding further, however, we need to introduce another concept—the *variable expense ratio.* The **variable expense ratio** is the ratio of variable expenses to sales. It can be computed by dividing the total variable expenses by the total sales, or in a single product analysis, it can be computed by dividing the variable expenses per unit by the unit selling price. In the case of Acoustic Concepts, the variable expense ratio is 0.60; that is, variable expense is 60% of sales. Expressed as an equation, the definition of the variable expense ratio is:

$$\text{Variable expense ratio} = \frac{\text{Variable expenses}}{\text{Sales}}$$

This leads to a useful equation that relates the CM ratio to the variable expense ratio as follows:

$$\text{CM ratio} = \frac{\text{Contribution margin}}{\text{Sales}}$$

$$\text{CM ratio} = \frac{\text{Sales} - \text{Variable expenses}}{\text{Sales}}$$

$$\text{CM ratio} = 1 - \text{Variable expense ratio}$$

Change in Fixed Cost and Sales Volume

Acoustic Concepts is currently selling 400 speakers per month at $250 per speaker for total monthly sales of $100,000. The sales manager feels that a $10,000 increase in the monthly advertising budget would increase monthly sales by $30,000 to a total of 520 units. Should the advertising budget be increased? The table on the next page shows the financial impact of the proposed change in the monthly advertising budget.

	Current Sales	Sales with Additional Advertising Budget	Difference	Percent of Sales
Sales	$100,000	$130,000	$30,000	100%
Variable expenses	60,000	78,000*	18,000	60%
Contribution margin	40,000	52,000	12,000	40%
Fixed expenses	35,000	45,000†	10,000	
Net operating income	$ 5,000	$ 7,000	$ 2,000	

*520 units × $150 per unit = $78,000.
†$35,000 + additional $10,000 monthly advertising budget = $45,000.

Assuming no other factors need to be considered, the increase in the advertising budget should be approved because it would increase net operating income by $2,000. There are two shorter ways to arrive at this solution. The first alternative solution follows:

Alternative Solution 1

Expected total contribution margin:	
$130,000 × 40% CM ratio	$52,000
Present total contribution margin:	
$100,000 × 40% CM ratio	40,000
Incremental contribution margin	12,000
Change in fixed expenses:	
Less incremental advertising expense	10,000
Increased net operating income	$ 2,000

Because in this case only the fixed costs and the sales volume change, the solution can also be quickly derived as follows:

Alternative Solution 2

Incremental contribution margin:	
$30,000 × 40% CM ratio	$12,000
Less incremental advertising expense	10,000
Increased net operating income	$ 2,000

Notice that this approach does not depend on knowledge of previous sales. Also note that it is unnecessary under either shorter approach to prepare an income statement. Both of the alternative solutions involve **incremental analysis**—they consider only the revenue, cost, and volume that will change if the new program is implemented. Although in each case a new income statement could have been prepared, the incremental approach is simpler and more direct and focuses attention on the specific changes that would occur as a result of the decision.

Change in Variable Costs and Sales Volume Refer to the original data. Recall that Acoustic Concepts is currently selling 400 speakers per month. Prem is considering the use of higher-quality components, which would increase variable costs (and thereby reduce the contribution margin) by $10 per speaker. However, the sales manager predicts that using higher-quality components would increase sales to 480 speakers per month. Should the higher-quality components be used?

The $10 increase in variable costs would decrease the unit contribution margin by $10—from $100 down to $90.

Solution

Expected total contribution margin with higher-quality components:	
480 speakers × $90 per speaker	$43,200
Present total contribution margin:	
400 speakers × $100 per speaker	40,000
Increase in total contribution margin	$ 3,200

According to this analysis, the higher-quality components should be used. Because fixed costs would not change, the $3,200 increase in contribution margin shown above should result in a $3,200 increase in net operating income.

IN BUSINESS

GROWING SALES AT AMAZON.COM

Amazon.com was deciding between two tactics for growing sales and profits. The first approach was to invest in television advertising. The second approach was to offer free shipping on larger orders. To evaluate the first option, Amazon.com invested in television ads in two markets—Minneapolis, Minnesota, and Portland, Oregon. The company quantified the profit impact of this choice by subtracting the increase in fixed advertising costs from the increase in contribution margin. The profit impact of television advertising paled in comparison to the free "super saver shipping" program, which the company introduced on orders over $99. In fact, the free shipping option proved to be so popular and profitable that within two years Amazon.com dropped its qualifying threshold to $49 and then again to a mere $25. At each stage of this progression, Amazon.com used cost-volume-profit analysis to determine whether the extra volume from liberalizing the free shipping offer more than offset the associated increase in shipping costs.

Source: Rob Walker, "Because 'Optimism is Essential,' " *Inc.* magazine, April 2004 pp. 149–150.

Change in Fixed Cost, Sales Price, and Sales Volume Refer to the original data and recall again that Acoustic Concepts is currently selling 400 speakers per month. To increase sales, the sales manager would like to cut the selling price by $20 per speaker and increase the advertising budget by $15,000 per month. The sales manager believes that if these two steps are taken, unit sales will increase by 50% to 600 speakers per month. Should the changes be made?

A decrease in the selling price of $20 per speaker would decrease the unit contribution margin by $20 down to $80.

Solution

Expected total contribution margin with lower selling price:	
600 speakers × $80 per speaker	$48,000
Present total contribution margin:	
400 speakers × $100 per speaker	40,000
Incremental contribution margin	8,000
Change in fixed expenses:	
Less incremental advertising expense	15,000
Reduction in net operating income	$ (7,000)

According to this analysis, the changes should not be made. The $7,000 reduction in net operating income that is shown above can be verified by preparing comparative income statements as shown on the next page.

	Present 400 Speakers per Month		Expected 600 Speakers per Month		
	Total	Per Unit	Total	Per Unit	Difference
Sales	$100,000	$250	$138,000	$230	$38,000
Variable expenses	60,000	150	90,000	150	30,000
Contribution margin	40,000	$100	48,000	$ 80	8,000
Fixed expenses	35,000		50,000*		15,000
Net operating income (loss)	$ 5,000		$ (2,000)		$ (7,000)

*35,000 + Additional monthly advertising budget of $15,000 = $50,000.

Change in Variable Cost, Fixed Cost, and Sales Volume Refer to Acoustic Concepts' original data. As before, the company is currently selling 400 speakers per month. The sales manager would like to pay salespersons a sales commission of $15 per speaker sold, rather than the flat salaries that now total $6,000 per month. The sales manager is confident that the change would increase monthly sales by 15% to 460 speakers per month. Should the change be made?

Solution Changing the sales staff's compensation from salaries to commissions would affect both fixed and variable expenses. Fixed expenses would decrease by $6,000, from $35,000 to $29,000. Variable expenses per unit would increase by $15, from $150 to $165, and the unit contribution margin would decrease from $100 to $85.

Expected total contribution margin with sales staff on commissions:	
460 speakers × $85 per speaker	$39,100
Present total contribution margin:	
400 speakers × $100 per speaker	40,000
Decrease in total contribution margin	(900)
Change in fixed expenses:	
Add salaries avoided if a commission is paid	6,000
Increase in net operating income	$ 5,100

According to this analysis, the changes should be made. Again, the same answer can be obtained by preparing comparative income statements:

	Present 400 Speakers per Month		Expected 460 Speakers per Month		
	Total	Per Unit	Total	Per Unit	Difference
Sales	$100,000	$250	$115,000	$250	$15,000
Variable expenses	60,000	150	75,900	165	15,900
Contribution margin	40,000	$100	39,100	$ 85	900
Fixed expenses	35,000		29,000		(6,000)*
Net operating income	$ 5,000		$ 10,100		$ 5,100

*Note: A *reduction* in fixed expenses has the effect of *increasing* net operating income.

Change in Selling Price Refer to the original data where Acoustic Concepts is currently selling 400 speakers per month. The company has an opportunity to make a bulk sale of 150 speakers to a wholesaler if an acceptable price can be negotiated. This sale would not disturb the company's regular sales and would not affect the company's total fixed expenses. What price per speaker should be quoted to the wholesaler if Acoustic Concepts is seeking a profit of $3,000 on the bulk sale?

Solution

Variable cost per speaker	$150
Desired profit per speaker:	
$3,000 ÷ 150 speakers	20
Quoted price per speaker	$170

Notice that fixed expenses are not included in the computation. This is because fixed expenses are not affected by the bulk sale, so all of the additional contribution margin increases the company's profits.

IN BUSINESS

MANAGING RISK IN THE BOOK PUBLISHING INDUSTRY

Greenleaf Book Group is a book publishing company in Austin, Texas, that attracts authors who are willing to pay publishing costs and forgo up-front advances in exchange for a larger royalty rate on each book sold. For example, assume a typical publisher prints 10,000 copies of a new book that it sells for $12.50 per unit. The publisher pays the author an advance of $20,000 to write the book and then incurs $60,000 of expenses to market, print, and edit the book. The publisher also pays the author a 20% royalty (or $2.50 per unit) on each book sold above 8,000 units. In this scenario, the publisher must sell 6,400 books to break even (= $80,000 in fixed costs ÷ $12.50 per unit). If all 10,000 copies are sold, the author earns $25,000 (= $20,000 advance + 2,000 copies × $2.50) and the publisher earns $40,000 (= $125,000 − $60,000 − $20,000 − $5,000).

Greenleaf alters the financial arrangement described above by requiring the author to assume the risk of poor sales. It pays the author a 70% royalty on all units sold (or $8.75 per unit), but the author forgoes the $20,000 advance and pays Greenleaf $60,000 to market, print, and edit the book. If the book flops, the author fails to recover her production costs. If all 10,000 units are sold, the author earns $27,500 (= $10,000 units × $8.75 − $60,000) and Greenleaf earns $37,500 (= 10,000 units × ($12.50 − $8.75)).

Source: Christopher Steiner, "Book It," *Forbes*, September 7, 2009, p. 58.

Target Profit and Break-Even Analysis

Target profit analysis and break-even analysis are used to answer questions such as how much would we have to sell to make a profit of $10,000 per month or how much would we have to sell to avoid incurring a loss?

Target Profit Analysis

LEARNING OBJECTIVE 5
Determine the level of sales needed to achieve a desired target profit.

Target profit analysis is one of the key uses of CVP analysis. In **target profit analysis,** we estimate what sales volume is needed to achieve a specific target profit. For example, suppose that Prem Narayan of Acoustic Concepts would like to know what sales would have to be to attain a target profit of $40,000 per month. To answer this question, we can proceed using the equation method or the formula method.

The Equation Method We can use a basic profit equation to find the sales volume required to attain a target profit. In the case of Acoustic Concepts, the company has only one product so we can use the contribution margin form of the equation. Remembering that the target profit is $40,000, the unit contribution margin is $100, and the fixed expense is $35,000, we can solve as follows:

$$\begin{aligned}
\text{Profit} &= \text{Unit CM} \times Q - \text{Fixed expense} \\
\$40{,}000 &= \$100 \times Q - \$35{,}000 \\
\$100 \times Q &= \$40{,}000 + \$35{,}000 \\
Q &= (\$40{,}000 + \$35{,}000) \div \$100 \\
Q &= 750
\end{aligned}$$

Thus, the target profit can be achieved by selling 750 speakers per month.

The Formula Method The formula method is a short-cut version of the equation method. Note that in the next to the last line of the above solution, the sum of the target profit of $40,000 and the fixed expense of $35,000 is divided by the unit contribution margin of $100. In general, in a single-product situation, we can compute the sales volume required to attain a specific target profit using the following formula:

$$\text{Unit sales to attain the target profit} = \frac{\text{Target profit} + \text{Fixed expenses}^{2}}{\text{Unit CM}}$$

In the case of Acoustic Concepts, the formula yields the following answer:

$$\begin{aligned}
\text{Unit sales to attain the target profit} &= \frac{\text{Target profit} + \text{Fixed expenses}}{\text{Unit CM}} \\
&= \frac{\$40{,}000 + \$35{,}000}{\$100} \\
&= 750
\end{aligned}$$

Note that this is the same answer we got when we used the equation method—and it always will be. The formula method simply skips a few steps in the equation method.

Target Profit Analysis in Terms of Sales Dollars Instead of unit sales, we may want to know what dollar sales are needed to attain the target profit. We can get this answer using several methods. First, we could solve for the unit sales to attain the target profit using the equation method or the formula method and then multiply the result by the selling price. In the case of Acoustic Concepts, the required sales volume using this approach would be computed as 750 speakers × $250 per speaker or $187,500 in total sales.

We can also solve for the required sales volume to attain the target profit of $40,000 at Acoustic Concepts using the basic equation stated in terms of the contribution margin ratio:

$$\begin{aligned}
\text{Profit} &= \text{CM ratio} \times \text{Sales} - \text{Fixed expenses} \\
\$40{,}000 &= 0.40 \times \text{Sales} - \$35{,}000 \\
0.40 \times \text{Sales} &= \$40{,}000 + \$35{,}000 \\
\text{Sales} &= (\$40{,}000 + \$35{,}000) \div 0.40 \\
\text{Sales} &= \$187{,}500
\end{aligned}$$

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[2] This equation can be derived as follows:

$$\begin{aligned}
\text{Profit} &= \text{Unit CM} \times Q - \text{Fixed expenses} \\
\text{Target profit} &= \text{Unit CM} \times Q - \text{Fixed expenses} \\
\text{Unit CM} \times Q &= \text{Target profit} + \text{Fixed expenses} \\
Q &= (\text{Target profit} + \text{Fixed expenses}) \div \text{Unit CM}
\end{aligned}$$

Note that in the next to the last line of the previous solution, the sum of the target profit of $40,000 and the fixed expense of $35,000 is divided by the contribution margin ratio of 0.40. In general, we can compute dollar sales to attain a target profit as follows:

$$\text{Dollar sales to attain a target profit} = \frac{\text{Target profit} + \text{Fixed expenses}}{\text{CM ratio}}$$[3]

At Acoustic Concepts, the formula yields the following answer:

$$\begin{aligned}\text{Dollar sales to attain a target profit} &= \frac{\text{Target profit} + \text{Fixed expenses}}{\text{CM ratio}} \\ &= \frac{\$40{,}000 + \$35{,}000}{0.40} \\ &= \$187{,}500\end{aligned}$$

Again, you get exactly the same answer whether you use the equation method or just use the formula.

In companies with multiple products, sales volume is more conveniently expressed in terms of total sales dollars than in terms of unit sales. The contribution margin ratio approach to target profit analysis is particularly useful for such companies.

Break-Even Analysis

LEARNING OBJECTIVE 6
Determine the break-even point.

Earlier in the chapter we defined the break-even point as the level of sales at which the company's profit is zero. What we call *break-even analysis* is really just a special case of target profit analysis in which the target profit is zero. We can use either the equation method or the formula method to solve for the break-even point, but for brevity we will illustrate just the formula method. The equation method works exactly like it did in target profit analysis. The only difference is that the target profit is zero in break-even analysis.

Break-Even in Unit Sales

In a single product situation, recall that the formula for the unit sales to attain a specific target profit is:

$$\text{Unit sales to attain the target profit} = \frac{\text{Target profit} + \text{Fixed expenses}}{\text{Unit CM}}$$

To compute the unit sales to break even, all we have to do is to set the target profit to zero in the above equation as follows:

$$\text{Unit sales to break even} = \frac{\$0 + \text{Fixed expenses}}{\text{Unit CM}}$$

$$\text{Unit sales to break even} = \frac{\text{Fixed expenses}}{\text{Unit CM}}$$

In the case of Acoustic Concepts, the break-even point can be computed as follows:

$$\begin{aligned}\text{Unit sales to break even} &= \frac{\text{Fixed expenses}}{\text{Unit CM}} \\ &= \frac{\$35{,}000}{\$100} \\ &= 350\end{aligned}$$

Thus, as we determined earlier in the chapter, Acoustic Concepts breaks even at sales of 350 speakers per month.

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[3] This equation can be derived as follows:

$$\begin{aligned}\text{Profit} &= \text{CM ratio} \times \text{Sales} - \text{Fixed expenses} \\ \text{Target profit} &= \text{CM ratio} \times \text{Sales} - \text{Fixed expenses} \\ \text{CM ratio} \times \text{Sales} &= \text{Target profit} + \text{Fixed expenses} \\ \text{Sales} &= (\text{Target profit} + \text{Fixed expenses}) \div \text{CM ratio}\end{aligned}$$

Break-Even in Sales Dollars We can find the break-even point in sales dollars using several methods. First, we could solve for the break-even point in unit sales using the equation method or the formula method and then multiply the result by the selling price. In the case of Acoustic Concepts, the break-even point in sales dollars using this approach would be computed as 350 speakers × $250 per speaker or $87,500 in total sales.

We can also solve for the break-even point in sales dollars at Acoustic Concepts using the basic profit equation stated in terms of the contribution margin ratio or we can use the formula for the target profit. Again, for brevity, we will use the formula.

$$\text{Dollar sales to attain a target profit} = \frac{\text{Target profit} + \text{Fixed expenses}}{\text{CM ratio}}$$

$$\text{Dollar sales to break even} = \frac{\$0 + \text{Fixed expenses}}{\text{CM ratio}}$$

$$\text{Dollar sales to break even} = \frac{\text{Fixed expenses}}{\text{CM ratio}}$$

The break-even point at Acoustic Concepts would be computed as follows:

$$\begin{aligned}\text{Dollar sales to break even} &= \frac{\text{Fixed expenses}}{\text{CM ratio}} \\ &= \frac{\$35{,}000}{0.40} \\ &= \$87{,}500\end{aligned}$$

IN BUSINESS

COST OVERRUNS INCREASE THE BREAK-EVEN POINT

When Airbus launched the A380 555-seat jetliner in 2000, the company said it would need to sell 250 units to break even on the project. By 2006, Airbus was admitting that more than $3 billion of cost overruns had raised the project's break-even point to 420 airplanes. Although Airbus has less than 170 orders for the A380, the company remains optimistic that it will sell 751 units over the next 20 years. Given that Airbus rival Boeing predicts the total market size for all airplanes with more than 400 seats will not exceed 990 units, it remains unclear if Airbus will ever break even on its investment in the A380 aircraft.

Source: Daniel Michaels, "Embattled Airbus Lifts Sales Target for A380 to Profit," *The Wall Street Journal*, October 20, 2006, p. A6.

The Margin of Safety

LEARNING OBJECTIVE 7
Compute the margin of safety and explain its significance.

The **margin of safety** is the excess of budgeted or actual sales dollars over the break-even volume of sales dollars. It is the amount by which sales can drop before losses are incurred. The higher the margin of safety, the lower the risk of not breaking even and incurring a loss. The formula for the margin of safety is:

$$\text{Margin of safety in dollars} = \text{Total budgeted (or actual) sales} - \text{Break-even sales}$$

The margin of safety can also be expressed in percentage form by dividing the margin of safety in dollars by total dollar sales:

$$\text{Margin of safety percentage} = \frac{\text{Margin of safety in dollars}}{\text{Total budgeted (or actual) sales in dollars}}$$

The calculation of the margin of safety for Acoustic Concepts is:

Sales (at the current volume of 400 speakers) (a)	$100,000
Break-even sales (at 350 speakers)	87,500
Margin of safety in dollars (b)	$ 12,500
Margin of safety percentage, (b) ÷ (a)	12.5%

This margin of safety means that at the current level of sales and with the company's current prices and cost structure, a reduction in sales of $12,500, or 12.5%, would result in just breaking even.

In a single-product company like Acoustic Concepts, the margin of safety can also be expressed in terms of the number of units sold by dividing the margin of safety in dollars by the selling price per unit. In this case, the margin of safety is 50 speakers ($12,500 ÷ $250 per speaker = 50 speakers).

IN BUSINESS

COMPUTING MARGIN OF SAFETY FOR A SMALL BUSINESS

Sam Calagione owns Dogfish Head Craft Brewery, a microbrewery in Rehobeth Beach, Delaware. He charges distributors as much as $100 per case for his premium beers such as World Wide Stout. The high-priced microbrews bring in $800,000 in operating income on revenue of $7 million. Calagione reports that his raw ingredients and labor costs for one case of World Wide Stout are $30 and $16, respectively. Bottling and packaging costs are $6 per case. Gas and electric costs are about $10 per case.

If we assume that World Wide Stout is representative of all Dogfish microbrews, then we can compute the company's margin of safety in five steps. First, variable cost as a percentage of sales is 62% [($30 + $16 + $6 + $10)/$100]. Second, the contribution margin ratio is 38% (1 − 0.62). Third, Dogfish's total fixed cost is $1,860,000 [($7,000,000 × 0.38) − $800,000]. Fourth, the break-even point in sales dollars is $4,894,737 ($1,860,000/0.38). Fifth, the margin of safety is $2,105,263 ($7,000,000 − $4,894,737).

Source: Patricia Huang, "Château Dogfish," *Forbes*, February 28, 2005, pp. 57–59.

MANAGERIAL ACCOUNTING IN ACTION

The Wrap-up

Prem Narayan and Bob Luchinni met to discuss the results of Bob's analysis.

Prem: Bob, everything you have shown me is pretty clear. I can see what impact the sales manager's suggestions would have on our profits. Some of those suggestions are quite good and others are not so good. I am concerned that our margin of safety is only 50 speakers. What can we do to increase this number?

Bob: Well, we have to increase total sales or decrease the break-even point or both.

Prem: And to decrease the break-even point, we have to either decrease our fixed expenses or increase our unit contribution margin?

Bob: Exactly.

Prem: And to increase our unit contribution margin, we must either increase our selling price or decrease the variable cost per unit?

Bob: Correct.

Prem: So what do you suggest?

Bob: Well, the analysis doesn't tell us which of these to do, but it does indicate we have a potential problem here.

Prem: If you don't have any immediate suggestions, I would like to call a general meeting next week to discuss ways we can work on increasing the margin of safety. I think everyone will be concerned about how vulnerable we are to even small downturns in sales.

CVP Considerations in Choosing a Cost Structure

Cost structure refers to the relative proportion of fixed and variable costs in an organization. Managers often have some latitude in trading off between these two types of costs. For example, fixed investments in automated equipment can reduce variable labor costs. In this section, we discuss the choice of a cost structure. We also introduce the concept of *operating leverage.*

Cost Structure and Profit Stability

Which cost structure is better—high variable costs and low fixed costs, or the opposite? No single answer to this question is possible; each approach has its advantages. To show what we mean, refer to the contribution format income statements given below for two blueberry farms. Bogside Farm depends on migrant workers to pick its berries by hand, whereas Sterling Farm has invested in expensive berry-picking machines. Consequently, Bogside Farm has higher variable costs, but Sterling Farm has higher fixed costs:

	Bogside Farm		Sterling Farm	
	Amount	Percent	Amount	Percent
Sales	$100,000	100%	$100,000	100%
Variable expenses	60,000	60%	30,000	30%
Contribution margin	40,000	40%	70,000	70%
Fixed expenses	30,000		60,000	
Net operating income	$ 10,000		$ 10,000	

Which farm has the better cost structure? The answer depends on many factors, including the long-run trend in sales, year-to-year fluctuations in the level of sales, and the attitude of the owners toward risk. If sales are expected to exceed $100,000 in the future, then Sterling Farm probably has the better cost structure. The reason is that its CM ratio is higher, and its profits will therefore increase more rapidly as sales increase. To illustrate, assume that each farm experiences a 10% increase in sales without any increase in fixed costs. The new income statements would be as follows:

	Bogside Farm		Sterling Farm	
	Amount	Percent	Amount	Percent
Sales	$110,000	100%	$110,000	100%
Variable expenses	66,000	60%	33,000	30%
Contribution margin	44,000	40%	77,000	70%
Fixed expenses	30,000		60,000	
Net operating income	$ 14,000		$ 17,000	

Sterling Farm has experienced a greater increase in net operating income due to its higher CM ratio even though the increase in sales was the same for both farms.

What if sales drop below $100,000? What are the farms' break-even points? What are their margins of safety? The computations needed to answer these questions are shown below using the formula method:

	Bogside Farm	Sterling Farm
Fixed expenses	$ 30,000	$ 60,000
Contribution margin ratio	÷ 0.40	÷ 0.70
Dollar sales to break even	$ 75,000	$ 85,714
Total current sales (a)	$100,000	$100,000
Break-even sales	75,000	85,714
Margin of safety in sales dollars (b)	$ 25,000	$ 14,286
Margin of safety percentage (b) ÷ (a)	25.0%	14.3%

Bogside Farm's margin of safety is greater and its contribution margin ratio is lower than Sterling Farm. Therefore, Bogside Farm is less vulnerable to downturns than Sterling Farm. Due to its lower contribution margin ratio, Bogside Farm will not lose contribution margin as rapidly as Sterling Farm when sales decline. Thus, Bogside Farm's profit will be less volatile. We saw earlier that this is a drawback when sales increase, but it provides more protection when sales drop. And because its break-even point is lower, Bogside Farm can suffer a larger sales decline before losses emerge.

To summarize, without knowing the future, it is not obvious which cost structure is better. Both have advantages and disadvantages. Sterling Farm, with its higher fixed costs and lower variable costs, will experience wider swings in net operating income as sales fluctuate, with greater profits in good years and greater losses in bad years. Bogside Farm, with its lower fixed costs and higher variable costs, will enjoy greater profit stability and will be more protected from losses during bad years, but at the cost of lower net operating income in good years.

Operating Leverage

LEARNING OBJECTIVE 8
Compute the degree of operating leverage at a particular level of sales and explain how it can be used to predict changes in net operating income.

A lever is a tool for multiplying force. Using a lever, a massive object can be moved with only a modest amount of force. In business, *operating leverage* serves a similar purpose. **Operating leverage** is a measure of how sensitive net operating income is to a given percentage change in dollar sales. Operating leverage acts as a multiplier. If operating leverage is high, a small percentage increase in sales can produce a much larger percentage increase in net operating income.

Operating leverage can be illustrated by returning to the data for the two blueberry farms. We previously showed that a 10% increase in sales (from $100,000 to $110,000 in each farm) results in a 70% increase in the net operating income of Sterling Farm (from $10,000 to $17,000) and only a 40% increase in the net operating income of Bogside Farm (from $10,000 to $14,000). Thus, for a 10% increase in sales, Sterling Farm experiences a much greater percentage increase in profits than does Bogside Farm. Therefore, Sterling Farm has greater operating leverage than Bogside Farm.

The **degree of operating leverage** at a given level of sales is computed by the following formula:

$$\text{Degree of operating leverage} = \frac{\text{Contribution margin}}{\text{Net operating income}}$$

The degree of operating leverage is a measure, at a given level of sales, of how a percentage change in sales volume will affect profits. To illustrate, the degree of operating leverage for the two farms at $100,000 sales would be computed as follows:

$$\text{Bogside Farm: } \frac{\$40{,}000}{\$10{,}000} = 4$$

$$\text{Sterling Farm: } \frac{\$70{,}000}{\$10{,}000} = 7$$

Because the degree of operating leverage for Bogside Farm is 4, the farm's net operating income grows four times as fast as its sales. In contrast, Sterling Farm's net operating income grows seven times as fast as its sales. Thus, if sales increase by 10%, then we can expect the net operating income of Bogside Farm to increase by four times this amount, or by 40%, and the net operating income of Sterling Farm to increase by seven times this amount, or by 70%. In general, this relation between the percentage change in sales and the percentage change in net operating income is given by the following formula:

$$\begin{array}{c}\text{Percentage change in} \\ \text{net operating income}\end{array} = \begin{array}{c}\text{Degree of} \\ \text{operating leverage}\end{array} \times \begin{array}{c}\text{Percentage} \\ \text{change in sales}\end{array}$$

$$\text{Bogside Farm: Percentage change in net operating income} = 4 \times 10\% = 40\%$$

$$\text{Sterling Farm: Percentage change in net operating income} = 7 \times 10\% = 70\%$$

What is responsible for the higher operating leverage at Sterling Farm? The only difference between the two farms is their cost structure. If two companies have the same total revenue and same total expense but different cost structures, then the company with the higher proportion of fixed costs in its cost structure will have higher operating leverage. Referring back to the original example on page 201, when both farms have sales of $100,000 and total expenses of $90,000, one-third of Bogside Farm's costs are fixed but two-thirds of Sterling Farm's costs are fixed. As a consequence, Sterling's degree of operating leverage is higher than Bogside's.

The degree of operating leverage is not a constant; it is greatest at sales levels near the break-even point and decreases as sales and profits rise. The following table shows the degree of operating leverage for Bogside Farm at various sales levels. (Data used earlier for Bogside Farm are shown in color.)

Sales	$75,000	$80,000	$100,000	$150,000	$225,000
Variable expenses	45,000	48,000	60,000	90,000	135,000
Contribution margin (a)	30,000	32,000	40,000	60,000	90,000
Fixed expenses	30,000	30,000	30,000	30,000	30,000
Net operating income (b)	$ 0	$ 2,000	$ 10,000	$ 30,000	$ 60,000
Degree of operating leverage, (a) ÷ (b)	∞	16	4	2	1.5

Thus, a 10% increase in sales would increase profits by only 15% (10% × 1.5) if sales were previously $225,000, as compared to the 40% increase we computed earlier at the $100,000 sales level. The degree of operating leverage will continue to decrease the farther the company moves from its break-even point. At the break-even point, the degree of operating leverage is infinitely large ($30,000 contribution margin ÷ $0 net operating income = ∞).

IN BUSINESS

THE DANGERS OF A HIGH DEGREE OF OPERATING LEVERAGE

In recent years, computer chip manufacturers have poured more than $75 billion into constructing new manufacturing facilities to meet the growing demand for digital devices such as iPhones and Blackberrys. Because 70% of the costs of running these facilities are fixed, a sharp drop in customer demand forces these companies to choose between two undesirable options. They can slash production levels and absorb large amounts of unused capacity costs, or they can continue producing large volumes of output in spite of shrinking demand, thereby flooding the market with excess supply and lowering prices. Either choice distresses investors who tend to shy away from computer chip makers in economic downturns.

Source: Bruce Einhorn, "Chipmakers on the Edge," *BusinessWeek*, January 5, 2009, pp. 30–31.

The degree of operating leverage can be used to quickly estimate what impact various percentage changes in sales will have on profits, without the necessity of preparing detailed income statements. As shown by our examples, the effects of operating leverage can be dramatic. If a company is near its break-even point, then even small percentage increases in sales can yield large percentage increases in profits. *This explains why management will often work very hard for only a small increase in sales volume.* If the degree of operating leverage is 5, then a 6% increase in sales would translate into a 30% increase in profits.

Structuring Sales Commissions

Companies usually compensate salespeople by paying them a commission based on sales, a salary, or a combination of the two. Commissions based on sales dollars can lead to lower profits. To illustrate, consider Pipeline Unlimited, a producer of surfing equipment. Salespersons sell the company's products to retail sporting goods stores throughout North America and the Pacific Basin. Data for two of the company's surfboards, the XR7 and Turbo models, appear below:

	Model	
	XR7	Turbo
Selling price	$695	$749
Variable expenses	344	410
Contribution margin	$351	$339

Which model will salespeople push hardest if they are paid a commission of 10% of sales revenue? The answer is the Turbo because it has the higher selling price and hence the larger commission. On the other hand, from the standpoint of the company, profits will be greater if salespeople steer customers toward the XR7 model because it has the higher contribution margin.

To eliminate such conflicts, commissions can be based on contribution margin rather than on selling price. If this is done, the salespersons will want to sell the mix of products that maximizes contribution margin. Providing that fixed costs are not affected by the sales mix, maximizing the contribution margin will also maximize the company's profit.[4] In effect, by maximizing their own compensation, salespersons will also maximize the company's profit.

IN BUSINESS

AN ALTERNATIVE APPROACH TO SALES COMMISSIONS

Thrive Networks, located in Concord, Massachusetts, used to pay its three salesmen based on individually earned commissions. This system seemed to be working fine as indicated by the company's sales growth from $2.7 million in 2002 to $3.6 million in 2003. However, the company felt there was a better way to motivate and compensate its salesmen. It pooled commissions across the three salesmen and compensated them collectively. The new approach was designed to build teamwork and leverage each salesman's individual strengths. Jim Lippie, the director of business development, was highly skilled at networking and generating sales leads. John Barrows, the sales director, excelled at meeting with prospective clients and producing compelling proposals. Nate Wolfson, the CEO and final member of the sales team, was the master at closing the deal. The new approach has worked so well that Wolfson plans to use three-person sales teams in his offices nationwide.

Source: Cara Cannella, "Kill the Commissions," *Inc.* Magazine, August 2004, p. 38.

Sales Mix

LEARNING OBJECTIVE 9
Compute the break-even point for a multiproduct company and explain the effects of shifts in the sales mix on contribution margin and the break-even point.

Before concluding our discussion of CVP concepts, we need to consider the impact of changes in *sales mix* on a company's profit.

[4] This also assumes the company has no production constraint. If it does, the sales commissions should be modified. See the Profitability Appendix at the end of the book.

The Definition of Sales Mix

The term **sales mix** refers to the relative proportions in which a company's products are sold. The idea is to achieve the combination, or mix, that will yield the greatest profits. Most companies have many products, and often these products are not equally profitable. Hence, profits will depend to some extent on the company's sales mix. Profits will be greater if high-margin rather than low-margin items make up a relatively large proportion of total sales.

Changes in the sales mix can cause perplexing variations in a company's profits. A shift in the sales mix from high-margin items to low-margin items can cause total profits to decrease even though total sales may increase. Conversely, a shift in the sales mix from low-margin items to high-margin items can cause the reverse effect—total profits may increase even though total sales decrease. It is one thing to achieve a particular sales volume; it is quite another to sell the most profitable mix of products.

IN BUSINESS

WALMART ATTEMPTS TO SHIFT ITS SALES MIX

Almost 130 million customers shop at Walmart's 3,200 U.S. stores each week. However, less than half of them shop the whole store—choosing to buy only low-margin basics while skipping higher-margin departments such as apparel. In an effort to shift its sales mix toward higher-margin merchandise, Walmart has reduced spending on advertising and plowed the money into remodeling the clothing departments within its stores. The company hopes this remodeling effort will entice its customers to add clothing to their shopping lists while bypassing the apparel offerings of competitors such as Kohl's and Target.

Source: Robert Berner, "Fashion Emergency at Walmart," *BusinessWeek,* July 31, 2006, p. 67.

Sales Mix and Break-Even Analysis

If a company sells more than one product, break-even analysis is more complex than discussed to this point. The reason is that different products will have different selling prices, different costs, and different contribution margins. Consequently, the break-even point depends on the mix in which the various products are sold. To illustrate, consider Virtual Journeys Unlimited, a small company that imports DVDs from France. At present, the company sells two DVDs: the Le Louvre DVD, a tour of the famous art museum in Paris; and the Le Vin DVD, which features the wines and wine-growing regions of France. The company's September sales, expenses, and break-even point are shown in Exhibit 5–4.

As shown in the exhibit, the break-even point is $60,000 in sales, which was computed by dividing the company's fixed expenses of $27,000 by its overall CM ratio of 45%. However, this is the break-even only if the company's sales mix does not change. Currently, the Le Louvre DVD is responsible for 20% and the Le Vin DVD for 80% of the company's dollar sales. Assuming this sales mix does not change, if total sales are $60,000, the sales of the Le Louvre DVD would be $12,000 (20% of $60,000) and the sales of the Le Vin DVD would be $48,000 (80% of $60,000). As shown in Exhibit 5–4, at these levels of sales, the company would indeed break even. But $60,000 in sales represents the break-even point for the company only if the sales mix does not change. *If the sales mix changes, then the break-even point will also usually change.* This is illustrated by the results for October in which the sales mix shifted away from the more profitable Le Vin DVD (which has a 50% CM ratio) toward the less profitable Le Louvre CD (which has a 25% CM ratio). These results appear in Exhibit 5–5.

EXHIBIT 5–4
Multiproduct Break-Even Analysis

Virtual Journeys Unlimited
Contribution Income Statement
For the Month of September

	Le Louvre DVD		Le Vin DVD		Total	
	Amount	Percent	Amount	Percent	Amount	Percent
Sales	$20,000	100%	$80,000	100%	$100,000	100%
Variable expenses	15,000	75%	40,000	50%	55,000	55%
Contribution margin	$ 5,000	25%	$40,000	50%	45,000	45%
Fixed expenses					27,000	
Net operating income					$ 18,000	

Computation of the break-even point:

$$\frac{\text{Fixed expenses}}{\text{Overall CM ratio}} = \frac{\$27{,}000}{0.45} = \$60{,}000$$

Verification of the break-even point:

	Le Louvre DVD	Le Vin DVD	Total
Current dollar sales	$20,000	$80,000	$100,000
Percentage of total dollar sales	20%	80%	100%
Sales at the break-even point	$12,000	$48,000	$60,000

	Le Louvre DVD		Le Vin DVD		Total	
	Amount	Percent	Amount	Percent	Amount	Percent
Sales	$12,000	100%	$48,000	100%	$ 60,000	100%
Variable expenses	9,000	75%	24,000	50%	33,000	55%
Contribution margin	$ 3,000	25%	$24,000	50%	27,000	45%
Fixed expenses					27,000	
Net operating income					$ 0	

EXHIBIT 5–5
Multiproduct Break-Even Analysis: A Shift in Sales Mix (see Exhibit 5–4)

Virtual Journeys Unlimited
Contribution Income Statement
For the Month of October

	Le Louvre DVD		Le Vin DVD		Total	
	Amount	Percent	Amount	Percent	Amount	Percent
Sales	$80,000	100%	$20,000	100%	$100,000	100%
Variable expenses	60,000	75%	10,000	50%	70,000	70%
Contribution margin	$20,000	25%	$10,000	50%	30,000	30%
Fixed expenses					27,000	
Net operating income					$ 3,000	

Computation of the break-even point:

$$\frac{\text{Fixed expenses}}{\text{Overall CM ratio}} = \frac{\$27{,}000}{0.30} = \$90{,}000$$

Although sales have remained unchanged at $100,000, the sales mix is exactly the reverse of what it was in Exhibit 5–4, with the bulk of the sales now coming from the less profitable Le Louvre DVD. Notice that this shift in the sales mix has caused both the overall CM ratio and total profits to drop sharply from the prior month even though total sales are the same. The overall CM ratio has dropped from 45% in September to only 30% in October, and net operating income has dropped from $18,000 to only $3,000. In addition, with the drop in the overall CM ratio, the company's break-even point is no longer $60,000 in sales. Because the company is now realizing less average contribution margin per dollar of sales, it takes more sales to cover the same amount of fixed costs. Thus, the break-even point has increased from $60,000 to $90,000 in sales per year.

In preparing a break-even analysis, an assumption must be made concerning the sales mix. Usually the assumption is that it will not change. However, if the sales mix is expected to change, then this must be explicitly considered in any CVP computations.

Assumptions of CVP Analysis

A number of assumptions commonly underlie CVP analysis:

1. Selling price is constant. The price of a product or service will not change as volume changes.
2. Costs are linear and can be accurately divided into variable and fixed elements. The variable element is constant per unit, and the fixed element is constant in total over the entire relevant range.
3. In multiproduct companies, the sales mix is constant.
4. In manufacturing companies, inventories do not change. The number of units produced equals the number of units sold.

While these assumptions may be violated in practice, the results of CVP analysis are often "good enough" to be quite useful. Perhaps the greatest danger lies in relying on simple CVP analysis when a manager is contemplating a large change in volume that lies outside of the relevant range. For example, a manager might contemplate increasing the level of sales far beyond what the company has ever experienced before. However, even in these situations the model can be adjusted as we have done in this chapter to take into account anticipated changes in selling prices, fixed costs, and the sales mix that would otherwise violate the assumptions mentioned above. For example, in a decision that would affect fixed costs, the change in fixed costs can be explicitly taken into account as illustrated earlier in the chapter in the Acoustic Concepts example on pages 192–195.

Summary

CVP analysis is based on a simple model of how profits respond to prices, costs, and volume. This model can be used to answer a variety of critical questions such as what is the company's break-even volume, what is its margin of safety, and what is likely to happen if specific changes are made in prices, costs, and volume.

A CVP graph depicts the relationships between unit sales on the one hand and fixed expenses, variable expenses, total expenses, total sales, and profits on the other hand. The profit graph is simpler than the CVP graph and shows how profits depend on sales. The CVP and profit graphs are useful for developing intuition about how costs and profits respond to changes in sales.

The contribution margin ratio is the ratio of the total contribution margin to total sales. This ratio can be used to quickly estimate what impact a change in total sales would have on net operating income. The ratio is also useful in break-even analysis.

Target profit analysis is used to estimate how much sales would have to be to attain a specified target profit. The unit sales required to attain the target profit can be estimated by dividing the sum of the target profit and fixed expense by the unit contribution margin. Break-even analysis is

a special case of target profit analysis that is used to estimate how much sales would have to be to just break even. The unit sales required to break even can be estimated by dividing the fixed expense by the unit contribution margin.

The margin of safety is the amount by which the company's current sales exceeds break-even sales.

The degree of operating leverage allows quick estimation of what impact a given percentage change in sales would have on the company's net operating income. The higher the degree of operating leverage, the greater is the impact on the company's profits. The degree of operating leverage is not constant—it depends on the company's current level of sales.

The profits of a multiproduct company are affected by its sales mix. Changes in the sales mix can affect the break-even point, margin of safety, and other critical factors.

Review Problem: CVP Relationships

Voltar Company manufactures and sells a specialized cordless telephone for high electromagnetic radiation environments. The company's contribution format income statement for the most recent year is given below:

	Total	Per Unit	Percent of Sales
Sales (20,000 units)	$1,200,000	$60	100%
Variable expenses	900,000	45	? %
Contribution margin	300,000	$15	? %
Fixed expenses	240,000		
Net operating income	$ 60,000		

Management is anxious to increase the company's profit and has asked for an analysis of a number of items.

Required:

1. Compute the company's CM ratio and variable expense ratio.
2. Compute the company's break-even point in both units and sales dollars. Use the equation method.
3. Assume that sales increase by $400,000 next year. If cost behavior patterns remain unchanged, by how much will the company's net operating income increase? Use the CM ratio to compute your answer.
4. Refer to the original data. Assume that next year management wants the company to earn a profit of at least $90,000. How many units will have to be sold to meet this target profit?
5. Refer to the original data. Compute the company's margin of safety in both dollar and percentage form.
6. *a.* Compute the company's degree of operating leverage at the present level of sales.
   b. Assume that through a more intense effort by the sales staff, the company's sales increase by 8% next year. By what percentage would you expect net operating income to increase? Use the degree of operating leverage to obtain your answer.
   c. Verify your answer to (*b*) by preparing a new contribution format income statement showing an 8% increase in sales.
7. In an effort to increase sales and profits, management is considering the use of a higher-quality speaker. The higher-quality speaker would increase variable costs by $3 per unit, but management could eliminate one quality inspector who is paid a salary of $30,000 per year. The sales manager estimates that the higher-quality speaker would increase annual sales by at least 20%.
   a. Assuming that changes are made as described above, prepare a projected contribution format income statement for next year. Show data on a total, per unit, and percentage basis.
   b. Compute the company's new break-even point in both units and dollars of sales. Use the formula method.
   c. Would you recommend that the changes be made?

Solution to Review Problem

1.

$$\text{CM ratio} = \frac{\text{Unit contribution margin}}{\text{Unit selling price}} = \frac{\$15}{\$60} = 25\%$$

$$\text{Variable expense ratio} = \frac{\text{Variable expense}}{\text{Selling price}} = \frac{\$45}{\$60} = 75\%$$

2.

$$\text{Profit} = \text{Unit CM} \times Q - \text{Fixed expenses}$$

$$\$0 = (\$60 - \$45) \times Q - \$240{,}000$$

$$\$15Q = \$240{,}000$$

$$Q = \$240{,}000 \div \$15$$

$$Q = 16{,}000 \text{ units; or at \$60 per unit, \$960,000}$$

3.

Increase in sales	$400,000
Multiply by the CM ratio	× 25%
Expected increase in contribution margin	$100,000

Because the fixed expenses are not expected to change, net operating income will increase by the entire $100,000 increase in contribution margin computed above.

4. Equation method:

$$\text{Profit} = \text{Unit CM} \times Q - \text{Fixed expenses}$$

$$\$90{,}000 = (\$60 - \$45) \times Q - \$240{,}000$$

$$\$15Q = \$90{,}000 + \$240{,}000$$

$$Q = \$330{,}000 \div \$15$$

$$Q = 22{,}000 \text{ units}$$

Formula method:

$$\text{Unit sales to attain the target profit} = \frac{\text{Target profit} + \text{Fixed expenses}}{\text{Contribution margin per unit}} = \frac{\$90{,}000 + \$240{,}000}{\$15 \text{ per unit}} = 22{,}000 \text{ units}$$

5.

$$\text{Margin of safety in dollars} = \text{Total sales} - \text{Break-even sales}$$

$$= \$1{,}200{,}000 - \$960{,}000 = \$240{,}000$$

$$\text{Margin of safety percentage} = \frac{\text{Margin of safety in dollars}}{\text{Total sales}} = \frac{\$240{,}000}{\$1{,}200{,}000} = 20\%$$

6. *a.*

$$\text{Degree of operating leverage} = \frac{\text{Contribution margin}}{\text{Net operating income}} = \frac{\$300{,}000}{\$60{,}000} = 5$$

b.

Expected increase in sales	8%
Degree of operating leverage	× 5
Expected increase in net operating income	40%

c. If sales increase by 8%, then 21,600 units (20,000 × 1.08 = 21,600) will be sold next year. The new contribution format income statement would be as follows:

	Total	Per Unit	Percent of Sales
Sales (21,600 units)	$1,296,000	$60	100%
Variable expenses	972,000	45	75%
Contribution margin	324,000	$15	25%
Fixed expenses	240,000		
Net operating income	$ 84,000		

Thus, the $84,000 expected net operating income for next year represents a 40% increase over the $60,000 net operating income earned during the current year:

$$\frac{\$84{,}000 - \$60{,}000}{\$60{,}000} = \frac{\$24{,}000}{\$60{,}000} = 40\% \text{ increase}$$

Note from the income statement on the prior page that the increase in sales from 20,000 to 21,600 units has increased *both* total sales and total variable expenses.

7. *a.* A 20% increase in sales would result in 24,000 units being sold next year: 20,000 units × 1.20 = 24,000 units.

	Total	Per Unit	Percent of Sales
Sales (24,000 units)	$1,440,000	$60	100%
Variable expenses	1,152,000	48*	80%
Contribution margin	288,000	$12	20%
Fixed expenses	210,000†		
Net operating income	$ 78,000		

*$45 + $3 = $48; $48 ÷ $60 = 80%.
†$240,000 − $30,000 = $210,000.

Note that the change in per unit variable expenses results in a change in both the per unit contribution margin and the CM ratio.

b.

$$\text{Unit sales to break even} = \frac{\text{Fixed expenses}}{\text{Unit contribution margin}}$$

$$= \frac{\$210{,}000}{\$12 \text{ per unit}} = 17{,}500 \text{ units}$$

$$\text{Dollar sales to break even} = \frac{\text{Fixed expenses}}{\text{CM ratio}}$$

$$= \frac{\$210{,}000}{0.20} = \$1{,}050{,}000$$

c. Yes, based on these data, the changes should be made. The changes increase the company's net operating income from the present $60,000 to $78,000 per year. Although the changes also result in a higher break-even point (17,500 units as compared to the present 16,000 units), the company's margin of safety actually becomes greater than before:

$$\text{Margin of safety in dollars} = \text{Total sales} - \text{Break-even sales}$$

$$= \$1{,}440{,}000 - \$1{,}050{,}000 = \$390{,}000$$

As shown in (5) on the prior page, the company's present margin of safety is only $240,000. Thus, several benefits will result from the proposed changes.

Glossary

Break-even point The level of sales at which profit is zero. (p. 186)

Contribution margin ratio (CM ratio) A ratio computed by dividing contribution margin by dollar sales. (p. 191)

Cost-volume-profit (CVP) graph A graphical representation of the relationships between an organization's revenues, costs, and profits on the one hand and its sales volume on the other hand. (p. 188)

Degree of operating leverage A measure, at a given level of sales, of how a percentage change in sales will affect profits. The degree of operating leverage is computed by dividing contribution margin by net operating income. (p. 202)

Incremental analysis An analytical approach that focuses only on those costs and revenues that change as a result of a decision. (p. 193)

Margin of safety The excess of budgeted or actual dollar sales over the break-even dollar sales. (p. 199)
Operating leverage A measure of how sensitive net operating income is to a given percentage change in dollar sales. (p. 202)
Sales mix The relative proportions in which a company's products are sold. Sales mix is computed by expressing the sales of each product as a percentage of total sales. (p. 205)
Target profit analysis Estimating what sales volume is needed to achieve a specific target profit. (p. 196)
Variable expense ratio A ratio computed by dividing variable expenses by dollar sales (p. 192)

Questions

5–1 What is meant by a product's contribution margin ratio? How is this ratio useful in planning business operations?
5–2 Often the most direct route to a business decision is an incremental analysis. What is meant by an *incremental analysis?*
5–3 In all respects, Company A and Company B are identical except that Company A's costs are mostly variable, whereas Company B's costs are mostly fixed. When sales increase, which company will tend to realize the greatest increase in profits? Explain.
5–4 What is meant by the term *operating leverage?*
5–5 What is meant by the term *break-even point?*
5–6 In response to a request from your immediate supervisor, you have prepared a CVP graph portraying the cost and revenue characteristics of your company's product and operations. Explain how the lines on the graph and the break-even point would change if (*a*) the selling price per unit decreased, (*b*) fixed cost increased throughout the entire range of activity portrayed on the graph, and (*c*) variable cost per unit increased.
5–7 What is meant by the margin of safety?
5–8 What is meant by the term *sales mix?* What assumption is usually made concerning sales mix in CVP analysis?
5–9 Explain how a shift in the sales mix could result in both a higher break-even point and a lower net income.

Multiple-choice questions are provided on the text website at www.mhhe.com/garrison14e.

Applying Excel

Available with McGraw-Hill's *Connect™ Accounting*.

LEARNING OBJECTIVES 6, 7, 8

The Excel worksheet form that appears on the next page is to be used to recreate portions of the Review Problem on pages 208–210. Download the workbook containing this form from the Online Learning Center at www.mhhe.com/garrison14e. *On the website you will also receive instructions about how to use this worksheet form.*

	A	B	C	D
1	**Chapter 5: Applying Excel**			
2				
3	**Data**			
4	Unit sales	20,000	units	
5	Selling price per unit	$60	per unit	
6	Variable expenses per unit	$45	per unit	
7	Fixed expenses	$240,000		
8				
9	*Enter a formula into each of the cells marked with a ? below*			
10	**Review Problem: CVP Relationships**			
11				
12	***Compute the CM ratio and variable expense ratio***			
13	Selling price per unit	?	per unit	
14	Variable expenses per unit	?	per unit	
15	Contribution margin per unit	?	per unit	
16				
17	CM ratio	?		
18	Variable expense ratio	?		
19				
20	***Compute the break-even***			
21	Break-even in unit sales	?	units	
22	Break-even in dollar sales	?		
23				
24	***Compute the margin of safety***			
25	Margin of safety in dollars	?		
26	Margin of safety percentage	?		
27				
28	***Compute the degree of operating leverage***			
29	Sales	?		
30	Variable expenses	?		
31	Contribution margin	?		
32	Fixed expenses	?		
33	Net operating income	?		
34				
35	Degree of operating leverage	?		
36				

Chapter 5 Form | Filled in Chapter 5 Form

You should proceed to the requirements below only after completing your worksheet.

Required:

1. Check your worksheet by changing the fixed expenses to $270,000. If your worksheet is operating properly, the degree of operating leverage should be 10. If you do not get this answer, find the errors in your worksheet and correct them. How much is the margin of safety percentage? Did it change? Why or why not?
2. Enter the following data from a different company into your worksheet:

Unit sales	10,000 units
Selling price per unit	$120 per unit
Variable expenses per unit	$72 per unit
Fixed expenses	$420,000

   What is the margin of safety percentage? What is the degree of operating leverage?
3. Using the degree of operating leverage and without changing anything in your worksheet, calculate the percentage change in net operating income if unit sales increase by 15%.

4. Confirm the calculations you made in part (3) above by increasing the unit sales in your worksheet by 15%. What is the new net operating income and by what percentage did it increase?
5. Thad Morgan, a motorcycle enthusiast, has been exploring the possibility of relaunching the Western Hombre brand of cycle that was popular in the 1930s. The retro-look cycle would be sold for $10,000 and at that price, Thad estimates 600 units would be sold each year. The variable cost to produce and sell the cycles would be $7,500 per unit. The annual fixed cost would be $1,200,000.
   a. What would be the break-even unit sales, the margin of safety in dollars, and the degree of operating leverage?
   b. Thad is worried about the selling price. Rumors are circulating that other retro brands of cycles may be revived. If so, the selling price for the Western Hombre would have to be reduced to $9,000 to compete effectively. In that event, Thad would also reduce fixed expenses by $300,000 by reducing advertising expenses, but he still hopes to sell 600 units per year. Do you think this is a good plan? Explain. Also, explain the degree of operating leverage that appears on your worksheet.

connect ACCOUNTING Exercises

All applicable exercises are available with McGraw-Hill's *Connect™ Accounting*.

EXERCISE 5–1 Preparing a Contribution Format Income Statement [LO1]

Wheeler Corporation's most recent income statement follows:

	Total	Per Unit
Sales (8,000 units)	$208,000	$26.00
Variable expenses	144,000	18.00
Contribution margin	64,000	$ 8.00
Fixed expenses	56,000	
Net operating income	$ 8,000	

Required:

Prepare a new contribution format income statement under each of the following conditions (consider each case independently):

1. The sales volume increases by 50 units.
2. The sales volume declines by 50 units.
3. The sales volume is 7,000 units.

EXERCISE 5–2 Prepare a Cost-Volume-Profit (CVP) Graph [LO2]

Katara Enterprises distributes a single product whose selling price is $36 and whose variable expense is $24 per unit. The company's monthly fixed expense is $12,000.

Required:

1. Prepare a cost-volume-profit graph for the company up to a sales level of 2,000 units.
2. Estimate the company's break-even point in unit sales using your cost-volume-profit graph.

EXERCISE 5–3 Prepare a Profit Graph [LO2]

Capricio Enterprises distributes a single product whose selling price is $19 and whose variable expense is $15 per unit. The company's fixed expense is $12,000 per month.

Required:

1. Prepare a profit graph for the company up to a sales level of 4,000 units.
2. Estimate the company's break-even point in unit sales using your profit graph.

EXERCISE 5–4 Computing and Using the CM Ratio [LO3]

Last month when Harrison Creations, Inc., sold 40,000 units, total sales were $300,000, total variable expenses were $240,000, and fixed expenses were $45,000.

Required:

1. What is the company's contribution margin (CM) ratio?
2. Estimate the change in the company's net operating income if it were to increase its total sales by $1,500.

EXERCISE 5–5 Changes in Variable Costs, Fixed Costs, Selling Price, and Volume [LO4]

Data for Herron Corporation are shown below:

	Per Unit	Percent of Sales
Selling price	$75	100%
Variable expenses	45	60%
Contribution margin	$30	40%

Fixed expenses are $75,000 per month and the company is selling 3,000 units per month.

Required:

1. The marketing manager believes that an $8,000 increase in the monthly advertising budget would increase monthly sales by $15,000. Should the advertising budget be increased?
2. Refer to the original data. Management is considering using higher-quality components that would increase the variable cost by $3 per unit. The marketing manager believes that the higher-quality product would increase sales by 15% per month. Should the higher-quality components be used?

EXERCISE 5–6 Compute the Level of Sales Required to Attain a Target Profit [LO5]

Liman Corporation has a single product whose selling price is $140 and whose variable expense is $60 per unit. The company's monthly fixed expense is $40,000.

Required:

1. Using the equation method, solve for the unit sales that are required to earn a target profit of $6,000.
2. Using the formula method, solve for the dollar sales that are required to earn a target profit of $8,000.

EXERCISE 5–7 Compute the Break-Even Point [LO6]

Maxson Products distributes a single product, a woven basket whose selling price is $8 and whose variable cost is $6 per unit. The company's monthly fixed expense is $5,500.

Required:

1. Solve for the company's break-even point in unit sales using the equation method.
2. Solve for the company's break-even point in sales dollars using the equation method and the CM ratio.
3. Solve for the company's break-even point in unit sales using the formula method.
4. Solve for the company's break-even point in sales dollars using formula method and the CM ratio.

EXERCISE 5–8 Compute the Margin of Safety [LO7]

Mohan Corporation is a distributor of a sun umbrella used at resort hotels. Data concerning next month's budget appear below:

Selling price	$25 per unit
Variable expenses	$15 per unit
Fixed expenses	$8,500 per month
Unit sales	1,000 units per month

Required:

1. Compute the company's margin of safety.
2. Compute the company's margin of safety as a percentage of its sales.

EXERCISE 5–9 Compute and Use the Degree of Operating Leverage [LO8]

Eneliko Company installs home theater systems. The company's most recent monthly contribution format income statement appears below:

	Amount	Percent of Sales
Sales	$120,000	100%
Variable expenses	84,000	70%
Contribution margin	36,000	30%
Fixed expenses	24,000	
Net operating income	$ 12,000	

Required:

1. Compute the company's degree of operating leverage.
2. Using the degree of operating leverage, estimate the impact on net operating income of a 10% increase in sales.
3. Verify your estimate from part (2) above by constructing a new contribution format income statement for the company assuming a 10% increase in sales.

EXERCISE 5–10 Compute the Break-Even Point for a Multiproduct Company [LO9]

Lucky Products markets two computer games: Predator and Runway. A contribution format income statement for a recent month for the two games appears below:

	Predator	Runway	Total
Sales	$100,000	$50,000	$150,000
Variable expenses	25,000	5,000	30,000
Contribution margin	$ 75,000	$45,000	120,000
Fixed expenses			90,000
Net operating income			$ 30,000

Required:

1. Compute the overall contribution margin (CM) ratio for the company.
2. Compute the overall break-even point for the company in sales dollars.
3. Verify the overall break-even point for the company by constructing a contribution format income statement showing the appropriate levels of sales for the two products.

EXERCISE 5–11 Break-Even Analysis; Target Profit; Margin of Safety; CM Ratio [LO1, LO3, LO5, LO6, LO7]

Pringle Company distributes a single product. The company's sales and expenses for a recent month follow:

	Total	Per Unit
Sales	$600,000	$40
Variable expenses	420,000	28
Contribution margin	180,000	$12
Fixed expenses	150,000	
Net operating income	$ 30,000	

Required:

1. What is the monthly break-even point in units sold and in sales dollars?
2. Without resorting to computations, what is the total contribution margin at the break-even point?
3. How many units would have to be sold each month to earn a target profit of $18,000? Use the formula method. Verify your answer by preparing a contribution format income statement at the target level of sales.
4. Refer to the original data. Compute the company's margin of safety in both dollar and percentage terms.
5. What is the company's CM ratio? If monthly sales increase by $80,000 and there is no change in fixed expenses, by how much would you expect monthly net operating income to increase?


EXERCISE 5–12 Break-Even and Target Profit Analysis [LO4, LO5, LO6]

Reveen Products sells camping equipment. One of the company's products, a camp lantern, sells for $90 per unit. Variable expenses are $63 per lantern, and fixed expenses associated with the lantern total $135,000 per month.

Required:

1. Compute the company's break-even point in number of lanterns and in total sales dollars.
2. If the variable expenses per lantern increase as a percentage of the selling price, will it result in a higher or a lower break-even point? Why? (Assume that the fixed expenses remain unchanged.)
3. At present, the company is selling 8,000 lanterns per month. The sales manager is convinced that a 10% reduction in the selling price will result in a 25% increase in the number of lanterns sold each month. Prepare two contribution format income statements, one under present operating conditions, and one as operations would appear after the proposed changes. Show both total and per unit data on your statements.
4. Refer to the data in (3) above. How many lanterns would have to be sold at the new selling price to yield a minimum net operating income of $72,000 per month?

EXERCISE 5–13 Break-Even Analysis and CVP Graphing [LO2, LO4, LO6]

Chi Omega Sorority is planning its annual Riverboat Extravaganza. The Extravaganza committee has assembled the following expected costs for the event:

Dinner (per person)	$7
Favors and program (per person)	$3
Band	$1,500
Tickets and advertising	$700
Riverboat rental	$4,800
Floorshow and strolling entertainers	$1,000

The committee members would like to charge $30 per person for the evening's activities.

Required:

1. Compute the break-even point for the Extravaganza (in terms of the number of persons that must attend).
2. Assume that only 250 persons attended the Extravaganza last year. If the same number attend this year, what price per ticket must be charged to break even?
3. Refer to the original data ($30 ticket price per person). Prepare a CVP graph for the Extravaganza from zero tickets up to 600 tickets sold.

EXERCISE 5–14 Multiproduct Break-Even Analysis [LO9]


Okabee Enterprises is the distributor for two products, Model A100 and Model B900. Monthly sales and the contribution margin ratios for the two products follow:

	Product		
	Model A100	Model B900	Total
Sales	$700,000	$300,000	$1,000,000
Contribution margin ratio	60%	70%	?

The company's fixed expenses total $598,500 per month.

Required:

1. Prepare a contribution format income statement for the company as a whole.
2. Compute the break-even point for the company based on the current sales mix.
3. If sales increase by $50,000 per month, by how much would you expect net operating income to increase? What are your assumptions?

EXERCISE 5–15 Operating Leverage [LO4, LO8]

Superior Door Company sells prehung doors to home builders. The doors are sold for $60 each. Variable costs are $42 per door, and fixed costs total $450,000 per year. The company is currently selling 30,000 doors per year.

Required:

1. Prepare a contribution format income statement for the company at the present level of sales and compute the degree of operating leverage.
2. Management is confident that the company can sell 37,500 doors next year (an increase of 7,500 doors, or 25%, over current sales). Compute the following:
   a. The expected percentage increase in net operating income for next year.
   b. The expected net operating income for next year. (Do not prepare an income statement; use the degree of operating leverage to compute your answer.)

EXERCISE 5–16 Break-Even and Target Profit Analysis [LO3, LO4, LO5, LO6]

Super Sales Company is the exclusive distributor for a revolutionary bookbag. The product sells for $60 per unit and has a CM ratio of 40%. The company's fixed expenses are $360,000 per year. The company plans to sell 17,000 bookbags this year.

Required:

1. What are the variable expenses per unit?
2. Using the equation method:
   a. What is the break-even point in units and in sales dollars?
   b. What sales level in units and in sales dollars is required to earn an annual profit of $90,000?
   c. Assume that through negotiation with the manufacturer the Super Sales Company is able to reduce its variable expenses by $3 per unit. What is the company's new break-even point in units and in sales dollars?
3. Repeat (2) above using the formula method.

EXERCISE 5–17 Using a Contribution Format Income Statement [LO1, LO4]

Porter Company's most recent contribution format income statement is shown below:

	Total	Per Unit
Sales (30,000 units)	$150,000	$5
Variable expenses	90,000	3
Contribution margin	60,000	$2
Fixed expenses	50,000	
Net operating income	$ 10,000	

Required:

Prepare a new contribution format income statement under each of the following conditions (consider each case independently):

1. The number of units sold increases by 15%.
2. The selling price decreases by 50 cents per unit, and the number of units sold increases by 20%.
3. The selling price increases by 50 cents per unit, fixed expenses increase by $10,000, and the number of units sold decreases by 5%.
4. Variable expenses increase by 20 cents per unit, the selling price increases by 12%, and the number of units sold decreases by 10%.

EXERCISE 5–18 Missing Data; Basic CVP Concepts [LO1, LO9]

Fill in the missing amounts in each of the eight case situations below. Each case is independent of the others. (Hint: One way to find the missing amounts would be to prepare a contribution format income statement for each case, enter the known data, and then compute the missing items.)

a. Assume that only one product is being sold in each of the four following case situations:

Case	Units Sold	Sales	Variable Expenses	Contribution Margin per Unit	Fixed Expenses	Net Operating Income (Loss)
1	9,000	$270,000	$162,000	?	$90,000	?
2	?	$350,000	?	$15	$170,000	$40,000
3	20,000	?	$280,000	$6	?	$35,000
4	5,000	$160,000	?	?	$82,000	$(12,000)

b. Assume that more than one product is being sold in each of the four following case situations:

Case	Sales	Variable Expenses	Average Contribution Margin (Percent)	Fixed Expenses	Net Operating Income (Loss)
1	$450,000	?	40%	?	$65,000
2	$200,000	$130,000	?	$60,000	?
3	?	?	80%	$470,000	$90,000
4	$300,000	$90,000	?	?	$(15,000)

Problems

All applicable problems are available with McGraw-Hill's *Connect™ Accounting*.


PROBLEM 5–19 Basic CVP Analysis; Graphing [LO1, LO2, LO4, LO6]

Shirts Unlimited operates a chain of shirt stores that carry many styles of shirts that are all sold at the same price. To encourage sales personnel to be aggressive in their sales efforts, the company pays a substantial sales commission on each shirt sold. Sales personnel also receive a small basic salary.

The following worksheet contains cost and revenue data for Store 36. These data are typical of the company's many outlets:

	A	B	C
1		*Per Shift*	
2	Selling price	$ 40.00	
3			
4	Variable expenses:		
5	Invoice cost	$ 18.00	
6	Sales commission	7.00	
7	Total variable expenses	$ 25.00	
8			
9		*Annual*	
10	Fixed expenses:		
11	Rent	$ 80,000	
12	Advertising	150,000	
13	Salaries	70,000	
14	Total fixed expenses	$ 300,000	
15			
16			

Sheet1 Sheet2 Shee

The company has asked you, as a member of its planning group, to assist in some basic analysis of its stores and company policies.

Required:

1. Calculate the annual break-even point in dollar sales and in unit sales for Store 36.
2. Prepare a CVP graph showing cost and revenue data for Store 36 from zero shirts up to 30,000 shirts sold each year. Clearly indicate the break-even point on the graph.
3. If 19,000 shirts are sold in a year, what would be Store 36's net operating income or loss?
4. The company is considering paying the store manager of Store 36 an incentive commission of $3 per shirt (in addition to the salespersons' commissions). If this change is made, what will be the new break-even point in dollar sales and in unit sales?
5. Refer to the original data. As an alternative to (4) above, the company is considering paying the store manager a $3 commission on each shirt sold in excess of the break-even point. If this change is made, what will be the store's net operating income or loss if 23,500 shirts are sold in a year?
6. Refer to the original data. The company is considering eliminating sales commissions entirely in its stores and increasing fixed salaries by $107,000 annually.
   a. If this change is made, what will be the new break-even point in dollar sales and in unit sales in Store 36?
   b. Would you recommend that the change be made? Explain.

PROBLEM 5–20 Basics of CVP Analysis; Cost Structure [LO1, LO3, LO4, LO5, LO6]

Memofax, Inc., produces memory enhancement kits for fax machines. Sales have been very erratic, with some months showing a profit and some months showing a loss. The company's contribution format income statement for the most recent month is given below:

Sales (13,500 units at $20 per unit)	$270,000
Variable expenses	189,000
Contribution margin	81,000
Fixed expenses	90,000
Net operating loss	$ (9,000)

Required:

1. Compute the company's CM ratio and its break-even point in both units and dollars.
2. The sales manager feels that an $8,000 increase in the monthly advertising budget, combined with an intensified effort by the sales staff, will result in a $70,000 increase in monthly sales. If the sales manager is right, what will be the effect on the company's monthly net operating income or loss? (Use the incremental approach in preparing your answer.)
3. Refer to the original data. The president is convinced that a 10% reduction in the selling price, combined with an increase of $35,000 in the monthly advertising budget, will double unit sales. What will the new contribution format income statement look like if these changes are adopted?
4. Refer to the original data. The company's advertising agency thinks that a new package would help sales. The new package being proposed would increase packaging costs by $0.60 per unit. Assuming no other changes, how many units would have to be sold each month to earn a profit of $4,500?
5. Refer to the original data. By automating, the company could slash its variable expenses in half. However, fixed costs would increase by $118,000 per month.
   a. Compute the new CM ratio and the new break-even point in both units and dollars.
   b. Assume that the company expects to sell 20,000 units next month. Prepare two contribution format income statements, one assuming that operations are not automated and one assuming that they are.
   c. Would you recommend that the company automate its operations? Explain.

PROBLEM 5–21 Basic CVP Analysis [LO1, LO3, LO4, LO6, LO8]

Stratford Company distributes a lightweight lawn chair that sells for $15 per unit. Variable expenses are $6 per unit, and fixed expenses total $180,000 annually.

Required:

Answer the following independent questions:

1. What is the product's CM ratio?
2. Use the CM ratio to determine the break-even point in sales dollars.
3. The company estimates that sales will increase by $45,000 during the coming year due to increased demand. By how much should net operating income increase?
4. Assume that the operating results for last year were as follows:

Sales	$360,000
Variable expenses	144,000
Contribution margin	216,000
Fixed expenses	180,000
Net operating income	$ 36,000

   a. Compute the degree of operating leverage at the current level of sales.
   b. The president expects sales to increase by 15% next year. By how much should net operating income increase?
5. Refer to the original data. Assume that the company sold 28,000 units last year. The sales manager is convinced that a 10% reduction in the selling price, combined with a $70,000 increase in advertising expenditures, would increase annual unit sales by 50%. Prepare two contribution format income statements, one showing the results of last year's operations and one showing what the results of operations would be if these changes were made. Would you recommend that the company do as the sales manager suggests?

6. Refer to the original data. Assume again that the company sold 28,000 units last year. The president feels that it would be unwise to change the selling price. Instead, he wants to increase the sales commission by $2 per unit. He thinks that this move, combined with some increase in advertising, would double annual unit sales. By how much could advertising be increased with profits remaining unchanged? Do not prepare an income statement; use the incremental analysis approach.

PROBLEM 5–22 Sales Mix; Multiproduct Break-Even Analysis [LO9]


Marlin Company, a wholesale distributor, has been operating for only a few months. The company sells three products—sinks, mirrors, and vanities. Budgeted sales by product and in total for the coming month are shown below:

	Product							
	Sinks		Mirrors		Vanities		Total	
Percentage of total sales	48%		20%		32%		100%	
Sales	$240,000	100%	$100,000	100%	$160,000	100%	$500,000	100%
Variable expenses	72,000	30%	80,000	80%	88,000	55%	240,000	48%
Contribution margin	$168,000	70%	$ 20,000	20%	$ 72,000	45%	260,000	52%
Fixed expenses							223,600	
Net operating income							$ 36,400	

$$\text{Dollar sales to break-even} = \frac{\text{Fixed expenses}}{\text{CM ratio}} = \frac{\$223{,}600}{0.52} = \$430{,}000$$

As shown by these data, net operating income is budgeted at $36,400 for the month, and break-even sales at $430,000.

Assume that actual sales for the month total $500,000 as planned. Actual sales by product are: sinks, $160,000; mirrors, $200,000; and vanities, $140,000.

Required:

1. Prepare a contribution format income statement for the month based on actual sales data. Present the income statement in the format shown above.
2. Compute the break-even point in sales dollars for the month, based on your actual data.
3. Considering the fact that the company met its $500,000 sales budget for the month, the president is shocked at the results shown on your income statement in (1) above. Prepare a brief memo for the president explaining why both the operating results and the break-even point in sales dollars are different from what was budgeted.

PROBLEM 5–23 Sales Mix; Break-Even Analysis; Margin of Safety [LO7, LO9]

Puleva Milenario SA, a company located in Toledo, Spain, manufactures and sells two models of luxuriously finished cutlery—Alvaro and Bazan. Present revenue, cost, and unit sales data for the two products appear below. All currency amounts are stated in terms of euros, which are indicated by the symbol €.

	Alvaro	Bazan
Selling price per unit	€4.00	€6.00
Variable expenses per unit	€2.40	€1.20
Number of units sold monthly	200 units	80 units

Fixed expenses are €660 per month.

Required:

1. Assuming the sales mix above, do the following:
   a. Prepare a contribution format income statement showing both euro and percent columns for each product and for the company as a whole.
   b. Compute the break-even point in euros for the company as a whole and the margin of safety in both euros and percent of sales.
2. The company has developed another product, Cano, that the company plans to sell for €8 each. At this price, the company expects to sell 40 units per month of the product. The variable expense would be €6 per unit. The company's fixed expenses would not change.

a. Prepare another contribution format income statement, including sales of Cano (sales of the other two products would not change).
b. Compute the company's new break-even point in euros for the company as a whole and the new margin of safety in both euros and percent of sales.

3. The president of the company was puzzled by your analysis. He did not understand why the break-even point has gone up even though there has been no increase in fixed expenses and the addition of the new product has increased the total contribution margin. Explain to the president what has happened.

PROBLEM 5–24 Sales Mix; Multiproduct Break-Even Analysis [LO9]

Topper Sports, Inc., produces high-quality sports equipment. The company's Racket Division manufactures three tennis rackets—the Standard, the Deluxe, and the Pro—that are widely used in amateur play. Selected information on the rackets is given below:

	Standard	Deluxe	Pro
Selling price per racket	$40.00	$60.00	$90.00
Variable expenses per racket:			
Production	$22.00	$27.00	$31.50
Selling (5% of selling price)	$2.00	$3.00	$4.50

All sales are made through the company's own retail outlets. The Racket Division has the following fixed costs:

	Per Month
Fixed production costs	$120,000
Advertising expense	100,000
Administrative salaries	50,000
Total	$270,000

Sales, in units, over the past two months have been as follows:

	Standard	Deluxe	Pro	Total
April	2,000	1,000	5,000	8,000
May	8,000	1,000	3,000	12,000

Required:

1. Prepare contribution format income statements for April and May. Use the following headings:

	Standard		Deluxe		Pro		Total	
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
Sales								
Etc.								

Place the fixed expenses only in the Total column. Do not show percentages for the fixed expenses.

2. Upon seeing the income statements in (1) above, the president stated, "I can't believe this! We sold 50% more rackets in May than in April, yet profits went down. It's obvious that costs are out of control in that division." What other explanation can you give for the drop in net operating income?
3. Compute the Racket Division's break-even point in dollar sales for April.
4. Without doing any calculations, explain whether the break-even point would be higher or lower with May's sales mix than with April's sales mix.
5. Assume that sales of the Standard racket increase by $20,000. What would be the effect on net operating income? What would be the effect if Pro racket sales increased by $20,000? Do not prepare income statements; use the incremental analysis approach in determining your answer.

PROBLEM 5–25 Break-Even Analysis; Pricing [LO1, LO4, LO6]

Detmer Holdings AG of Zurich, Switzerland, has just introduced a new fashion watch for which the company is trying to find an optimal selling price. Marketing studies suggest that the company can increase sales by 5,000 units for each SFr2 per unit reduction in the selling price. (SFr2 denotes 2 Swiss francs.) The company's present selling price is SFr90 per unit, and variable expenses are SFr60 per unit. Fixed expenses are SFr840,000 per year. The present annual sales volume (at the SFr90 selling price) is 25,000 units.

Required:

1. What is the present yearly net operating income or loss?
2. What is the present break-even point in units and in Swiss franc sales?
3. Assuming that the marketing studies are correct, what is the *maximum* profit that the company can earn yearly? At how many units and at what selling price per unit would the company generate this profit?
4. What would be the break-even point in units and in Swiss franc sales using the selling price you determined in (3) above (i.e., the selling price at the level of maximum profits)? Why is this break-even point different from the break-even point you computed in (2) above?

PROBLEM 5–26 Changes in Cost Structure; Break-Even Analysis; Operating Leverage; Margin of Safety [LO4, LO6, LO7, LO8]

Frieden Company's contribution format income statement for the most recent month is given below:

Sales (40,000 units)	$800,000
Variable expenses	560,000
Contribution margin	240,000
Fixed expenses	192,000
Net operating income	$ 48,000

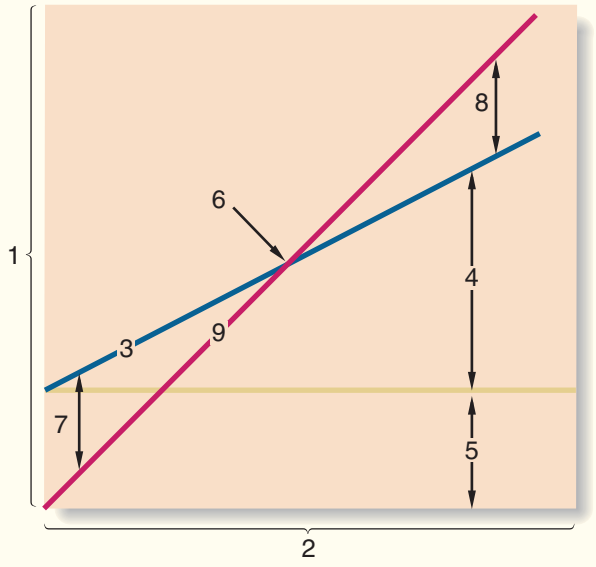
The industry in which Frieden Company operates is quite sensitive to cyclical movements in the economy. Thus, profits vary considerably from year to year according to general economic conditions. The company has a large amount of unused capacity and is studying ways of improving profits.

Required:

1. New equipment has come on the market that would allow Frieden Company to automate a portion of its operations. Variable expenses would be reduced by $6 per unit. However, fixed expenses would increase to a total of $432,000 each month. Prepare two contribution format income statements, one showing present operations and one showing how operations would appear if the new equipment is purchased. Show an Amount column, a Per Unit column, and a Percent column on each statement. Do not show percentages for the fixed expenses.
2. Refer to the income statements in (1) above. For both present operations and the proposed new operations, compute (*a*) the degree of operating leverage, (*b*) the break-even point in dollars, and (*c*) the margin of safety in both dollar and percentage terms.
3. Refer again to the data in (1) above. As a manager, what factor would be paramount in your mind in deciding whether to purchase the new equipment? (Assume that ample funds are available to make the purchase.)
4. Refer to the original data. Rather than purchase new equipment, the marketing manager argues that the company's marketing strategy should be changed. Instead of paying sales commissions, which are included in variable expenses, the marketing manager suggests that salespersons be paid fixed salaries and that the company invest heavily in advertising. The marketing manager claims that this new approach would increase unit sales by 50% without any change in selling price; the company's new monthly fixed expenses would be $240,000; and its net operating income would increase by 25%. Compute the break-even point in dollar sales for the company under the new marketing strategy. Do you agree with the marketing manager's proposal?

PROBLEM 5–27 Interpretive Questions on the CVP Graph [LO2, LO6]

A CVP graph, as illustrated on the next page, is a useful technique for showing relationships among an organization's costs, volume, and profits.



Required:

1. Identify the numbered components in the CVP graph.
2. State the effect of each of the following actions on line 3, line 9, and the break-even point. For line 3 and line 9, state whether the action will cause the line to:
   - Remain unchanged.
   - Shift upward.
   - Shift downward.
   - Have a steeper slope (i.e., rotate upward).
   - Have a flatter slope (i.e., rotate downward).
   - Shift upward *and* have a steeper slope.
   - Shift upward *and* have a flatter slope.
   - Shift downward *and* have a steeper slope.
   - Shift downward *and* have a flatter slope.

   In the case of the break-even point, state whether the action will cause the break-even point to:
   - Remain unchanged.
   - Increase.
   - Decrease.
   - Probably change, but the direction is uncertain.

   Treat each case independently.

   x. *Example.* Fixed costs are increased by $20,000 each period.
   Answer (see choices above): Line 3: Shift upward.
   Line 9: Remain unchanged.
   Break-even point: Increase.

   a. The unit selling price is decreased from $30 to $27.
   b. The per unit variable costs are increased from $12 to $15.
   c. The total fixed costs are reduced by $40,000.
   d. Five thousand fewer units are sold during the period than were budgeted.
   e. Due to purchasing a robot to perform a task that was previously done by workers, fixed costs are increased by $25,000 per period, and variable costs are reduced by $8 per unit.
   f. As a result of a decrease in the cost of materials, both unit variable costs and the selling price are decreased by $3.
   g. Advertising costs are increased by $50,000 per period, resulting in a 10% increase in the number of units sold.
   h. Due to paying salespersons a commission rather than a flat salary, fixed costs are reduced by $21,000 per period, and unit variable costs are increased by $6.

PROBLEM 5–28 Graphing; Incremental Analysis; Operating Leverage [LO2, LO4, LO5, LO6, LO8]

Teri Hall has recently opened Sheer Elegance, Inc., a store specializing in fashionable stockings. Ms. Hall has just completed a course in managerial accounting, and she believes that she can apply certain aspects of the course to her business. She is particularly interested in adopting the cost-volume-profit (CVP) approach to decision making. Thus, she has prepared the following analysis:

Sales price per pair of stockings	$2.00
Variable expense per pair of stockings	0.80
Contribution margin per pair of stockings	$1.20
Fixed expense per year:	
Building rental	$12,000
Equipment depreciation	3,000
Selling	30,000
Administrative	15,000
Total fixed expense	$60,000

Required:

1. How many pairs of stockings must be sold to break even? What does this represent in total dollar sales?
2. Prepare a CVP graph or a profit graph for the store from zero pairs up to 70,000 pairs of stockings sold each year. Indicate the break-even point on the graph.
3. How many pairs of stockings must be sold to earn a $9,000 target profit for the first year?
4. Ms. Hall now has one full-time and one part-time salesperson working in the store. It will cost her an additional $8,000 per year to convert the part-time position to a full-time position. Ms. Hall believes that the change would bring in an additional $20,000 in sales each year. Should she convert the position? Use the incremental approach. (Do not prepare an income statement.)
5. Refer to the original data. Actual operating results for the first year are as follows:

Sales	$125,000
Variable expenses	50,000
Contribution margin	75,000
Fixed expenses	60,000
Net operating income	$ 15,000

   a. What is the store's degree of operating leverage?
   b. Ms. Hall is confident that with some effort she can increase sales by 20% next year. What would be the expected percentage increase in net operating income? Use the degree of operating leverage concept to compute your answer.

PROBLEM 5–29 Various CVP Questions: Break-Even Point; Cost Structure; Target Sales [LO1, LO3, LO4, LO5, LO6, LO8]

Tyrene Products manufactures recreational equipment. One of the company's products, a skateboard, sells for $37.50. The skateboards are manufactured in an antiquated plant that relies heavily on direct labor workers. Thus, variable costs are high, totaling $22.50 per skateboard of which 60% is direct labor cost.

Over the past year the company sold 40,000 skateboards, with the following operating results:

Sales (40,000 skateboards)	$1,500,000
Variable expenses	900,000
Contribution margin	600,000
Fixed expenses	480,000
Net operating income	$ 120,000

Management is anxious to maintain and perhaps even improve its present level of income from the skateboards.

Required:

1. Compute (*a*) the CM ratio and the break-even point in skateboards, and (*b*) the degree of operating leverage at last year's level of sales.
2. Due to an increase in labor rates, the company estimates that variable costs will increase by $3 per skateboard next year. If this change takes place and the selling price per skateboard remains constant at $37.50, what will be the new CM ratio and the new break-even point in skateboards?
3. Refer to the data in (2) above. If the expected change in variable costs takes place, how many skateboards will have to be sold next year to earn the same net operating income, $120,000, as last year?
4. Refer again to the data in (2) above. The president has decided that the company may have to raise the selling price of its skateboards. If Tyrene Products wants to maintain *the same CM ratio as last year*, what selling price per skateboard must it charge next year to cover the increased labor costs?
5. Refer to the original data. The company is considering the construction of a new, automated plant. The new plant would slash variable costs by 40%, but it would cause fixed costs to increase by 90%. If the new plant is built, what would be the company's new CM ratio and new break-even point in skateboards?
6. Refer to the data in (5) above.
   a. If the new plant is built, how many skateboards will have to be sold next year to earn the same net operating income, $120,000, as last year?
   b. Assume that the new plant is constructed and that next year the company manufactures and sells 40,000 skateboards (the same number as sold last year). Prepare a contribution format income statement, and compute the degree of operating leverage.
   c. If you were a member of top management, would you have been in favor of constructing the new plant? Explain.


PROBLEM 5–30 Break-Even and Target Profit Analysis [LO5, LO6]

The Marbury Stein Shop sells steins from all parts of the world. The owner of the shop, Clint Marbury, is thinking of expanding his operations by hiring college students, on a commission basis, to sell steins at the local college. The steins will bear the school emblem.

These steins must be ordered from the manufacturer three months in advance, and because of the unique emblem of each college, they cannot be returned. The steins would cost Marbury $15 each with a minimum order of 200 steins. Any additional steins would have to be ordered in increments of 50.

Because Marbury's plan would not require any additional facilities, the only costs associated with the project would be the cost of the steins and the cost of sales commissions. The selling price of the steins would be $30 each. Marbury would pay the students a commission of $6 for each stein sold.

Required:

1. To make the project worthwhile in terms of his own time, Marbury would require a $7,200 profit for the first six months of the venture. What level of sales in units and dollars would be required to attain this target net operating income? Show all computations.
2. Assume that the venture is undertaken and an order is placed for 200 steins. What would be Marbury's break-even point in units and in sales dollars? Show computations, and explain the reasoning behind your answer.

PROBLEM 5–31 Changes in Fixed and Variable Costs; Break-Even and Target Profit Analysis [LO4, LO5, LO6]

Novelties, Inc., produces and sells highly faddish products directed toward the preteen market. A new product has come onto the market that the company is anxious to produce and sell. Enough capacity exists in the company's plant to produce 30,000 units each month. Variable expenses to manufacture and sell one unit would be $1.60, and fixed expenses would total $40,000 per month.

The Marketing Department predicts that demand for the product will exceed the 30,000 units that the company is able to produce. Additional production capacity can be rented from another company at a fixed expense of $2,000 per month. Variable expenses in the rented facility would total $1.75 per unit, due to somewhat less efficient operations than in the main plant. The product would sell for $2.50 per unit.

Required:

1. Compute the monthly break-even point for the new product in units and in total dollar sales.
2. How many units must be sold each month to make a monthly profit of $9,000?
3. If the sales manager receives a bonus of 15 cents for each unit sold in excess of the break-even point, how many units must be sold each month to earn a return of 25% on the monthly investment in fixed expenses?

connect ACCOUNTING Cases

All applicable cases are available with McGraw-Hill's *Connect™ Accounting*.

CASE 5–32 Cost Structure; Break-Even Point; Target Profits [LO4, LO5, LO6]

Marston Corporation manufactures disposable thermometers that are sold to hospitals through a network of independent sales agents located in the United States and Canada. These sales agents sell a variety of products to hospitals in addition to Marston's disposable thermometer. The sales agents are currently paid an 18% commission on sales, and this commission rate was used when Marston's management prepared the following budgeted absorption income statement for the upcoming year.

Marston Corporation Budgeted Income Statement		
Sales		$30,000,000
Cost of goods sold:		
Variable	$17,400,000	
Fixed	2,800,000	20,200,000
Gross margin		9,800,000
Selling and administrative expenses:		
Commissions	5,400,000	
Fixed advertising expense	800,000	
Fixed administrative expense	3,200,000	9,400,000
Net operating income		$ 400,000

Since the completion of the above statement, Marston's management has learned that the independent sales agents are demanding an increase in the commission rate to 20% of sales for the upcoming year. This would be the third increase in commissions demanded by the independent sales agents in five years. As a result, Marston's management has decided to investigate the possibility of hiring its own sales staff to replace the independent sales agents.

Marston's controller estimates that the company will have to hire eight salespeople to cover the current market area, and the total annual payroll cost of these employees will be about $700,000, including fringe benefits. The salespeople will also be paid commissions of 10% of sales. Travel and entertainment expenses are expected to total about $400,000 for the year. The company will also have to hire a sales manager and support staff whose salaries and fringe benefits will come to $200,000 per year. To make up for the promotions that the independent sales agents had been running on behalf of Marston, management believes that the company's budget for fixed advertising expenses should be increased by $500,000.

Required:

1. Assuming sales of $30,000,000, construct a budgeted contribution format income statement for the upcoming year for each of the following alternatives:
   a. The independent sales agents' commission rate remains unchanged at 18%.
   b. The independent sales agents' commission rate increases to 20%.
   c. The company employs its own sales force.
2. Calculate Marston Corporation's break-even point in sales dollars for the upcoming year assuming the following:
   a. The independent sales agents' commission rate remains unchanged at 18%.
   b. The independent sales agents' commission rate increases to 20%.
   c. The company employs its own sales force.

3. Refer to your answer to (1)(b) above. If the company employs its own sales force, what volume of sales would be necessary to generate the net operating income the company would realize if sales are $30,000,000 and the company continues to sell through agents (at a 20% commission rate)?
4. Determine the volume of sales at which net operating income would be equal regardless of whether Marston Corporation sells through agents (at a 20% commission rate) or employs its own sales force.
5. Prepare a graph on which you plot the profits for both of the following alternatives.
   a. The independent sales agents' commission rate increases to 20%.
   b. The company employs its own sales force.
   On the graph, use total sales revenue as the measure of activity.
6. Write a memo to the president of Marston Corporation in which you make a recommendation as to whether the company should continue to use independent sales agents (at a 20% commission rate) or employ its own sales force. Fully explain the reasons for your recommendation in the memo.

(CMA, adapted)

CASE 5–33 Break-Evens for Individual Products in a Multiproduct Company [LO6, LO9]

Jasmine Park encountered her boss, Rick Gompers, at the pop machine in the lobby. Rick is the vice president of marketing at Down South Lures Corporation. Jasmine was puzzled by some calculations she had been doing, so she asked him:

Jasmine: "Rick, I'm not sure how to go about answering the questions that came up at the meeting with the president yesterday."

Rick: "What's the problem?"

Jasmine: "The president wanted to know the break even for each of the company's products, but I am having trouble figuring them out."

Rick: "I'm sure you can handle it, Jasmine. And, by the way, I need your analysis on my desk tomorrow morning at 8:00 A.M. sharp so I can look at it before the follow-up meeting at 9:00."

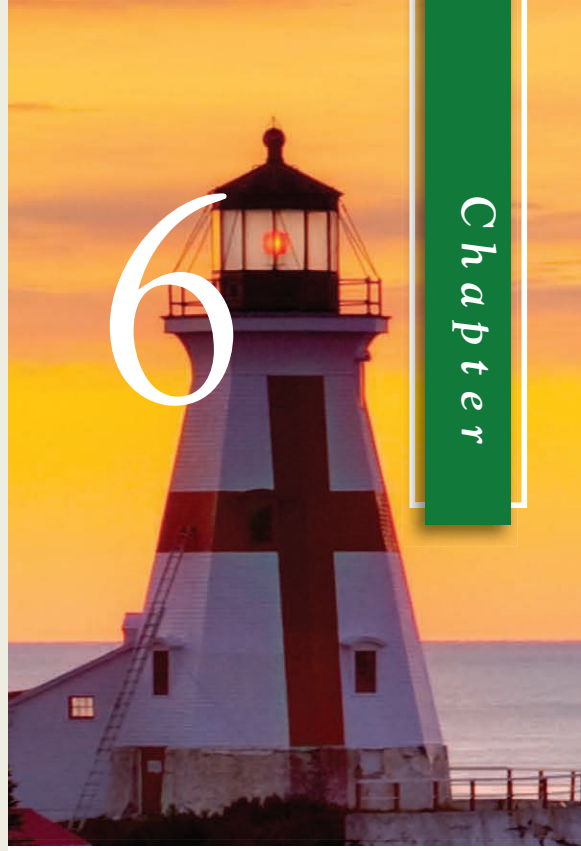
Down South Lures makes three fishing lures in its manufacturing facility in Alabama. Data concerning these products appear below.

	Frog	Minnow	Worm
Normal annual sales volume	100,000	200,000	300,000
Unit selling price	$2.00	$1.40	$0.80
Variable cost per unit	$1.20	$0.80	$0.50

Total fixed expenses for the entire company are $282,000 per year. All three products are sold in highly competitive markets, so the company is unable to raise its prices without losing unacceptable numbers of customers. The company has no work in process or finished goods inventories due to an extremely effective lean manufacturing system.

Required:

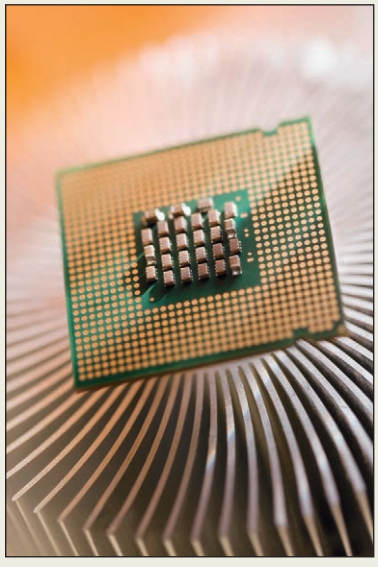
1. What is the company's overall break-even point in total sales dollars?
2. Of the total fixed costs of $282,000, $18,000 could be avoided if the Frog lure product were dropped, $96,000 if the Minnow lure product were dropped, and $60,000 if the Worm lure product were dropped. The remaining fixed expenses of $108,000 consist of common fixed costs such as administrative salaries and rent on the factory building that could be avoided only by going out of business entirely.
   a. What is the break-even point in units for each product?
   b. If the company sells exactly the break-even quantity of each product, what will be the overall profit of the company? Explain this result.



Variable Costing and Segment Reporting: Tools for Management

IBM's $2.5 Billion Investment in Technology

BUSINESS FOCUS



When it comes to state-of-the-art in automation, IBM's $2.5 billion semiconductor manufacturing facility in East Fishkill, New York, is tough to beat. The plant uses wireless networks, 600 miles of cable, and more than 420 servers to equip itself with what IBM claims is more computing power than NASA uses to launch a space shuttle.

Each batch of 25 wafers (one wafer can be processed into 1,000 computer chips) travels through the East Fishkill plant's manufacturing process without ever being touched by human hands. A computer system "looks at orders and schedules production runs . . . adjusts schedules to allow for planned maintenance and . . . feeds vast reams of production data into enterprise-wide management and financial-reporting systems." The plant can literally run itself as was the case a few years ago when a snowstorm hit and everyone went home while the automated system continued to manufacture computer chips until it ran out of work.

In a manufacturing environment such as this, labor costs are insignificant and fixed overhead costs are huge. There is a strong temptation to build inventories and increase profits without increasing sales. How can this be done you ask? It would seem logical that producing more units would have no impact on profits unless the units were sold, right? Wrong! As we will discover in this chapter, absorption costing—the most widely used method of determining product costs—can artificially increase profits by increasing the quantity of units produced. ■

Source: Ghostwriter, "Big Blue's $2.5 Billion Sales Tool," *Fortune*, September 19, 2005, pp. 316F–316J.

LEARNING OBJECTIVES

After studying Chapter 6, you should be able to:

LO1 Explain how variable costing differs from absorption costing and compute unit product costs under each method.

LO2 Prepare income statements using both variable and absorption costing.

LO3 Reconcile variable costing and absorption costing net operating incomes and explain why the two amounts differ.

LO4 Prepare a segmented income statement that differentiates traceable fixed costs from common fixed costs and use it to make decisions.

This chapter describes two applications of the contribution format income statements that were introduced in Chapters 2 and 5. First, it explains how manufacturing companies can prepare *variable costing* income statements, which rely on the contribution format, for internal decision making purposes. The variable costing approach will be contrasted with *absorption costing* income statements, which were discussed in Chapter 3 and are generally used for external reports. Ordinarily, variable costing and absorption costing produce different net operating income figures, and the difference can be quite large. In addition to showing how these two methods differ, we will describe the advantages of variable costing for internal reporting purposes and we will show how management decisions can be affected by the costing method chosen.

Second, the chapter explains how the contribution format can be used to prepare segmented income statements. In addition to companywide income statements, managers need to measure the profitability of individual *segments* of their organizations. A **segment** is a part or activity of an organization about which managers would like cost, revenue, or profit data. This chapter explains how to create contribution format income statements that report profit data for business segments, such as divisions, individual stores, geographic regions, customers, and product lines.

Overview of Variable and Absorption Costing

LEARNING OBJECTIVE 1
Explain how variable costing differs from absorption costing and compute unit product costs under each method.

As you begin to read about variable and absorption costing income statements in the coming pages, focus your attention on three key concepts. First, both income statement formats include product costs and period costs, although they define these cost classifications differently. Second, variable costing income statements are grounded in the contribution format. They categorize expenses based on cost behavior—variable costs are reported separately from fixed costs. Absorption costing income statements ignore variable and fixed cost distinctions. Third, as mentioned in the paragraph above, variable and absorption costing net operating income figures often differ from one another. The reason for these differences always relates to the fact the variable costing and absorption costing income statements account for fixed manufacturing overhead differently. *Pay very close attention to the two different ways that variable costing and absorption costing account for fixed manufacturing overhead.*

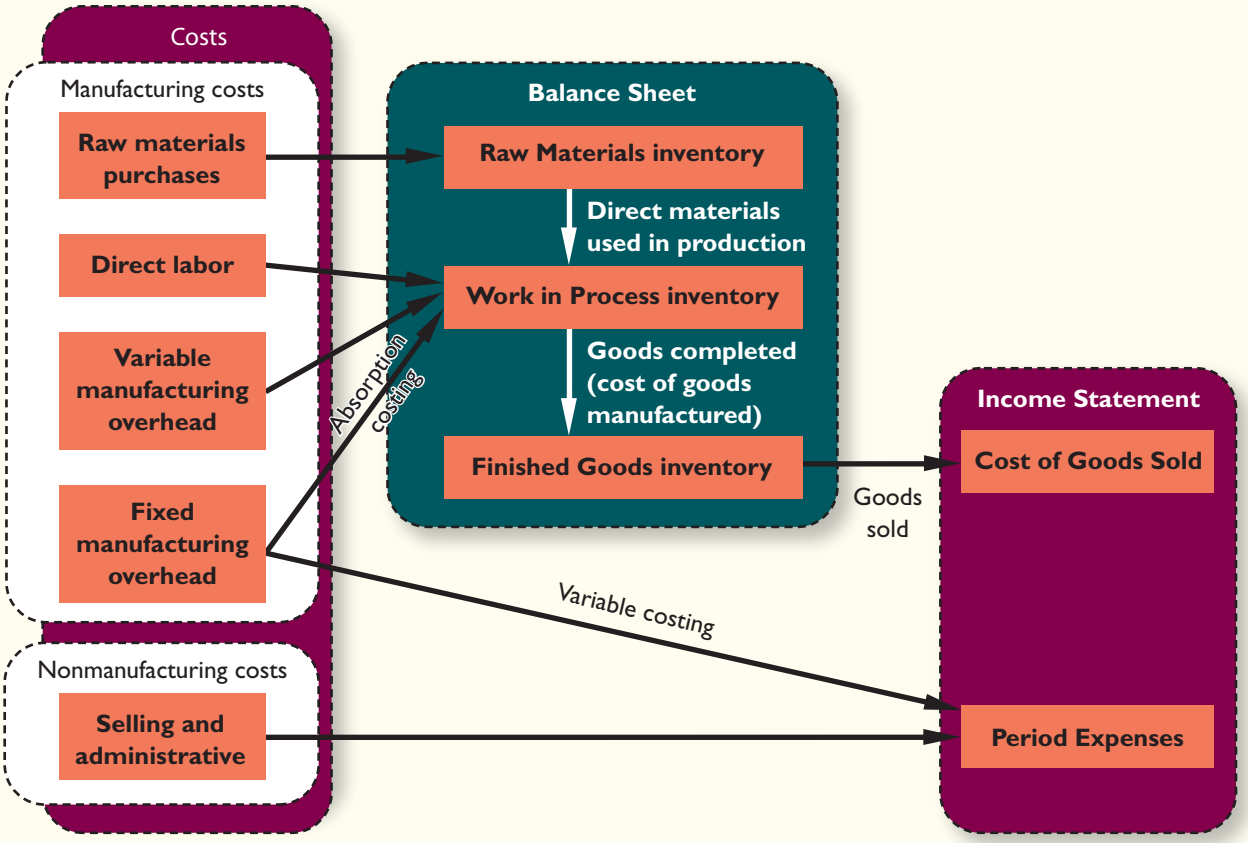
Variable Costing

Under **variable costing,** only those manufacturing costs that vary with output are treated as product costs. This would usually include direct materials, direct labor, and the variable portion of manufacturing overhead. Fixed manufacturing overhead is not treated as a product cost under this method. Rather, fixed manufacturing overhead is treated as a period cost and, like selling and administrative expenses, it is expensed in its entirety each period. Consequently, the cost of a unit of product in inventory or in cost of goods sold under the variable costing method does not contain any fixed manufacturing overhead cost. Variable costing is sometimes referred to as *direct costing* or *marginal costing.*

Absorption Costing

As discussed in Chapter 3, **absorption costing** treats *all* manufacturing costs as product costs, regardless of whether they are variable or fixed. The cost of a unit of product under the absorption costing method consists of direct materials, direct labor, and *both* variable and fixed manufacturing overhead. Thus, absorption costing allocates a portion of fixed

EXHIBIT 6–1
Variable Costing versus Absorption Costing



manufacturing overhead cost to each unit of product, along with the variable manufacturing costs. Because absorption costing includes all manufacturing costs in product costs, it is frequently referred to as the *full cost* method.

Selling and Administrative Expenses

Selling and administrative expenses are never treated as product costs, regardless of the costing method. Thus, under absorption and variable costing, variable and fixed selling and administrative expenses are always treated as period costs and are expensed as incurred.

Summary of Differences The essential difference between variable costing and absorption costing, as illustrated in Exhibit 6–1, is how each method accounts for fixed manufacturing overhead costs—all other costs are treated the same under the two methods. In absorption costing, fixed manufacturing overhead costs are included as part of the costs of work in process inventories. When units are completed, these costs are transferred to finished goods and only when the units are sold do these costs flow through to the income statement as part of cost of goods sold. In variable costing, fixed manufacturing overhead costs are considered to be period costs—just like selling and administrative costs—and are taken immediately to the income statement as period expenses.

Variable and Absorption Costing—An Example

To illustrate the difference between variable costing and absorption costing, consider Weber Light Aircraft, a company that produces light recreational aircraft. Data concerning the company's operations appear below:

	Per Aircraft	Per Month
Selling price	$100,000	
Direct materials	$19,000	
Direct labor	$5,000	
Variable manufacturing overhead	$1,000	
Fixed manufacturing overhead		$70,000
Variable selling and administrative expenses	$10,000	
Fixed selling and administrative expenses		$20,000

	January	February	March
Beginning inventory	0	0	1
Units produced	1	2	4
Units sold	1	1	5
Ending inventory	0	1	0

As you review the data above, it is important to realize that for the months of January, February, and March, the selling price per aircraft, variable cost per aircraft, and total monthly fixed expenses never change. The only variables that change in this example are the number of units produced (January = 1 unit produced; February = 2 units produced; March = 4 units produced) and the number of units sold (January = 1 unit sold; February = 1 unit sold; March = 5 units sold).

We will first construct the company's variable costing income statements for January, February, and March. Then we will show how the company's net operating income would be determined for the same months using absorption costing.

Variable Costing Contribution Format Income Statement

LEARNING OBJECTIVE 2
Prepare income statements using both variable and absorption costing.

To prepare the company's variable costing income statements for January, February, and March we begin by computing the unit product cost. Under variable costing, product costs consist solely of variable production costs. At Weber Light Aircraft, the variable production cost per unit is $25,000, determined as follows:

Variable Costing Unit Product Cost	
Direct materials	$19,000
Direct labor	5,000
Variable manufacturing overhead	1,000
Variable costing unit product cost	$25,000

Since each month's variable production cost is $25,000 per aircraft, the variable costing cost of goods sold for all three months can be easily computed as follows:

Variable Costing Cost of Goods Sold	January	February	March
Variable production cost (a)	$25,000	$25,000	$25,000
Units sold (b)	1	1	5
Variable cost of goods sold (a) × (b)	$25,000	$25,000	$125,000

And the company's total selling and administrative expense would be derived as follows:

Selling and Administrative Expenses	January	February	March
Variable selling and administrative expense (@ $10,000 per unit sold)	$10,000	$10,000	$50,000
Fixed selling and administrative expense	20,000	20,000	20,000
Total selling and administrative expense	$30,000	$30,000	$70,000

Putting it all together, the variable costing income statements would appear as shown in Exhibit 6–2. Notice, the contribution format has been used in these income statements. Also, the monthly fixed manufacturing overhead costs ($70,000) have been recorded as a period expense in the month incurred.

EXHIBIT 6–2
Variable Costing Income Statements

Variable Costing Contribution Format Income Statements	January	February	March
Sales	$100,000	$100,000	$500,000
Variable expenses:			
Variable cost of goods sold	25,000	25,000	125,000
Variable selling and administrative expense	10,000	10,000	50,000
Total variable expenses	35,000	35,000	175,000
Contribution margin	65,000	65,000	325,000
Fixed expenses:			
Fixed manufacturing overhead	70,000	70,000	70,000
Fixed selling and administrative expense	20,000	20,000	20,000
Total fixed expenses	90,000	90,000	90,000
Net operating income (loss)	$ (25,000)	$ (25,000)	$235,000

A simple method for understanding how Weber Light Aircraft computed its variable costing net operating income figures is to focus on the contribution margin per aircraft sold, which is computed as follows:

Contribution Margin per Aircraft Sold		
Selling price per aircraft		$100,000
Variable production cost per aircraft	$25,000	
Variable selling and administrative expense per aircraft	10,000	35,000
Contribution margin per aircraft		$ 65,000

The variable costing net operating income for each period can always be computed by multiplying the number of units sold by the contribution margin per unit and then subtracting total fixed costs. For Weber Light Aircraft these computations would appear as follows:

	January	February	March
Number of aircraft sold	1	1	5
Contribution margin per aircraft	× $65,000	× $65,000	× $65,000
Total contribution margin	$65,000	$65,000	$325,000
Total fixed expenses	90,000	90,000	90,000
Net operating income (loss)	$(25,000)	$(25,000)	$235,000

Notice, January and February have the same net operating loss. This occurs because one aircraft was sold in each month and, as previously mentioned, the selling price per aircraft, variable cost per aircraft, and total monthly fixed expenses remain constant.

Absorption Costing Income Statement

As we begin the absorption costing portion of the example, remember that the only reason absorption costing income differs from variable costing is that the methods account for fixed manufacturing overhead differently. Under absorption costing, fixed manufacturing overhead is included in product costs. In variable costing, fixed manufacturing overhead is not included in product costs and instead is treated as a period expense just like selling and administrative expenses.

The first step in preparing Weber's absorption costing income statements for January, February, and March, is to determine the company's unit product costs for each month as follows[1]:

Absorption Costing Unit Product Cost	January	February	March
Direct materials	$19,000	$19,000	$19,000
Direct labor	5,000	5,000	5,000
Variable manufacturing overhead	1,000	1,000	1,000
Fixed manufacturing overhead ($70,000 ÷ 1 unit produced in January; $70,000 ÷ 2 units produced in February; $70,000 ÷ 4 units produced in March)	70,000	35,000	17,500
Absorption costing unit product cost	$95,000	$60,000	$42,500

Notice that in each month, Weber's fixed manufacturing overhead cost of $70,000 is divided by the number of units produced to determine the fixed manufacturing overhead cost per unit.

Given these unit product costs, the company's absorption costing net operating income in each month would be determined as shown in Exhibit 6–3.

The sales for all three months in Exhibit 6–3 are the same as the sales shown in the variable costing income statements. The January cost of goods sold consists of one unit produced during January at a cost of $95,000 according to the absorption costing system. The February cost of goods sold consists of one unit produced during February at a cost of $60,000 according to the absorption costing system. The March cost of goods sold ($230,000) consists of one unit produced during February at an absorption cost of $60,000 plus four units produced in March with a total absorption cost of $170,000 (= 4 units produced × $42,500 per unit). The selling and administrative expenses equal the amounts reported in the variable costing income statements; however they are reported as one amount rather than being separated into variable and fixed components.

EXHIBIT 6–3
Absorption Costing Income Statements

Absorption Costing Income Statements	January	February	March
Sales	$100,000	$100,000	$500,000
Cost of goods sold ($95,000 × 1 unit; $60,000 × 1 unit; $60,000 × 1 unit + $42,500 × 4 units)	95,000	60,000	230,000
Gross margin	5,000	40,000	270,000
Selling and administrative expenses	30,000	30,000	70,000
Net operating income (loss)	$(25,000)	$ 10,000	$200,000

[1] For simplicity, we assume in this section that an actual costing system is used in which actual costs are spread over the units produced during the period. If a predetermined overhead rate were used, the analysis would be similar, but more complex.

Note that even though sales were exactly the same in January and February and the cost structure did not change, net operating income was $35,000 higher in February than in January under absorption costing. This occurs because one aircraft produced in February is not sold until March. This aircraft has $35,000 of fixed manufacturing overhead attached to it that was incurred in February, but will not be recorded as part of cost of goods sold until March.

Contrasting the variable costing and absorption costing income statements in Exhibits 6–2 and 6–3, note that net operating income is the same in January under variable costing and absorption costing, but differs in the other two months. We will discuss this in some depth shortly. Also note that the format of the variable costing income statement differs from the absorption costing income statement. An absorption costing income statement categorizes costs by function—manufacturing versus selling and administrative. All of the manufacturing costs flow through the absorption costing cost of goods sold and all of the selling and administrative costs are listed separately as period expenses. In contrast, in the contribution approach, costs are categorized according to how they behave. All of the variable expenses are listed together and all of the fixed expenses are listed together. The variable expenses category includes manufacturing costs (i.e., variable cost of goods sold) as well as selling and administrative expenses. The fixed expenses category also includes both manufacturing costs and selling and administrative expenses.

IN BUSINESS

THE BEHAVIORAL SIDE OF CALCULATING UNIT PRODUCT COSTS

In 2004, Andreas STIHL, a manufacturer of chain saws and other landscaping products, asked its U.S. subsidiary, STIHL Inc., to replace its absorption costing income statements with the variable costing approach. From a computer systems standpoint, the change was not disruptive because STIHL used an enterprise system called SAP that accommodates both absorption and variable costing. However, from a behavioral standpoint, STIHL felt the change could be very disruptive. For example, STIHL's senior managers were keenly aware that the variable costing approach reported lower unit product costs than the absorption costing approach. Given this reality, the sales force might be inclined to erroneously conclude that each product had magically become more profitable, thereby justifying ill-advised price reductions. Because of behavioral concerns such as this, STIHL worked hard to teach its employees how to interpret a variable costing income statement.

Source: Carl S. Smith, "Going for GPK: STIHL Moves Toward This Costing System in the United States," *Strategic Finance,* April 2005, pp. 36–39.

Reconciliation of Variable Costing with Absorption Costing Income

LEARNING OBJECTIVE 3
Reconcile variable costing and absorption costing net operating incomes and explain why the two amounts differ.

As noted earlier, variable costing and absorption costing net operating incomes may not be the same. In the case of Weber Light Aircraft, the net operating incomes are the same in January, but differ in the other two months. These differences occur because under absorption costing some fixed manufacturing overhead is capitalized in inventories (i.e., included in product costs) rather than currently expensed on the income statement. If inventories increase during a period, under absorption costing some of the fixed manufacturing overhead of the current period will be *deferred* in ending inventories. For example, in February two aircraft were produced and each carried with it $35,000 (= $70,000 ÷ 2 aircraft produced) in fixed manufacturing overhead. Since only one aircraft was sold, $35,000 of this fixed manufacturing overhead was on February's absorption costing income statement as part of cost of goods sold, but $35,000 would have been on the balance sheet as part of finished goods inventories. In contrast, under variable costing *all* of the $70,000 of fixed manufacturing overhead appeared

on the February income statement as a period expense. Consequently, net operating income was higher under absorption costing than under variable costing by $35,000 in February. This was reversed in March when four units were produced, but five were sold. In March, under absorption costing $105,000 of fixed manufacturing overhead was included in cost of goods sold ($35,000 for the unit produced in February and sold in March plus $17,500 for each of the four units produced and sold in March), but only $70,000 was recognized as a period expense under variable costing. Hence, the net operating income in March was $35,000 lower under absorption costing than under variable costing.

In general, when the units produced exceed unit sales and hence inventories increase, net operating income is higher under absorption costing than under variable costing. This occurs because some of the fixed manufacturing overhead of the period is *deferred* in inventories under absorption costing. In contrast, when unit sales exceed the units produced and hence inventories decrease, net operating income is lower under absorption costing than under variable costing. This occurs because some of the fixed manufacturing overhead of previous periods is *released* from inventories under absorption costing. When the units produced and unit sales are equal, no change in inventories occurs and absorption costing and variable costing net operating incomes are the same.[2]

Variable costing and absorption costing net operating incomes can be reconciled by determining how much fixed manufacturing overhead was deferred in, or released from, inventories during the period:

Fixed Manufacturing Overhead Deferred in, or Released from, Inventories under Absorption Costing	January	February	March
Fixed manufacturing overhead in beginning inventories	$0	$ 0	$ 35,000
Fixed manufacturing overhead in ending inventories	0	35,000	0
Fixed manufacturing overhead deferred in (released from) inventories	$0	$35,000	$(35,000)

The reconciliation would then be reported as shown in Exhibit 6–4:

EXHIBIT 6–4
Reconciliation of Variable Costing and Absorption Costing Net Operating Incomes

Reconciliation of Variable Costing and Absorption Costing Net Operating Incomes	January	February	March
Variable costing net operating income (loss)	$(25,000)	$(25,000)	$235,000
Add (deduct) fixed manufacturing overhead deferred in (released from) inventory under absorption costing	0	35,000	(35,000)
Absorption costing net operating income (loss)	$(25,000)	$ 10,000	$200,000

Again note that the difference between variable costing net operating income and absorption costing net operating income is entirely due to the amount of fixed manufacturing overhead that is deferred in, or released from, inventories during the period

[2] These general statements about the relation between variable costing and absorption costing net operating income assume LIFO is used to value inventories. Even when LIFO is not used, the general statements tend to be correct. Although U.S. GAAP allows LIFO and FIFO inventory flow assumptions, International Financial Reporting Standards do not allow a LIFO inventory flow assumption.

Relation between Production and Sales for the Period	Effect on Inventories 	Relation between Absorption and Variable Costing Net Operating Incomes
Units produced = Units sold	No change in inventories 	Absorption costing net operating income = Variable costing net operating income
Units produced > Units sold	Inventories increase 	Absorption costing net operating income > Variable costing net operating income*
Units produced < Units sold	Inventories decrease 	Absorption costing net operating income < Variable costing net operating income†

*Net operating income is higher under absorption costing because fixed manufacturing overhead cost is *deferred* in inventory under absorption costing as inventories increase.
†Net operating income is lower under absorption costing because fixed manufacturing overhead cost is *released* from inventory under absorption costing as inventories decrease.

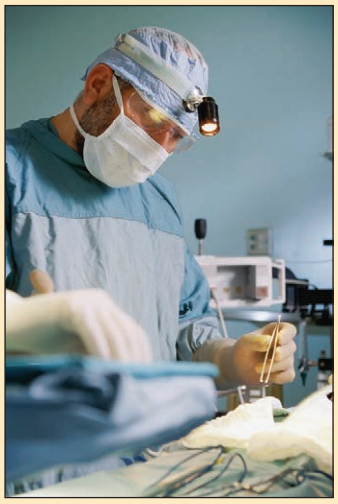
EXHIBIT 6–5
Comparative Income Effects—Absorption and Variable Costing

under absorption costing. Changes in inventories affect absorption costing net operating income—they do not affect variable costing net operating income, providing that variable manufacturing costs per unit are stable.

The reasons for differences between variable and absorption costing net operating incomes are summarized in Exhibit 6–5. When the units produced equal the units sold, as in January for Weber Light Aircraft, absorption costing net operating income will equal variable costing net operating income. This occurs because when production equals sales, all of the fixed manufacturing overhead incurred in the current period flows through to the income statement under both methods. For companies that use Lean Production, the number of units produced tends to equal the number of units sold. This occurs because goods are produced in response to customer orders, thereby eliminating finished goods inventories and reducing work in process inventory to almost nothing. So, when a company uses Lean Production differences in variable costing and absorption costing net operating income will largely disappear.

When the units produced exceed the units sold, absorption costing net operating income will exceed variable costing net operating income. This occurs because inventories have increased; therefore, under absorption costing some of the fixed manufacturing overhead incurred in the current period is deferred in ending inventories on the balance sheet, whereas under variable costing all of the fixed manufacturing overhead incurred in the current period flows through to the income statement. In contrast, when the units produced are less than the units sold, absorption costing net operating income will be less than variable costing net operating income. This occurs because inventories have decreased; therefore, under absorption costing fixed manufacturing overhead that had been deferred in inventories during a prior period flows through to the current period's income statement together with all of the fixed manufacturing overhead incurred during the current period. Under variable costing, just the fixed manufacturing overhead of the current period flows through to the income statement.

IN BUSINESS



LEAN MANUFACTURING SHRINKS INVENTORIES

Conmed, a surgical device maker in Utica, New York, switched to lean manufacturing by replacing its assembly lines with U-shaped production cells. It also started producing only enough units to satisfy customer demand rather than producing as many units as possible and storing them in warehouses. The company calculated that its customers use one of its disposable surgical devices every 90 seconds, so that is precisely how often it produces a new unit. Its assembly area for fluid-injection devices used to occupy 3,300 square feet of space and contained $93,000 worth of parts. Now the company produces its fluid-injection devices in 660 square feet of space while maintaining only $6,000 of parts inventory.

When Conmed adopted lean manufacturing, it substantially reduced its finished goods inventories. What impact do you think this initial reduction in inventories may have had on net operating income? Why?

Source: Pete Engardio, "Lean and Mean Gets Extreme," *BusinessWeek*, March 23 and 30, 2009, pp. 60–62.

Advantages of Variable Costing and the Contribution Approach

Variable costing, together with the contribution approach, offers appealing advantages for internal reports. This section discusses four of those advantages.

Enabling CVP Analysis

CVP analysis requires that we break costs down into their fixed and variable components. Because variable costing income statements categorize costs as fixed and variable, it is much easier to use this income statement format to perform CVP analysis than attempting to use the absorption costing format, which mixes together fixed and variable costs.

Moreover, absorption costing net operating income may or may not agree with the results of CVP analysis. For example, let's suppose that you are interested in computing the sales that would be necessary to generate a target profit of $235,000 at Weber Light Aircraft. A CVP analysis based on the January variable costing income statement from Exhibit 6–2 would proceed as follows:

Sales (a)	$100,000
Contribution margin (b)	$65,000
Contribution margin ratio (b) ÷ (a)	65%
Total fixed expenses	$90,000

$$\text{Dollar sales to attain target profit} = \frac{\text{Target profit} + \text{Fixed expenses}}{\text{CM ratio}}$$

$$= \frac{\$235{,}000 + \$90{,}000}{0.65} = \$500{,}000$$

Thus, a CVP analysis based on the January variable costing income statement predicts that the net operating income would be $235,000 when sales are $500,000. And indeed, the net operating income under variable costing *is* $235,000 when the sales are $500,000

in March. However, the net operating income under absorption costing is *not* $235,000 in March, even though the sales are $500,000. Why is this? The reason is that under absorption costing, net operating income can be distorted by changes in inventories. In March, inventories decreased, so some of the fixed manufacturing overhead that had been deferred in February's ending inventories was released to the March income statement, resulting in a net operating income that is $35,000 lower than the $235,000 predicted by CVP analysis. If inventories had increased in March, the opposite would have occurred—the absorption costing net operating income would have been higher than the $235,000 predicted by CVP analysis.

Explaining Changes in Net Operating Income

The variable costing income statements in Exhibit 6–2 are clear and easy to understand. All other things the same, when sales go up, net operating income goes up. When sales go down, net operating income goes down. When sales are constant, net operating income is constant. The number of unit produced does not affect net operating income.

Absorption costing income statements can be confusing and are easily misinterpreted. Look again at the absorption costing income statements in Exhibit 6–3; a manager might wonder why net operating income went up from January to February even though sales were exactly the same. Was it a result of lower selling costs, more efficient operations, or was it some other factor? In fact, it was simply because the number of units produced exceeded the number of units sold in February and so some of the fixed manufacturing overhead costs were deferred in inventories in that month. These costs have not gone away—they will eventually flow through to the income statement in a later period when inventories go down. There is no way to tell this from the absorption costing income statements.

To avoid mistakes when absorption costing is used, readers of financial statements should be alert to changes in inventory levels. Under absorption costing, if inventories increase, fixed manufacturing overhead costs are deferred in inventories, which in turn increases net operating income. If inventories decrease, fixed manufacturing overhead costs are released from inventories, which in turn decreases net operating income. Thus, when absorption costing is used, fluctuations in net operating income can be due to changes in inventories rather than to changes in sales.

Supporting Decision Making

The variable costing method correctly identifies the additional variable costs that will be incurred to make one more unit. It also emphasizes the impact of fixed costs on profits. The total amount of fixed manufacturing costs appears explicitly on the income statement, highlighting that the whole amount of fixed manufacturing costs must be covered for the company to be truly profitable. In the Weber Light Aircraft example, the variable costing income statements correctly report that the cost of producing another unit is $25,000 and they explicitly recognize that $70,000 of fixed manufactured overhead must be covered to earn a profit.

Under absorption costing, fixed manufacturing overhead costs appear to be variable with respect to the number of units sold, but they are not. For example, in January, the absorption unit product cost at Weber Light Aircraft is $95,000, but the variable portion of this cost is only $25,000. The fixed overhead costs of $70,000 are commingled with variable production costs, thereby obscuring the impact of fixed overhead costs on profits. Because absorption unit product costs are stated on a per unit basis, managers may mistakenly believe that if another unit is produced, it will cost the company $95,000. But of course it would not. The cost of producing another unit would be only $25,000. Misinterpreting absorption unit product costs as variable can lead to many problems, including inappropriate pricing decisions and decisions to drop products that are in fact profitable.

Adapting to the Theory of Constraints

The Theory of Constraints (TOC), which was introduced in Chapter 1, suggests that the key to improving a company's profits is managing its constraints. For reasons that will be discussed in a later chapter, this requires careful identification of each product's variable costs. Consequently, companies involved in TOC use a form of variable costing.

Variable costing income statements require one adjustment to support the TOC approach. Direct labor costs need to be removed from variable production costs and reported as part of the fixed manufacturing costs that are entirely expensed in the period incurred. The TOC treats direct labor costs as a fixed cost for three reasons. First, even though direct labor workers may be paid on an hourly basis, many companies have a commitment—sometimes enforced by labor contracts or by law—to guarantee workers a minimum number of paid hours. Second, direct labor is not usually the constraint; therefore, there is no reason to increase it. Hiring more direct labor workers would increase costs without increasing the output of saleable products and services. Third, TOC emphasizes continuous improvement to maintain competitiveness. Without committed and enthusiastic employees, sustained continuous improvement is virtually impossible. Because layoffs often have devastating effects on employee morale, managers involved in TOC are extremely reluctant to lay off employees.

For these reasons, most managers in TOC companies regard direct labor as a committed-fixed cost rather than a variable cost. Hence, in the modified form of variable costing used in TOC companies, direct labor is not usually classified as a product cost.

Segmented Income Statements and the Contribution Approach

LEARNING OBJECTIVE 4
Prepare a segmented income statement that differentiates traceable fixed costs from common fixed costs and use it to make decisions.

In the remainder of the chapter, we'll learn how to use the contribution approach to construct income statements for business segments. These segmented income statements are useful for analyzing the profitability of segments, making decisions, and measuring the performance of segment managers.

Traceable and Common Fixed Costs and the Segment Margin

You need to understand three new terms to prepare segmented income statements using the contribution approach—*traceable fixed cost, common fixed cost,* and *segment margin.*

A **traceable fixed cost** of a segment is a fixed cost that is incurred because of the existence of the segment—if the segment had never existed, the fixed cost would not have been incurred; and if the segment were eliminated, the fixed cost would disappear. Examples of traceable fixed costs include the following:

- The salary of the Fritos product manager at PepsiCo is a *traceable* fixed cost of the Fritos business segment of PepsiCo.
- The maintenance cost for the building in which Boeing 747s are assembled is a *traceable* fixed cost of the 747 business segment of Boeing.
- The liability insurance at Disney World is a *traceable* fixed cost of the Disney World business segment of the Disney Corporation.

A **common fixed cost** is a fixed cost that supports the operations of more than one segment, but is not traceable in whole or in part to any one segment. Even if a segment were entirely eliminated, there would be no change in a true common fixed cost. For example:

- The salary of the CEO of General Motors is a *common* fixed cost of the various divisions of General Motors.
- The cost of heating a Safeway or Kroger grocery store is a *common* fixed cost of the store's various departments—groceries, produce, bakery, meat, etc.

- The cost of the receptionist's salary at an office shared by a number of doctors is a *common* fixed cost of the doctors. The cost is traceable to the office, but not to individual doctors.

To prepare a segmented income statement, variable expenses are deducted from sales to yield the contribution margin for the segment. The contribution margin tells us what happens to profits as volume changes—holding a segment's capacity and fixed costs constant. The contribution margin is especially useful in decisions involving temporary uses of capacity such as special orders. These types of decisions often involve only variable costs and revenues—the two components of contribution margin.

The **segment margin** is obtained by deducting the traceable fixed costs of a segment from the segment's contribution margin. It represents the margin available after a segment has covered all of its own costs. *The segment margin is the best gauge of the long-run profitability of a segment* because it includes only those costs that are caused by the segment. If a segment can't cover its own costs, then that segment probably should be dropped (unless it has important side effects on other segments). Notice, common fixed costs are not allocated to segments.

From a decision-making point of view, the segment margin is most useful in major decisions that affect capacity such as dropping a segment. By contrast, as we noted earlier, the contribution margin is most useful in decisions involving short-run changes in volume, such as pricing special orders that involve temporary use of existing capacity.

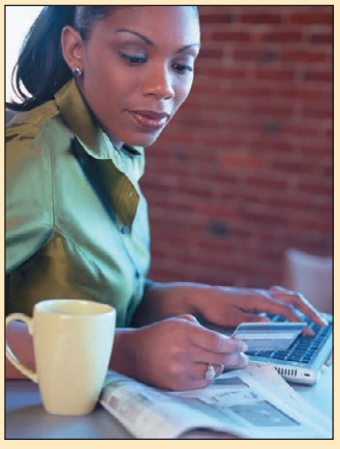
IN BUSINESS

HAS THE INTERNET KILLED CATALOGS?

Smith & Hawken, an outdoor-accessories retailer, has experienced growing Internet sales and declining catalog sales. These trends seem consistent with conventional wisdom, which suggests that the Internet will make catalogs obsolete. Yet, Smith & Hawken, like many retailers with growing Internet sales, has no plans to discontinue its catalogs. In fact, the total number of catalogs mailed in the United States by all companies has jumped from 16.6 billion in 2002 to 19.2 billion in 2005. Why?

Catalog shoppers and Internet shoppers are not independent customer segments. Catalog shoppers frequently choose to complete their sales transactions online rather than placing telephone orders. This explains why catalogs remain a compelling marketing medium even though catalog sales are declining for many companies. If retailers separately analyze catalog sales and Internet sales, they may discontinue the catalogs segment while overlooking the adverse impact of this decision on Internet segment margins.

Source: Louise Lee, "Catalogs, Catalogs, Everywhere," *BusinessWeek,* December 4, 2006, pp. 32–34.



Identifying Traceable Fixed Costs

The distinction between traceable and common fixed costs is crucial in segment reporting because traceable fixed costs are charged to segments and common fixed costs are not. In an actual situation, it is sometimes hard to determine whether a cost should be classified as traceable or common.

The general guideline is to treat as traceable costs *only those costs that would disappear over time if the segment itself disappeared.* For example, if one division within a company were sold or discontinued, it would no longer be necessary to pay that division manager's salary. Therefore the division manager's salary would be classified as a traceable fixed cost of the division. On the other hand, the president of the company undoubtedly would continue to be paid even if one of many divisions was dropped. In fact, he or she might even be paid more if dropping the division was a good idea. Therefore, the president's salary is common to the company's divisions and should not be charged to them.

When assigning costs to segments, the key point is to resist the temptation to allocate costs (such as depreciation of corporate facilities) that are clearly common and that will continue regardless of whether the segment exists or not. *Any allocation of common costs to segments reduces the value of the segment margin as a measure of long-run segment profitability and segment performance.*

Traceable Costs Can Become Common Costs

Fixed costs that are traceable to one segment may be a common cost of another segment. For example, United Airlines might want a segmented income statement that shows the segment margin for a particular flight from Chicago to Paris further broken down into first-class, business-class, and economy-class segment margins. The airline must pay a substantial landing fee at Charles DeGaulle airport in Paris. This fixed landing fee is a traceable cost of the flight, but it is a common cost of the first-class, business-class, and economy-class segments. Even if the first-class cabin is empty, the entire landing fee must be paid. So the landing fee is not a traceable cost of the first-class cabin. But on the other hand, paying the fee is necessary in order to have any first-class, business-class, or economy-class passengers. So the landing fee is a common cost of these three classes.

Segmented Income Statements—An Example

ProphetMax, Inc., is a rapidly growing computer software company. Exhibit 6–6 shows its variable costing income statement for the most recent month. As the company has grown, its senior managers have asked for segmented income statements that could be used to make decisions and evaluate managerial performance. ProphetMax's controller responded by creating examples of contribution format income statements segmented by the company's divisions, product lines, and sales channels. She created Exhibit 6–7 to explain that ProphetMax's profits can be segmented into its two divisions—the Business Products Division and the Consumer Products Division. The Consumer Products Division's profits can be further segmented into the Clip Art and Computer Games product lines. Finally, the Computer Games product line's profits (within the Consumer Products Division) can be segmented into the Online and Retail Stores sales channels.

IN BUSINESS

COMPUTING SEGMENT MARGINS HELPS AN ENTREPRENEUR

In 2001, Victoria Pappas Collection, a small company specializing in women's sportswear, reported a net loss of $280,000 on sales of $1 million. When the company's founder, Vickie Giannukos, segmented her company's income statement into the six markets that she was serving, the results were revealing. The Dallas and Atlanta markets generated $825,000 of sales and incurred $90,000 of traceable fixed costs. The other four markets combined produced $175,000 of sales and also incurred $90,000 of traceable fixed costs. Given the average contribution margin ratio of 38%, the Dallas and Atlanta markets earned a segment margin of $223,500 [($825,000 × 38%) − $90,000] while the other four markets combined incurred a loss of $23,500 [($175,000 × 38%) − $90,000].

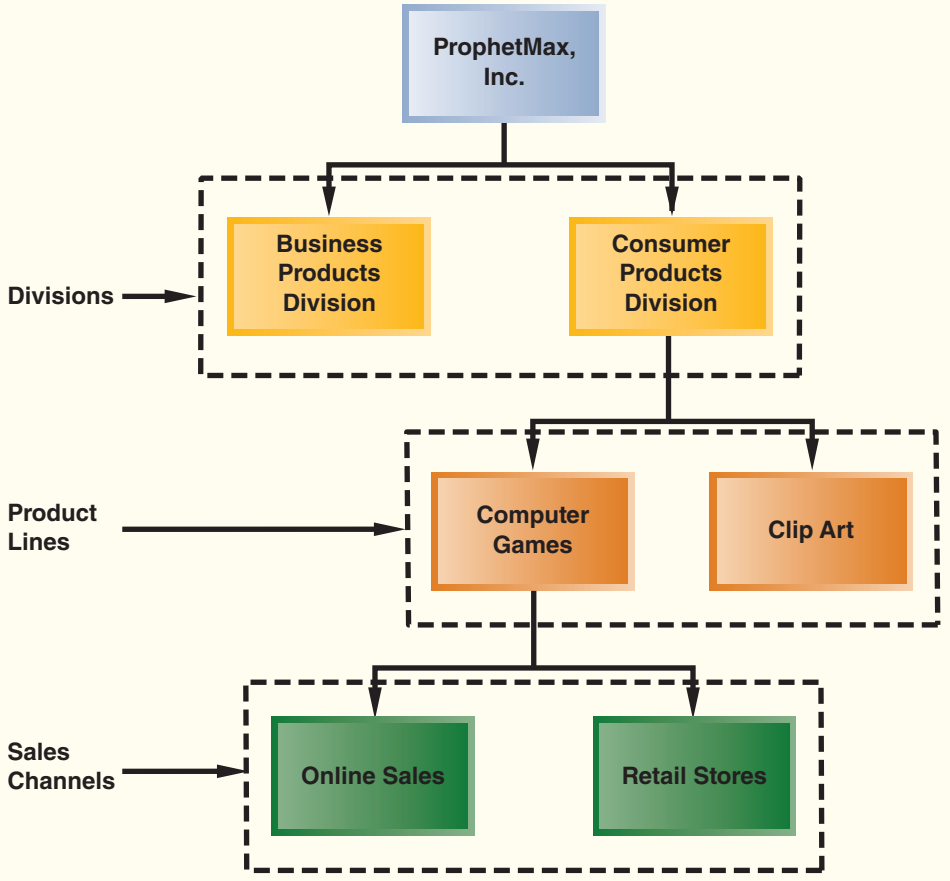
Vicky had made a common mistake—she chased every possible dollar of sales without knowing if her efforts were profitable. Based on her segmented income statements, she discontinued operations in three cities and hired a new sales representative in Los Angeles. She decided to focus on growing sales in Dallas and Atlanta while deferring expansion into new markets until it could be done profitably.

Source: Norm Brodsky, "The Thin Red Line," *Inc.* Magazine, January 2004, pp. 49–52.

EXHIBIT 6–6
ProphetMax, Inc. Variable Costing Income Statement

ProphetMax, Inc. Variable Costing Income Statement	
Sales	$500,000
Variable expenses:	
Variable cost of goods sold	180,000
Other variable expenses	50,000
Total variable expenses	230,000
Contribution margin	270,000
Fixed expenses	255,000
Net operating income	$ 15,000

EXHIBIT 6–7
ProphetMax, Inc.: Examples of Business Segments



Levels of Segmented Income Statements

Exhibit 6–8, on the next page, contains the controller's segmented income statements for the segments depicted in Exhibit 6–7. The contribution format income statement for the entire company appears at the very top of the exhibit under the column labeled Total Company. Notice, the net operating income shown in this column ($15,000) is the same as the net operating income shown in Exhibit 6–6. Immediately to the right of the Total Company column are two columns—one for each of the two divisions. We can see that the Business Products Division's traceable fixed expenses are $90,000 and the Consumer Products Division's are $80,000. These $170,000 of traceable fixed expenses (as shown in the Total Company column) plus the $85,000 of common fixed expenses not traceable to individual divisions equals ProphetMax's total fixed expenses ($255,000) as shown in Exhibit 6–6. We can also see that the Business Products Division's segment margin is $60,000 and the Consumer

EXHIBIT 6–8
ProphetMax, Inc.—Segmented Income Statements in the Contribution Format

Segments Defined as Divisions

	Total Company	Divisions: Business Products Division	Divisions: Consumer Products Division
Sales	$500,000	$300,000	$200,000
Variable expenses:			
Variable cost of goods sold	180,000	120,000	60,000
Other variable expenses	50,000	30,000	20,000
Total variable expenses	230,000	150,000	80,000
Contribution margin	270,000	150,000	120,000
Traceable fixed expenses	170,000	90,000	80,000
Divisional segment margin	100,000	$ 60,000	$ 40,000
Common fixed expenses not traceable to individual divisions	85,000		
Net operating income	$ 15,000		

Segments Defined as Product Lines of the Consumer Products Division

	Consumer Products Division	Product Line: Clip Art	Product Line: Computer Games
Sales	$200,000	$75,000	$125,000
Variable expenses:			
Variable cost of goods sold	60,000	20,000	40,000
Other variable expenses	20,000	5,000	15,000
Total variable expenses	80,000	25,000	55,000
Contribution margin	120,000	50,000	70,000
Traceable fixed expenses	70,000	30,000	40,000
Product-line segment margin	50,000	$20,000	$ 30,000
Common fixed expenses not traceable to individual product lines	10,000		
Divisional segment margin	$ 40,000		

Segments Defined as Sales Channels for One Product Line, Computer Games, of the Consumer Products Division

	Computer Games	Sales Channels: Online Sales	Sales Channels: Retail Stores
Sales	$125,000	$100,000	$25,000
Variable expenses:			
Variable cost of goods sold	40,000	32,000	8,000
Other variable expenses	15,000	5,000	10,000
Total variable expenses	55,000	37,000	18,000
Contribution margin	70,000	63,000	7,000
Traceable fixed expenses	25,000	15,000	10,000
Sales-channel segment margin	45,000	$ 48,000	$ (3,000)
Common fixed expenses not traceable to individual sales channels	15,000		
Product-line segment margin	$ 30,000		

Products Division's is $40,000. These segment margins show the company's divisional managers how much each of their divisions is contributing to the company's profits.

The middle portion of Exhibit 6–8 further segments the Consumer Products Division into its two product lines, Clip Art and Computer Games. The dual nature of some fixed costs can be seen in this portion of the exhibit. Notice, in the top portion of Exhibit 6–8 when segments are defined as divisions, the Consumer Products Division has $80,000 in traceable fixed expenses. However, when we drill down to the product lines (in the middle portion of the exhibit), only $70,000 of the $80,000 cost that was traceable to the Consumer Products Division is traceable to the product lines. The other $10,000 becomes a common fixed cost of the two product lines of the Consumer Products Division.

Why would $10,000 of traceable fixed costs become a common fixed cost when the division is divided into product lines? The $10,000 is the monthly depreciation expense on a machine that is used to encase products in tamper-proof packages for the consumer market. The depreciation expense is a traceable cost of the Consumer Products Division as a whole, but it is a common cost of the division's two product lines. Even if one of the product lines were discontinued entirely, the machine would still be used to wrap the remaining products. Therefore, none of the depreciation expense can really be traced to individual products.

The $70,000 traceable fixed cost of the product lines consists of the costs of product specific advertising. A total of $30,000 was spent on advertising clip art and $40,000 was spent on advertising computer games. Clearly, these costs can be traced to the individual product lines.

Segmented Income Statements and Decision Making

The bottom portion of Exhibit 6–8 can be used to illustrate how segmented income statements support decision making. It further segments the Computer Games product line into its two sales channels, Online Sales and Retail Stores. The Online Sales segment has a segment margin of $48,000 and the Retail Stores segment has a segment margin of $(3,000). Let's assume that ProphetMax wants to know the profit impact of discontinuing the sale of computer games through its Retail Stores sales channel. The company believes that online sales of its computer games will increase 10% if it discontinues the Retail Stores sales channel. It also believes that the Business Products Division and Clip Art product line will be unaffected by this decision. How would you compute the profit impact of this decision?

The first step is to calculate the profit impact of the Retail Stores sales channel disappearing. If this sales channel disappears, we assume its sales, variable expenses, and traceable fixed expenses would all disappear. The quickest way to summarize these financial impacts is to focus on the Retail Stores' segment margin. In other words, if the Retail Stores sales channel disappears, then its segment margin of a loss of $3,000 would also disappear. This would increase ProphetMax's net operating income by $3,000. The second step is to calculate the profit impact of increasing online sales of computer games by 10%. To perform this calculation, we assume that the Online Sales total traceable fixed expenses ($15,000) remain constant and its contribution margin ratio remains constant at 63% (= $63,000 ÷ $100,000). If online sales increase $10,000 (= $100,000 × 10%), then the Online Sales segment's contribution margin will increase by $6,300 (= $10,000 × 63%). The overall profit impact of discontinuing the Retail Stores sales channel can be summarized as follows:

Avoidance of the retail segment's loss	$3,000
Online Sales additional contribution margin	6,300
Increase in ProphetMax's net operating income	$9,300

Segmented Income Statements—Common Mistakes

All of the costs attributable to a segment—and only those costs—should be assigned to the segment. Unfortunately, companies often make mistakes when assigning costs to segments. They omit some costs, inappropriately assign traceable fixed costs, and arbitrarily allocate common fixed costs.

Omission of Costs

The costs assigned to a segment should include all costs attributable to that segment from the company's entire value chain. All of these functions, from research and development, through product design, manufacturing, marketing, distribution, and customer service, are required to bring a product or service to the customer and generate revenues.

However, only manufacturing costs are included in product costs under absorption costing, which is widely regarded as required for external financial reporting. To avoid having to maintain two costing systems and to provide consistency between internal and external reports, many companies also use absorption costing for their internal reports such as segmented income statements. As a result, such companies omit from their profitability analysis part or all of the "upstream" costs in the value chain, which consist of research and development and product design, and the "downstream" costs, which consist of marketing, distribution, and customer service. Yet these nonmanufacturing costs are just as essential in determining product profitability as are the manufacturing costs. These upstream and downstream costs, which are usually included in selling and administrative expenses on absorption costing income statements, can represent half or more of the total costs of an organization. If either the upstream or downstream costs are omitted in profitability analysis, then the product is undercosted and management may unwittingly develop and maintain products that in the long run result in losses.

Inappropriate Methods for Assigning Traceable Costs among Segments

In addition to omitting costs, many companies do not correctly handle traceable fixed expenses on segmented income statements. First, they do not trace fixed expenses to segments even when it is feasible to do so. Second, they use inappropriate allocation bases to allocate traceable fixed expenses to segments.

Failure to Trace Costs Directly Costs that can be traced directly to a specific segment should be charged directly to that segment and should not be allocated to other segments. For example, the rent for a branch office of an insurance company should be charged directly to the branch office rather than included in a companywide overhead pool and then spread throughout the company.

Inappropriate Allocation Base Some companies use arbitrary allocation bases to allocate costs to segments. For example, some companies allocate selling and administrative expenses on the basis of sales revenues. Thus, if a segment generates 20% of total company sales, it would be allocated 20% of the company's selling and administrative expenses as its "fair share." This same basic procedure is followed if cost of goods sold or some other measure is used as the allocation base.

Costs should be allocated to segments for internal decision-making purposes only when the allocation base actually drives the cost being allocated (or is very highly correlated with the real cost driver). For example, sales should be used to allocate selling and administrative expenses only if a 10% increase in sales will result in a 10% increase in selling and administrative expenses. To the extent that selling and administrative expenses are not driven by sales volume, these expenses will be improperly allocated—with a disproportionately high percentage of the selling and administrative expenses assigned to the segments with the largest sales.

Arbitrarily Dividing Common Costs among Segments

The third business practice that leads to distorted segment costs is the practice of assigning nontraceable costs to segments. For example, some companies allocate the common costs of the corporate headquarters building to products on segment reports. However, in a multiproduct company, no single product is likely to be responsible for any significant amount of this cost. Even if a product were eliminated entirely, there would usually be

no significant effect on any of the costs of the corporate headquarters building. In short, there is no cause-and-effect relation between the cost of the corporate headquarters building and the existence of any one product. As a consequence, any allocation of the cost of the corporate headquarters building to the products must be arbitrary.

Common costs like the costs of the corporate headquarters building are necessary, of course, to have a functioning organization. The practice of arbitrarily allocating common costs to segments is often justified on the grounds that "someone" has to "cover the common costs." While it is undeniably true that a company must cover its common costs to earn a profit, arbitrarily allocating common costs to segments does not ensure that this will happen. In fact, adding a share of common costs to the real costs of a segment may make an otherwise profitable segment appear to be unprofitable. If a manager eliminates the apparently unprofitable segment, the real traceable costs of the segment will be saved, but its revenues will be lost. And what happens to the common fixed costs that were allocated to the segment? They don't disappear; they are reallocated to the remaining segments of the company. That makes all of the remaining segments appear to be less profitable—possibly resulting in dropping other segments. The net effect will be to reduce the overall profits of the company and make it even more difficult to "cover the common costs."

Additionally, common fixed costs are not manageable by the manager to whom they are arbitrarily allocated; they are the responsibility of higher-level managers. When common fixed costs are allocated to managers, they are held responsible for those costs even though they cannot control them.

IN BUSINESS

MANAGING PRODUCT INNOVATION AT GOOGLE

Marissa Mayer, Google's vice president for search products and user experience, believes that the company's future success hinges on innovation. She encourages risk-taking and readily acknowledges that 60–80% of the company's new products will fail. However, creating an organizational culture that embraces failure also helps produce the new product introductions that should sustain the company's future sales growth. Google's senior managers can use segmented income statements to identify the unprofitable products that should be discontinued and to track the performance of thriving new product innovations.

Source: Ben Elgin, "So Much Fanfare, So Few Hits," *BusinessWeek,* July 10, 2006, pp. 26–29.

Income Statements—An External Reporting Perspective

Companywide Income Statements

Practically speaking, absorption costing is required for external reports according to U.S. generally accepted accounting principles (GAAP).[3] Furthermore, International Financial Reporting Standards (IFRS) explicitly require companies to use absorption costing. Probably because of the cost and possible confusion of maintaining two separate costing systems—one for external reporting and one for internal reporting—most companies use absorption costing for their external and internal reports.

[3] The Financial Accounting Standards Board (FASB) has created a single source of authoritative nongovernmental U.S. generally accepted accounting principles (GAAP) called the FASB Accounting Standards Codification (FASB codification). Although the FASB codification does not explicitly disallow variable costing, it does explicitly prohibit companies from excluding all manufacturing overhead costs from product costs. It also provides an in-depth discussion of fixed overhead allocation to products, thereby implying that absorption costing is required for external reports. Although some companies expense significant elements of fixed manufacturing costs on their external reports, practically speaking, U.S. GAAP requires absorption costing for external reports.

With all of the advantages of the contribution approach, you may wonder why the absorption approach is used at all. While the answer is partly due to adhering to tradition, absorption costing is also attractive to many accountants and managers because they believe it better matches costs with revenues. Advocates of absorption costing argue that *all* manufacturing costs must be assigned to products in order to properly match the costs of producing units of product with their revenues when they are sold. The fixed costs of depreciation, taxes, insurance, supervisory salaries, and so on, are just as essential to manufacturing products as are the variable costs.

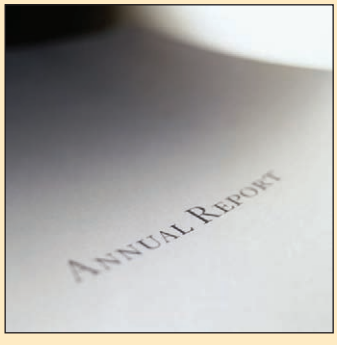
Advocates of variable costing argue that fixed manufacturing costs are not really the costs of any particular unit of product. These costs are incurred to have the *capacity* to make products during a particular period and will be incurred even if nothing is made during the period. Moreover, whether a unit is made or not, the fixed manufacturing costs will be exactly the same. Therefore, variable costing advocates argue that fixed manufacturing costs are not part of the costs of producing a particular unit of product, and thus, the matching principle dictates that fixed manufacturing costs should be charged to the current period.

Segmented Financial Information

U.S. GAAP and IFRS require that publicly traded companies include segmented financial and other data in their annual reports and that the segmented reports prepared for external users *must use the same methods and definitions that the companies use in internal segmented reports that are prepared to aid in making operating decisions.* This is a very unusual stipulation because companies are not ordinarily required to report the same data to external users that are used for internal decision-making purposes. This requirement creates incentives for publicly traded companies to avoid using the contribution format for internal segmented reports. Segmented contribution format income statements contain vital information that companies are often very reluctant to release to the public (and hence competitors). In addition, this requirement creates problems in reconciling internal and external reports.

IN BUSINESS

3M REPORTS SEGMENTED PROFITABILITY TO SHAREHOLDERS



In 2009, 3M Company reported segmented profitability to its shareholders by product lines and geographic areas. A portion of the company's segmented information is summarized below (all numbers are in millions):

	Net Sales	Net Operating Income
Product Lines:		
Industrial and transportation	$7,116	$1,238
Health care	$4,294	$1,350
Consumer and office	$3,471	$748
Safety, security, and protection services	$3,180	$745
Display and graphics	$3,132	$590
Electro and communications	$2,276	$322
Geographic Areas:		
United States	$8,509	$1,640
Asia Pacific	$6,120	$1,528
Europe, Middle East and Africa	$5,972	$1,003
Latin America and Canada	$2,516	$631

3M's annual report does not report the gross margins or contribution margins for its business segments. Why do you think this is the case?

Source: 3M Company, 2009 Annual Report.

Summary

Variable and absorption costing are alternative methods of determining unit product costs. Under variable costing, only those manufacturing costs that vary with output are treated as product costs. This includes direct materials, variable overhead, and ordinarily direct labor. Fixed manufacturing overhead is treated as a period cost and it is expensed on the income statement as incurred. By contrast, absorption costing treats fixed manufacturing overhead as a product cost, along with direct materials, direct labor, and variable overhead. Under both costing methods, selling and administrative expenses are treated as period costs and they are expensed on the income statement as incurred.

Because absorption costing treats fixed manufacturing overhead as a product cost, a portion of fixed manufacturing overhead is assigned to each unit as it is produced. If units of product are unsold at the end of a period, then the fixed manufacturing overhead cost attached to those units is carried with them into the inventory account and deferred to a future period. When these units are later sold, the fixed manufacturing overhead cost attached to them is released from the inventory account and charged against income as part of cost of goods sold. Thus, under absorption costing, it is possible to defer a portion of the fixed manufacturing overhead cost from one period to a future period through the inventory account.

Unfortunately, this shifting of fixed manufacturing overhead cost between periods can cause erratic fluctuations in net operating income and can result in confusion and unwise decisions. To guard against mistakes when they interpret income statement data, managers should be alert to changes in inventory levels or unit product costs during the period.

Segmented income statements provide information for evaluating the profitability and performance of divisions, product lines, sales territories, and other segments of a company. Under the contribution approach, variable costs and fixed costs are clearly distinguished from each other and only those costs that are traceable to a segment are assigned to the segment. A cost is considered traceable to a segment only if the cost is caused by the segment and could be avoided by eliminating the segment. Fixed common costs are not allocated to segments. The segment margin consists of revenues, less variable expenses, less traceable fixed expenses of the segment.

Review Problem 1: Contrasting Variable and Absorption Costing

Dexter Corporation produces and sells a single product, a wooden hand loom for weaving small items such as scarves. Selected cost and operating data relating to the product for two years are given below:

Selling price per unit	$50
Manufacturing costs:	
Variable per unit produced:	
Direct materials	$11
Direct labor	$6
Variable manufacturing overhead	$3
Fixed manufacturing overhead per year	$120,000
Selling and administrative expenses:	
Variable per unit sold	$4
Fixed per year	$70,000

	Year 1	Year 2
Units in beginning inventory	0	2,000
Units produced during the year	10,000	6,000
Units sold during the year	8,000	8,000
Units in ending inventory	2,000	0

Required:

1. Assume the company uses absorption costing.
   a. Compute the unit product cost in each year.
   b. Prepare an income statement for each year.

2. Assume the company uses variable costing.
   a. Compute the unit product cost in each year.
   b. Prepare an income statement for each year.
3. Reconcile the variable costing and absorption costing net operating incomes.

Solution to Review Problem 1

1. *a.* Under absorption costing, all manufacturing costs, variable and fixed, are included in unit product costs:

	Year 1	Year 2
Direct materials	$11	$11
Direct labor	6	6
Variable manufacturing overhead	3	3
Fixed manufacturing overhead		
($120,000 ÷ 10,000 units)	12	
($120,000 ÷ 6,000 units)		20
Absorption costing unit product cost	$32	$40

b. The absorption costing income statements follow:

	Year 1	Year 2
Sales (8,000 units × $50 per unit)	$400,000	$400,000
Cost of goods sold (8,000 units × $32 per unit); (2,000 units × $32 per unit) + (6,000 units × $40 per unit)	256,000	304,000
Gross margin	144,000	96,000
Selling and administrative expenses (8,000 units × $4 per unit + $70,000)	102,000	102,000
Net operating income (loss)	$ 42,000	$ (6,000)

2. *a.* Under variable costing, only the variable manufacturing costs are included in unit product costs:

	Year 1	Year 2
Direct materials	$11	$11
Direct labor	6	6
Variable manufacturing overhead	3	3
Variable costing unit product cost	$20	$20

b. The variable costing income statements follow:

	Year 1		Year 2	
Sales (8,000 units × $50 per unit)		$400,000		$400,000
Variable expenses:				
Variable cost of goods sold (8,000 units × $20 per unit)	$160,000		$160,000	
Variable selling and administrative expenses (8,000 units × $4 per unit)	32,000	192,000	32,000	192,000
Contribution margin		208,000		208,000
Fixed expenses:				
Fixed manufacturing overhead	120,000		120,000	
Fixed selling and administrative expenses	70,000	190,000	70,000	190,000
Net operating income		$ 18,000		$ 18,000

3. The reconciliation of the variable and absorption costing net operating incomes follows:

	Year 1	Year 2
Variable costing net operating income	$18,000	$18,000
Add fixed manufacturing overhead costs deferred in inventory under absorption costing (2,000 units × $12 per unit)	24,000	
Deduct fixed manufacturing overhead costs released from inventory under absorption costing (2,000 units × $12 per unit)		(24,000)
Absorption costing net operating income (loss)	$42,000	$ (6,000)

Review Problem 2: Segmented Income Statements

The business staff of the law firm Frampton, Davis & Smythe has constructed the following report which breaks down the firm's overall results for last month into two business segments—family law and commercial law:

	Total	Family Law	Commercial Law
Revenues from clients	$1,000,000	$400,000	$600,000
Variable expenses	220,000	100,000	120,000
Contribution margin	780,000	300,000	480,000
Traceable fixed expenses	670,000	280,000	390,000
Segment margin	110,000	20,000	90,000
Common fixed expenses	60,000	24,000	36,000
Net operating income (loss)	$ 50,000	$ (4,000)	$ 54,000

However, this report is not quite correct. The common fixed expenses such as the managing partner's salary, general administrative expenses, and general firm advertising have been allocated to the two segments based on revenues from clients.

Required:

1. Redo the segment report, eliminating the allocation of common fixed expenses. Would the firm be better off financially if the family law segment were dropped? (Note: Many of the firm's commercial law clients also use the firm for their family law requirements such as drawing up wills.)
2. The firm's advertising agency has proposed an ad campaign targeted at boosting the revenues of the family law segment. The ad campaign would cost $20,000, and the advertising agency claims that it would increase family law revenues by $100,000. The managing partner of Frampton, Davis & Smythe believes this increase in business could be accommodated without any increase in fixed expenses. Estimate the effect this ad campaign would have on the family law segment margin and on the firm's overall net operating income.

Solution to Review Problem 2

1. The corrected segmented income statement appears below:

	Total	Family Law	Commercial Law
Revenues from clients	$1,000,000	$400,000	$600,000
Variable expenses	220,000	100,000	120,000
Contribution margin	780,000	300,000	480,000
Traceable fixed expenses	670,000	280,000	390,000
Segment margin	110,000	$ 20,000	$ 90,000
Common fixed expenses	60,000		
Net operating income	$ 50,000		

No, the firm would not be financially better off if the family law practice were dropped. The family law segment is covering all of its own costs and is contributing $20,000 per month to covering the common fixed expenses of the firm. While the segment margin for family law is much lower than for commercial law, it is still profitable. Moreover, family law may be a service that the firm must provide to its commercial clients in order to remain competitive.

2. The ad campaign can be estimated to increase the family law segment margin by $55,000 as follows:

Increased revenues from clients	$100,000
Family law contribution margin ratio ($300,000 ÷ $400,000)	× 75%
Incremental contribution margin	$ 75,000
Less cost of the ad campaign	20,000
Increased segment margin	$ 55,000

Because there would be no increase in fixed expenses (including common fixed expenses), the increase in overall net operating income is also $55,000.

Glossary

Absorption costing A costing method that includes all manufacturing costs—direct materials, direct labor, and both variable and fixed manufacturing overhead—in unit product costs. (p. 230)

Common fixed cost A fixed cost that supports more than one business segment, but is not traceable in whole or in part to any one of the business segments. (p. 240)

Segment Any part or activity of an organization about which managers seek cost, revenue, or profit data. (p. 230)

Segment margin A segment's contribution margin less its traceable fixed costs. It represents the margin available after a segment has covered all of its own traceable costs. (p. 241)

Traceable fixed cost A fixed cost that is incurred because of the existence of a particular business segment and that would be eliminated if the segment were eliminated. (p. 240)

Variable costing A costing method that includes only variable manufacturing costs—direct materials, direct labor, and variable manufacturing overhead—in unit product costs. (p. 230)

Questions

6–1 What is the basic difference between absorption costing and variable costing?

6–2 Are selling and administrative expenses treated as product costs or as period costs under variable costing?

6–3 Explain how fixed manufacturing overhead costs are shifted from one period to another under absorption costing.

6–4 What are the arguments in favor of treating fixed manufacturing overhead costs as product costs?

6–5 What are the arguments in favor of treating fixed manufacturing overhead costs as period costs?

6–6 If the units produced and unit sales are equal, which method would you expect to show the higher net operating income, variable costing or absorption costing? Why?

6–7 If the units produced exceed unit sales, which method would you expect to show the higher net operating income, variable costing or absorption costing? Why?

6–8 If fixed manufacturing overhead costs are released from inventory under absorption costing, what does this tell you about the level of production in relation to the level of sales?

6–9 Under absorption costing, how is it possible to increase net operating income without increasing sales?

6–10 How does Lean Production reduce or eliminate the difference in reported net operating income between absorption and variable costing?

6–11 What is a segment of an organization? Give several examples of segments.

6–12 What costs are assigned to a segment under the contribution approach?

6–13 Distinguish between a traceable cost and a common cost. Give several examples of each.

6–14 Explain how the segment margin differs from the contribution margin.

6–15 Why aren't common costs allocated to segments under the contribution approach?
6–16 How is it possible for a cost that is traceable to a segment to become a common cost if the segment is divided into further segments?

Multiple-choice questions are provided on the text website at www.mhhe.com/garrison14e.

Applying Excel

Available with McGraw-Hill's *Connect™ Accounting*.

LEARNING OBJECTIVE 2

The Excel worksheet form that appears below is to be used to recreate portions of Review Problem 1 on pages 249–251. Download the workbook containing this form from the Online Learning Center at www.mhhe.com/garrison14e. *On the website you will also receive instructions about how to use this worksheet form.*

	A	B	C	D	E	F
1	**Chapter 6: Applying Excel**					
2						
3	**Data**					
4	Selling price per unit	$50				
5	Manufacturing costs:					
6	Variable per unit produced:					
7	Direct materials	$11				
8	Direct labor	$6				
9	Variable manufacturing overhead	$3				
10	Fixed manufacturing overhead per year	$120,000				
11	Selling and administrative expenses:					
12	Variable per unit sold	$4				
13	Fixed per year	$70,000				
14						
15		Year 1	Year 2			
16	Units in beginning inventory	0				
17	Units produced during the year	10,000	6,000			
18	Units sold during the year	8,000	8,000			
19						
20	*Enter a formula into each of the cells marked with a ? below*					
21	**Review Problem 1: Contrasting Variable and Absorption Costing**					
22						
23	***Compute the Ending Inventory***					
24		Year 1	Year 2			
25	Units in beginning inventory	0	?			
26	Units produced during the year	?	?			
27	Units sold during the year	?	?			
28	Units in ending inventory	?	?			
29						
30	***Compute the Absorption Costing Unit Product Cost***					
31		Year 1	Year 2			
32	Direct materials	?	?			
33	Direct labor	?	?			
34	Variable manufacturing overhead	?	?			
35	Fixed manufacturing overhead	?	?			
36	Absorption costing unit product cost	?	?			
37						
38	***Construct the Absorption Costing Income Statement***					
39		Year 1	Year 2			
40	Sales	?	?			
41	Cost of goods sold	?	?			
42	Gross margin	?	?			
43	Selling and administrative expenses	?	?			
44	Net operating income	?	?			
45						
46	***Compute the Variable Costing Unit Product Cost***					
47		Year 1	Year 2			
48	Direct materials	?	?			
49	Direct labor	?	?			
50	Variable manufacturing overhead	?	?			
51	Variable costing unit product cost	?	?			
52						
53	***Construct the Variable Costing Income Statement***					
54		Year 1		Year 2		
55	Sales		?		?	
56	Variable expenses:					
57	Variable cost of goods sold	?		?		
58	Variable selling and administrative expenses	?	?	?	?	
59	Contribution margin		?		?	
60	Fixed expenses:					
61	Fixed manufacturing overhead	?		?		
62	Fixed selling and administrative expenses	?	?	?	?	
63	Net operating income		?		?	
64						

Chapter 6 Form | Filled in Chapter 6 Form | Chapter 6

You should proceed to the requirements below only after completing your worksheet.

Required:

1. Check your worksheet by changing the units sold in the Data to 6,000 for Year 2. The cost of goods sold under absorption costing for Year 2 should now be $240,000. If it isn't, check cell C41. The formula in this cell should be =IF(C26<C27,C26*C36+(C27-C26)*B36,C27*C36).] If your worksheet is operating properly, the net operating income under both absorption costing and variable costing should be $(34,000) for Year 2. That is, the loss in Year 2 is $34,000 under both systems. If you do not get these answers, find the errors in your worksheet and correct them.

   Why is the absorption costing net operating income now equal to the variable costing net operating income in Year 2?
2. Enter the following data from a different company into your worksheet:

Data		
Selling price per unit	$75	
Manufacturing costs:		
Variable per unit produced:		
Direct materials	$12	
Direct labor	$5	
Variable manufacturing overhead	$7	
Fixed manufacturing overhead per year	$150,000	
Selling and administrative expenses:		
Variable per unit sold	$1	
Fixed per year	$60,000	
	Year 1	Year 2
Units in beginning inventory	0	
Units produced during the year	15,000	10,000
Units sold during the year	12,000	12,000

   Is the net operating income under variable costing different in Year 1 and Year 2? Why or why not? Explain the relation between the net operating income under absorption costing and variable costing in Year 1. Explain the relation between the net operating income under absorption costing and variable costing in Year 2.
3. At the end of Year 1, the company's board of directors set a target for Year 2 of net operating income of $500,000 under absorption costing. If this target is met, a hefty bonus would be paid to the CEO of the company. Keeping everything else the same from part (2) above, change the units produced in Year 2 to 50,000 units. Would this change result in a bonus being paid to the CEO? Do you think this change would be in the best interests of the company? What is likely to happen in Year 3 to the absorption costing net operating income if sales remain constant at 12,000 units per year?

Exercises

All applicable exercises are available with McGraw-Hill's *Connect™ Accounting*.

EXERCISE 6–1 Variable and Absorption Costing Unit Product Costs [LO1]

Shastri Bicycle of Bombay, India, produces an inexpensive, yet rugged, bicycle for use on the city's crowded streets that it sells for 500 rupees. (Indian currency is denominated in rupees, denoted by R.) Selected data for the company's operations last year follow:

Units in beginning inventory	0
Units produced	10,000
Units sold	8,000
Units in ending inventory	2,000
Variable costs per unit:	
Direct materials	R120
Direct labor	R140
Variable manufacturing overhead	R50
Variable selling and administrative	R20
Fixed costs:	
Fixed manufacturing overhead	R600,000
Fixed selling and administrative	R400,000

Required:

1. Assume that the company uses absorption costing. Compute the unit product cost for one bicycle.
2. Assume that the company uses variable costing. Compute the unit product cost for one bicycle.

EXERCISE 6–2 Variable Costing Income Statement; Explanation of Difference in Net Operating Income [LO2]

Refer to the data in Exercise 6–1 for Shastri Bicycle. The absorption costing income statement prepared by the company's accountant for last year appears below:

Sales	R4,000,000
Cost of goods sold	2,960,000
Gross margin	1,040,000
Selling and administrative expense	560,000
Net operating income	R 480,000

Required:

1. Determine how much of the ending inventory consists of fixed manufacturing overhead cost deferred in inventory to the next period.
2. Prepare an income statement for the year using variable costing. Explain the difference in net operating income between the two costing methods.

EXERCISE 6–3 Reconciliation of Absorption and Variable Costing Net Operating Incomes [LO3]

High Tension Transformers, Inc., manufactures heavy-duty transformers for electrical switching stations. The company uses variable costing for internal management reports and absorption costing for external reports to shareholders, creditors, and the government. The company has provided the following data:

	Year 1	Year 2	Year 3
Inventories:			
Beginning (units)	180	150	160
Ending (units)	150	160	200
Variable costing net operating income	$292,400	$269,200	$251,800

The company's fixed manufacturing overhead per unit was constant at $450 for all three years.

Required:

1. Determine each year's absorption costing net operating income. Present your answer in the form of a reconciliation report.
2. In Year 4, the company's variable costing net operating income was $240,200 and its absorption costing net operating income was $267,200. Did inventories increase or decrease during Year 4? How much fixed manufacturing overhead cost was deferred or released from inventory during Year 4?

EXERCISE 6–4 Basic Segmented Income Statement [LO4]

Caltec, Inc., produces and sells recordable CD and DVD packs. Revenue and cost information relating to the products follow:

	Product	
	CD	DVD
Selling price per pack	$8.00	$25.00
Variable expenses per pack	$3.20	$17.50
Traceable fixed expenses per year	$138,000	$45,000

Common fixed expenses in the company total $105,000 annually. Last year the company produced and sold 37,500 CD packs and 18,000 DVD packs.

Required:

Prepare a contribution format income statement for the year segmented by product lines.

EXERCISE 6–5 Deducing Changes in Inventories [LO3]

Ferguson Products Inc., a manufacturer, reported $130 million in sales and a loss of $25 million in its absorption costing income statement provided to shareholders. According to a CVP analysis prepared for management, the company's break-even point is $120 million in sales.

Required:

Assuming that the CVP analysis is correct, is it likely that the company's inventory level increased, decreased, or remained unchanged during the year? Explain.

EXERCISE 6–6 Inferring Costing Method; Unit Product Cost [LO1]

Amcor, Inc., incurs the following costs to produce and sell a single product.

Variable costs per unit:	
Direct materials	$10
Direct labor	$5
Variable manufacturing overhead	$2
Variable selling and administrative expenses	$4
Fixed costs per year:	
Fixed manufacturing overhead	$90,000
Fixed selling and administrative expenses	$300,000

During the last year, 30,000 units were produced and 25,000 units were sold. The Finished Goods inventory account at the end of the year shows a balance of $85,000 for the 5,000 unsold units.

Required:

1. Is the company using absorption costing or variable costing to cost units in the Finished Goods inventory account? Show computations to support your answer.
2. Assume that the company wishes to prepare financial statements for the year to issue to its stockholders.
   a. Is the $85,000 figure for Finished Goods inventory the correct amount to use on these statements for external reporting purposes? Explain.
   b. At what dollar amount *should* the 5,000 units be carried in inventory for external reporting purposes?

EXERCISE 6–7 Variable and Absorption Costing Unit Product Costs and Income Statements [LO1, LO2]

Maxwell Company manufactures and sells a single product. The following costs were incurred during the company's first year of operations:

Variable costs per unit:	
Manufacturing:	
Direct materials	$18
Direct labor	$7
Variable manufacturing overhead	$2
Variable selling and administrative	$2
Fixed costs per year:	
Fixed manufacturing overhead	$200,000
Fixed selling and administrative expenses	$110,000

During the year, the company produced 20,000 units and sold 16,000 units. The selling price of the company's product is $50 per unit.

Required:

1. Assume that the company uses absorption costing:
   a. Compute the unit product cost.
   b. Prepare an income statement for the year.
2. Assume that the company uses variable costing:
   a. Compute the unit product cost.
   b. Prepare an income statement for the year.
3. The company's controller believes that the company should have set last year's selling price at $51 instead of $50 per unit. She estimates the company could have sold 15,000 units at a price of $51 per unit, thereby increasing the company's gross margin by $2,000 and its net operating income by $4,000. Assuming the controller's estimates are accurate, do you think the price increase would have been a good idea?

EXERCISE 6–8 Segmented Income Statement [LO4]

Michaels Company segments its income statement into its East and West Divisions. The company's overall sales, contribution margin ratio, and net operating income are $600,000, 50%, and $50,000, respectively. The West Division's contribution margin and contribution margin ratio are $150,000 and 75%, respectively. The East Division's segment margin is $70,000. The company has $60,000 of common fixed costs that cannot be traced to either division.

Required:

Prepare an income statement for Michaels Company that uses the contribution format and is segmented by divisions. In addition, for the company as a whole and for each segment, show each item on the segmented income statements as a percent of sales.

EXERCISE 6–9 Variable Costing Unit Product Cost and Income Statement; Break-Even [LO1, LO2]

CompuDesk, Inc., makes an oak desk specially designed for personal computers. The desk sells for $200. Data for last year's operations follow:

Units in beginning inventory	0
Units produced	10,000
Units sold	9,000
Units in ending inventory	1,000
Variable costs per unit:	
Direct materials	$ 60
Direct labor	30
Variable manufacturing overhead	10
Variable selling and administrative	20
Total variable cost per unit	$120
Fixed costs:	
Fixed manufacturing overhead	$300,000
Fixed selling and administrative	450,000
Total fixed costs	$750,000

Required:

1. Assume that the company uses variable costing. Compute the unit product cost for one computer desk.
2. Assume that the company uses variable costing. Prepare a contribution format income statement for the year.
3. What is the company's break-even point in terms of units sold?

EXERCISE 6–10 Absorption Costing Unit Product Cost and Income Statement [LO1, LO2]

Refer to the data in Exercise 6–9 for CompuDesk. Assume in this exercise that the company uses absorption costing.

Required:

1. Compute the unit product cost for one computer desk.
2. Prepare an income statement.

EXERCISE 6–11 Segmented Income Statement [LO4]

Bovine Company, a wholesale distributor of DVDs, has been experiencing losses for some time, as shown by its most recent monthly contribution format income statement below:

Sales	$1,500,000
Variable expenses	588,000
Contribution margin	912,000
Fixed expenses	945,000
Net operating loss	$ (33,000)

In an effort to isolate the problem, the president has asked for an income statement segmented by geographic market. Accordingly, the Accounting Department has developed the following data:

	Geographic Market		
	South	Central	North
Sales	$400,000	$600,000	$500,000
Variable expenses as a percentage of sales	52%	30%	40%
Traceable fixed expenses	$240,000	$330,000	$200,000

Required:

1. Prepare a contribution format income statement segmented by geographic market, as desired by the president.
2. The company's sales manager believes that sales in the Central geographic market could be increased by 15% if monthly advertising were increased by $25,000. Would you recommend the increased advertising? Show computations to support your answer.

EXERCISE 6–12 Variable and Absorption Costing Unit Product Costs and Income Statements [LO1, LO2, LO3]

Fletcher Company manufactures and sells one product. The following information pertains to each of the company's first two years of operations:

Variable costs per unit:	
Manufacturing:	
Direct materials	$20
Direct labor	$12
Variable manufacturing overhead	$4
Variable selling and administrative	$3
Fixed costs per year:	
Fixed manufacturing overhead	$200,000
Fixed selling and administrative expenses	$80,000

During its first year of operations, Fletcher produced 50,000 units and sold 40,000 units. During its second year of operations, it produced 40,000 units and sold 50,000 units. The selling price of the company's product is $50 per unit.

Required:

1. Assume the company uses variable costing:
   a. Compute the unit product cost for year 1 and year 2.
   b. Prepare an income statement for year 1 and year 2.
2. Assume the company uses absorption costing:
   a. Compute the unit product cost for year 1 and year 2.
   b. Prepare an income statement for year 1 and year 2.
3. Explain the difference between variable costing and absorption costing net operating income in year 1. Also, explain why the two net operating incomes differ in year 2.

EXERCISE 6–13 Variable Costing Income Statement; Reconciliation [LO2, LO3]

Morey Company has just completed its first year of operations. The company's absorption costing income statement for the year appears below:

Morey Company Income Statement	
Sales (40,000 units at $33.75 per unit)	$1,350,000
Cost of goods sold (40,000 units × $21 per unit)	840,000
Gross margin	510,000
Selling and administrative expenses	420,000
Net operating income	$ 90,000

The company's selling and administrative expenses consist of $300,000 per year in fixed expenses and $3 per unit sold in variable expenses. The company's $21 per unit product cost given above is computed as follows:

Direct materials	$10
Direct labor	4
Variable manufacturing overhead	2
Fixed manufacturing overhead ($250,000 ÷ 50,000 units)	5
Absorption costing unit product cost	$21

Required:

1. Redo the company's income statement in the contribution format using variable costing.
2. Reconcile any difference between the net operating income on your variable costing income statement and the net operating income on the absorption costing income statement.


EXERCISE 6–14 Working with a Segmented Income Statement [LO4]

Marple Associates is a consulting firm that specializes in information systems for construction and landscaping companies. The firm has two offices—one in Houston and one in Dallas. The firm classifies the direct costs of consulting jobs as variable costs. A segmented contribution format income statement for the company's most recent year is given below:

	Total Company		Office			
			Houston		Dallas	
Sales	$750,000	100.0%	$150,000	100%	$600,000	100%
Variable expenses	405,000	54.0	45,000	30	360,000	60
Contribution margin	345,000	46.0	105,000	70	240,000	40
Traceable fixed expenses	168,000	22.4	78,000	52	90,000	15
Office segment margin	177,000	23.6	$ 27,000	18%	$150,000	25%
Common fixed expenses not traceable to offices	120,000	16.0				
Net operating income	$ 57,000	7.6%				

Required:

1. By how much would the company's net operating income increase if Dallas increased its sales by $75,000 per year? Assume no change in cost behavior patterns.
2. Refer to the original data. Assume that sales in Houston increase by $50,000 next year and that sales in Dallas remain unchanged. Assume no change in fixed costs.
   a. Prepare a new segmented income statement for the company using the above format. Show both amounts and percentages.
   b. Observe from the income statement you have prepared that the CM ratio for Houston has remained unchanged at 70% (the same as in the above data) but that the segment margin ratio has changed. How do you explain the change in the segment margin ratio?


EXERCISE 6–15 Working with a Segmented Income Statement [LO4]

Refer to the data in Exercise 6–14. Assume that Dallas' sales by major market are as follows:

	Dallas		Market			
			Construction Clients		Landscaping Clients	
Sales	$600,000	100%	$400,000	100%	$200,000	100%
Variable expenses	360,000	60	260,000	65	100,000	50
Contribution margin	240,000	40	140,000	35	100,000	50
Traceable fixed expenses	72,000	12	20,000	5	52,000	26
Market segment margin	168,000	28	$120,000	30%	$ 48,000	24%
Common fixed expenses not traceable to markets	18,000	3				
Office segment margin	$150,000	25%				

The company would like to initiate an intensive advertising campaign in one of the two markets during the next month. The campaign would cost $8,000. Marketing studies indicate that such a campaign would increase sales in the construction market by $70,000 or increase sales in the landscaping market by $60,000.

Required:

1. In which of the markets would you recommend that the company focus its advertising campaign? Show computations to support your answer.
2. In Exercise 6–14, Dallas shows $90,000 in traceable fixed expenses. What happened to the $90,000 in this exercise?

Problems

All applicable problems are available with McGraw-Hill's *Connect™ Accounting*.

PROBLEM 6–16 Variable and Absorption Costing Unit Product Costs and Income Statements; Explanation of Difference in Net Operating Income [LO1, LO2, LO3]

Wiengot Antennas, Inc., produces and sells a unique type of TV antenna. The company has just opened a new plant to manufacture the antenna, and the following cost and revenue data have been provided for the first month of the plant's operation in the form of a worksheet.

	A	B	C
1	Beginning inventory	0	
2	Units produced	40,000	
3	Units sold	35,000	
4	Selling price per unit	$60	
5			
6	Selling and administrative expenses:		
7	Variable per unit	$2	
8	Fixed (total)	$560,000	
9	Manufacturing costs		
10	Direct materials cost per unit	$15	
11	Direct labor cost per unit	$7	
12	Variable manufacturing overhead cost per unit	$2	
13	Fixed manufacturing overhead cost (total)	$640,000	
14			

Sheet1 Sheet2 Sheet3

Because the new antenna is unique in design, management is anxious to see how profitable it will be and has asked that an income statement be prepared for the month.

Required:

1. Assume that the company uses absorption costing.
   a. Determine the unit product cost.
   b. Prepare an income statement for the month.
2. Assume that the company uses variable costing.
   a. Determine the unit product cost.
   b. Prepare a contribution format income statement for the month.
3. Explain the reason for any difference in the ending inventory balances under the two costing methods and the impact of this difference on reported net operating income.

PROBLEM 6–17 Variable and Absorption Costing Unit Product Costs and Income Statements [LO1, LO2]

Nickelson Company manufactures and sells one product. The following information pertains to each of the company's first three years of operations:

Variable costs per unit:	
Manufacturing:	
Direct materials	$25
Direct labor	$16
Variable manufacturing overhead	$5
Variable selling and administrative	$2
Fixed costs per year:	
Fixed manufacturing overhead	$300,000
Fixed selling and administrative expenses	$180,000

During its first year of operations Nickelson produced 60,000 units and sold 60,000 units. During its second year of operations it produced 75,000 units and sold 50,000 units. In its third year, Nickelson produced 40,000 units and sold 65,000 units. The selling price of the company's product is $56 per unit.

Required:

1. Compute the company's break-even point in units sold.
2. Assume the company uses variable costing:
   a. Compute the unit product cost for year 1, year 2, and year 3.
   b. Prepare an income statement for year 1, year 2, and year 3.
3. Assume the company uses absorption costing:
   a. Compute the unit product cost for year 1, year 2, and year 3.
   b. Prepare an income statement for year 1, year 2, and year 3.
4. Compare the net operating income figures that you computed in requirements 2 and 3 to the break-even point that you computed in requirement 1. Which net operating income figures seem counterintuitive? Why?

PROBLEM 6–18 Variable Costing Income Statement; Reconciliation [LO2, LO3]

During Denton Company's first two years of operations, the company reported absorption costing net operating income as follows:

	Year 1	Year 2
Sales (@ $50 per unit)	$1,000,000	$1,500,000
Cost of goods sold (@ $34 per unit)	680,000	1,020,000
Gross margin	320,000	480,000
Selling and administrative expenses*	310,000	340,000
Net operating income	$ 10,000	$ 140,000

*$3 per unit variable; $250,000 fixed each year.

The company's $34 unit product cost is computed as follows:

Direct materials	$ 8
Direct labor	10
Variable manufacturing overhead	2
Fixed manufacturing overhead ($350,000 ÷ 25,000 units)	14
Absorption costing unit product cost	$34

Production and cost data for the two years are given below:

	Year 1	Year 2
Units produced	25,000	25,000
Units sold	20,000	30,000

Required:

1. Prepare a variable costing contribution format income statement for each year.
2. Reconcile the absorption costing and variable costing net operating income figures for each year.

PROBLEM 6–19 Segment Reporting and Decision Making [LO4]


The most recent monthly contribution format income statement for Reston Company is given below:

Reston Company Income Statement For the Month Ended May 31		
Sales	$900,000	100.0%
Variable expenses	408,000	45.3
Contribution margin	492,000	54.7
Fixed expenses	465,000	51.7
Net operating income	$ 27,000	3.0%

Management is disappointed with the company's performance and is wondering what can be done to improve profits. By examining sales and cost records, you have determined the following:

a. The company is divided into two sales territories—Central and Eastern. The Central Territory recorded $400,000 in sales and $208,000 in variable expenses during May. The remaining sales and variable expenses were recorded in the Eastern Territory. Fixed expenses of $160,000 and $130,000 are traceable to the Central and Eastern Territories, respectively. The rest of the fixed expenses are common to the two territories.
b. The company is the exclusive distributor for two products—Awls and Pows. Sales of Awls and Pows totaled $100,000 and $300,000, respectively, in the Central Territory during May. Variable expenses are 25% of the selling price for Awls and 61% for Pows. Cost records show that $60,000 of the Central Territory's fixed expenses are traceable to Awls and $54,000 to Pows, with the remainder common to the two products.

Required:

1. Prepare contribution format segmented income statements, first showing the total company broken down between sales territories and then showing the Central Territory broken down by product line. In addition, for the company as a whole and for each segment, show each item on the segmented income statements as a percent of sales.
2. Look at the statement you have prepared showing the total company segmented by sales territory. What points revealed by this statement should be brought to management's attention?
3. Look at the statement you have prepared showing the Central Territory segmented by product lines. What points revealed by this statement should be brought to management's attention?

PROBLEM 6–20 Comprehensive Problem with Labor Fixed [LO1, LO2, LO3]

Advance Products, Inc., has just organized a new division to manufacture and sell specially designed tables using select hardwoods for personal computers. The division's monthly costs are shown in the schedule below:

Manufacturing costs:	
Variable costs per unit:	
Direct materials	$86
Variable manufacturing overhead	$4
Fixed manufacturing overhead costs (total)	$240,000
Selling and administrative costs:	
Variable	15% of sales
Fixed (total)	$160,000

Advance Products regards all of its workers as full-time employees and the company has a long-standing no-layoff policy. Furthermore, production is highly automated. Accordingly, the company includes its labor costs in its fixed manufacturing overhead. The tables sell for $250 each.

During the first month of operations, the following activity was recorded:

Units produced	4,000
Units sold	3,200

Required:

1. Compute the unit product cost under:
   a. Absorption costing.
   b. Variable costing.
2. Prepare an income statement for the month using absorption costing.
3. Prepare a contribution format income statement for the month using variable costing.
4. Assume that the company must obtain additional financing. As a member of top management, which of the statements that you have prepared in (2) and (3) above would you prefer to take with you to negotiate with the bank? Why?
5. Reconcile the absorption costing and variable costing net operating incomes in (2) and (3) above.

PROBLEM 6–21 Prepare and Reconcile Variable Costing Statements [LO1, LO2, LO3]

Linden Company manufactures and sells a single product. Cost data for the product follow:

Variable costs per unit:	
Direct materials	$ 6
Direct labor	12
Variable factory overhead	4
Variable selling and administrative	3
Total variable costs per unit	$25
Fixed costs per month:	
Fixed manufacturing overhead	$240,000
Fixed selling and administrative	180,000
Total fixed cost per month	$420,000

The product sells for $40 per unit. Production and sales data for May and June, the first two months of operations, are as follows:

	Units Produced	Units Sold
May	30,000	26,000
June	30,000	34,000

Income statements prepared by the accounting department, using absorption costing, are presented below:

	May	June
Sales	$1,040,000	$1,360,000
Cost of goods sold	780,000	1,020,000
Gross margin	260,000	340,000
Selling and administrative expenses	258,000	282,000
Net operating income	$ 2,000	$ 58,000

Required:

1. Determine the unit product cost under:
   a. Absorption costing.
   b. Variable costing.
2. Prepare contribution format variable costing income statements for May and June.
3. Reconcile the variable costing and absorption costing net operating incomes.
4. The company's Accounting Department has determined the break-even point to be 28,000 units per month, computed as follows:

$$\frac{\text{Fixed cost per month}}{\text{Unit contribution margin}} = \frac{\$420{,}000}{\$15 \text{ per unit}} = 28{,}000 \text{ units}$$

Upon receiving this figure, the president commented, "There's something peculiar here. The controller says that the break-even point is 28,000 units per month. Yet we sold only 26,000 units in

May, and the income statement we received showed a $2,000 profit. Which figure do we believe?" Prepare a brief explanation of what happened on the May income statement.

PROBLEM 6–22 Absorption and Variable Costing; Production Constant, Sales Fluctuate [LO1, LO2, LO3]

Sandi Scott obtained a patent on a small electronic device and organized Scott Products, Inc., to produce and sell the device. During the first month of operations, the device was very well received on the market, so Ms. Scott looked forward to a healthy profit. For this reason, she was surprised to see a loss for the month on her income statement. This statement was prepared by her accounting service, which takes great pride in providing its clients with timely financial data. The statement follows:

Scott Products, Inc. Income Statement		
Sales (40,000 units)		$200,000
Variable expenses:		
Variable cost of goods sold	$80,000	
Variable selling and administrative expenses	30,000	110,000
Contribution margin		90,000
Fixed expenses:		
Fixed manufacturing overhead	75,000	
Fixed selling and administrative expenses	20,000	95,000
Net operating loss		$ (5,000)

Ms. Scott is discouraged over the loss shown for the month, particularly because she had planned to use the statement to encourage investors to purchase stock in the new company. A friend, who is a CPA, insists that the company should be using absorption costing rather than variable costing. He argues that if absorption costing had been used, the company would probably have reported a profit for the month.

Selected cost data relating to the product and to the first month of operations follow:

Units produced	50,000
Units sold	40,000
Variable costs per unit:	
Direct materials	$1.00
Direct labor	$0.80
Variable manufacturing overhead	$0.20
Variable selling and administrative expenses	$0.75

Required:

1. Complete the following:
   a. Compute the unit product cost under absorption costing.
   b. Redo the company's income statement for the month using absorption costing.
   c. Reconcile the variable and absorption costing net operating income (loss) figures.
2. Was the CPA correct in suggesting that the company really earned a "profit" for the month? Explain.
3. During the second month of operations, the company again produced 50,000 units but sold 60,000 units. (Assume no change in total fixed costs.)
   a. Prepare a contribution format income statement for the month using variable costing.
   b. Prepare an income statement for the month using absorption costing.
   c. Reconcile the variable costing and absorption costing net operating incomes.

PROBLEM 6–23 Restructuring a Segmented Income Statement [LO4]

Brabant NV of the Netherlands is a wholesale distributor of Dutch cheeses that it sells throughout the European Community. Unfortunately, the company's profits have been declining, which has caused considerable concern. To help understand the condition of the company, the managing director of the company has requested that the monthly income statement be segmented by sales territory. Accordingly, the company's accounting department has prepared the following statement for March, the most recent month. (The Dutch currency is the euro which is designated by €.)

	Sales Territory		
	Southern Europe	Middle Europe	Northern Europe
Sales	€300,000	€800,000	€700,000
Territorial expenses (traceable):			
Cost of goods sold	93,000	240,000	315,000
Salaries	54,000	56,000	112,000
Insurance	9,000	16,000	14,000
Advertising	105,000	240,000	245,000
Depreciation	21,000	32,000	28,000
Shipping	15,000	32,000	42,000
Total territorial expenses	297,000	616,000	756,000
Territorial income (loss) before corporate expenses	3,000	184,000	(56,000)
Corporate expenses:			
Advertising (general)	15,000	40,000	35,000
General administrative	20,000	20,000	20,000
Total corporate expenses	35,000	60,000	55,000
Net operating income (loss)	€(32,000)	€124,000	€(111,000)

Cost of goods sold and shipping expenses are both variable; other costs are all fixed. Brabant NV purchases cheeses at auction and from farmers' cooperatives, and it distributes them in the three territories listed above. Each of the three sales territories has its own manager and sales staff. The cheeses vary widely in profitability; some have a high margin and some have a low margin. (Certain cheeses, after having been aged for long periods, are the most expensive and carry the highest margins.)

Required:

1. List any disadvantages or weaknesses that you see to the statement format illustrated above.
2. Explain the basis that is apparently being used to allocate the corporate expenses to the territories. Do you agree with these allocations? Explain.
3. Prepare a new segmented contribution format income statement for May. Show a Total column as well as data for each territory. In addition, for the company as a whole and for each sales territory, show each item on the segmented income statement as a percent of sales.
4. Analyze the statement that you prepared in (3) above. What points that might help to improve the company's performance would you bring to management's attention?


PROBLEM 6–24 Incentives Created by Absorption Costing; Ethics and the Manager [LO2]

Aristotle Constantinos, the manager of DuraProducts' Australian Division, is trying to set the production schedule for the last quarter of the year. The Australian Division had planned to sell 100,000 units during the year, but current projections indicate sales will be only 78,000 units in total. By September 30 the following activity had been reported:

	Units
Inventory, January 1	0
Production	72,000
Sales	60,000
Inventory, September 30	12,000

Demand has been soft, and the sales forecast for the last quarter is only 18,000 units.

The division can rent warehouse space to store up to 30,000 units. The division should maintain a minimum inventory level of at least 1,500 units. Mr. Constantinos is aware that production

must be at least 6,000 units per quarter in order to retain a nucleus of key employees. Maximum production capacity is 45,000 units per quarter.

Due to the nature of the division's operations, fixed manufacturing overhead is a major element of product cost.

Required:

1. Assume that the division is using variable costing. How many units should be scheduled for production during the last quarter of the year? (The basic formula for computing the required production for a period in a company is: Expected sales + Desired ending inventory − Beginning inventory = Required production.) Show computations and explain your answer. Will the number of units scheduled for production affect the division's reported profit for the year? Explain.
2. Assume that the division is using absorption costing and that the divisional manager is given an annual bonus based on the division's net operating income. If Mr. Constantinos wants to maximize his division's net operating income for the year, how many units should be scheduled for production during the last quarter? [See the formula in (1) above.] Explain.
3. Identify the ethical issues involved in the decision Mr. Constantinos must make about the level of production for the last quarter of the year.

PROBLEM 6–25 Prepare and Interpret Statements; Changes in Both Sales and Production; Lean Production [LO1, LO2, LO3]

eXcel

Memotec, Inc., manufactures and sells a unique electronic part. Operating results for the first three years of activity were as follows (absorption costing basis):

	Year 1	Year 2	Year 3
Sales	$1,000,000	$800,000	$1,000,000
Cost of goods sold	800,000	560,000	850,000
Gross margin	200,000	240,000	150,000
Selling and administrative expenses	170,000	150,000	170,000
Net operating income (loss)	$ 30,000	$ 90,000	$ (20,000)

Sales dropped by 20% during Year 2 due to the entry of several foreign competitors into the market. Memotec had expected sales to remain constant at 50,000 units for the year; production was set at 60,000 units in order to build a buffer of protection against unexpected spurts in demand. By the start of Year 3, management could see that spurts in demand were unlikely and that the inventory was excessive. To work off the excessive inventories, Memotec cut back production during Year 3, as shown below:

	Year 1	Year 2	Year 3
Production in units	50,000	60,000	40,000
Sales in units	50,000	40,000	50,000

Additional information about the company follows:

a. The company's plant is highly automated. Variable manufacturing costs (direct materials, direct labor, and variable manufacturing overhead) total only $4 per unit, and fixed manufacturing overhead costs total $600,000 per year.
b. Fixed manufacturing overhead costs are applied to units of product on the basis of each year's production. That is, a new fixed overhead rate is computed each year.
c. Variable selling and administrative expenses are $2 per unit sold. Fixed selling and administrative expenses total $70,000 per year.
d. The company uses a FIFO inventory flow assumption.

Memotec's management can't understand why profits tripled during Year 2 when sales dropped by 20%, and why a loss was incurred during Year 3 when sales recovered to previous levels.

Required:

1. Prepare a contribution format variable costing income statement for each year.
2. Refer to the absorption costing income statements on the previous page.
   a. Compute the unit product cost in each year under absorption costing. (Show how much of this cost is variable and how much is fixed.)
   b. Reconcile the variable costing and absorption costing net operating incomes for each year.
3. Refer again to the absorption costing income statements. Explain why net operating income was higher in Year 2 than it was in Year 1 under the absorption approach, in light of the fact that fewer units were sold in Year 2 than in Year 1.
4. Refer again to the absorption costing income statements. Explain why the company suffered a loss in Year 3 but reported a profit in Year 1, although the same number of units was sold in each year.
5. *a.* Explain how operations would have differed in Year 2 and Year 3 if the company had been using Lean Production with the result that ending inventory was zero.
   b. If Lean Production had been in use during Year 2 and Year 3, and the predetermined overhead rate is based on 50,000 units per year, what would the company's net operating income (or loss) have been in each year under absorption costing? Explain the reason for any differences between these income figures and the figures reported by the company in the statements on the previous page.

PROBLEM 6–26 Segmented Income Statements [LO4]

Vega Foods, Inc., has recently purchased a small mill that it intends to operate as one of its subsidiaries. The newly acquired mill has three products that it offers for sale—wheat cereal, pancake mix, and flour. Each product sells for $10 per package. Materials, labor, and other variable production costs are $3.00 per bag of wheat cereal, $4.20 per bag of pancake mix, and $1.80 per bag of flour. Sales commissions are 10% of sales for any product. All other costs are fixed.

The mill's income statement for the most recent month is given below:

		Product Line		
	Total Company	Wheat Cereal	Pancake Mix	Flour
Sales	$600,000	$200,000	$300,000	$100,000
Expenses:				
Materials, labor, and other	204,000	60,000	126,000	18,000
Sales commissions	60,000	20,000	30,000	10,000
Advertising	123,000	48,000	60,000	15,000
Salaries	66,000	34,000	21,000	11,000
Equipment depreciation	30,000	10,000	15,000	5,000
Warehouse rent	12,000	4,000	6,000	2,000
General administration	90,000	30,000	30,000	30,000
Total expenses	585,000	206,000	288,000	91,000
Net operating income (loss)	$ 15,000	$ (6,000)	$ 12,000	$ 9,000

The following additional information is available about the company:

a. The same equipment is used to mill and package all three products. In the above income statement, equipment depreciation has been allocated on the basis of sales dollars. An analysis of equipment usage indicates that it is used 40% of the time to make wheat cereal, 50% of the time to make pancake mix, and 10% of the time to make flour.
b. All three products are stored in the same warehouse. In the above income statement, the warehouse rent has been allocated on the basis of sales dollars. The warehouse contains 24,000 square feet of space, of which 8,000 square feet are used for wheat cereal, 14,000 square feet are used for pancake mix, and 2,000 square feet are used for flour. The warehouse space costs the company $0.50 per square foot per month to rent.
c. The general administration costs relate to the administration of the company as a whole. In the above income statement, these costs have been divided equally among the three product lines.
d. All other costs are traceable to the product lines.

Vega Foods' management is anxious to improve the mill's 2.5% margin on sales.

Required:

1. Prepare a new contribution format segmented income statement for the month. Adjust the allocation of equipment depreciation and warehouse rent as indicated by the additional information provided.
2. After seeing the income statement in the main body of the problem, management has decided to eliminate the wheat cereal because it is not returning a profit, and to focus all available resources on promoting the pancake mix.
   a. Based on the statement you have prepared, do you agree with the decision to eliminate the wheat cereal? Explain.
   b. Based on the statement you have prepared, do you agree with the decision to focus all available resources on promoting the pancake mix? Assume that an ample market is available for all three products. (Hint: compute the contribution margin ratio for each product.)

connect ACCOUNTING Cases

All applicable cases are available with McGraw-Hill's *Connect™ Accounting*.

CASE 6–27 Variable and Absorption Costing Unit Product Costs and Income Statements [LO1, LO2]

O'Donnell Company manufactures and sells one product. The following information pertains to each of the company's first three years of operations:

Variable costs per unit:	
Manufacturing	
Direct materials	$30
Direct labor	$18
Variable manufacturing overhead	$6
Variable selling and administrative	$4
Fixed costs per year:	
Fixed manufacturing overhead	$600,000
Fixed selling and administrative expenses	$180,000

During its first year of operations, O'Donnell produced 100,000 units and sold 80,000 units. During its second year of operations, it produced 75,000 units and sold 90,000 units. In its third year, O'Donnell produced 80,000 units and sold 75,000 units. The selling price of the company's product is $70 per unit.

Required:

1. Assume the company uses variable costing and a FIFO inventory flow assumption (FIFO means first-in first-out. In other words, it assumes that the oldest units in inventory are sold first):
   a. Compute the unit product cost for year 1, year 2, and year 3.
   b. Prepare an income statement for year 1, year 2, and year 3.
2. Assume the company uses variable costing and a LIFO inventory flow assumption (LIFO means last-in first-out. In other words, it assumes that the newest units in inventory are sold first):
   a. Compute the unit product cost for year 1, year 2, and year 3.
   b. Prepare an income statement for year 1, year 2, and year 3.
3. Assume the company uses absorption costing and a FIFO inventory flow assumption (FIFO means first-in first-out. In other words, it assumes that the oldest units in inventory are sold first):
   a. Compute the unit product cost for year 1, year 2, and year 3.
   b. Prepare an income statement for year 1, year 2, and year 3.
4. Assume the company uses absorption costing and a LIFO inventory flow assumption (LIFO means last-in first-out. In other words, it assumes that the newest units in inventory are sold first):
   a. Compute the unit product cost for year 1, year 2, and year 3.
   b. Prepare an income statement for year 1, year 2, and year 3.


CASE 6–28 Service Organization; Segment Reporting [LO4]

The American Association of Acupuncturists is a professional association for acupuncturists that has 10,000 members. The association operates from a central headquarters but has local chapters throughout North America. The association's monthly journal, *American Acupuncture,* features recent developments in the field. The association also publishes special reports and books, and it sponsors courses that qualify members for the continuing professional education credit required by state certification boards. The association's statement of revenues and expenses for the current year is presented below:

American Association of Acupuncturists Statement of Revenues and Expenses For the Year Ended December 31	
Revenues	$970,000
Expenses:	
Salaries	440,000
Occupancy costs	120,000
Distributions to local chapters	210,000
Printing	82,000
Mailing	24,000
Continuing education instructors' fees	60,000
General and administrative	27,000
Total expenses	963,000
Excess of revenues over expenses	$ 7,000

The board of directors of the association has requested that you construct a segmented income statement that shows the financial contribution of each of the association's four major programs—membership service, journal, books and reports, and continuing education. The following data have been gathered to aid you:

a. Membership dues are $60 per year, of which $15 covers a one-year subscription to the association's journal. The other $45 pays for general membership services.
b. One-year subscriptions to *American Acupuncture* are sold to nonmembers and libraries at $20 per subscription. A total of 1,000 of these subscriptions were sold last year. In addition to subscriptions, the journal generated $50,000 in advertising revenues. The costs per journal subscription, for members as well as nonmembers, were $4 for printing and $1 for mailing.
c. A variety of technical reports and professional books were sold for a total of $70,000 during the year. Printing costs for these materials totaled $25,000, and mailing costs totaled $8,000.
d. The association offers a number of continuing education courses. The courses generated revenues of $230,000 last year.
e. Salary costs and space occupied by each program and the central staff are as follows:

	Salaries	Space Occupied (square feet)
Membership services	$170,000	3,000
Journal	60,000	1,000
Books and reports	40,000	1,000
Continuing education	50,000	2,000
Central staff	120,000	3,000
Total	$440,000	10,000

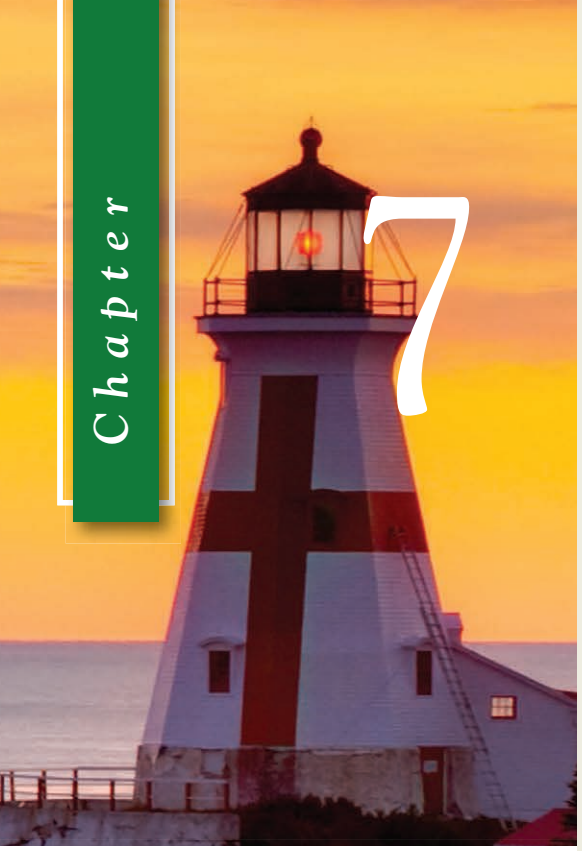
f. The $120,000 in occupancy costs incurred last year includes $20,000 in rental cost for a portion of the warehouse used by the Membership Services program for storage purposes. The association has a flexible rental agreement that allows it to pay rent only on the warehouse space it uses.
g. Printing costs other than for journal subscriptions and for books and reports related to Continuing Education.
h. Distributions to local chapters are for general membership services.

i. General and administrative expenses include costs relating to overall administration of the association as a whole. The association's central staff does some mailing of materials for general administrative purposes.
j. The expenses that can be traced or assigned to the central staff, as well as any other expenses that are not traceable to the programs, will be treated as common costs. It is not necessary to distinguish between variable and fixed costs.

Required:

1. Prepare a contribution format segmented income statement for the American Association of Acupuncturists for last year. This statement should show the segment margin for each program as well as results for the association as a whole.
2. Give arguments for and against allocating all costs of the association to the four programs.

(CMA, adapted)



Chapter 7

Activity-Based Costing: A Tool to Aid Decision Making

LEARNING OBJECTIVES

After studying Chapter 7, you should be able to:

LO1 Understand activity-based costing and how it differs from a traditional costing system.

LO2 Assign costs to cost pools using a first-stage allocation.

LO3 Compute activity rates for cost pools.

LO4 Assign costs to a cost object using a second-stage allocation.

LO5 Use activity-based costing to compute product and customer margins.

LO6 (Appendix 7A) Prepare an action analysis report using activity-based costing data and interpret the report.

LO7 (Appendix 7B) Use activity-based costing techniques to compute unit product costs for external reports.

Managing Product Complexity

BUSINESS FOCUS

Managers often understand that increasing the variety of raw material inputs used in their products increases costs. For example, General Mills studied its 50 varieties of Hamburger Helper and concluded that it could lower costs by discontinuing half of them without alienating customers. Seagate studied seven varieties of its computer hard drives and found that only 2% of their parts could be shared by more than one hard drive. The engineers fixed the problem by redesigning the hard drives so that they used more common component parts. Instead of using 61 types of screws to make the hard drives, the engineers reduced the number of screws needed to 19. Eventually all Seagate products were designed so that 75% of their component parts were shared with other product lines.

Activity-based costing systems quantify the increase in costs, such as procurement costs, material handling costs, and assembly costs that are caused by inefficient product designs and other factors. ■

Sources: Mina Kimes, "Cereal Cost Cutters," *Fortune*, November 10, 2008, p. 24; Erika Brown, "Drive Fast, Drive Hard," *Forbes*, January 9, 2006, pp. 92–96.

This chapter introduces the concept of *activity-based costing* which has been embraced by a wide variety of organizations including Charles Schwab, Citigroup, Lowe's, Coca-Cola, Conco Food Service, Banta Foods, J&B Wholesale, Fairchild Semiconductor, Assan Aluminum, Sysco Foods, Fisher Scientific International, and Peregrine Outfitters. **Activity-based costing (ABC)** is a costing method that is designed to provide managers with cost information for strategic and other decisions that potentially affect capacity and therefore "fixed" as well as variable costs. Activity-based costing is ordinarily used as a supplement to, rather than as a replacement for, a company's usual costing system. Most organizations that use activity-based costing have two costing systems—the official costing system that is used for preparing external financial reports and the activity-based costing system that is used for internal decision making and for managing activities.

This chapter focuses primarily on ABC applications in manufacturing to provide a contrast with the material presented in earlier chapters. More specifically, Chapters 3 and 4 focused on traditional absorption costing systems used by manufacturing companies to calculate unit product costs for the purpose of valuing inventories and determining cost of goods sold for external financial reports. In contrast, this chapter explains how manufacturing companies can use activity-based costing rather than traditional methods to calculate unit product costs for the purposes of managing overhead and making decisions. Chapter 6 had a similar purpose. That chapter focused on how to use variable costing to aid decisions that do not affect fixed costs. This chapter extends that idea to show how activity-based costing can be used to aid decisions that potentially affect fixed costs as well as variable costs.

Activity-Based Costing: An Overview

LEARNING OBJECTIVE 1
Understand activity-based costing and how it differs from a traditional costing system.

As stated above, traditional absorption costing is designed to provide data for external financial reports. In contrast, activity-based costing is designed to be used for internal decision making. As a consequence, activity-based costing differs from traditional cost accounting in three ways. In activity-based costing:

1. Nonmanufacturing as well as manufacturing costs may be assigned to products, but only on a cause-and-effect basis.
2. Some manufacturing costs may be excluded from product costs.
3. Numerous overhead cost pools are used, each of which is allocated to products and other cost objects using its own unique measure of activity.

Each of these departures from traditional cost accounting practice will be discussed in turn.

Nonmanufacturing Costs and Activity-Based Costing

In traditional cost accounting, only manufacturing costs are assigned to products. Selling and administrative expenses are treated as period expenses and are not assigned to products. However, many of these nonmanufacturing costs are also part of the costs of selling, distributing, and servicing specific products. For example, commissions paid to salespersons, shipping costs, and warranty repair costs can be easily traced to individual products. In this chapter, we will use the term *overhead* to refer to nonmanufacturing costs as well as to indirect manufacturing costs. In activity-based costing, products are assigned all of the overhead costs—nonmanufacturing as well as manufacturing—that they can reasonably be supposed to have caused. In essence, we will be determining the entire cost of a product rather than just its manufacturing cost. The focus in Chapters 3 and 4 was on determining just the manufacturing cost of a product.

Manufacturing Costs and Activity-Based Costing

In traditional cost accounting systems, *all* manufacturing costs are assigned to products—even manufacturing costs that are not caused by the products. For example, in Chapter 3 we learned that a predetermined plantwide overhead rate is computed by dividing *all* budgeted manufacturing overhead costs by a measure of budgeted activity such as direct labor-hours. This approach spreads *all* manufacturing overhead costs across products based on each product's direct labor-hour usage. In contrast, activity-based costing systems purposely do not assign two types of manufacturing overhead costs to products.

Manufacturing overhead includes costs such as the factory security guard's wages, the plant controller's salary, and the cost of supplies used by the plant manager's secretary. These types of costs are assigned to products in a traditional absorption costing system even though they are totally unaffected by which products are made during a period. In contrast, activity-based costing systems do not arbitrarily assign these types of costs, which are called *organization-sustaining* costs, to products. Activity-based costing treats these types of costs as period expenses rather than product costs.

Additionally, in a traditional absorption costing system, the costs of unused, or idle, capacity are assigned to products. If the budgeted level of activity declines, the overhead rate and unit product costs increase as the increasing costs of idle capacity are spread over a smaller base. In contrast, in activity-based costing, products are only charged for the costs of the capacity they use—not for the costs of capacity they don't use. This provides more stable unit product costs and is consistent with the goal of assigning to products only the costs of the resources that they use.[1]

Cost Pools, Allocation Bases, and Activity-Based Costing

Throughout the 19th century and most of the 20th century, cost system designs were simple and satisfactory. Typically, either one plantwide overhead cost pool or a number of departmental overhead cost pools were used to assign overhead costs to products. The plantwide and departmental approaches always had one thing in common—they relied on allocation bases such as direct labor-hours and machine-hours for allocating overhead costs to products. In the labor-intensive production processes of many years ago, direct labor was the most common choice for an overhead allocation base because it represented a large component of product costs, direct labor-hours were closely tracked, and many managers believed that direct labor-hours, the total volume of units produced, and overhead costs were highly correlated. (Three variables, such as direct labor-hours, the total volume of units produced, and overhead costs, are highly correlated if they tend to move together.) Given that most companies at the time were producing a very limited variety of products that required similar resources to produce, allocation bases such as direct labor-hours, or even machine-hours, worked fine because, in fact, there was probably little difference in the overhead costs attributable to different products.

Then conditions began to change. As a percentage of total cost, direct labor began declining and overhead began increasing. Many tasks previously done by direct laborers were being performed by automated equipment—a component of overhead. Companies began creating new products and services at an ever-accelerating rate that differed in volume, batch size, and complexity. Managing and sustaining this product diversity required investing in many more overhead resources, such as production schedulers and product design engineers, that had no obvious connection to direct labor-hours or machine-hours. In this new environment, continuing to rely exclusively on a limited number of overhead cost pools and traditional allocation bases posed the risk that reported unit product costs would be distorted and, therefore, misleading when used for decision-making purposes.

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[1] Appendix 3A discusses how the costs of idle capacity can be accounted for as a period cost in an income statement. This treatment highlights the cost of idle capacity rather than burying it in inventory and cost of goods sold. The procedures laid out in this chapter for activity-based costing have the same end effect.

Activity-based costing, thanks to advances in technology that make more complex cost systems feasible, provides an alternative to the traditional plantwide and departmental approaches to defining cost pools and selecting allocation bases. The activity-based approach has appeal in today's business environment because it uses more cost pools and unique measures of activity to better understand the costs of managing and sustaining product diversity.

In activity-based costing, an **activity** is any event that causes the consumption of overhead resources. An **activity cost pool** is a "bucket" in which costs are accumulated that relate to a single activity measure in the ABC system. An **activity measure** is an allocation base in an activity-based costing system. The term *cost driver* is also used to refer to an activity measure because the activity measure should "drive" the cost being allocated. The two most common types of activity measures are *transaction drivers* and *duration drivers.* **Transaction drivers** are simple counts of the number of times an activity occurs, such as the number of bills sent out to customers. **Duration drivers** measure the amount of time required to perform an activity, such as the time spent preparing individual bills for customers. In general, duration drivers are more accurate measures of resource consumption than transaction drivers, but they take more effort to record. For that reason, transaction drivers are often used in practice.

IN BUSINESS

GASTRONOMIC COST DRIVERS AT THE CLUB MED—BORA BORA

The Club Med—Bora Bora of Tahiti is a resort owned and operated by the French company Club Med. Most guests buy all-inclusive packages that include lodging, participation in the resort's many activities, a full range of beverages, and sumptuous buffet meals. The resort's guests come from around the world including Asia, North America, South America, and Europe. The international nature of the club's guests poses challenges for the kitchen staff—for example, Japanese breakfasts feature miso soup, stewed vegetables in soy sauce, and rice porridge whereas Germans are accustomed to cold cuts, cheese, and bread for breakfast. Moreover, the number of guests varies widely from 300 in the high season to 20 in the low season. The chefs in the kitchen must ensure that food in the correct quantities and variety are available to please the club's varied clientele. To make this possible, a report is prepared each day that lists how many Japanese guests, German guests, French guests, Polish guests, U.S. guests, and so forth, are currently registered. This information helps the chefs prepare the appropriate quantities of specialized foods. In essence, costs in the kitchen are driven not by the number of guests alone, but by how many guests are Japanese, how many German, how many French, and so on. The costs are driven by multiple drivers.

Source: Conversation with Dominique Tredano, Chef de Village (i.e., general manager), Club Med—Bora, Bora. For information about Club Med, see www.clubmed.com.

Traditional cost systems rely exclusively on allocation bases that are driven by the volume of production. On the other hand, activity-based costing defines five levels of activity—unit-level, batch-level, product-level, customer-level, and organization-sustaining—that largely do *not* relate to the volume of units produced. The costs and corresponding activity measures for unit-level activities do relate to the volume of units produced; however, the remaining categories do not. These levels are described as follows:[2]

1. **Unit-level activities** are performed each time a unit is produced. The costs of unit-level activities should be proportional to the number of units produced. For example, providing power to run processing equipment would be a unit-level activity because power tends to be consumed in proportion to the number of units produced.
2. **Batch-level activities** are performed each time a batch is handled or processed, regardless of how many units are in the batch. For example, tasks such as placing

[2] Robin Cooper, "Cost Classification in Unit-Based and Activity-Based Manufacturing Cost Systems," *Journal of Cost Management,* Fall 1990, pp. 4–14.

purchase orders, setting up equipment, and arranging for shipments to customers are batch-level activities. They are incurred once for each batch (or customer order). Costs at the batch level depend on the number of batches processed rather than on the number of units produced, the number of units sold, or other measures of volume. For example, the cost of setting up a machine for batch processing is the same regardless of whether the batch contains one or thousands of items.

3. **Product-level activities** relate to specific products and typically must be carried out regardless of how many batches are run or units of product are produced or sold. For example, activities such as designing a product, advertising a product, and maintaining a product manager and staff are all product-level activities.
4. **Customer-level activities** relate to specific customers and include activities such as sales calls, catalog mailings, and general technical support that are not tied to any specific product.
5. **Organization-sustaining activities** are carried out regardless of which customers are served, which products are produced, how many batches are run, or how many units are made. This category includes activities such as heating the factory, cleaning executive offices, providing a computer network, arranging for loans, preparing annual reports to shareholders, and so on.

Many companies throughout the world continue to base overhead allocations on direct labor-hours or machine-hours. In situations where overhead costs and direct labor-hours are highly correlated or in situations where the goal of the overhead allocation process is to prepare external financial reports, this practice makes sense. However, if plantwide overhead costs do not move in tandem with plantwide direct labor-hours or machine-hours, product costs will be distorted—with the potential of distorting decisions made within the company.

IN BUSINESS

DINING IN THE CANYON

Western River Expeditions (www.westernriver.com) runs river rafting trips on the Colorado, Green, and Salmon rivers. One of its most popular trips is a six-day trip down the Grand Canyon, which features famous rapids such as Crystal and Lava Falls as well as the awesome scenery accessible only from the bottom of the Grand Canyon. The company runs trips of one or two rafts, each of which carries two guides and up to 18 guests. The company provides all meals on the trip, which are prepared by the guides.

In terms of the hierarchy of activities, a guest can be considered as a unit and a raft as a batch. In that context, the wages paid to the guides are a batch-level cost because each raft requires two guides regardless of the number of guests in the raft. Each guest is given a mug to use during the trip and to take home at the end of the trip as a souvenir. The cost of the mug is a unit-level cost because the number of mugs given away is strictly proportional to the number of guests on a trip.

What about the costs of food served to guests and guides—is this a unit-level cost, a batch-level cost, a product-level cost, or an organization-sustaining cost? At first glance, it might be thought that food costs are a unit-level cost—the greater the number of guests, the higher the food costs. However, that is not quite correct. Standard menus have been created for each day of the trip. For example, the first night's menu might consist of shrimp cocktail, steak, cornbread, salad, and cheesecake. The day before a trip begins, all of the food needed for the trip is taken from the central warehouse and packed in modular containers. It isn't practical to finely adjust the amount of food for the actual number of guests planned to be on a trip—most of the food comes prepackaged in large lots. For example, the shrimp cocktail menu may call for two large bags of frozen shrimp per raft and that many bags will be packed regardless of how many guests are expected on the raft. Consequently, the costs of food are not a unit-level cost that varies with the number of guests actually on a trip. Instead, the costs of food are a batch-level cost.

Source: Conversations with Western River Expeditions personnel.

Designing an Activity-Based Costing (ABC) System

There are three essential characteristics of a successful activity-based costing implementation. First, top managers must strongly support the ABC implementation because their leadership is instrumental in properly motivating all employees to embrace the need to change. Second, top managers should ensure that ABC data is linked to how people are evaluated and rewarded. If employees continue to be evaluated and rewarded using traditional (non-ABC) cost data, they will quickly get the message that ABC is not important and they will abandon it. Third, a cross-functional team should be created to design and implement the ABC system. The team should include representatives from each area that will use ABC data, such as the marketing, production, engineering, and accounting departments. These cross-functional employees possess intimate knowledge of many parts of an organization's operations that is necessary for designing an effective ABC system. Furthermore, tapping the knowledge of cross-functional managers lessens their resistance to ABC because they feel included in the implementation process. Time after time, when accountants have attempted to implement an ABC system on their own without top-management support and cross-functional involvement, the results have been ignored.

IN BUSINESS

IMPLEMENTING ACTIVITY-BASED COSTING IN CHINA

Xu Ji Electric Company is publicly traded on China's Shen Zhen Stock Exchange. From 2001–2003, it successfully implemented an activity-based costing (ABC) system because top-level managers continuously supported the new system—particularly during a challenging phase when the ABC software encountered problems. The ABC adoption was also aided by Xu Ji's decision to drive the implementation using a top-down approach, which is aligned with the company's cultural norm of deferring to and supporting the hierarchical chain of command.

Xu Ji's experience is similar to Western ABC implementations that have consistently recognized the necessity of top-level management support. However, contrary to Xu Ji's experience, many Western managers do not readily support the top-down implementation of new management innovations in their organizations. They prefer to be involved in the decision-making processes that introduce change into their organizations.

Source: Lana Y.J. Liu and Fei Pan, "The Implementation of Activity-Based Costing in China: An Innovation Action Research Approach," *The British Accounting Review* 39, 2007, pp. 249–264.

MANAGERIAL ACCOUNTING IN ACTION

The Issue

Classic Brass, Inc., makes two main product lines for luxury yachts—standard stanchions and custom compass housings. The president of the company, John Towers, recently attended a management conference at which activity-based costing was discussed. Following the conference, he called a meeting of the company's top managers to discuss what he had learned. Attending the meeting were production manager Susan Richter, the marketing manager Tom Olafson, and the accounting manager Mary Goodman. He began the conference by distributing the company's income statement that Mary Goodman had prepared a few hours earlier (see Exhibit 7–1):

John: Well, it's official. Our company has sunk into the red for the first time in its history—a loss of $1,250.

Tom: I don't know what else we can do! Given our successful efforts to grow sales of the custom compass housings, I was expecting to see a boost to our bottom line, not a net loss. Granted, we have been losing even more bids than usual for standard stanchions because of our recent price increase, but . . .

John: Do you think our prices for standard stanchions are too high?

Tom: No, I don't think our prices are too high. I think our competitors' prices are too low. In fact, I'll bet they are pricing below their cost.

EXHIBIT 7–1
Classic Brass Income Statement

Classic Brass
Income Statement
Year Ended December 31, 2011

Sales		$3,200,000
Cost of goods sold:		
Direct materials	$ 975,000	
Direct labor	351,250	
Manufacturing overhead*	1,000,000	2,326,250
Gross margin		873,750
Selling and administrative expenses:		
Shipping expenses	65,000	
General administrative expenses	510,000	
Marketing expenses	300,000	875,000
Net operating loss		$ (1,250)

*The company's traditional cost system allocates manufacturing overhead to products using a plantwide overhead rate and machine-hours as the allocation base. Inventory levels did not change during the year.

Susan: Why would our competitors price below their cost?
Tom: They are out to grab market share.
Susan: What good is more market share if they are losing money on every unit sold?
John: I think Susan has a point. Mary, what is your take on this?
Mary: If our competitors are pricing standard stanchions below cost, shouldn't they be losing money rather than us? If our company is the one using accurate information to make informed decisions while our competitors are supposedly clueless, then why is our "bottom line" taking a beating? Unfortunately, I think we may be the ones shooting in the dark, not our competitors.
John: Based on what I heard at the conference that I just attended, I am inclined to agree. One of the presentations at the conference dealt with activity-based costing. As the speaker began describing the usual insights revealed by activity-based costing systems, I was sitting in the audience getting an ill feeling in my stomach.
Mary: Honestly John, I have been claiming for years that our existing cost system is okay for external reporting, but it is dangerous to use it for internal decision making. It sounds like you are on board now, right?
John: Yes.
Mary: Well then, how about if all of you commit the time and energy to help me build a fairly simple activity-based costing system that may shed some light on the problems we are facing?
John: Let's do it. I want each of you to appoint one of your top people to a special "ABC team" to investigate how we cost products.

Like most other ABC implementations, the ABC team decided that its new ABC system would supplement, rather than replace, the existing cost accounting system, which would continue to be used for external financial reports. The new ABC system would be used to prepare special reports for management decisions such as bidding on new business.

The accounting manager drew the chart appearing in Exhibit 7–2 to explain the general structure of the ABC model to her team members. Cost objects such as products generate activities. For example, a customer order for a custom compass housing requires the activity of preparing a production order. Such an activity consumes resources. A production order uses a sheet of paper and takes time to fill out. And consumption of resources causes costs. The greater the number of sheets used to fill out production orders and the greater the amount of time devoted to filling out such orders, the greater the cost. Activity-based costing attempts to trace through these relationships to identify how products and customers affect costs.

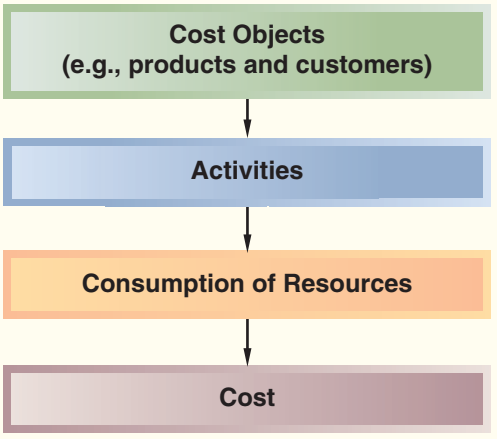


EXHIBIT 7–2
The Activity-Based Costing Model

As in most other companies, the ABC team at Classic Brass felt that the company's traditional cost accounting system adequately measured the direct materials and direct labor costs of products because these costs are directly traced to products. Therefore, the ABC study would be concerned solely with the other costs of the company—manufacturing overhead and selling and administrative costs.

The team felt it was important to carefully plan how it would go about implementing the new ABC system at Classic Brass. Accordingly, it broke down the implementation process into five steps:

Steps for Implementing Activity-Based Costing:

1. Define activities, activity cost pools, and activity measures.
2. Assign overhead costs to activity cost pools.
3. Calculate activity rates.
4. Assign overhead costs to cost objects using the activity rates and activity measures.
5. Prepare management reports.

Step 1: Define Activities, Activity Cost Pools, and Activity Measures

The first major step in implementing an ABC system is to identify the activities that will form the foundation for the system. This can be difficult and time-consuming and involves a great deal of judgment. A common procedure is for the individuals on the ABC implementation team to interview people who work in overhead departments and ask them to describe their major activities. Ordinarily, this results in a very long list of activities.

The length of such lists of activities poses a problem. On the one hand, the greater the number of activities tracked in the ABC system, the more accurate the costs are likely to be. On the other hand, a complex system involving large numbers of activities is costly to design, implement, maintain, and use. Consequently, the original lengthy list of activities is usually reduced to a handful by combining similar activities. For example, several actions may be involved in handling and moving raw materials—from receiving raw materials on the loading dock to sorting them into the appropriate bins in the storeroom. All of these activities might be combined into a single activity called material handling.

When combining activities in an ABC system, activities should be grouped together at the appropriate level. Batch-level activities should not be combined with unit-level activities or product-level activities with batch-level activities and so on. In general, it is best to combine only those activities that are highly correlated with each other within a level. For example, the number of customer orders received is likely to be highly

correlated with the number of completed customer orders shipped, so these two batch-level activities (receiving and shipping orders) can usually be combined with little loss of accuracy.

At Classic Brass, the ABC team, in consultation with top managers, selected the following *activity cost pools* and *activity measures:*

Activity Cost Pools at Classic Brass	
Activity Cost Pool	**Activity Measure**
Customer orders	Number of customer orders
Product design	Number of product designs
Order size	Machine-hours
Customer relations	Number of active customers
Other	Not applicable

The *Customer Orders* cost pool will be assigned all costs of resources that are consumed by taking and processing customer orders, including costs of processing paperwork and any costs involved in setting up machines for specific orders. The activity measure for this cost pool is the number of customer orders received. This is a batch-level activity because each order generates work that occurs regardless of whether the order is for one unit or 1,000 units.

The *Product Design* cost pool will be assigned all costs of resources consumed by designing products. The activity measure for this cost pool is the number of products designed. This is a product-level activity because the amount of design work on a new product does not depend on the number of units ultimately ordered or batches ultimately run.

The *Order Size* cost pool will be assigned all costs of resources consumed as a consequence of the number of units produced, including the costs of miscellaneous factory supplies, power to run machines, and some equipment depreciation. This is a unit-level activity because each unit requires some of these resources. The activity measure for this cost pool is machine-hours.

The *Customer Relations* cost pool will be assigned all costs associated with maintaining relations with customers, including the costs of sales calls and the costs of entertaining customers. The activity measure for this cost pool is the number of customers the company has on its active customer list. The Customer Relations cost pool represents a customer-level activity.

The *Other* cost pool will be assigned all overhead costs that are not associated with customer orders, product design, the size of the orders, or customer relations. These costs mainly consist of organization-sustaining costs and the costs of unused, idle capacity. These costs *will not* be assigned to products because they represent resources that are *not* consumed by products.

It is unlikely that any other company would use exactly the same activity cost pools and activity measures that were selected by Classic Brass. Because of the amount of judgment involved, the number and definitions of the activity cost pools and activity measures used by companies vary considerably.

The Mechanics of Activity-Based Costing

LEARNING OBJECTIVE 2
Assign costs to cost pools using a first-stage allocation.

Step 2: Assign Overhead Costs to Activity Cost Pools

Exhibit 7–3 shows the annual overhead costs (both manufacturing and nonmanufacturing) that Classic Brass intends to assign to its activity cost pools. Notice the data in the exhibit are organized by department (e.g., Production, General Administrative, and Marketing). This is because the data have been extracted from the company's general ledger. General ledgers usually classify costs within the departments where the costs

Production Department:		
Indirect factory wages	$500,000	
Factory equipment depreciation	300,000	
Factory utilities	120,000	
Factory building lease	80,000	$1,000,000
General Administrative Department:		
Administrative wages and salaries	400,000	
Office equipment depreciation	50,000	
Administrative building lease	60,000	510,000
Marketing Department:		
Marketing wages and salaries	250,000	
Selling expenses	50,000	300,000
Total overhead cost		$1,810,000

EXHIBIT 7–3
Annual Overhead Costs (Both Manufacturing and Nonmanufacturing) at Classic Brass

are incurred. For example, salaries, supplies, rent, and so forth incurred in the marketing department are charged to that department. The functional orientation of the general ledger mirrors the presentation of costs in the absorption income statement in Exhibit 7–1. In fact, you'll notice the total costs for the Production Department in Exhibit 7–3 ($1,000,000) equal the total manufacturing overhead costs from the income statement in Exhibit 7–1. Similarly, the total costs for the General Administrative and Marketing Departments in Exhibit 7–3 ($510,000 and $300,000) equal the marketing and general and administrative expenses shown in Exhibit 7–1.

Three costs included in the income statement in Exhibit 7–1—direct materials, direct labor, and shipping—are excluded from the costs shown in Exhibit 7–3. The ABC team purposely excluded these costs from Exhibit 7–3 because the existing cost system can accurately trace direct materials, direct labor, and shipping costs to products. There is no need to incorporate these direct costs in the activity-based allocations of indirect costs.

Classic Brass's activity-based costing system will divide the nine types of overhead costs in Exhibit 7–3 among its activity cost pools via an allocation process called *first-stage allocation.* The **first-stage allocation** in an ABC system is the process of assigning functionally organized overhead costs derived from a company's general ledger to the activity cost pools.

First-stage allocations are usually based on the results of interviews with employees who have first-hand knowledge of the activities. For example, Classic Brass needs to allocate $500,000 of indirect factory wages to its five activity cost pools. These allocations will be more accurate if the employees who are classified as indirect factory workers (e.g., supervisors, engineers, and quality inspectors) are asked to estimate what percentage of their time is spent dealing with customer orders, with product design, with processing units of product (i.e., order size), and with customer relations. These interviews are conducted with considerable care. Those who are interviewed must thoroughly understand what the activities encompass and what is expected of them in the interview. In addition, departmental managers are typically interviewed to determine how the nonpersonnel costs should be distributed across the activity cost pools. For example, the Classic Brass production manager would be interviewed to determine how the $300,000 of factory equipment depreciation (shown in Exhibit 7–3) should be allocated to the activity cost pools. The key question that the production manager would need to answer is "What percentage of the available machine capacity is consumed by each activity such as the number of customer orders or the number of units processed (i.e., size of orders)?"

IN BUSINESS

ABC HELPS A DAIRY UNDERSTAND ITS COSTS

Kemps LLC, headquartered in Minneapolis, Minnesota, produces dairy products such as milk, yogurt, and ice cream. The company implemented an ABC system that helped managers understand the impact of product and customer diversity on profit margins. The ABC model "captured differences in how the company entered orders from customers (customer phone call, salesperson call, fax, truck-driver entry, EDI, or Internet), how it packaged orders (full stacks of six cases, individual cases, or partial break-pack cases for small orders), how it delivered orders (commercial carriers or its own fleet, including route miles), and time spent by the driver at each customer location."

Kemps' ABC system helped the company acquire a large national customer because it identified "the specific manufacturing, distribution, and order handling costs associated with serving this customer." The ability to provide the customer with accurate cost information built a trusting relationship that distinguished Kemps from other competitors. Kemps also used its ABC data to transform unprofitable customers into profitable ones. For example, one customer agreed to accept a 13% price increase, to eliminate two low-volume products, and to begin placing full truckload orders rather than requiring partial truckload shipments, thereby lowering Kemps' costs by $150,000 per year.

Source: Robert S. Kaplan and Steven R. Anderson, "Time-Driven Activity-Based Costing," *Harvard Business Review*, November 2004, pp. 131–139.

The results of the interviews at Classic Brass are displayed in Exhibit 7–4. For example, factory equipment depreciation is distributed 20% to Customer Orders, 60% to Order Size, and 20% to the Other cost pool. The resource in this instance is machine time. According to the estimates made by the production manager, 60% of the total available machine time was used to actually process units to fill orders. This percentage is entered in the Order Size column. Each customer order requires setting up, which also requires machine time. This activity consumes 20% of the total available machine time and is entered under the Customer Orders column. The remaining 20% of available machine time represents idle time and is entered under the Other column.

Exhibit 7–4 and many of the other exhibits in this chapter are presented in the form of Excel spreadsheets. All of the calculations required in activity-based costing can be done by hand. Nevertheless, setting up an activity-based costing system on a spreadsheet or using special ABC software can save a lot of work—particularly in situations involving many activity cost pools and in organizations that periodically update their ABC systems.

We will not go into the details of how all of the percentages in Exhibit 7–4 were determined. However, note that 100% of the factory building lease has been assigned to the Other cost pool. Classic Brass has a single production facility. It has no plans to expand or to sublease any excess space. The cost of this production facility is treated as an organization-sustaining cost because there is no way to avoid even a portion of this cost if a particular product or customer were to be dropped. (Remember that organization-sustaining costs are assigned to the Other cost pool and are not allocated to products.) In contrast, some companies have separate facilities for manufacturing specific products. The costs of these separate facilities could be directly traced to the specific products.

Once the percentage distributions in Exhibit 7–4 have been established, it is easy to allocate costs to the activity cost pools. The results of this first-stage allocation are displayed in Exhibit 7–5. Each cost is allocated across the activity cost pools by multiplying it by the percentages in Exhibit 7–4. For example, the indirect factory wages of $500,000 are multiplied by the 25% entry under Customer Orders in Exhibit 7–4 to arrive at the $125,000 entry under Customer Orders in Exhibit 7–5. Similarly, the indirect factory wages of $500,000 are multiplied by the 40% entry under Product Design in Exhibit 7–4 to arrive at the $200,000 entry under Product Design in Exhibit 7–5. All of the entries in Exhibit 7–5 are computed in this way.

EXHIBIT 7–4
Results of Interviews: Distribution of Resource Consumption across Activity Cost Pools

	A	B	C	D	E	F	G
1		Activity Cost Pools					
2		Customer Orders	Product Design	Order Size	Customer Relations	Other	Totals
4	Production Department:						
5	Indirect factory wages	25%	40%	20%	10%	5%	100%
6	Factory equipment depreciation	20%	0%	60%	0%	20%	100%
7	Factory utilities	0%	10%	50%	0%	40%	100%
8	Factory building lease	0%	0%	0%	0%	100%	100%
10	General Administrative Department:						
11	Administrative wages and salaries	15%	5%	10%	30%	40%	100%
12	Office equipment depreciation	30%	0%	0%	25%	45%	100%
13	Administrative building lease	0%	0%	0%	0%	100%	100%
15	Marketing Department:						
16	Marketing wages and salaries	22%	8%	0%	60%	10%	100%
17	Selling expenses	10%	0%	0%	70%	20%	100%

Exhibit 7-4 | Exhibit 7-5 | Exhibit 7-6 | Exhibit 7-8 | Exhibit 7-9

EXHIBIT 7–5
First-Stage Allocations to Activity Cost Pools

	A	B	C	D	E	F	G
1		Activity Cost Pools					
2		Customer Orders	Product Design	Order Size	Customer Relations	Other	Totals
4	Production Department:						
5	Indirect factory wages	$ 125,000	$ 200,000	$ 100,000	$ 50,000	$ 25,000	$ 500,000
6	Factory equipment depreciation	60,000	0	180,000	0	60,000	300,000
7	Factory utilities	0	12,000	60,000	0	48,000	120,000
8	Factory building lease	0	0	0	0	80,000	80,000
10	General Administrative Department:						
11	Administrative wages and salaries	60,000	20,000	40,000	120,000	160,000	400,000
12	Office equipment depreciation	15,000	0	0	12,500	22,500	50,000
13	Administrative building lease	0	0	0	0	60,000	60,000
15	Marketing Department:						
16	Marketing wages and salaries	55,000	20,000	0	150,000	25,000	250,000
17	Selling expenses	5,000	0	0	35,000	10,000	50,000
19	Total	$ 320,000	$ 252,000	$ 380,000	$ 367,500	$ 490,500	$ 1,810,000

Exhibit 7-4 | Exhibit 7-5 | Exhibit 7-6 | Exhibit 7-8 | Exhibit 7-9

Exhibit 7–4 shows that Customer Orders consume 25% of the resources represented by the $500,000 of indirected factory wages.

$25\% \times \$500{,}000 = \$125{,}000$

Other entries in the table are computed in a similar fashion.

Now that the first-stage allocations to the activity cost pools have been completed, the next step is to compute the activity rates.

LEARNING OBJECTIVE 3
Compute activity rates for cost pools.

Step 3: Calculate Activity Rates

The activity rates that will be used for assigning overhead costs to products and customers are computed in Exhibit 7–6. The ABC team determined the total activity for each cost pool that would be required to produce the company's present product mix and to serve its present customers. These numbers are listed in Exhibit 7–6. For example, the ABC team found that 400 new product designs are required each year to serve the company's present customers. The activity rates are computed by dividing the *total* cost for each activity by its *total* activity. For example, the $320,000 total annual cost for the Customer Orders cost pool (which was computed in Exhibit 7–5) is divided by the total of 1,000 customer orders per year to arrive at the activity rate of $320 per customer order. Similarly, the $252,000 *total* cost for the Product Design cost pool is divided by the *total* number of designs (i.e., 400 product designs) to determine the activity rate of $630 per design. Note that an activity rate is not computed for the Other category of costs. This is because the *Other* cost pool consists of organization-sustaining costs and costs of idle capacity that are not allocated to products and customers.

The rates in Exhibit 7–6 indicate that *on average* a customer order consumes resources that cost $320; a product design consumes resources that cost $630; a unit of product consumes resources that cost $19 per machine-hour; and maintaining relations with a customer consumes resources that cost $1,470. Note that these are *average* figures. Some members of the ABC design team at Classic Brass argued that it would be unfair to charge all new products the same $630 product design cost regardless of how much design time they actually require. After discussing the pros and cons, the team concluded that it would not be worth the effort at the present time to keep track of actual design time spent on each new product. They felt that the benefits of increased accuracy would not be great enough to justify the higher cost of implementing and maintaining the more detailed costing system. Similarly, some team members were uncomfortable assigning the same $1,470 cost to each customer. Some customers are undemanding—ordering standard products well in advance of their needs. Others are very demanding and consume large amounts of marketing and administrative staff time. These are generally customers who order customized products, who tend to order at the last minute, and who change their minds. While everyone agreed with this observation, the data that would be required to measure individual customers' demands on resources were not currently available. Rather than delay implementation of the ABC system, the team decided to defer such refinements to a later date.

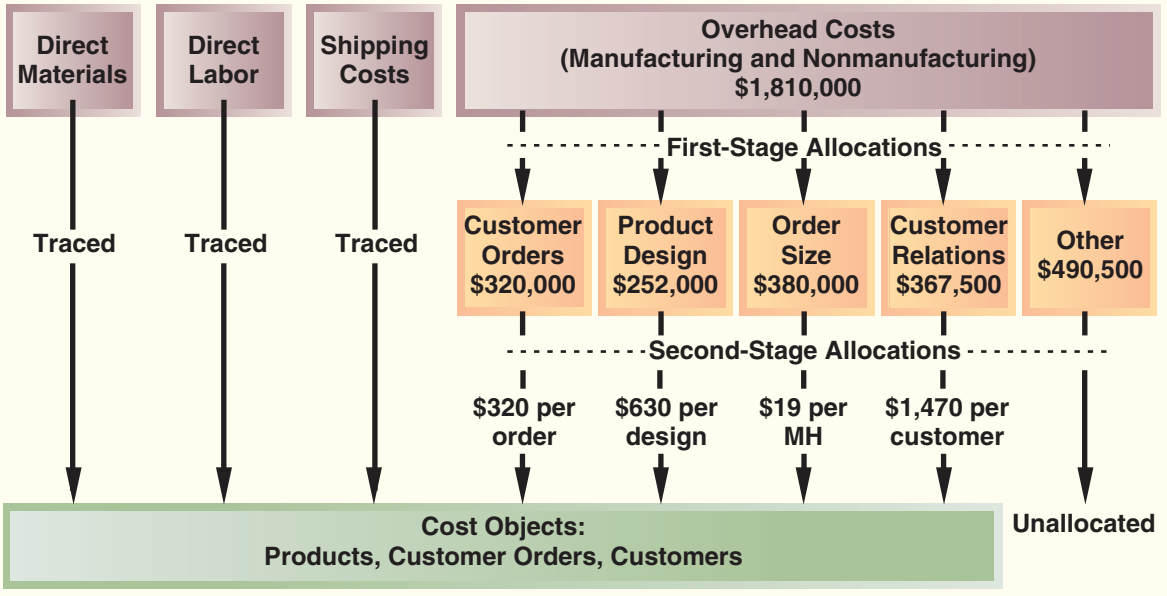
Before proceeding further, it would be helpful to get a better idea of the overall process of assigning costs to products and other cost objects in an ABC system. Exhibit 7–7 provides

EXHIBIT 7–6
Computation of Activity Rates

	A	B	C	D	E	F
1	*Activity Cost Pools*	*(a) Total Cost**	*(b) Total Activity*		*(a) ÷ (b) Activity Rate*	
2	Customer orders	$320,000	1,000	orders	$320	per order
3	Product design	$252,000	400	designs	$630	per design
4	Order size	$380,000	20,000	MHs	$19	per MH
5	Customer relations	$367,500	250	customers	$1,470	per customer
6	Other	$490,500	Not applicable		Not applicable	
8	*From Exhibit 7-5.					
9						

Exhibit 7-4 | Exhibit 7-5 | **Exhibit 7-6** | Exhibit 7-8

EXHIBIT 7–7
The Activity-Based Costing Model at Classic Brass



a visual perspective of the ABC system at Classic Brass. We recommend that you carefully go over this exhibit. In particular, note that the Other category, which contains organization-sustaining costs and costs of idle capacity, is not allocated to products or customers.

Step 4: Assign Overhead Costs to Cost Objects

LEARNING OBJECTIVE 4
Assign costs to a cost object using a second-stage allocation.

The fourth step in the implementation of activity-based costing is called *second-stage allocation.* In the **second-stage allocation,** activity rates are used to apply overhead costs to products and customers. First, we will illustrate how to assign costs to products followed by an example of how to assign costs to customers.

The data needed by the ABC team to assign overhead costs to Classic Brass's two products—standard stanchions and custom compass housings—are as follows:

Standard Stanchions

1. This product line does not require any new design resources.
2. 30,000 units were ordered during the year, comprising 600 separate orders.
3. Each stanchion requires 35 minutes of machine time for a total of 17,500 machine-hours.

Custom Compass Housings

1. This is a custom product that requires new design resources.
2. There were 400 orders for custom compass housings. Orders for this product are placed separately from orders for standard stanchions.
3. There were 400 custom designs prepared. One custom design was prepared for each order.
4. Because some orders were for more than one unit, a total of 1,250 custom compass housings were produced during the year. A custom compass housing requires an average of 2 machine-hours for a total of 2,500 machine-hours.

Notice, 600 customer orders were placed for standard stanchions and 400 customer orders were placed for custom compass housings, for a total of 1,000 customer orders. All 400 product designs related to custom compass housings; none related to standard stanchions. Producing 30,000 standard stanchions required 17,500 machine-hours and

IN BUSINESS

HOW MUCH DOES IT COST TO HANDLE A PIECE OF LUGGAGE?

It costs an airline about $15 to carry a piece of checked luggage from one destination another. The activity "transporting luggage" consists of numerous sub-activities such as tagging bags, sorting them, placing them on carts, transporting bags planeside, loading them into the airplane, and delivering them to carousels and connecting flights.

A variety of employees invest a portion of their labor hours "transporting luggage" including ground personnel, check-in agents, service clerks, baggage service managers, and maintenance workers. In total, labor costs comprise $9 per bag. Airlines also spend millions of dollars on baggage equipment, sorting systems, carts, tractors, and conveyors, as well as rental costs related to bag rooms, carousels, and offices. They also pay to deliver misplaced bags to customers' homes and to compensate customers for lost bags that are never found. These expenses add up to about $4 per bag. The final expense related to transporting luggage is fuel costs, which average about $2 per bag.

Many major airlines are charging $15 each way for one checked bag and $25 each way for a second checked bag. United Airlines expects to collect $275 million annually for its first and second bag fees.

Source: Scott McCartney, "What It Costs an Airline to Fly Your Luggage," *The Wall Street Journal*, November 25, 2008, p. D1 and D8.

producing 1,250 custom compass housings required 2,500 machine-hours, for a total of 20,000 machine-hours.

Exhibit 7–8 illustrates how overhead costs are assigned to the standard stanchions and custom compass housings. For example, the exhibit shows that $192,000 of overhead costs are assigned from the Customer Orders activity cost pool to the standard stanchions ($320 per order × 600 orders). Similarly, $128,000 of overhead costs are assigned from the Customer Orders activity cost pool to the custom compass housings ($320 per

EXHIBIT 7–8
Assigning Overhead Costs to Products

	A	B	C	D	E	F
1	**Overhead Cost for the Standard Stanchions**					
2	*Activity Cost Pools*	*(a) Activity Rate**		*(b) Activity*		*(a) × (b) ABC Cost*
3	Customer orders	$320	per order	600	orders	$ 192,000
4	Product design	$630	per design	0	designs	0
5	Order size	$19	per MH	17,500	MHs	332,500
6	Total					$ 524,500
7						
8	**Overhead Cost for the Custom Compass Housing**					
9	*Activity Cost Pools*	*(a) Activity Rate**		*(b) Activity*		*(a) × (b) ABC Cost*
10	Customer orders	$320	per order	400	orders	$ 128,000
11	Product design	$630	per design	400	designs	252,000
12	Order size	$19	per MH	2,500	MHs	47,500
13	Total					$ 427,500
14						
15	*From Exhibit 7-6.					
16						

Exhibit 7-6 | Exhibit 7-8 | Exhibit 7-9 | Ex

order × 400 orders). The Customer Orders cost pool contained a total of $320,000 (see Exhibit 7–5 or 7–6) and this total amount has been assigned to the two products ($192,000 + $128,000 = $320,000).

Exhibit 7–8 shows that a total of $952,000 of overhead costs is assigned to Classic Brass's two product lines—$524,500 to standard stanchions and $427,500 to custom compass housings. This amount is less than the $1,810,000 of overhead costs included in the ABC system. Why? The total amount of overhead assigned to products does not match the total amount of overhead cost in the ABC system because the ABC team purposely did not assign the $367,500 of Customer Relations and $490,500 of Other costs to products. The Customer Relations activity is a customer-level activity and the Other activity is an organization-sustaining activity—neither activity is caused by products. As shown below, when the Customer Relations and Other activity costs are added to the $952,000 of overhead costs assigned to products, the total is $1,810,000.

	Standard Stanchions	Custom Compass Housings	Total
Overhead Costs Assigned to Products			
Customer orders	$192,000	$128,000	$ 320,000
Product design	0	252,000	252,000
Order size	332,500	47,500	380,000
Subtotal	$524,500	$427,500	952,000
Overhead Costs not Assigned to Products			
Customer relations			367,500
Other			490,500
Subtotal			858,000
Total overhead cost			$1,810,000

Next, we describe another example of second-stage allocation—assigning activity costs to customers. The data needed by Classic Brass to assign overhead costs to one of its customers—Windward Yachts—are as follows:

Windward Yachts

1. The company placed a total of three orders.
   a. Two orders were for 150 standard stanchions per order.
   b. One order was for a single custom compass housing unit.
2. A total of 177 machine-hours were used to fulfill the three customer orders.
   a. The 300 standard stanchions required 175 machine-hours.
   b. The custom compass housing required 2 machine-hours.
3. Windward Yachts is one of 250 customers served by Classic Brass.

Exhibit 7–9 illustrates how the ABC system assigns overhead costs to this customer. As shown in Exhibit 7–9, the ABC team calculated that $6,423 of overhead costs should be assigned to Windward Yachts. The exhibit shows that Windward Yachts is assigned $960 ($320 per order × 3 orders) of overhead costs from the Customer Orders activity cost pool; $630 ($630 per design × 1 design) from the Product Design cost pool; $3,363 ($19 per machine-hour × 177 machine-hours) from the Order Size cost pool; and $1,470 ($1,470 per customer × 1 customer) from the Customer Relations cost pool.

EXHIBIT 7–9
Assigning Overhead Costs to Customers

	A	B	C	D	E	F
1	**Overhead Cost for Windward Yachts**					
2						
3	*Activity Cost Pools*	*(a) Activity Rate**		*(b) Activity*		*(a) × (b) ABC Cost*
4	Customer orders	$320	per order	3	orders	$ 960
5	Product design	$630	per design	1	designs	630
6	Order size	$19	per MH	177	MHs	3,363
7	Customer relations	$1,470	per customer	1	customer	1,470
8	Total overhead cost assigned to customer					$ 6,423
9						
10	*From Exhibit 7-6.					
11						

Exhibit 7-9 | Exhibit 7-10 | Exhibit 7-10 (2) | Exhib

With second-stage allocations complete, the ABC design team was ready to turn its attention to creating reports that would help explain the company's first ever net operating loss.

Step 5: Prepare Management Reports

LEARNING OBJECTIVE 5
Use activity-based costing to compute product and customer margins.

The most common management reports prepared with ABC data are product and customer profitability reports. These reports help companies channel their resources to their most profitable growth opportunities while at the same time highlighting products and customers that drain profits. We begin by illustrating a product profitability report followed by a customer profitability report.

The Classic Brass ABC team realized that the profit from a product, also called the *product margin,* is a function of the product's sales and the direct and indirect costs that the product causes. The ABC cost allocations shown in Exhibit 7–8 only summarize each product's indirect (i.e., overhead) costs. Therefore, to compute a product's profit (i.e., product margin), the design team needed to gather each product's sales and direct costs in addition to the overhead costs previously computed. The pertinent sales and direct cost data for each product are shown below. Notice the numbers in the total column agree with the income statement in Exhibit 7–1.

	Standard Stanchions	Custom Compass Housings	Total
Sales	$2,660,000	$540,000	$3,200,000
Direct costs:			
Direct materials	$905,500	$69,500	$975,000
Direct labor	$263,750	$87,500	$351,250
Shipping	$60,000	$5,000	$65,000

Having gathered the above data, the design team created the product profitability report shown in Exhibit 7–10. The report revealed that standard stanchions are profitable, with a positive product margin of $906,250, whereas the custom compass housings are unprofitable, with a negative product margin of $49,500. Keep in mind that the product profitability report purposely does not include the costs in the Customer Relations and Other activity cost pools. These costs, which total $858,000, were excluded from the

EXHIBIT 7–10
Product Margins—Activity-Based Costing

	A	B	C	D	E	F
1	**Product Margins—Activity-Based Costing**					
2		*Standard Stanchions*			*Custom Compass Housings*	
3	Sales		$ 2,660,000			$ 540,000
4	Costs:					
5	Direct materials	$ 905,500			$ 69,500	
6	Direct labor	263,750			87,500	
7	Shipping	60,000			5,000	
8	Customer orders (from Exhibit 7-8)	192,000			128,000	
9	Product design (from Exhibit 7-8)	-			252,000	
10	Order size (from Exhibit 7-8)	332,500			47,500	
11	Total cost		1,753,750			589,500
12	Product margin		$ 906,250			$ (49,500)
13						

Exhibit 7-10 | Exhibit 7-10 (2) | Exhibit 7-11 | Exhibit 7-1

report because they are not caused by the products. Customer Relations costs are caused by customers, not products. The Other costs are organization-sustaining costs and unused capacity costs that are not caused by any particular product.

The product margins can be reconciled with the company's net operating loss as follows:

	Standard Stanchions	Custom Compass Housings	Total
Sales (See Exhibit 7–10)	$2,660,000	$540,000	$3,200,000
Total costs (See Exhibit 7–10)	1,753,750	589,500	2,343,250
Product margins (See Exhibit 7–10)	$ 906,250	$ (49,500)	856,750
Overhead costs not assigned to products:			
Customer relations			367,500
Other			490,500
Total			858,000
Net operating loss			$ (1,250)

Next, the design team created a customer profitability report for Windward Yachts. Similar to the product profitability report, the design team needed to gather data concerning sales to Windward Yachts and the direct material, direct labor, and shipping costs associated with those sales. Those data are presented below:

	Windward Yachts
Sales	$11,350
Direct costs:	
Direct material costs	$2,123
Direct labor costs	$1,900
Shipping costs	$205

IN BUSINESS

IS ACTIVITY-BASED COSTING STILL BEING USED?

Researchers surveyed 348 managers to determine which costing methods their companies use. The table below shows the percentage of respondents whose companies use the various costing methods to assign departmental costs to cost objects such as products.

	Departments						
Costing Method	Research and Development	Product and Process Design	Production	Sales and Marketing	Distribution	Customer Service	Shared Services
Activity-based	13.0%	14.7%	18.3%	17.3%	17.2%	21.8%	23.0%
Standard[1]	17.6%	20.7%	42.0%	18.1%	28.4%	18.5%	23.0%
Normal[2]	4.6%	8.6%	9.9%	7.9%	6.0%	8.1%	5.6%
Actual[3]	23.1%	25.0%	23.7%	23.6%	26.7%	16.9%	15.9%
Other	1.9%	0.9%	0.0%	0.8%	0.9%	1.6%	2.4%
Not allocated	39.8%	30.2%	6.1%	32.3%	20.7%	33.1%	30.2%

[1]Standard costing is used for the variance computations in Chapter 10.
[2]Normal costing is used for the job-order costing computations in Chapter 3.
[3]Actual costing is used to create the absorption and variable costing income statements in Chapter 6.

The results show that 18.3% of respondents use ABC to allocate production costs to cost objects and 42% use standard costing for the same purpose. ABC is used by at least 13% of respondents within all functional departments across the value chain. Many companies do not allocate nonproduction costs to cost objects.

Source: William O. Stratton, Denis Desroches, Raef Lawson, and Toby Hatch, "Activity-Based Costing: Is It Still Relevant?" *Management Accounting Quarterly*, Spring 2009, pp. 31–40.

Using these data and the data from Exhibit 7–9, the design team created the customer profitability report shown in Exhibit 7–11. The report revealed that the customer margin for Windward Yachts is $699. A similar report could be prepared for each of Classic

EXHIBIT 7–11
Customer Margin—Activity-Based Costing

	A	B	C
1	**Customer Margin—Activity-Based Costing**		
2		*Windward Yachts*	
3	Sales		$ 11,350
4	Costs:		
5	Direct materials	$ 2,123	
6	Direct labor	1,900	
7	Shipping	205	
8	Customer orders (from Exhibit 7-9)	960	
9	Product design (from Exhibit 7-9)	630	
10	Order size (from Exhibit 7-9)	3,363	
11	Customer relations (from Exhibit 7-9)	1,470	10,651
12	Customer margin		$ 699
13			

Exhibit 7-11 | Exhibit 7-12 | Exhib

Brass's 250 customers, thereby enabling the company to cultivate relationships with its most profitable customers, while taking steps to reduce the negative impact of unprofitable customers.

Comparison of Traditional and ABC Product Costs

The ABC team used a two-step process to compare its traditional and ABC product costs. First, the team reviewed the product margins reported by the traditional cost system. Then, it contrasted the differences between the traditional and ABC product margins.

Product Margins Computed Using the Traditional Cost System

Classic Brass's traditional cost system assigns only manufacturing costs to products—this includes direct materials, direct labor, and manufacturing overhead. Selling and administrative costs are not assigned to products. Exhibit 7–12 shows the product margins reported by Classic Brass's traditional cost system. We will explain how these margins were calculated in three steps. First, the sales and direct materials and direct labor cost data are the same numbers used by the ABC team to prepare Exhibit 7–10. In other words, the traditional cost system and the ABC system treat these three pieces of revenue and cost data identically.

Second, the traditional cost system uses a plantwide overhead rate to assign manufacturing overhead costs to products. The numerator for the plantwide overhead rate is $1,000,000, which is the total amount of manufacturing overhead shown on the income statement in Exhibit 7–1. The footnote in Exhibit 7–1 mentions that the traditional cost system uses machine-hours to assign manufacturing overhead costs to products. The Order Size activity in Exhibit 7–6 used 20,000 machine-hours as its level of activity. These same 20,000 machine-hours would be used in the denominator of the plantwide overhead rate, which is computed as follows:

$$\text{Plantwide overhead rate} = \frac{\text{Total estimated manufacturing overhead}}{\text{Total estimated machine-hours}}$$

$$= \frac{\$1{,}000{,}000}{20{,}000 \text{ machine-hours}}$$

$$= \$50 \text{ per machine-hour}$$

Because 17,500 machine-hours were worked on standard stanchions, this product line is assigned $875,000 (17,500 machine-hours × $50 per machine-hour) of manufacturing overhead cost. Similarly, the custom compass housings required 2,500 machine-hours, so this product line is assigned $125,000 (2,500 machine-hours × $50 per machine-hour) of manufacturing overhead cost. The sales of each product minus its cost of goods sold equals the product margin of $615,750 for standard stanchions and $258,000 for custom compass housings.

Notice, the net operating loss of $1,250 shown in Exhibit 7–12 agrees with the loss reported in the income statement in Exhibit 7–1 and with the loss shown in the table beneath Exhibit 7–10. The company's *total* sales, *total* costs, and its resulting net operating loss are the same regardless of whether you are looking at the absorption income statement in Exhibit 7–1, the ABC product profitability analysis depicted on page 289, or the traditional product profitability analysis in Exhibit 7–12. Although the "total pie" remains constant across the traditional and ABC systems, what differs is how the pie is divided between the two product lines. The traditional product margin calculations suggest that standard stanchions are generating a product margin of $615,750 and the custom compass housings a product margin of $258,000. However, these product margins differ

EXHIBIT 7–12
Product Margins—Traditional Costing System

	A	B	C	D	E	F	G	H	I
1	**Product Margins—Traditional Cost System**								
2		*Standard Stanchions*			*Custom Compass Housings*			*Total*	
3	Sales		$2,660,000			$ 540,000			$3,200,000
4	Cost of goods sold:								
5	Direct materials	$ 905,500			$ 69,500			$ 975,000	
6	Direct labor	263,750			87,500			351,250	
7	Manufacturing overhead	875,000	2,044,250		125,000	282,000		1,000,000	2,326,250
8	Product margin		$ 615,750			$ 258,000			873,750
9	Selling and administrative								875,000
10	Net operating loss								$ (1,250)
11									
12									

Exhibit 7-10 (2) | Exhibit 7-11 | **Exhibit 7-12** | Exhibit 7-13 | Exhibit 7A-1

from the ABC product margins reported in Exhibit 7–10. Indeed, the traditional cost system is sending misleading signals to Classic Brass's managers about each product's profitability. Let's explain why.

The Differences between ABC and Traditional Product Costs

The changes in product margins caused by switching from the traditional cost system to the activity-based costing system are shown below:

	Standard Stanchions	Custom Compass Housings
Product margins—traditional	$615,750	$ 258,000
Product margins—ABC	906,250	(49,500)
Change in reported product margins	$290,500	$(307,500)

The traditional cost system overcosts the standard stanchions and consequently reports an artificially low product margin for this product. The switch to an activity-based view of product profitability increases the product margin on standard stanchions by $290,500. In contrast, the traditional cost system undercosts the custom compass housings and reports an artificially high product margin for this product. The switch to activity-based costing decreases the product margin on custom compass housings by $307,500.

The reasons for the change in reported product margins between the two costing methods are revealed in Exhibit 7–13. The top portion of the exhibit shows each product's direct and indirect cost assignments as reported by the traditional cost system in Exhibit 7–12. For example, Exhibit 7–13 includes the following costs for standard stanchions: direct materials, $905,500; direct labor, $263,750; and manufacturing overhead, $875,000. Each of these costs corresponds with those reported in Exhibit 7–12. Notice, the selling and administrative costs of $875,000 are purposely not allocated to products because these costs are considered to be period costs. Similarly, the bottom portion of Exhibit 7–13 summarizes the direct and indirect cost assignments as reported by the activity-based costing system in Exhibit 7–10. The only new information in Exhibit 7–13 is shown in the two columns of percentages. The first column of percentages shows the percentage of each cost assigned to standard stanchions. For example, the $905,500 of direct materials cost traced to standard stanchions is 92.9% of the company's total direct materials cost of $975,000. The second column of percentages does the same thing for custom compass housings.

EXHIBIT 7–13
A Comparison of Traditional and Activity-Based Cost Assignments

Traditional Cost System	Standard Stanchions (a) Amount	Standard Stanchions (a) ÷ (c) %	Custom Compass Housings (b) Amount	Custom Compass Housings (b) ÷ (c) %	(c) Total
Direct materials	$ 905,500	92.9%	$ 69,500	7.1%	$ 975,000
Direct labor	263,750	75.1%	87,500	24.9%	351,250
Manufacturing overhead	875,000	87.5%	125,000	12.5%	1,000,000
Total cost assigned to products	$2,044,250		$282,000		2,326,250
Selling and administrative					875,000
Total cost					$3,201,250
Activity-Based Costing System					
Direct costs:					
Direct materials	$ 905,500	92.9%	$ 69,500	7.1%	$ 975,000
Direct labor	263,750	75.1%	87,500	24.9%	351,250
Shipping	60,000	92.3%	5,000	7.7%	65,000
Indirect costs:					
Customer orders	192,000	60.0%	128,000	40.0%	320,000
Product design	0	0.0%	252,000	100.0%	252,000
Order size	332,500	87.5%	47,500	12.5%	380,000
Total cost assigned to products	$1,753,750		$589,500		2,343,250
Costs not assigned to products:					
Customer relations					367,500
Other					490,500
Total cost					$3,201,250

There are three reasons why the traditional and activity-based costing systems report different product margins. First, Classic Brass's traditional cost system allocates all manufacturing overhead costs to products. This forces both products to absorb all manufacturing overhead costs regardless of whether they actually consumed the costs that were allocated to them. The ABC system does not assign the manufacturing overhead costs consumed by the Customer Relations activity to products because these costs are caused by customers, not specific products. It also does not assign the manufacturing overhead costs included in the Other activity to products because these organization-sustaining and unused capacity costs are not caused by any particular product. From an ABC point of view, assigning these costs to products is inherently arbitrary and counterproductive.

Second, Classic Brass's traditional cost system allocates all of the manufacturing overhead costs using a volume-related allocation base—machine-hours—that may or may not reflect what actually causes the costs. In other words, in the traditional system, 87.5% of each manufacturing overhead cost is implicitly assigned to standard stanchions and 12.5% is assigned to custom compass housings. For example, the traditional cost system inappropriately assigns 87.5% of the costs of the Customer Orders activity (a batch-level activity) to standard stanchions even though the ABC system revealed that standard stanchions

caused only 60% of these costs. Conversely, the traditional cost system assigns only 12.5% of these costs to custom compass housings even though this product caused 40% of these costs. Similarly, the traditional cost system assigns 87.5% of the costs of the Product Design activity (a product-level activity) to standard stanchions even though the standard stanchions caused none (0%) of these costs. All (100%) of the costs of the Product Design activity, rather than just 12.5%, should be assigned to custom compass housings. The result is that traditional cost systems overcost high-volume products (such as the standard stanchions) and undercost low-volume products (such as the custom compass housings) because they assign batch-level and product-level costs using volume-related allocation bases.

The third reason the product margins differ between the two cost systems is that the ABC system assigns the nonmanufacturing overhead costs caused by products to those products on a cause-and-effect basis. The traditional cost system disregards these costs because they are classified as period costs. The ABC system directly traces shipping costs to products and includes the nonmanufacturing overhead costs caused by products in the activity cost pools that are assigned to products.

The ABC design team presented the results of its work in a meeting attended by all of the top managers of Classic Brass, including the president John Towers, the production manager Susan Richter, the marketing manager Tom Olafson, and the accounting manager Mary Goodman. The ABC team brought with them copies of the chart showing the ABC design (Exhibit 7–7), and the table comparing the traditional and ABC cost assignments (Exhibit 7–13). After the formal presentation by the ABC team, the following discussion took place:

MANAGERIAL ACCOUNTING IN ACTION
The Wrap-Up

John: I would like to personally thank the ABC team for all of the work they have done and for an extremely interesting presentation. I am now beginning to wonder about a lot of the decisions we have made in the past using our old cost accounting system. According to the ABC analysis, we had it all backwards. We are losing money on the custom products and making a fistful on the standard products.

Mary: I have to admit that I had no idea that the Product Design work for custom compass housings was so expensive! I knew burying these costs in our plantwide overhead rate was penalizing standard stanchions, but I didn't understand the magnitude of the problem.

Susan: I never did believe we were making a lot of money on the custom jobs. You ought to see all of the problems they create for us in production.

Tom: I hate to admit it, but the custom jobs always seem to give us headaches in marketing, too.

John: If we are losing money on custom compass housings, why not suggest to our customers that they go elsewhere for that kind of work?

Tom: Wait a minute, we would lose a lot of sales.

Susan: So what, we would save a lot more costs.

Mary: Maybe yes, maybe no. Some of the costs would not disappear if we were to drop the custom business.

Tom: Like what?

Mary: Well Tom, I believe you said that about 10% of your time is spent dealing with new products. As a consequence, 10% of your salary was allocated to the Product Design cost pool. If we were to drop all of the products requiring design work, would you be willing to take a 10% pay cut?

Tom: I trust you're joking.

Mary: Do you see the problem? Just because 10% of your time is spent on custom products doesn't mean that the company would save 10% of your salary if the custom products were dropped. Before we take a drastic action like dropping the custom products, we should identify which costs are really relevant.

John: I think I see what you are driving at. We wouldn't want to drop a lot of products only to find that our costs really haven't changed much. It is true that dropping the

products would free up resources like Tom's time, but we had better be sure we have some good use for those resources *before* we take such an action.

As this discussion among the managers of Classic Brass illustrates, caution should be exercised before taking action based on an ABC analysis such as the one shown in Exhibits 7–10 and 7–11. The product and customer margins computed in these exhibits are a useful starting point for further analysis, but managers need to know what costs are really affected before taking any action such as dropping a product or customer or changing the prices of products or services. Appendix 7A shows how an *action analysis report* can be constructed to help managers make such decisions. An **action analysis report** provides more detail about costs and how they might adjust to changes in activity than the ABC analysis presented in Exhibits 7–10 and 7–11.

IN BUSINESS

COMPARING ACTIVITY-BASED AND TRADITIONAL PRODUCT COSTS

Airco Heating and Air Conditioning (Airco), located in Van Buren, Arkansas, implemented an ABC system to better understand the profitability of its products. The ABC system assigned $4,458,605 of overhead costs to eight activities as follows:

Activity Cost Pool	Total Cost	Total Activity	Activity Rate
Machines	$ 435,425	73,872 machine-hours	$5.89
Data record maintenance	132,597	14 products administered	$9,471.21
Material handling	1,560,027	16,872 products	$92.46
Product changeover	723,338	72 setup hours	$10,046.36
Scheduling	24,877	2,788 production runs	$8.92
Raw material receiving	877,107	2,859 receipts	$306.79
Product shipment	561,014	13,784,015 miles	$0.04
Customer service	144,220	2,533 customer contacts	$56.94
Total	$4,458,605		

Airco's managers were surprised by the fact that 55% [($1,560,027 + $877,107) ÷ $4,458,605] of its overhead resources were consumed by the material handling and raw material receiving activities. They responded by reducing the raw material and part transport distances within the facility. In addition, they compared the traditional and ABC product margin percentages (computed by dividing each product's margin by the sales of the product) for the company's seven product lines of air conditioners as summarized below:

	Product						
	5-Ton	6-Ton	7.5-Ton	10-Ton	12.5-Ton	15-Ton	20-Ton
Traditional product margin %	–20%	4%	40%	–4%	20%	42%	70%
ABC product margin %	–15%	–8%	50%	1%	–6%	40%	69%

In response to the ABC data, Airco decided to explore the possibility of raising prices on 5-ton, 6-ton, and 12.5-ton air conditioners while at the same time seeking to reduce overhead consumption by these products.

Source: Copyright 2004 from Heather Nachtmann and Mohammad Hani Al-Rifai, "An Application of Activity-Based Costing in the Air Conditioner Manufacturing Industry," *The Engineering Economist* 49, Issue 3, 2004, pp. 221–236. Reproduced by permission of Taylor & Francis Group, LLC, www.taylorandfrancis.com.

Targeting Process Improvements

Activity-based costing can also be used to identify activities that would benefit from process improvements. When used in this way, activity-based costing is often called *activity-based management.* Basically, **activity-based management** involves focusing on activities to eliminate waste, decrease processing time, and reduce defects. Activity-based management is used in organizations as diverse as manufacturing companies, hospitals, and the U.S. Marine Corps.

The first step in any improvement program is to decide what to improve. The Theory of Constraints approach discussed in Chapter 1 is a powerful tool for targeting the area in an organization whose improvement will yield the greatest benefit. Activity-based management provides another approach. The activity rates computed in activity-based costing can provide valuable clues concerning where there is waste and opportunity for improvement. For example, looking at the activity rates in Exhibit 7–6, managers at Classic Brass may conclude that $320 to process a customer order is far too expensive for an activity that adds no value to the product. As a consequence, they may target their process improvement efforts toward the Customer Orders activity.

Benchmarking is another way to leverage the information in activity rates. **Benchmarking** is a systematic approach to identifying the activities with the greatest room for improvement. It is based on comparing the performance in an organization with the performance of other, similar organizations known for their outstanding performance. If a particular part of the organization performs far below the world-class standard, managers will be likely to target that area for improvement.

IN BUSINESS

PROCESS IMPROVEMENTS HELP NURSES

Providence Portland Medical Center (PPMC) used ABC to improve one of the most expensive and error-prone processes within its nursing units—ordering, distributing, and administering medications to patients. To the surprise of everyone involved, the ABC data showed that "medication-related activities made up 43% of the nursing unit's total operating costs." The ABC team members knew that one of the root causes of this time-consuming process was the illegibility of physician orders that are faxed to the pharmacy. Replacing the standard fax machine with a much better $5,000 machine virtually eliminated unreadable orders and decreased follow-up telephone calls by more than 90%—saving the hospital $500,000 per year. In total, the ABC team generated improvement ideas that offered $1 million of net savings in redeployable resources. "This amount translates to additional time that nurses and pharmacists can spend on direct patient care."

Source: "How ABC Analysis Will Save PPMC Over $1 Million a Year," *Financial Analysis, Planning & Reporting,* November 2003, pp. 6–10.

Activity-Based Costing and External Reports

Although activity-based costing generally provides more accurate product costs than traditional costing methods, it is infrequently used for external reports for a number of reasons.[3] First, external reports are less detailed than internal reports prepared for decision making. On the external reports, individual product costs are not reported. Cost of goods sold and inventory valuations are disclosed, but they are not broken down by product. If

[3] Appendix 7B illustrates how a variation of activity-based costing can be used to develop product costs for external reports.

some products are undercosted and some are overcosted, the errors tend to offset each other when the product costs are added together.

Second, it is often very difficult to make changes in a company's accounting system. The official cost accounting systems in most large companies are usually embedded in complex computer programs that have been modified in-house over the course of many years. It is extremely difficult to make changes in such computer programs without causing numerous bugs.

Third, an ABC system such as the one described in this chapter does not conform to generally accepted accounting principles (GAAP). As discussed in Chapters 2, 3, and 4, product costs computed for external reports must include all of the manufacturing costs and only manufacturing costs; but in an ABC system as described in this chapter, product costs exclude some manufacturing costs and include some nonmanufacturing costs. It is possible to adjust the ABC data at the end of the period to conform to GAAP, but that requires more work.

Fourth, auditors are likely to be uncomfortable with allocations that are based on interviews with the company's personnel. Such subjective data can be easily manipulated by management to make earnings and other key variables look more favorable.

For all of these reasons, most companies confine their ABC efforts to special studies for management, and they do not attempt to integrate activity-based costing into their formal cost accounting systems.

The Limitations of Activity-Based Costing

Implementing an activity-based costing system is a major project that requires substantial resources. And once implemented, an activity-based costing system is more costly to maintain than a traditional costing system—data concerning numerous activity measures must be periodically collected, checked, and entered into the system. The benefits of increased accuracy may not outweigh these costs.

Activity-based costing produces numbers, such as product margins, that are at odds with the numbers produced by traditional costing systems. But managers are accustomed to using traditional costing systems to run their operations and traditional costing systems are often used in performance evaluations. Essentially, activity-based costing changes the rules of the game. It is a fact of human nature that changes in organizations, particularly those that alter the rules of the game, inevitably face resistance. This underscores the importance of top management support and the full participation of line managers, as well as the accounting staff, in any activity-based costing initiative. If activity-based costing is viewed as an accounting initiative that does not have the full support of top management, it is doomed to failure.

In practice, most managers insist on fully allocating all costs to products, customers, and other costing objects in an activity-based costing system—including the costs of idle capacity and organization-sustaining costs. This results in overstated costs and understated margins and mistakes in pricing and other critical decisions.

Activity-based costing data can easily be misinterpreted and must be used with care when used in making decisions. Costs assigned to products, customers, and other cost objects are only *potentially* relevant. Before making any significant decisions using activity-based costing data, managers must identify which costs are really relevant for the decision at hand. See Appendix 7A for more details.

As discussed in the previous section, reports generated by the best activity-based costing systems do not conform to external reporting requirements. Consequently, an organization involved in activity-based costing should have two cost systems—one for internal use and one for preparing external reports. This is costlier than maintaining just one system and may cause confusion about which system is to be believed and relied on.

IN BUSINESS

A CRITICAL PERSPECTIVE OF ABC

Marconi is a Portuguese telecommunications company that encountered problems with its ABC system. The company's production managers felt that 23% of the costs included in the system were common costs that should not be allocated to products and that allocating these costs to products was not only inaccurate, but also irrelevant to their operational cost reduction efforts. Furthermore, Marconi's front-line workers resisted the ABC system because they felt it might be used to weaken their autonomy and to justify downsizing, outsourcing, and work intensification. They believed that ABC created a "turkeys queuing for Christmas syndrome" because they were expected to volunteer information to help create a cost system that could eventually lead to their demise. These two complications created a third problem—the data necessary to build the ABC cost model was provided by disgruntled and distrustful employees. Consequently, the accuracy of the data was questionable at best. In short, Marconi's experiences illustrate some of the challenges that complicate real-world ABC implementations.

Source: Maria Major and Trevor Hopper, "Managers Divided: Implementing ABC in a Portuguese Telecommunications Company," *Management Accounting Research*, June 2005, pp. 205–229.

Summary

Traditional cost accounting methods suffer from several defects that can result in distorted costs for decision-making purposes. All manufacturing costs—even those that are not caused by any specific product—are allocated to products. Nonmanufacturing costs that are caused by products are not assigned to products. And finally, traditional methods tend to place too much reliance on unit-level allocation bases such as direct labor and machine-hours. This results in overcosting high-volume products and undercosting low-volume products and can lead to mistakes when making decisions.

Activity-based costing estimates the costs of the resources consumed by cost objects such as products and customers. The activity-based costing approach assumes that cost objects generate activities that in turn consume costly resources. Activities form the link between costs and cost objects. Activity-based costing is concerned with overhead—both manufacturing overhead and selling and administrative overhead. The accounting for direct labor and direct materials is usually the same under traditional and ABC costing methods.

To build an ABC system, companies typically choose a small set of activities that summarize much of the work performed in overhead departments. Associated with each activity is an activity cost pool. To the extent possible, overhead costs are directly traced to these activity cost pools. The remaining overhead costs are allocated to the activity cost pools in the first-stage allocation. Interviews with managers often form the basis for these allocations.

An activity rate is computed for each cost pool by dividing the costs assigned to the cost pool by the measure of activity for the cost pool. Activity rates provide useful information to managers concerning the costs of performing overhead activities. A particularly high cost for an activity may trigger efforts to improve the way the activity is carried out in the organization.

In the second-stage allocation, activity rates are used to apply costs to cost objects such as products and customers. The costs computed under activity-based costing are often quite different from the costs generated by a company's traditional cost accounting system. While the ABC system is almost certainly more accurate, managers should nevertheless exercise caution before making decisions based on the ABC data. Some of the costs may not be avoidable and hence would not be relevant.

Review Problem: Activity-Based Costing

Ferris Corporation makes a single product—a fire-resistant commercial filing cabinet—that it sells to office furniture distributors. The company has a simple ABC system that it uses for internal decision making. The company has two overhead departments whose costs are listed on the following page:

Manufacturing overhead	$500,000
Selling and administrative overhead	300,000
Total overhead costs	$800,000

The company's ABC system has the following activity cost pools and activity measures:

Activity Cost Pool	Activity Measure
Assembling units	Number of units
Processing orders	Number of orders
Supporting customers	Number of customers
Other	Not applicable

Costs assigned to the "Other" activity cost pool have no activity measure; they consist of the costs of unused capacity and organization-sustaining costs—neither of which are assigned to orders, customers, or the product.

Ferris Corporation distributes the costs of manufacturing overhead and selling and administrative overhead to the activity cost pools based on employee interviews, the results of which are reported below:

Distribution of Resource Consumption Across Activity Cost Pools					
	Assembling Units	Processing Orders	Supporting Customers	Other	Total
Manufacturing overhead	50%	35%	5%	10%	100%
Selling and administrative overhead	10%	45%	25%	20%	100%
Total activity	1,000 units	250 orders	100 customers		

Required:

1. Perform the first-stage allocation of overhead costs to the activity cost pools as in Exhibit 7–5.
2. Compute activity rates for the activity cost pools as in Exhibit 7–6.
3. OfficeMart is one of Ferris Corporation's customers. Last year, OfficeMart ordered filing cabinets four different times. OfficeMart ordered a total of 80 filing cabinets during the year. Construct a table as in Exhibit 7–9 showing the overhead costs attributable to OfficeMart.
4. The selling price of a filing cabinet is $595. The cost of direct materials is $180 per filing cabinet, and direct labor is $50 per filing cabinet. What is the customer margin of OfficeMart? See Exhibit 7–11 for an example of how to complete this report.

Solution to Review Problem

1. The first-stage allocation of costs to the activity cost pools appears below:

	Activity Cost Pools				
	Assembling Units	Processing Orders	Supporting Customers	Other	Total
Manufacturing overhead	$250,000	$175,000	$ 25,000	$ 50,000	$500,000
Selling and administrative overhead	30,000	135,000	75,000	60,000	300,000
Total cost	$280,000	$310,000	$100,000	$110,000	$800,000

2. The activity rates for the activity cost pools are:

Activity Cost Pools	(a) Total Cost	(b) Total Activity	(a) ÷ (b) Activity Rate
Assembling units	$280,000	1,000 units	$280 per unit
Processing orders	$310,000	250 orders	$1,240 per order
Supporting customers	$100,000	100 customers	$1,000 per customer

3. The overhead cost attributable to OfficeMart would be computed as follows:

Activity Cost Pools	(a) Activity Rate	(b) Activity	(a) × (b) ABC Cost
Assembling units	$280 per unit	80 units	$22,400
Processing orders	$1,240 per order	4 orders	$4,960
Supporting customers	$1,000 per customer	1 customer	$1,000

4. The customer margin can be computed as follows:

Sales ($595 per unit × 80 units)		$47,600
Costs:		
Direct materials ($180 per unit × 80 units)	$14,400	
Direct labor ($50 per unit × 80 units)	4,000	
Assembling units (above)	22,400	
Processing orders (above)	4,960	
Supporting customers (above)	1,000	46,760
Customer margin		$ 840

Glossary

Action analysis report A report showing what costs have been assigned to a cost object, such as a product or customer, and how difficult it would be to adjust the cost if there is a change in activity. (p. 295)

Activity An event that causes the consumption of overhead resources in an organization. (p. 275)

Activity-based costing (ABC) A costing method based on activities that is designed to provide managers with cost information for strategic and other decisions that potentially affect capacity and therefore fixed as well as variable costs. (p. 273)

Activity-based management (ABM) A management approach that focuses on managing activities as a way of eliminating waste and reducing delays and defects. (p. 296)

Activity cost pool A "bucket" in which costs are accumulated that relate to a single activity measure in an activity-based costing system. (p. 275)

Activity measure An allocation base in an activity-based costing system; ideally, a measure of the amount of activity that drives the costs in an activity cost pool. (p. 275)

Batch-level activities Activities that are performed each time a batch of goods is handled or processed, regardless of how many units are in the batch. The amount of resource consumed depends on the number of batches run rather than on the number of units in the batch. (p. 275)

Benchmarking A systematic approach to identifying the activities with the greatest potential for improvement. (p. 296)
Customer-level activities Activities that are carried out to support customers, but that are not related to any specific product. (p. 276)
Duration driver A measure of the amount of time required to perform an activity. (p. 275)
First-stage allocation The process by which overhead costs are assigned to activity cost pools in an activity-based costing system. (p. 281)
Organization-sustaining activities Activities that are carried out regardless of which customers are served, which products are produced, how many batches are run, or how many units are made. (p. 276)
Product-level activities Activities that relate to specific products that must be carried out regardless of how many units are produced and sold or batches run. (p. 276)
Second-stage allocation The process by which activity rates are used to apply costs to products and customers in activity-based costing. (p. 285)
Transaction driver A simple count of the number of times an activity occurs. (p. 275)
Unit-level activities Activities that are performed each time a unit is produced. (p. 275)

Questions

7–1 In what fundamental ways does activity-based costing differ from traditional costing methods such as job-order costing as described in Chapter 3?
7–2 Why is direct labor a poor base for allocating overhead in many companies?
7–3 Why are top management support and cross-functional involvement crucial when attempting to implement an activity-based costing system?
7–4 What are unit-level, batch-level, product-level, customer-level, and organization-sustaining activities?
7–5 What types of costs should not be assigned to products in an activity-based costing system?
7–6 Why are there two stages of allocation in activity-based costing?
7–7 Why is the first stage of the allocation process in activity-based costing often based on interviews?
7–8 When activity-based costing is used, why do manufacturing overhead costs often shift from high-volume products to low-volume products?
7–9 How can the activity rates (i.e., cost per activity) for the various activities be used to target process improvements?
7–10 Why is the activity-based costing described in this chapter unacceptable for external financial reports?

Multiple-choice questions are provided on the text website at www.mhhe.com/garrison14e.

Applying Excel

Available with McGraw-Hill's *Connect™ Accounting*.

LEARNING OBJECTIVES 1, 2, 3, 4

The Excel worksheet form that appears on the next page is to be used to recreate the Review Problem on pages 298–300. Download the workbook containing this form from the Online Learning Center at www.mhhe.com/garrison14e. *On the website you will also receive instructions about how to use this worksheet form.*

	A	B	C	D	E	F	G
1	**Chapter 7: Applying Excel**						
2							
3	**Data**						
4	Manufacturing overhead	$500,000					
5	Selling and administrative overhead	$300,000					
6							
7		*Assembling Units*	*Processing Orders*	*Supporting Customers*	*Other*		
8	Manufacturing overhead	50%	35%	5%	10%		
9	Selling and administrative overhead	10%	45%	25%	20%		
10	Total activity	1,000	250	100			
11		units	orders	customers			
12							
13	OfficeMart orders:						
14	Customers	1	customer				
15	Orders	4	orders				
16	Number of filing cabinets ordered in total	80	units				
17	Selling price	$595					
18	Direct materials	$180					
19	Direct labor	$50					
20							
21	*Enter a formula into each of the cells marked with a ? below*						
22	**Review Problem: Activity-Based Costing**						
23							
24	***Perform the first stage allocations***						
25		*Assembling Units*	*Processing Orders*	*Supporting Customers*	*Other*	*Total*	
26	Manufacturing overhead	?	?	?	?	?	
27	Selling and administrative overhead	?	?	?	?	?	
28	Total cost	?	?	?	?	?	
29							
30	***Compute the activity rates***						
31	*Activity Cost Pools*	*Total Cost*	*Total Activity*		*Activity Rate*		
32	Assembling units	?	?	units	?	per unit	
33	Processing orders	?	?	orders	?	per order	
34	Supporting customers	?	?	customers	?	per customer	
35							
36	***Compute the overhead cost attributable to the OfficeMart orders***						
37	*Activity Cost Pools*	*Activity Rate*		*Activity*		*ABC Cost*	
38	Assembling units	?	per unit	?	units	?	
39	Processing orders	?	per order	?	orders	?	
40	Supporting customers	?	per customer	?	customer	?	
41							
42	***Determine the customer margin for the OfficeMart orders under Activity-Based Costing***						
43	Sales		?				
44	Costs:						
45	Direct materials	?					
46	Direct labor	?					
47	Unit-related overhead	?					
48	Order-related overhead	?					
49	Customer-related overhead	?	?				
50	Customer margin		?				
51							
52	***Determine the product margin for the OfficeMart orders under a traditional cost system***						
53	Manufacturing overhead	?					
54	Total activity	?	units				
55	Manufacturing overhead per unit	?	per unit				
56							
57	Sales		?				
58	Costs:						
59	Direct materials	?					
60	Direct labor	?					
61	Manufacturing overhead	?	?				
62	Traditional costing product margin		?				
63							

Chapter 7 Form | Filled in Chapter 7 Form | Chapter 7 Formulas

You should proceed to the requirements below only after completing your worksheet.

Required:

1. Check your worksheet by doubling the units ordered in cell B16 to 160. The customer margin under activity-based costing should now be $7,640 and the traditional costing product margin should be $(21,600). If you do not get these results, find the errors in your worksheet and correct them.
   a. Why has the customer margin under activity-based costing more than doubled when the number of units ordered is doubled?
   b. Why has the traditional costing product margin exactly doubled from a loss of $10,800 to a loss of $21,600?
   c. Which costing system, activity-based costing or traditional costing, provides a more accurate picture of what happens to profits as the number of units ordered increases? Explain.
2. Let's assume that OfficeMart places different orders next year, purchasing higher-end filing cabinets more frequently, but in smaller quantities per order. Enter the following data into your worksheet:

Data				
Manufacturing overhead	$500,000			
Selling and administrative overhead	$300,000			
	Assembling Units	Processing Orders	Supporting Customers	Other
Manufacturing overhead	50%	35%	5%	10%
Selling and administrative overhead	10%	45%	25%	20%
Total activity	1,000 units	250 orders	100 customers	
OfficeMart orders:				
Customers	1 customer			
Orders	20 orders			
Total number of filing cabinets ordered	80 units			
Selling price	$795			
Direct materials	$185			
Direct labor	$90			

   a. What is the customer margin under activity-based costing?
   b. What is the product margin under the traditional cost system?
   c. Explain why the profitability picture looks much different now than it did when OfficeMart was ordering less expensive filing cabinets less frequently, but in larger quantities per order.
3. Using the data you entered in part (2), change the percentage of selling and administrative overhead attributable to processing orders from 45% to 30% and the percentage attributable to supporting customers from 25% to 40%. That portion of the worksheet should look like this:

	Assembling Units	Processing Orders	Supporting Customers	Other
Manufacturing overhead	50%	35%	5%	10%
Selling and administrative overhead	10%	30%	40%	20%
Total activity	1,000 units	250 orders	100 customers	

a. Relative to the results from part (2), what has happened to the customer margin under activity-based costing? Why?
b. Relative to the results from part (2), what has happened to the product margin under the traditional cost system? Why?

Exercises

All applicable exercises are available with McGraw-Hill's *Connect™ Accounting*.

EXERCISE 7–1 ABC Cost Hierarchy [LO1]

The following activities occur at Greenwich Corporation, a company that manufactures a variety of products.

a. Various individuals manage the parts inventories.
b. A clerk in the factory issues purchase orders for a job.
c. The personnel department trains new production workers.
d. The factory's general manager meets with other department heads such as marketing to coordinate plans.
e. Direct labor workers assemble products.
f. Engineers design new products.
g. The materials storekeeper issues raw materials to be used in jobs.
h. The maintenance department performs periodic preventive maintenance on general-use equipment.

Required:

Classify each of the activities above as either a unit-level, batch-level, product-level, or organization-sustaining activity.

EXERCISE 7–2 First-Stage Allocation [LO2]

VaultOnWheels Corporation operates a fleet of armored cars that make scheduled pickups and deliveries for its customers in the Phoenix area. The company is implementing an activity-based costing system that has four activity cost pools: Travel, Pickup and Delivery, Customer Service, and Other. The activity measures are miles for the Travel cost pool, number of pickups and deliveries for the Pickup and Delivery cost pool, and number of customers for the Customer Service cost pool. The Other cost pool has no activity measure because it is an organization-sustaining activity. The following costs will be assigned using the activity-based costing system:

Driver and guard wages	$ 840,000
Vehicle operating expense	270,000
Vehicle depreciation	150,000
Customer representative salaries and expenses	180,000
Office expenses	40,000
Administrative expenses	340,000
Total cost	$1,820,000

The distribution of resource consumption across the activity cost pools is as follows:

	Travel	Pickup and Delivery	Customer Service	Other	Totals
Driver and guard wages	40%	45%	10%	5%	100%
Vehicle operating expense	75%	5%	0%	20%	100%
Vehicle depreciation	70%	10%	0%	20%	100%
Customer representative salaries and expenses	0%	0%	85%	15%	100%
Office expenses	0%	25%	35%	40%	100%
Administrative expenses	0%	5%	55%	40%	100%

Required:
Complete the first-stage allocations of costs to activity cost pools as illustrated in Exhibit 7–5.

EXERCISE 7–3 Compute Activity Rates [LO3]

As You Like It Gardening is a small gardening service that uses activity-based costing to estimate costs for pricing and other purposes. The proprietor of the company believes that costs are driven primarily by the size of customer lawns, the size of customer garden beds, the distance to travel to customers, and the number of customers. In addition, the costs of maintaining garden beds depends on whether the beds are low-maintenance beds (mainly ordinary trees and shrubs) or high-maintenance beds (mainly flowers and exotic plants). Accordingly, the company uses the five activity cost pools listed below:

Activity Cost Pool	Activity Measure
Caring for lawn	Square feet of lawn
Caring for garden beds—low maintenance	Square feet of low-maintenance beds
Caring for garden beds—high maintenance	Square feet of high-maintenance beds
Travel to jobs	Miles
Customer billing and service	Number of customers

The company has already completed its first-stage allocations of costs. The company's annual costs and activities are summarized as follows:

Activity Cost Pool	Estimated Overhead Cost	Expected Activity
Caring for lawn	$77,400	180,000 square feet of lawn
Caring for garden beds—low maintenance	$30,000	24,000 square feet of low-maintenance beds
Caring for garden beds—high maintenance	$57,600	18,000 square feet of high-maintenance beds
Travel to jobs	$4,200	15,000 miles
Customer billing and service	$8,700	30 customers

Required:
Compute the activity rate for each of the activity cost pools.

EXERCISE 7–4 Second-Stage Allocation [LO4]

Larner Corporation is a diversified manufacturer of industrial goods. The company's activity-based costing system contains the following six activity cost pools and activity rates:

Activity Cost Pool	Activity Rates
Supporting direct labor	$7.00 per direct labor-hour
Machine processing	$3.00 per machine-hour
Machine setups	$40.00 per setup
Production orders	$160.00 per order
Shipments	$120.00 per shipment
Product sustaining	$800.00 per product

Activity data have been supplied for the following products:

	Total Expected Activity	
	J78	W52
Direct labor-hours	1,000	40
Machine-hours	3,200	30
Machine setups	5	1
Production orders	5	1
Shipments	10	1
Product sustaining	1	1

Required:
Determine the total overhead cost that would be assigned to each of the products listed above in the activity-based costing system.

EXERCISE 7–5 Product and Customer Profitability Analysis [LO4, LO5]
Updraft Systems, Inc., makes paragliders for sale through specialty sporting goods stores. The company has a standard paraglider model, but also makes custom-designed paragliders. Management has designed an activity-based costing system with the following activity cost pools and activity rates:

Activity Cost Pool	Activity Rate
Supporting direct labor	$18 per direct labor-hour
Order processing	$192 per order
Custom designing	$261 per custom design
Customer service	$426 per customer

Management would like an analysis of the profitability of a particular customer, Eagle Wings, which has ordered the following products over the last 12 months:

	Standard Model	Custom Design
Number of gliders	10	2
Number of orders	1	2
Number of custom designs	0	2
Direct labor-hours per glider	28.50	32.00
Selling price per glider	$1,650	$2,300
Direct materials cost per glider	$462	$576

The company's direct labor rate is $19 per hour.

Required:
Using the company's activity-based costing system, compute the customer margin of Eagle Wings.

EXERCISE 7–6 Second-Stage Allocation to an Order [LO4]
Transvaal Mining Tools Ltd. of South Africa makes specialty tools used in the mining industry. The company uses an activity-based costing system for internal decision-making purposes. The company has four activity cost pools as listed below:

Activity Cost Pool	Activity Measure	Activity Rate
Order size	Number of direct labor-hours	R17.60 per direct labor-hour*
Customer orders	Number of customer orders	R360 per customer order
Product testing	Number of testing hours	R79 per testing hour
Selling	Number of sales calls	R1,494 per sales call

*(The currency in South Africa is the rand, denoted here by R.)

The managing director of the company would like information concerning the cost of a recently completed order for hard-rock drills. The order required 150 direct labor-hours, 18 hours of product testing, and three sales calls.

Required:
Prepare a report summarizing the overhead costs assigned to the order for hard-rock drills. What is the total overhead cost assigned to the order?

EXERCISE 7–7 First-Stage Allocations [LO2]

The operations vice president of First Bank of Eagle, Kristin Wu, has been interested in investigating the efficiency of the bank's operations. She has been particularly concerned about the costs of handling routine transactions at the bank and would like to compare these costs at the bank's various branches. If the branches with the most efficient operations can be identified, their methods can be studied and then replicated elsewhere. While the bank maintains meticulous records of wages and other costs, there has been no attempt thus far to show how those costs are related to the various services provided by the bank. Ms. Wu has asked your help in conducting an activity-based costing study of bank operations. In particular, she would like to know the cost of opening an account, the cost of processing deposits and withdrawals, and the cost of processing other customer transactions.

The Avon branch of First Bank of Eagle has submitted the following cost data for last year:

Teller wages	$150,000
Assistant branch manager salary	70,000
Branch manager salary	85,000
Total	$305,000

Virtually all of the other costs of the branch—rent, depreciation, utilities, and so on—are organization-sustaining costs that cannot be meaningfully assigned to individual customer transactions such as depositing checks.

In addition to the cost data above, the employees of the Avon branch have been interviewed concerning how their time was distributed last year across the activities included in the activity-based costing study. The results of those interviews appear below:

	Distribution of Resource Consumption Across Activities				
	Opening Accounts	Processing Deposits and Withdrawals	Processing Other Customer Transactions	Other Activities	Totals
Teller wages	0%	75%	15%	10%	100%
Assistant branch manager salary	10%	15%	25%	50%	100%
Branch manager salary	0%	0%	20%	80%	100%

Required:

Prepare the first-stage allocation for Ms. Wu as illustrated in Exhibit 7–5.

EXERCISE 7–8 Computing and Interpreting Activity Rates [LO3]

(This exercise is a continuation of Exercise 7–7; it should be assigned *only* if Exercise 7–7 is also assigned.) The manager of the Avon branch of First Bank of Eagle has provided the following data concerning the transactions of the branch during the past year:

Activity	Total Activity at the Avon Branch
Opening accounts	200 accounts opened
Processing deposits and withdrawals	50,000 deposits and withdrawals
Processing other customer transactions	1,000 other customer transactions

The lowest costs reported by other branches for these activities are displayed below:

Activity	Lowest Cost among All First Bank of Eagle Branches
Opening accounts	$24.35 per account opened
Processing deposits and withdrawals	$2.72 per deposit or withdrawal
Processing other customer transactions	$48.90 per other customer transaction

Required:

1. Using the first-stage allocation from Exercise 7–7 and the above data, compute the activity rates for the activity-based costing system. (Use Exhibit 7–6 as a guide.) Round all computations to the nearest whole cent.
2. What do these results suggest to you concerning operations at the Avon branch?


EXERCISE 7–9 Customer Profitability Analysis [LO3, LO4, LO5]

Med Max buys surgical supplies from a variety of manufacturers and then resells and delivers these supplies to hundreds of hospitals. Med Max sets its prices for all hospitals by marking up its cost of goods sold to those hospitals by 5%. For example, if a hospital buys supplies from Med Max that had cost Med Max $100 to buy from manufacturers, Med Max would charge the hospital $105 to purchase these supplies.

For years, Med Max believed that the 5% markup covered its selling and administrative expenses and provided a reasonable profit. However, in the face of declining profits Med Max decided to implement an activity-based costing system to help improve its understanding of customer profitability. The company broke its selling and administrative expenses into five activities as shown below:

Activity Cost Pool	Activity Measure	Total Cost	Total Activity
Customer deliveries	Number of deliveries	$ 400,000	5,000 deliveries
Manual order processing	Number of manual orders	300,000	4,000 orders
Electronic order processing	Number of electronic orders	200,000	12,500 orders
Line item picking	Number of line items picked	500,000	400,000 line items
Other organization-sustaining costs	NA	600,000	
Total selling and administrative expenses		$2,000,000	

Med Max gathered the data below for two of the many hospitals that it serves—City General and County General (both hospitals purchased a total quantity of medical supplies that had cost Med Max $30,000 to buy from its manufacturers):

	Activity	
Activity Measure	City General	County General
Number of deliveries	10	20
Number of manual orders	0	40
Number of electronic orders	10	0
Number of line items picked	100	260

Required:

1. Compute the total revenue that Med Max would receive from City General and County General.
2. Compute the activity rate for each activity cost pool.
3. Compute the total activity costs that would be assigned to City General and County General.
4. Compute Med Max's customer margin for City General and County General. (Hint: Do not overlook the $30,000 cost of goods sold that Med Max incurred serving each hospital.)
5. Describe the purchasing behaviors that are likely to characterize Med Max's least profitable customers.

EXERCISE 7–10 Activity Measures [LO1]

Various activities at Morales Corporation, a manufacturing company, are listed below. Each activity has been classified as unit-level, batch-level, product-level, customer-level, or organization-sustaining.

	Activity	Activity Classification	Examples of Activity Measures
a.	Materials are moved from the receiving dock to the assembly area by a material-handling crew	Batch-level	
b.	Direct labor workers assemble various products	Unit-level	
c.	Diversity training is provided to all employees in the company	Organization-sustaining	
d.	A product is designed by a cross-functional team	Product-level	
e.	Equipment is set up to process a batch	Batch-level	
f.	A customer is billed for all products delivered during the month	Customer-level	

Required:

Complete the table by providing an example of an activity measure for each activity.

EXERCISE 7–11 Comprehensive Activity-Based Costing Exercise [LO2, LO3, LO4, LO5]

Silicon Optics has supplied the following data for use in its activity-based costing system:

Overhead Costs	
Wages and salaries	$350,000
Other overhead costs	200,000
Total overhead costs	$550,000

Activity Cost Pool	Activity Measure	Total Activity
Direct labor support	Number of direct labor-hours	10,000 DLHs
Order processing	Number of orders	500 orders
Customer support	Number of customers	100 customers
Other	This is an organization-sustaining activity	Not applicable

	Distribution of Resource Consumption Across Activities				
	Direct Labor Support	Order Processing	Customer Support	Other	Total
Wages and salaries	30%	35%	25%	10%	100%
Other overhead costs	25%	15%	20%	40%	100%

During the year, Silicon Optics completed an order for a special optical switch for a new customer, Indus Telecom. This customer did not order any other products during the year. Data concerning that order follow:

Data Concerning the Indus Telecom Order	
Selling price	$295 per unit
Units ordered	100 units
Direct materials	$264 per unit
Direct labor-hours	0.5 DLH per unit
Direct labor rate	$25 per DLH

Required:

1. Using Exhibit 7–5 as a guide, prepare a report showing the first-stage allocations of overhead costs to the activity cost pools.
2. Using Exhibit 7–6 as a guide, compute the activity rates for the activity cost pools.
3. Prepare a report showing the overhead costs for the order from Indus Telecom, including customer support costs.
4. Using Exhibit 7–11 as a guide, prepare a report showing the customer margin for Indus Telecom.

EXERCISE 7–12 Computing ABC Product Costs [LO3, LO4]

Performance Products Corporation makes two products, titanium Rims and Posts. Data regarding the two products follow:

	Direct Labor-Hours per Unit	Annual Production
Rims	0.40	20,000 units
Posts	0.20	80,000 units

Additional information about the company follows:

a. Rims require $17 in direct materials per unit, and Posts require $10.
b. The direct labor wage rate is $16 per hour.
c. Rims are more complex to manufacture than Posts, and they require special equipment.
d. The ABC system has the following activity cost pools:

	A	B	C	D	E	F
1		Estimated	Activity			
2	Activity Cost Pool (and activity measure)	Overhead Cost	Rims	Posts	Total	
3	Machine setups (number of setups)	$21,600	100	80	180	
4	Special processing (machine-hours)	$180,000	4,000	0	4,000	
5	General factory (direct labor-hours)	$288,000	8,000	16,000	24,000	
6						

Sheet1 Sheet2 Sheet3

Required:

1. Compute the activity rate for each activity cost pool.
2. Determine the unit cost of each product according to the ABC system, including direct materials and direct labor.

EXERCISE 7–13 Second-Stage Allocation and Margin Calculations [LO4, LO5]

Theatre Seating, Inc., makes high-quality adjustable seats for theaters. The company's activity-based costing system has four activity cost pools, which are listed below along with their activity measures and activity rates:

Activity Cost Pool	Activity Measure	Activity Rate
Supporting direct labor	Number of direct labor-hours	$12 per direct labor-hour
Batch processing	Number of batches	$96 per batch
Order processing	Number of orders	$284 per order
Customer service	Number of customers	$2,620 per customer

The company just completed a single order from CineMax Entertainment Corporation for 2,400 custom seats. The order was produced in four batches. Each seat required 0.8 direct labor-hours. The selling price was $137.95 per seat, the direct materials cost was $112.00 per seat, and the direct labor cost was $14.40 per seat. This was the only order from CineMax Entertainment for the year.

Required:

Using Exhibit 7–11 as a guide, prepare a report showing the customer margin on sales to CineMax Entertainment for the year.

EXERCISE 7–14 Cost Hierarchy [LO1]

Green Glider Corporation makes golf carts that it sells directly to golf courses throughout the world. Several basic models are available, which are modified to suit the needs of each particular golf course. A golf course located in the Pacific Northwest, for example, would typically specify that its golf carts come equipped with retractable rain-proof covers. In addition, each customer (i.e., golf course) customizes its golf carts with its own color scheme and logo. The company typically makes all of the golf carts for a customer before starting work on the next customer's golf carts. A number of activities carried out at Green Glider Corporation are listed below:

a. The purchasing department orders the specific color of paint specified by the customer from the company's supplier.
b. A steering wheel is installed in a golf cart.
c. An outside attorney draws up a new generic sales contract for the company limiting Green Glider's liability in case of accidents that involve its golf carts.
d. The company's paint shop makes a stencil for a customer's logo.
e. A sales representative visits an old customer to check on how the company's golf carts are working out and to try to make a new sale.
f. The accounts receivable department prepares the bill for a completed order.
g. Electricity is used to heat and light the factory and the administrative offices.
h. A golf cart is painted.
i. The company's engineer modifies the design of a model to eliminate a potential safety problem.
j. The marketing department has a catalogue printed and then mails copies to golf course managers.
k. Completed golf carts are individually tested on the company's test track.
l. A new model golf cart is shipped to the leading golfing trade magazine to be evaluated for the magazine's annual rating of golf carts.

Required:

Classify each of the costs or activities above as unit-level, batch-level, product-level, customer-level, or organization-sustaining. In this case, customers are golf courses, products are models of the golf cart, a batch is a specific order from a customer, and units are individual golf carts.

EXERCISE 7–15 Calculating and Interpreting Activity-Based Costing Data [LO3, LO4]


Sven's Cookhouse is a popular restaurant located on Lake Union in Seattle. The owner of the restaurant has been trying to better understand costs at the restaurant and has hired a student intern to conduct an activity-based costing study. The intern, in consultation with the owner, identified three major activities. She then completed the first-stage allocations of costs to the activity cost pools, using data from last month's operations. The results appear below:

Activity Cost Pool	Activity Measure	Total Cost	Total Activity
Serving a party of diners	Number of parties served	$12,000	5,000 parties
Serving a diner	Number of diners served	$90,000	12,000 diners
Serving a drink	Number of drinks ordered	$26,000	10,000 drinks

The above costs include all of the costs of the restaurant except for organization-sustaining costs such as rent, property taxes, and top-management salaries. A group of diners who ask to sit at the same table are counted as a party. Some costs, such as the costs of cleaning linen, are the same whether one person is at a table or the table is full. Other costs, such as washing dishes, depend on the number of diners served.

Prior to the activity-based costing study, the owner knew very little about the costs of the restaurant. He knew that the total cost for the month (including organization-sustaining costs) was $180,000 and that 12,000 diners had been served. Therefore, the average cost per diner was $15.

Required:

1. According to the activity-based costing system, what is the total cost of serving each of the following parties of diners?

a. A party of four diners who order three drinks in total.
b. A party of two diners who do not order any drinks.
c. A lone diner who orders two drinks.

2. Convert the total costs you computed in (1) above to costs per diner. In other words, what is the average cost per diner for serving each of the following parties?
   a. A party of four diners who order three drinks in total.
   b. A party of two diners who do not order any drinks.
   c. A lone diner who orders two drinks.
3. Why do the costs per diner for the three different parties differ from each other and from the overall average cost of $15.00 per diner?

Problems


All applicable problems are available with McGraw-Hill's *Connect™ Accounting*.

PROBLEM 7–16 Second-Stage Allocations and Product Margins [LO4, LO5]

AnimPix, Inc., is a small company that creates computer-generated animations for films and television. Much of the company's work consists of short commercials for television, but the company also does realistic computer animations for special effects in movies.

The young founders of the company have become increasingly concerned with the economics of the business—particularly because many competitors have sprung up recently in the local area. To help understand the company's cost structure, an activity-based costing system has been designed. Three major activities are carried out in the company: animation concept, animation production, and contract administration. The animation concept activity is carried out at the contract proposal stage when the company bids on projects. This is an intensive activity that involves individuals from all parts of the company in creating storyboards and prototype stills to be shown to the prospective client. After the client has accepted a project, the animation goes into production and contract administration begins. Technical staff do almost all of the work involved in animation production, whereas the administrative staff is largely responsible for contract administration. The activity cost pools and their activity measures and rates are listed below:

Activity Cost Pool	Activity Measure	Activity Rate
Animation concept	Number of proposals	$6,000 per proposal
Animation production	Minutes of animation	$7,700 per minute of animation
Contract administration	Number of contracts	$6,600 per contract

These activity rates include all of the costs of the company, except for the costs of idle capacity and organization-sustaining costs. There are no direct labor or direct materials costs.

Preliminary analysis using these activity rates has indicated that the local commercials segment of the market may be unprofitable. This segment is highly competitive. Producers of local commercials may ask several companies like AnimPix to bid, which results in an unusually low ratio of accepted contracts to bids. Furthermore, the animation sequences tend to be much shorter for local commercials than for other work. Because animation work is billed at standard rates according to the running time of the completed animation, the revenues from these short projects tend to be below average. Data concerning activity in the local commercials market appear below:

Activity Measure	Local Commercials
Number of proposals	20
Minutes of animation	12
Number of contracts	8

The total sales for local commercials amounted to $240,000.

Required:

1. Determine the cost of serving the local commercials market.
2. Prepare a report showing the margin earned serving the local commercials market. (Remember, this company has no direct materials or direct labor costs.)
3. What would you recommend to management concerning the local commercials market?

PROBLEM 7–17 Comparing Traditional and Activity-Based Product Margins [LO1, LO3, LO4, LO5]

Precision Manufacturing Inc. (PMI) makes two types of industrial component parts—the EX300 and the TX500. An absorption costing income statement for the most recent period is shown below:

Precision Manufacturing Inc. Income Statement	
Sales	$1,700,000
Cost of goods sold	1,200,000
Gross margin	500,000
Selling and administrative expenses	550,000
Net operating loss	$ (50,000)

PMI produced and sold 60,000 units of EX300 at a price of $20 per unit and 12,500 units of TX500 at a price of $40 per unit. The company's traditional cost system allocates manufacturing overhead to products using a plantwide overhead rate and direct labor dollars as the allocation base. Additional information relating to the company's two product lines is shown below:

	EX300	TX500	Total
Direct materials	$366,325	$162,550	$ 528,875
Direct labor	$120,000	$42,500	162,500
Manufacturing overhead			508,625
Cost of goods sold			$1,200,000

The company has created an activity-based costing system to evaluate the profitability of its products. PMI's ABC implementation team concluded that $50,000 and $100,000 of the company's advertising expenses could be directly traced to EX300 and TX500, respectively. The remainder of the selling and administrative expenses was organization-sustaining in nature. The ABC team also distributed the company's manufacturing overhead to four activities as shown below:

Activity Cost Pool (and Activity Measure)	Manufacturing Overhead	Activity		
		EX300	TX500	Total
Machining (machine-hours)	$198,250	90,000	62,500	152,500
Setups (setup hours)	150,000	75	300	375
Product-sustaining (number of products)	100,000	1	1	2
Other (organization-sustaining costs)	60,375	NA	NA	NA
Total manufacturing overhead cost	$508,625			

Required:

1. Using Exhibit 7–12 as a guide, compute the product margins for the EX300 and TX500 under the company's traditional costing system.
2. Using Exhibit 7–10 as a guide, compute the product margins for EX300 and TX500 under the activity-based costing system.
3. Using Exhibit 7–13 as a guide, prepare a quantitative comparison of the traditional and activity-based cost assignments. Explain why the traditional and activity-based cost assignments differ.

PROBLEM 7–18 Comparing Traditional and Activity-Based Product Margins [LO1, LO3, LO4, LO5]

Rocky Mountain Corporation makes two types of hiking boots—Xactive and the Pathbreaker. Data concerning these two product lines appear below:

	Xactive	Pathbreaker
Selling price per unit	$127.00	$89.00
Direct materials per unit	$64.80	$51.00
Direct labor per unit	$18.20	$13.00
Direct labor-hours per unit	1.4 DLHs	1.0 DLHs
Estimated annual production and sales	25,000 units	75,000 units

The company has a traditional costing system in which manufacturing overhead is applied to units based on direct labor-hours. Data concerning manufacturing overhead and direct labor-hours for the upcoming year appear below:

Estimated total manufacturing overhead	$2,200,000
Estimated total direct labor-hours	110,000 DLHs

Required:

1. Using Exhibit 7–12 as a guide, compute the product margins for the Xactive and the Pathbreaker products under the company's traditional costing system.
2. The company is considering replacing its traditional costing system with an activity-based costing system that would assign its manufacturing overhead to the following four activity cost pools (the Other cost pool includes organization-sustaining costs and idle capacity costs):

Activities and Activity Measures	Estimated Overhead Cost	Expected Activity		
		Xactive	Pathbreaker	Total
Supporting direct labor (direct labor-hours)	$ 797,500	35,000	75,000	110,000
Batch setups (setups)	680,000	250	150	400
Product sustaining (number of products)	650,000	1	1	2
Other	72,500	NA	NA	NA
Total manufacturing overhead cost	$2,200,000			

   Using Exhibit 7–10 as a guide, compute the product margins for the Xactive and the Pathbreaker products under the activity-based costing system.
3. Using Exhibit 7–13 as a guide, prepare a quantitative comparison of the traditional and activity-based cost assignments. Explain why the traditional and activity-based cost assignments differ.

PROBLEM 7–19 Activity-Based Costing and Bidding on Jobs [LO2, LO3, LO4]

Denny Asbestos Removal Company removes potentially toxic asbestos insulation and related products from buildings. The company's estimator has been involved in a long-simmering dispute with the on-site work supervisors. The on-site supervisors claim that the estimator does not adequately distinguish between routine work such as removal of asbestos insulation around heating pipes in older homes and nonroutine work such as removing asbestos-contaminated ceiling plaster in industrial buildings. The on-site supervisors believe that nonroutine work is far more expensive than routine work and should bear higher customer charges. The estimator sums up his position in this way: "My job is to measure the area to be cleared of asbestos. As directed by top management, I simply multiply the square footage by $4,000 per thousand square feet to determine the bid price. Since our average cost is only $3,000 per thousand square feet, that leaves enough cushion to take

care of the additional costs of nonroutine work that shows up. Besides, it is difficult to know what is routine or nonroutine until you actually start tearing things apart."

To shed light on this controversy, the company initiated an activity-based costing study of all of its costs. Data from the activity-based costing system follow:

Activity Cost Pool	Activity Measure	Total Activity
Removing asbestos	Thousands of square feet	500 thousand square feet
Estimating and job setup	Number of jobs	200 jobs*
Working on nonroutine jobs	Number of nonroutine jobs	25 nonroutine jobs
Other (organization-sustaining and idle capacity costs)	None	Not applicable

*The total number of jobs includes nonroutine jobs as well as routine jobs. Nonroutine jobs as well as routine jobs require estimating and setup work.

Costs for the Year	
Wages and salaries	$ 200,000
Disposal fees	600,000
Equipment depreciation	80,000
On-site supplies	60,000
Office expenses	190,000
Licensing and insurance	370,000
Total cost	$1,500,000

	Distribution of Resource Consumption Across Activities				
	Removing Asbestos	Estimating and Job Setup	Working on Nonroutine Jobs	Other	Total
Wages and salaries	40%	10%	35%	15%	100%
Disposal fees	70%	0%	30%	0%	100%
Equipment depreciation	50%	0%	40%	10%	100%
On-site supplies	55%	15%	20%	10%	100%
Office expenses	10%	40%	30%	20%	100%
Licensing and insurance	50%	0%	40%	10%	100%

Required:

1. Using Exhibit 7–5 as a guide, perform the first-stage allocation of costs to the activity cost pools.
2. Using Exhibit 7–6 as a guide, compute the activity rates for the activity cost pools.
3. Using the activity rates you have computed, determine the total cost and the average cost per thousand square feet of each of the following jobs according to the activity-based costing system.
   a. A routine 2,000-square-foot asbestos removal job.
   b. A routine 4,000-square-foot asbestos removal job.
   c. A nonroutine 2,000-square-foot asbestos removal job.
4. Given the results you obtained in (3) above, do you agree with the estimator that the company's present policy for bidding on jobs is adequate?


PROBLEM 7–20 Evaluating the Profitability of Services [LO2, LO3, LO4, LO5]

Gore Range Carpet Cleaning is a family-owned business in Eagle-Vail, Colorado. For its services, the company has always charged a flat fee per hundred square feet of carpet cleaned. The current fee is $22.95 per hundred square feet. However, there is some question about whether the company is actually making any money on jobs for some customers—particularly those located on more

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remote ranches that require considerable travel time. The owner's daughter, home for the summer from college, has suggested investigating this question using activity-based costing. After some discussion, a simple system consisting of four activity cost pools seemed to be adequate. The activity cost pools and their activity measures appear below:

Activity Cost Pool	Activity Measure	Activity for the Year
Cleaning carpets	Square feet cleaned (00s)	10,000 hundred square feet
Travel to jobs	Miles driven	50,000 miles
Job support	Number of jobs	1,800 jobs
Other (organization-sustaining and idle capacity costs)	None	Not applicable

The total cost of operating the company for the year is $340,000, which includes the following costs:

Wages	$140,000
Cleaning supplies	25,000
Cleaning equipment depreciation	10,000
Vehicle expenses	30,000
Office expenses	60,000
President's compensation	75,000
Total cost	$340,000

Resource consumption is distributed across the activities as follows:

	Distribution of Resource Consumption Across Activities				
	Cleaning Carpets	Travel to Jobs	Job Support	Other	Total
Wages	75%	15%	0%	10%	100%
Cleaning supplies	100%	0%	0%	0%	100%
Cleaning equipment depreciation	70%	0%	0%	30%	100%
Vehicle expenses	0%	80%	0%	20%	100%
Office expenses	0%	0%	60%	40%	100%
President's compensation	0%	0%	30%	70%	100%

Job support consists of receiving calls from potential customers at the home office, scheduling jobs, billing, resolving issues, and so on.

Required:

1. Using Exhibit 7–5 as a guide, prepare the first-stage allocation of costs to the activity cost pools.
2. Using Exhibit 7–6 as a guide, compute the activity rates for the activity cost pools.
3. The company recently completed a 6 hundred square-foot carpet-cleaning job at the Lazy Bee Ranch—a 52-mile round-trip from the company's offices in Eagle-Vail. Compute the cost of this job using the activity-based costing system.
4. The revenue from the Lazy Bee Ranch was $137.70 (6 hundred square-feet at $22.95 per hundred square feet). Using Exhibit 7–11 as a guide, prepare a report showing the margin from this job.
5. What do you conclude concerning the profitability of the Lazy Bee Ranch job? Explain.
6. What advice would you give the president concerning pricing jobs in the future?

Appendix 7A: ABC Action Analysis

LEARNING OBJECTIVE 6
Prepare an action analysis report using activity-based costing data and interpret the report.

A conventional ABC analysis, such as the one presented in Exhibits 7–10 and 7–11 in the chapter, has several important limitations. Referring back to Exhibit 7–10, recall that the custom compass housings show a negative product margin of $49,500. Because of this apparent loss, managers were considering dropping this product. However, as the discussion among the managers revealed, it is unlikely that all of the $589,500 cost of the product would be avoided if it were dropped. Some of these costs would continue even if the product were totally eliminated. *Before* taking action, it is vital to identify which costs would be avoided and which costs would continue. Only those costs that can be avoided are relevant in the decision. Moreover, many of the costs are managed costs that would require explicit management action to eliminate. If the custom compass housings product line were eliminated, the direct materials cost would be avoided without any explicit management action—the materials simply wouldn't be ordered. On the other hand, if the custom compass housings were dropped, explicit management action would be required to eliminate the salaries of overhead workers that are assigned to this product.

Simply shifting these managed costs to other products would not solve anything. These costs would have to be eliminated or the resources *shifted to the constraint* to have any benefit to the company. While eliminating the cost is obviously beneficial, redeploying the resources is only beneficial if the resources are shifted to the constraint in the process. If the resources are redeployed to a work center that is not a constraint, it would increase the excess capacity in that work center—which has no direct benefit to the company.

In addition, if some overhead costs need to be eliminated as a result of dropping a product, specific managers must be held responsible for eliminating those costs or the reductions are unlikely to occur. If no one is specifically held responsible for eliminating the costs, they will almost certainly continue to be incurred. Without external pressure, managers usually avoid cutting costs in their areas of responsibility. The action analysis report developed in this appendix is intended to help top managers identify what costs are relevant in a decision and to place responsibility for the elimination of those costs on the appropriate managers.

Activity Rates—Action Analysis Report

Constructing an action analysis report begins with the results of the first-stage allocation, which is reproduced as Exhibit 7A–1 (page 318). In contrast to the conventional ABC analysis covered in the chapter, the calculation of the activity rates for an action analysis report is a bit more involved. In addition to computing an overall activity rate for each activity cost pool, an activity rate is computed for each cell in Exhibit 7A–1. The computations of activity rates for the action analysis are carried out in Exhibit 7A–2 (page 318). For example, the $125,000 cost of indirect factory wages for the Customer Orders cost pool is divided by the total activity for that cost pool—1,000 orders—to arrive at the activity rate of $125 per customer order for indirect factory wages. Similarly, the $200,000 cost of indirect factory wages for the Product Design cost pool is divided by the total activity for that cost pool—400 designs—to arrive at the activity rate of $500 per design for indirect factory wages. Note that the totals at the bottom of Exhibit 7A–2 agree with the overall activity rates in Exhibit 7–6 in the chapter. Exhibit 7A–2, which shows the activity rates for the action analysis report, contains more detail than Exhibit 7–6, which contains the activity rates for the conventional ABC analysis.

EXHIBIT 7A–1
First-Stage Allocations to Activity Cost Pools

	Activity Cost Pools					
	Customer Orders	Product Design	Order Size	Customer Relations	Other	Total
Production Department:						
Indirect factory wages	$ 125,000	$ 200,000	$ 100,000	$ 50,000	$ 25,000	$ 500,000
Factory equipment depreciation	60,000	0	180,000	0	60,000	300,000
Factory utilities	0	12,000	60,000	0	48,000	120,000
Factory building lease	0	0	0	0	80,000	80,000
General Administrative Department:						
Administrative wages and salaries	60,000	20,000	40,000	120,000	160,000	400,000
Office equipment depreciation	15,000	0	0	12,500	22,500	50,000
Administrative building lease	0	0	0	0	60,000	60,000
Marketing Department:						
Marketing wages and salaries	55,000	20,000	0	150,000	25,000	250,000
Selling expenses	5,000	0	0	35,000	10,000	50,000
Total cost	$ 320,000	$ 252,000	$ 380,000	$ 367,500	$ 490,500	$ 1,810,000

Exhibit 7A-1 | Exhibit 7A-2 | Exhibit 7A-3A | Exhibit 7A-3B | Exhibit

EXHIBIT 7A–2
Computation of the Activity Rates for the Action Analysis Report

	Activity Cost Pools				
	Customer Orders	Product Design	Order Size	Customer Relations	Other
Total activity	1,000 orders	400 product designs	20,000 machine-hours	250 active customers	Not applicable*
Production Department:					
Indirect factory wages	$ 125	$ 500	$ 5	$ 200	
Factory equipment depreciation	60	0	9	0	
Factory utilities	0	30	3	0	
Factory building lease	0	0	0	0	
General Administrative Department:					
Administrative wages and salaries	60	50	2	480	
Office equipment depreciation	15	0	0	50	
Administrative building lease	0	0	0	0	
Marketing Department:					
Marketing wages and salaries	55	50	0	600	
Selling expenses	5	0	0	140	
Total (conventional ABC analysis)	$ 320	$ 630	$ 19	$ 1,470	

*Activity rates are not computed for the Other cost pool since these costs will not be allocated further.

Exhibit 7A-2 | Exhibit 7A-3A | Exhibit 7A-3B | Exhibit

$125,000 ÷ 1,000 orders = $125 per order.

Other entries in the table are computed similarly.

Assignment of Overhead Costs to Products—Action Analysis Report

Computing the overhead costs to be assigned to products for an action analysis report also involves more detail than for a conventional ABC analysis. The computations for Classic Brass are carried out in Exhibit 7A–3. For example, the activity rate of $125 per customer order for indirect factory wages is multiplied by 600 orders for the standard stanchions to arrive at the cost of $75,000 for indirect factory wages in Exhibit 7A–3. Instead

EXHIBIT 7A–3
Action Analysis Cost Matrices

	A	B	C	D	E	F
1	**Action Analysis Cost Matrix for Standard Stanchions**					
3		*Activity Cost Pools*				
4		*Customer Orders*	*Product Design*	*Order Size*	*Customer Relations*	*Total*
6	Total activity for stanchions	600 orders		17,500 machine-hours	Not applicable	
7			product designs			
9	Production Department:					
10	Indirect factory wages	$ 75,000	$ 0	$ 87,500		$ 162,500
11	Factory equipment depreciation	36,000	0	157,500		193,500
12	Factory utilities	0	0	52,500		52,500
13	Factory building lease	0	0	0		0
15	General Administrative Department:					
16	Administrative wages and salaries	36,000	0	35,000		71,000
17	Office equipment depreciation	9,000	0	0		9,000
18	Administrative building lease	0	0	0		0
20	Marketing Department:					
21	Marketing wages and salaries	33,000	0	0		33,000
22	Selling expenses	3,000	0	0		3,000
24	Total (conventional ABC analysis)	$ 192,000	$ 0	$ 332,500		$ 524,500
25						

Exhibit 7A-1 | Exhibit 7A-2 | **Exhibit 7A-3A** | Exhibit 7A

From Exhibit 7A–2, the activity rate for indirect factory wages for the Customer Orders cost pool is $125 per order.

$125 per order × 600 orders = $75,000

Other entries in the table are computed in a similar way.

	A	B	C	D	E	F
1	**Action Analysis Cost Matrix for the Custom Compass Housings**					
3		*Activity Cost Pools*				
4		*Customer Orders*	*Product Design*	*Order Size*	*Customer Relations*	*Total*
6	Total activity for custom compass housings	400 order	400 product design	2,500 machine-hours	Not applicable	
9	Production Department:					
10	Indirect factory wages	$ 50,000	$ 200,000	$ 12,500		$ 262,500
11	Factory equipment depreciation	24,000	0	22,500		46,500
12	Factory utilities	0	12,000	7,500		19,500
13	Factory building lease	0	0	0		0
15	General Administrative Department:					
16	Administrative wages and salaries	24,000	20,000	5,000		49,000
17	Office equipment depreciation	6,000	0	0		6,000
18	Administrative building lease	0	0	0		0
20	Marketing Department:					
21	Marketing wages and salaries	22,000	20,000	0		42,000
22	Selling expenses	2,000	0	0		2,000
24	Total (conventional ABC analysis)	$ 128,000	$ 252,000	$ 47,500		$ 427,500
25						

Exhibit 7A-2 | Exhibit 7A-3A | **Exhibit 7A-3B** | Exhibit 7A-

From Exhibit 7A–2, the activity rate for indirect factory wages for the Customer Orders cost pool is $125 per order.

$125 per order × 400 orders = $50,000

Other entries in the table are computed in a similar way.

of just a single cost number for each cost pool as in the conventional ABC analysis, we now have an entire cost matrix showing much more detail. Note that the column totals for the cost matrix in Exhibit 7A–3 agree with the ABC costs for standard stanchions in Exhibit 7–8. Indeed, the conventional ABC analysis of Exhibit 7–10 can be easily constructed using the column totals at the bottom of the cost matrices in Exhibit 7A–3. In contrast, the action analysis report will be based on the row totals at the right of the cost matrices in Exhibit 7A–3. In addition, the action analysis report will include a simple color-coding scheme that will help managers identify how easily the various costs can be adjusted.

Ease of Adjustment Codes

The ABC team constructed Exhibit 7A–4 to aid managers in the use of the ABC data. In this exhibit, each cost has been assigned an *ease of adjustment code*—Green, Yellow, or Red. The **ease of adjustment code** reflects how easily the cost could be adjusted to changes in activity.[4] "Green" costs are those costs that would adjust more or less automatically to changes in activity without any action by managers. For example, direct materials costs would adjust to changes in orders without any action being taken by managers. If a customer does not order stanchions, the direct materials for the stanchions would not be required and would not be ordered. "Yellow" costs are those costs that could be adjusted in response to changes in activity, but such adjustments require management action; the adjustment is not automatic. The ABC team believes, for example, that direct labor costs should be included in the Yellow category. Managers must make difficult decisions and take explicit action to increase or decrease, in aggregate, direct labor costs—particularly because the company has a no lay-off policy. "Red" costs are costs that could be adjusted to changes in activity only with a great deal of difficulty, and the adjustment would require management action. The building leases fall into this category because it would be very difficult and expensive to break the leases.

The Action Analysis View of the ABC Data

Looking at Exhibit 7A–3, the totals on the right-hand side of the table indicate that the $427,500 of overhead cost for the custom compass housings consists of $262,500 of indirect factory wages, $46,500 of factory equipment depreciation, and so on. These data

EXHIBIT 7A–4
Ease of Adjustment Codes

Green: *Costs that adjust automatically to changes in activity without management action.*

Direct materials
Shipping costs

Yellow: *Costs that could, in principle, be adjusted to changes in activity, but management action would be required.*

Direct labor
Indirect factory wages
Factory utilities
Administrative wages and salaries
Office equipment depreciation
Marketing wages and salaries
Selling expenses

Red: *Costs that would be very difficult to adjust to changes in activity and management action would be required.*

Factory equipment depreciation
Factory building lease
Administrative building lease

[4] The idea of using colors to code how easily costs can be adjusted was suggested to us at a seminar put on by Boeing and by an article by Alfred King, "Green Dollars and Blue Dollars: The Paradox of Cost Reduction," *Journal of Cost Management,* Fall 1993, pp. 44–52.

	A	B	C
1	**Custom Compass Housings**		
2	Sales (from Exhibit 7-10)		$ 540,000
4	Green costs:		
5	Direct materials (from Exhibit 7-10)	$ 69,500	
6	Shipping (from Exhibit 7-10)	5,000	74,500
7	Green margin		465,500
9	Yellow costs:		
10	Direct labor (from Exhibit 7-10)	87,500	
11	Indirect factory wages (from Exhibit 7A-3)	262,500	
12	Factory utilities (from Exhibit 7A-3)	19,500	
13	Administrative wages and salaries (from Exhibit 7A-3)	49,000	
14	Office equipment depreciation (from Exhibit 7A-3)	6,000	
15	Marketing wages and salaries (from Exhibit 7A-3)	42,000	
16	Selling expenses (from Exhibit 7A-3)	2,000	468,500
17	Yellow margin		(3,000)
19	Red costs:		
20	Factory equipment depreciation (from Exhibit 7A-3)	46,500	
21	Factory building lease (from Exhibit 7A-3)	0	
22	Administrative building lease (from Exhibit 7A-3)	0	46,500
23	Red margin		$ (49,500)
24			

Exhibit 7A-3B | Exhibit 7A-5 | Activity rates

EXHIBIT 7A–5
Action Analysis of Custom Compass Housings: Activity-Based Costing System

are displayed in Exhibit 7A–5, which shows an action analysis of the custom compass housings product. An action analysis report shows what costs have been assigned to the cost object, such as a product or customer, and how difficult it would be to adjust the cost if there is a change in activity. Note that the Red margin at the bottom of Exhibit 7A–5, ($49,500), is exactly the same as the product margin for the custom compass housings in Exhibit 7–10 in the chapter.

The cost data in the action analysis in Exhibit 7A–5 are arranged by the color coded ease of adjustment. All of the Green costs—those that adjust more or less automatically to changes in activity—appear together at the top of the list of costs. These costs total $74,500 and are subtracted from the sales of $540,000 to yield a Green margin of $465,500. The same procedure is followed for the Yellow and Red costs. This action analysis indicates what costs would have to be cut and how difficult it would be to cut them if the custom compass housings product were dropped. Prior to making any decision about dropping products, the managers responsible for the costs must agree to either eliminate the resources represented by those costs or to transfer the resources to an area in the organization that really needs the resources—namely, a constraint. If managers do not make such a commitment, it is likely that the costs would continue to be incurred. As a result, the company would lose the sales from the products without really eliminating the costs.

MANAGERIAL ACCOUNTING IN ACTION
The Wrap-Up

After the action analysis was prepared by the ABC team, top management at Classic Brass met once again to review the results of the ABC analysis.

John: When we last met, we had discussed the advisability of discontinuing the custom compass housings product line. I understand that the ABC team has done some additional analysis to help us in making this decision.

Mary: That's right. The action analysis report we put together indicates how easy it would be to adjust each cost and where specific cost savings would have to come from if we were to drop the custom compass housings.

John: What's this red margin at the bottom of the action analysis? Isn't that a product margin?

Mary: Yes, it is. However, we call it a red margin because we should stop and think very, very carefully before taking any actions based on that margin.

John: Why is that?

Mary: As an example, we subtracted the costs of factory equipment depreciation to arrive at that red margin. We doubt that we could avoid any of that cost if we were to drop custom orders. We use the same machines on custom orders that we use on standard products. The factory equipment has no resale value, and it does not wear out through use.

John: What about this yellow margin?

Mary: Yellow means proceed with a great deal of caution. To get to the yellow margin we deducted from sales numerous costs that could be adjusted only if the managers involved are willing to eliminate resources or shift them to the constraint.

John: If I understand the yellow margin correctly, the apparent loss of $3,000 on the custom compass housings is the result of the indirect factory wages of $262,500.

Susan: Right, that's basically the wages of our design engineers.

John: I am uncomfortable with the idea of laying off any of our designers for numerous reasons. So where does that leave us?

Mary: What about raising prices on our custom products?

Tom: We should be able to do that. We have been undercutting the competition to make sure that we won bids on custom work because we thought it was a very profitable thing to do.

John: Why don't we just charge directly for design work?

Tom: Some of our competitors already do that. However, I don't think we would be able to charge enough to cover our design costs.

John: Can we do anything to make our design work more efficient so it costs us less? I'm not going to lay anyone off, but if we make the design process more efficient, we could lower the charge for design work and spread those costs across more customers.

Susan: That may be possible. I'll form a process improvement team to look at it.

John: Let's get some benchmark data on design costs. If we set our minds to it, I'm sure we can be world class in no time.

Susan: Okay. Mary, will you help with the benchmark data?

Mary: Sure.

John: Let's meet again in about a week to discuss our progress. Is there anything else on the agenda for today?

The points raised in the preceding discussion are extremely important. By measuring the resources consumed by products (and other cost objects), an ABC system provides a much better basis for decision making than a traditional cost accounting system that spreads overhead costs around without much regard for what might be causing the overhead. A well-designed ABC system provides managers with estimates of potentially relevant costs that can be a very useful starting point for management analysis.

Summary (Appendix 7A)

The action analysis report illustrated in this appendix is a valuable addition to the ABC toolkit. An action analysis report provides more information for decision making than a conventional ABC analysis. The action analysis report makes it clear where costs would have to be adjusted in the organization as a result of an action. In a conventional ABC analysis, a cost such as $320 for processing an order represents costs from many parts of the organization. If an order is dropped, there will be little pressure to actually eliminate the $320 cost unless it is clear where the costs are incurred and which managers would be responsible for reducing the cost. In contrast, an action analysis report traces the costs to where they are incurred in the organization and makes it much easier to assign responsibility to managers for reducing costs. In addition, an action analysis report provides information concerning how easily a cost can be adjusted. Costs that cannot be adjusted are not relevant in a decision.

Exhibit 7A–6 summarizes all of the steps required to create both an action analysis report as illustrated in this appendix and an activity analysis as shown in the chapter.

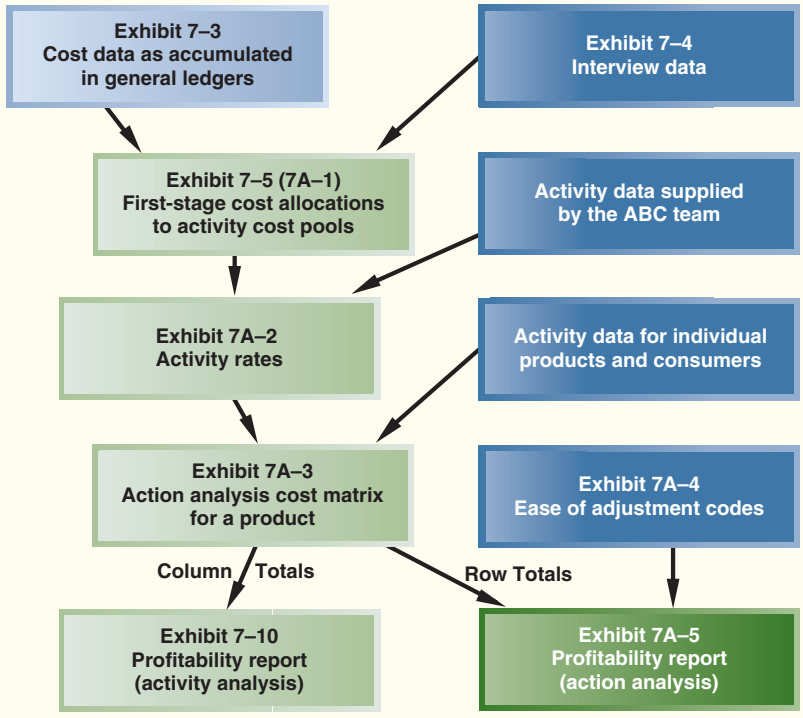


EXHIBIT 7A–6
Summary of the Steps to Produce an Action Analysis Report

Review Problem: Activity Analysis Report

Refer to the data for Ferris Corporation in the Review Problem at the end of the chapter on pages 298–300.

Required:

1. Compute activity rates for Ferris Corporation as in Exhibit 7A–2.
2. Using Exhibit 7A–3 as a guide, construct a table showing the overhead costs for the OfficeMart orders described in requirement (3) of the Review Problem at the end of the chapter.
3. The management of Ferris Corporation has assigned ease of adjustment codes to costs as follows:

Cost	Ease of Adjustment Code
Direct materials	Green
Direct labor	Yellow
Manufacturing overhead	Yellow
Selling and administrative overhead	Red

Using Exhibit 7A–5 as a guide, prepare an action analysis of the OfficeMart orders.

Solution to Review Problem

1. The activity rates for the activity cost pools are:

	Assembling Units	Processing Orders	Supporting Customers
Total activity	1,000 units	250 orders	100 customers
Manufacturing overhead	$250	$ 700	$ 250
Selling and administrative overhead	30	540	750
Total	$280	$1,240	$1,000

2. The overhead cost for the four orders of a total of 80 filing cabinets would be computed as follows:

	Assembling Units	Processing Orders	Supporting Customers	Total
Activity	80 units	4 orders	1 customer	
Manufacturing overhead	$20,000	$2,800	$ 250	$23,050
Selling and administrative overhead	2,400	2,160	750	5,310
Total	$22,400	$4,960	$1,000	$28,360

3. The action analysis report is:

Sales		$47,600
Green costs:		
Direct materials	$14,400	14,400
Green margin		33,200
Yellow costs:		
Direct labor	4,000	
Manufacturing overhead	23,050	27,050
Yellow margin		6,150
Red costs:		
Selling and administrative overhead	5,310	5,310
Red margin		$ 840

Glossary (Appendix 7A)

Ease of adjustment codes Costs are coded as Green, Yellow, or Red—depending on how easily the cost could be adjusted to changes in activity. "Green" costs adjust automatically to changes in activity. "Yellow" costs could be adjusted in response to changes in activity, but such adjustments require management action; the adjustment is not automatic. "Red" costs could be adjusted to changes in activity only with a great deal of difficulty and would require management action. (p. 320)

Appendix 7A Exercises and Problems

All applicable exercises and problems are available with McGraw-Hill's *Connect™ Accounting*.

EXERCISE 7A–1 Preparing an Action Analysis Report [LO6]

Pro Golf Corporation produces private label golf clubs for pro shops throughout North America. The company uses activity-based costing to evaluate the profitability of serving its customers. This analysis is based on categorizing the company's costs as follows, using the ease of adjustment color coding scheme described in Appendix 7A:

	Ease of Adjustment Code
Direct materials	Green
Direct labor	Yellow
Indirect labor	Yellow
Factory equipment depreciation	Red
Factory administration	Red
Selling and administrative wages and salaries	Red
Selling and administrative depreciation	Red
Marketing expenses	Yellow

Management would like to evaluate the profitability of a particular customer—the Peregrine Golf Club of Eagle, Colorado. Over the last 12 months this customer submitted one order for 80 golf clubs that had to be produced in two batches due to differences in product labeling requested by the customer. Summary data concerning the order appear below:

Number of clubs	80
Number of orders	1
Number of batches	2
Direct labor-hours per club	0.3
Selling price per club	$48.00
Direct materials cost per club	$25.40
Direct labor rate per hour	$21.50

A cost analyst working in the controller's office at the company has already produced the action analysis cost matrix for the Peregrine Golf Club that follows:

Action Analysis Cost Matrix for Peregrine Golf Club

	Activity Cost Pools				
Activity	Volume 24 direct labor-hours	Batch Processing 2 batches	Order Processing 1 order	Customer Service 1 customer	Total
Manufacturing overhead:					
Indirect labor	$ 33.60	$51.60	$ 4.80	$ 0.00	$ 90.00
Factory equipment depreciation	105.60	0.80	0.00	0.00	106.40
Factory administration	16.80	0.60	14.00	231.00	262.40
Selling and administrative overhead:					
Wages and salaries	12.00	0.00	38.00	386.00	436.00
Depreciation	0.00	0.00	5.00	25.00	30.00
Marketing expenses	115.20	0.00	57.00	368.00	540.20
Total	$283.20	$53.00	$118.80	$1,010.00	$1,465.00

Required:

Prepare an action analysis report showing the profitability of the Peregrine Golf Club. Include direct materials and direct labor costs in the report. Use Exhibit 7A–5 as a guide for organizing the report.

EXERCISE 7A–2 Second-Stage Allocation Using the Action Analysis Approach [LO4, LO6]

This exercise should be assigned in conjunction with Exercise 7–6.

The results of the first-stage allocation of the activity-based costing system at Transvaal Mining Tools Ltd., in which the activity rates were computed, appear below:

	Order Size	Customer Orders	Product Testing	Selling
Manufacturing overhead:				
Indirect labor	R 9.60	R 231.00	R 36.00	R 0.00
Factory depreciation	7.00	0.00	18.00	0.00
Factory utilities	0.20	0.00	1.00	0.00
Factory administration	0.00	46.00	24.00	12.00
Selling and administrative:				
Wages and salaries	0.80	72.00	0.00	965.00
Depreciation	0.00	11.00	0.00	36.00
Taxes and insurance	0.00	0.00	0.00	49.00
Selling expenses	0.00	0.00	0.00	432.00
Total overhead cost	R 17.60	R 360.00	R 79.00	R 1,494.00

Required:

1. Using Exhibit 7A–3 as a guide, prepare a report showing the overhead cost of the order for hard-rock drills discussed in Exercise 7–6. What is the total overhead cost of the order?
2. Explain the two different perspectives this report gives to managers concerning the nature of the overhead costs involved in the order. (Hint: Look at the row and column totals of the report you have prepared.)

EXERCISE 7A–3 Second-Stage Allocations and Margin Calculations Using the Action Analysis Approach [LO4, LO6]

Refer to the data for Theatre Seating, Inc., in Exercise 7–13 and the following additional details concerning the activity rates:

	Activity Rates			
	Supporting Direct Labor	Batch Processing	Order Processing	Customer Service
Manufacturing overhead:				
Indirect labor	$ 1.80	$72.00	$ 18.00	$ 0.00
Factory equipment depreciation	7.35	3.25	0.00	0.00
Factory administration	2.10	7.00	28.00	268.00
Selling and administrative:				
Wages and salaries	0.50	13.00	153.00	1,864.00
Depreciation	0.00	0.75	6.00	26.00
Marketing expenses	0.25	0.00	79.00	462.00
Total activity rate	$12.00	$96.00	$284.00	$2,620.00

Management has provided their ease of adjustment codes for purposes of preparing action analyses.

	Ease of Adjustment Codes
Direct materials	Green
Direct labor	Yellow
Manufacturing overhead:	
Indirect labor	Yellow
Factory equipment depreciation	Red
Factory administration	Red
Selling and administrative:	
Wages and salaries	Red
Depreciation	Red
Marketing expenses	Yellow

Required:
Using Exhibit 7A–5 as a guide, prepare an action analysis report for CineMax Entertainment similar to those prepared for products.

EXERCISE 7A–4 Comprehensive Activity-Based Costing Exercise [LO2, LO3, LO4, LO6]

Refer to the data for Silicon Optics in Exercise 7–11.

Required:
1. Using Exhibit 7A–1 as a guide, prepare a report showing the first-stage allocations of overhead costs to the activity cost pools.
2. Using Exhibit 7A–2 as a guide, compute the activity rates for the activity cost pools.
3. Using Exhibit 7A–3 as a guide, prepare a report showing the overhead costs for the order from Indus Telecom including customer support costs.
4. Using Exhibit 7–11 as a guide, prepare a report showing the customer margin for Indus Telecom.
5. Using Exhibit 7A–5 as a guide, prepare an action analysis report showing the customer margin for Indus Telecom. Direct materials should be coded as a Green cost, direct labor and wages and salaries as Yellow costs, and other overhead costs as a Red cost.
6. What action, if any, do you recommend as a result of the above analyses?

PROBLEM 7A–5 Second-Stage Allocations and Product Margins [LO4, LO6]

Refer to the data for AnimPix, Inc., in Problem 7–16. In addition, the company has provided the following details concerning its activity rates:

	Activity Rates		
	Animation Concept	Animation Production	Contract Administration
Technical staff salaries	$3,500	$5,000	$1,800
Animation equipment depreciation	600	1,500	0
Administrative wages and salaries	1,400	200	4,600
Supplies costs	300	600	100
Facility costs	200	400	100
Total	$6,000	$7,700	$6,600

Management has provided the following ease of adjustment codes for the various costs:

	Ease of Adjustment Code
Technical staff salaries	Red
Animation equipment depreciation	Red
Administrative wages and salaries	Yellow
Supplies costs	Green
Facility costs	Red

These codes created some controversy. In particular, some administrators objected to coding their own salaries Yellow, while the technical staff salaries were coded Red. However, the founders of the firm overruled these objections by pointing out that "our technical staff is our most valuable asset. Good animators are extremely difficult to find, and they would be the last to go if we had to cut back."

Required:
1. Using Exhibit 7A–3 as a guide, determine the cost of the local commercials market. (Think of the local commercials market as a product.)
2. Using Exhibit 7A–5 as a guide, prepare an action analysis report concerning the local commercials market. (This company has no direct materials or direct labor costs.)
3. What would you recommend to management concerning the local commercials market?

Appendix 7B: Using a Modified Form of Activity-Based Costing to Determine Product Costs for External Reports

LEARNING OBJECTIVE 7
Use activity-based costing techniques to compute unit product costs for external reports.

This chapter has emphasized using activity-based costing information in internal decisions. However, a modified form of activity-based costing can also be used to develop product costs for external financial reports. For this purpose, product costs include all manufacturing overhead costs—including organization-sustaining costs and the costs of idle capacity—and exclude all nonmanufacturing costs, even costs that are clearly caused by the products.

The simplest absorption costing systems as described in Chapter 3 assign manufacturing overhead costs to products using a single factory-wide predetermined overhead rate based on direct labor-hours or machine-hours. When activity-based costing is used to assign manufacturing overhead costs to products, a predetermined overhead rate is computed for each activity cost pool. An example will make this difference clear.

Maxtar Industries manufactures high-quality smoker/barbecue units. The company has two product lines—Premium and Standard. The company has traditionally applied manufacturing overhead costs to these products using a plantwide predetermined overhead rate based on direct labor-hours. Exhibit 7B–1 details how the unit product costs of the two product lines are computed using the company's traditional costing system. The unit product cost of the Premium product line is $71.60 and the unit product cost of the Standard product line is $53.70 according to this traditional costing system.

Maxtar Industries has recently experimented with an activity-based costing approach for determining its unit product costs for external reporting purposes. The company's activity-based costing system has three activity cost pools: (1) supporting direct labor; (2) setting up machines; and (3) parts administration. The top of Exhibit 7B–2 displays basic data concerning these activity cost pools. Note that the total estimated overhead cost in

EXHIBIT 7B–1
Maxtar Industries' Traditional Costing System

Basic Data

Total estimated manufacturing overhead cost	$1,520,000
Total estimated direct labor-hours	400,000 DLHs

	Premium	Standard
Direct materials per unit	$40.00	$30.00
Direct labor per unit	$24.00	$18.00
Direct labor-hours per unit	2.0 DLHs	1.5 DLHs
Units produced	50,000 units	200,000 units

Computation of the Predetermined Overhead Rate

$$\text{Predetermined overhead rate} = \frac{\text{Total estimated manufacturing overhead}}{\text{Total estimated amount of the allocation base}}$$

$$= \frac{\$1{,}520{,}000}{400{,}000 \text{ DLHs}} = \$3.80 \text{ per DLH}$$

Traditional Unit Product Costs

	Premium	Standard
Direct materials	$40.00	$30.00
Direct labor	24.00	18.00
Manufacturing overhead (2.0 DLHs × $3.80 per DLH; 1.5 DLHs × $3.80 per DLH)	7.60	5.70
Unit product cost	$71.60	$53.70

EXHIBIT 7B–2
Maxtar Industries' Activity-Based Costing System

Basic Data

Activities and Activity Measures	Estimated Overhead Cost	Expected Activity: Premium	Expected Activity: Standard	Expected Activity: Total
Supporting direct labor (DLHs)	$ 800,000	100,000	300,000	400,000
Setting up machines (setups)	480,000	600	200	800
Parts administration (part types)	240,000	140	60	200
Total manufacturing overhead cost	$1,520,000			

Computation of Activity Rates

Activities	(a) Estimated Overhead Cost	(b) Total Expected Activity	(a) ÷ (b) Activity Rate
Supporting direct labor	$800,000	400,000 DLHs	$2 per DLH
Setting up machines	$480,000	800 setups	$600 per setup
Parts administration	$240,000	200 part types	$1,200 per part type

Assigning Overhead Costs to Products

Overhead Cost for the Premium Product

Activity Cost Pools	(a) Activity Rate	(b) Activity	(a) × (b) ABC Cost
Supporting direct labor	$2 per DLH	100,000 DLHs	$200,000
Setting up machines	$600 per setup	600 setups	360,000
Parts administration	$1,200 per part type	140 part types	168,000
Total			$728,000

Overhead Cost for the Standard Product

Activity Cost Pools	(a) Activity Rate	(b) Activity	(a) × (b) ABC Cost
Supporting direct labor	$2 per DLH	300,000 DLHs	$600,000
Setting up machines	$600 per setup	200 setups	120,000
Parts administration	$1,200 per part type	60 part types	72,000
Total			$792,000

Activity-Based Costing Product Costs

	Premium	Standard
Direct materials	$40.00	$30.00
Direct labor	24.00	18.00
Manufacturing overhead ($728,000 ÷ 50,000 units; $792,000 ÷ 200,000 units)	14.56	3.96
Unit product cost	$78.56	$51.96

these three costs pools, $1,520,000, agrees with the total estimated overhead cost in the company's traditional costing system. The company's activity-based costing system simply provides an alternative way to allocate the company's manufacturing overhead across the two products.

The activity rates for the three activity cost pools are computed in the second table in Exhibit 7B–2. For example, the total cost in the "setting up machines" activity cost pool, $480,000, is divided by the total activity associated with that cost pool, 800 setups, to determine the activity rate of $600 per setup.

The activity rates are used to allocate overhead costs to the two products in the third table in Exhibit 7B–2. For example, the activity rate for the "setting up machines" activity cost pool, $600 per setup, is multiplied by the Premium product line's 600 setups to determine the $360,000 machine setup cost allocated to the Premium product line.

The table at the bottom of Exhibit 7B–2 displays the overhead costs per unit and the activity-based costing unit product costs. The overhead cost per unit is determined by dividing the total overhead cost by the number of units produced. For example, the Premium product line's total overhead cost of $728,000 is divided by 50,000 units to determine the $14.56 overhead cost per unit. Note that the unit product costs differ from those computed using the company's traditional costing system in Exhibit 7B–1. Because the activity-based costing system contains both a batch-level (setting up machines) and a product-level (parts administration) activity cost pool, the unit product costs under activity-based costing follow the usual pattern in which overhead costs are shifted from the high-volume to the low-volume product. The unit product cost of the Standard product line, the high-volume product, has gone down from $53.70 under the traditional costing system to $51.96 under activity-based costing. In contrast, the unit product cost of the Premium product line, the low-volume product, has increased from $71.60 under the traditional costing system to $78.56 under activity-based costing. Instead of arbitrarily assigning most of the costs of setting up machines and of parts administration to the high-volume product, the activity-based costing system more accurately assigns these costs to the two products.

Appendix 7B Exercises and Problems

All applicable exercises and problems are available with McGraw-Hill's *Connect™ Accounting*.

EXERCISE 7B–1 Activity-Based Costing Product Costs for External Reports [LO7]

Pryad Corporation makes ultra-lightweight backpacking tents. Data concerning the company's two product lines appear below:

	Deluxe	Standard
Direct materials per unit	$60.00	$45.00
Direct labor per unit	$9.60	$7.20
Direct labor-hours per unit	0.8 DLHs	0.6 DLHs
Estimated annual production	10,000 units	70,000 units

The company has a traditional costing system in which manufacturing overhead is applied to units based on direct labor-hours. Data concerning manufacturing overhead and direct labor-hours for the upcoming year appear below:

Estimated total manufacturing overhead	$290,000
Estimated total direct labor-hours	50,000 DLHs

Required:

1. Determine the unit product costs of the Deluxe and Standard products under the company's traditional costing system.

2. The company is considering replacing its traditional costing system for determining unit product costs for external reports with an activity-based costing system. The activity-based costing system would have the following three activity cost pools:

Activities and Activity Measures	Estimated Overhead Cost	Expected Activity		
		Deluxe	Standard	Total
Supporting direct labor (direct labor-hours) . . .	$150,000	8,000	42,000	50,000
Batch setups (setups)	60,000	200	50	250
Safety testing (tests)	80,000	80	20	100
Total manufacturing overhead cost	$290,000			

Determine the unit product costs of the Deluxe and Standard products under the activity-based costing system.

EXERCISE 7B–2 Activity-Based Costing Product Costs for External Reports [LO7]

Kunkel Company makes two products and uses a traditional costing system in which a single plantwide predetermined overhead rate is computed based on direct labor-hours. Data for the two products for the upcoming year follow:

	Mercon	Wurcon
Direct materials cost per unit . . .	$10.00	$8.00
Direct labor cost per unit	$3.00	$3.75
Direct labor-hours per unit	0.20	0.25
Number of units produced	10,000	40,000

These products are customized to some degree for specific customers.

Required:

1. The company's manufacturing overhead costs for the year are expected to be $336,000. Using the company's traditional costing system, compute the unit product costs for the two products.
2. Management is considering an activity-based costing system in which half of the overhead would continue to be allocated on the basis of direct labor-hours and half would be allocated on the basis of engineering design time. The Mercon product is expected to need 4,000 engineering design hours and the Wurcon product is also expected to need 4,000 engineering design hours. Compute the unit product costs for the two products using the proposed ABC system.
3. Explain why the unit product costs differ between the two systems.

PROBLEM 7B–3 Activity-Based Costing as an Alternative to Traditional Product Costing [LO7]

Rehm Company manufactures a product that is available in both a deluxe model and a regular model. The company has manufactured the regular model for years. The deluxe model was introduced several years ago to tap a new segment of the market. Since introduction of the deluxe model, the company's profits have steadily declined, and management has become increasingly concerned about the accuracy of its costing system. Sales of the deluxe model have been increasing rapidly.

Manufacturing overhead is assigned to products on the basis of direct labor-hours. For the current year, the company has estimated that it will incur $6,000,000 in manufacturing overhead cost and produce 15,000 units of the deluxe model and 120,000 units of the regular model. The deluxe model requires 1.6 hours of direct labor time per unit, and the regular model requires 0.8 hours. Material and labor costs per unit are as follows:

	Model	
	Deluxe	Regular
Direct materials	$154	$112
Direct labor	$16	$8

Required:

1. Using direct labor-hours as the base for assigning manufacturing overhead cost to products, compute the predetermined overhead rate. Using this rate and other data from the problem, determine the unit product cost of each model.
2. Management is considering using activity-based costing to apply manufacturing overhead costs to products for external financial reports. The activity-based costing system would have the following four activity cost pools:

Activity Cost Pool	Activity Measure	Estimated Overhead Costs
Purchase orders	Number of purchase orders	$ 252,000
Scrap/rework orders	Number of scrap/rework orders	648,000
Product testing	Number of tests	1,350,000
Machine related	Machine-hours	3,750,000
Total overhead cost		$6,000,000

	Expected Activity		
Activity Measure	Deluxe	Regular	Total
Number of purchase orders	400	800	1,200
Number of scrap/rework orders	500	400	900
Number of tests	6,000	9,000	15,000
Machine-hours	20,000	30,000	50,000

Using Exhibit 7–6 as a guide, compute the predetermined overhead rates (i.e., activity rates) for each of the four activity cost pools.

3. Using the predetermined overhead rates computed in part (2) above, do the following:
   a. Compute the total amount of manufacturing overhead cost that would be applied to each model using the activity-based costing system. After these totals have been computed, determine the amount of manufacturing overhead cost per unit for each model.
   b. Compute the unit product cost of each model (materials, labor, and manufacturing overhead).
4. From the data you have developed in (1) through (3) above, identify factors that may account for the company's declining profits.

PROBLEM 7B–4 Activity-Based Costing as an Alternative to Traditional Product Costing [LO7]

Erte, Inc., manufactures two models of high-pressure steam valves, the XR7 model and the ZD5 model. Data regarding the two products follow:

Product	Direct Labor-Hours	Annual Production	Total Direct Labor-Hours
XR7	0.2 DLHs per unit	20,000 units	4,000 DLHs
ZD5	0.4 DLHs per unit	40,000 units	16,000 DLHs
			20,000 DLHs

Additional information about the company follows:

a. Product XR7 requires $35 in direct materials per unit, and product ZD5 requires $25.
b. The direct labor rate is $20 per hour.
c. The company has always used direct labor-hours as the base for applying manufacturing overhead cost to products. Manufacturing overhead totals $1,480,000 per year.

d. Product XR7 is more complex to manufacture than product ZD5 and requires the use of a special milling machine.
e. Because of the special work required in (d) above, the company is considering the use of activity-based costing to apply overhead cost to products. Three activity cost pools have been identified and the first-stage allocations have been completed. Data concerning these activity cost pools appear below:

Activity Cost Pool	Activity Measure	Estimated Total Cost	Estimated Total Activity		
			XR7	ZD5	Total
Machine setups	Number of setups	$ 180,000	150	100	250
Special milling	Machine-hours	300,000	1,000	0	1,000
General factory	Direct labor-hours	1,000,000	4,000	16,000	20,000
		$1,480,000			

Required:

1. Assume that the company continues to use direct labor-hours as the base for applying overhead cost to products.
   a. Compute the predetermined overhead rate.
   b. Determine the unit product cost of each product.
2. Assume that the company decides to use activity-based costing to apply overhead cost to products.
   a. Compute the activity rate for each activity cost pool. Also, compute the amount of overhead cost that would be applied to each product.
   b. Determine the unit product cost of each product.
3. Explain why overhead cost shifted from the high-volume product to the low-volume product under activity-based costing.

CASE 7B–5 Activity-Based Costing as an Alternative to Traditional Product Costing [LO7]

Coffee Bean, Inc. (CBI), is a processor and distributor of a variety of blends of coffee. The company buys coffee beans from around the world and roasts, blends, and packages them for resale. CBI currently has 40 different coffees that it sells to gourmet shops in one-pound bags. The major cost of the coffee is raw materials. However, the company's predominantly automated roasting, blending, and packing process requires a substantial amount of manufacturing overhead. The company uses relatively little direct labor.

Some of CBI's coffees are very popular and sell in large volumes, while a few of the newer blends have very low volumes. CBI prices its coffee at manufacturing cost plus a markup of 30%. If CBI's prices for certain coffees are significantly higher than market, adjustments are made to bring CBI's prices more into alignment with the market because customers are somewhat price conscious.

For the coming year, CBI's budget includes estimated manufacturing overhead cost of $3,000,000. CBI assigns manufacturing overhead to products on the basis of direct labor-hours. The expected direct labor cost totals $600,000, which represents 50,000 hours of direct labor time. Based on the sales budget and expected raw materials costs, the company will purchase and use $6,000,000 of raw materials (mostly coffee beans) during the year.

The expected costs for direct materials and direct labor for one-pound bags of two of the company's coffee products appear below.

	Mona Loa	Malaysian
Direct materials	$4.20	$3.20
Direct labor (0.025 hours per bag)	$0.30	$0.30

CBI's controller believes that the company's traditional costing system may be providing misleading cost information. To determine whether or not this is correct, the controller has prepared an analysis of the year's expected manufacturing overhead costs, as shown in the following table:

Activity Cost Pool	Activity Measure	Expected Activity for the Year	Expected Cost for the Year
Purchasing	Purchase orders	1,710 orders	$ 513,000
Material handling	Number of setups	1,800 setups	720,000
Quality control	Number of batches	600 batches	144,000
Roasting	Roasting hours	96,100 roasting hours	961,000
Blending	Blending hours	33,500 blending hours	402,000
Packaging	Packaging hours	26,000 packaging hours	260,000
Total manufacturing overhead cost			$3,000,000

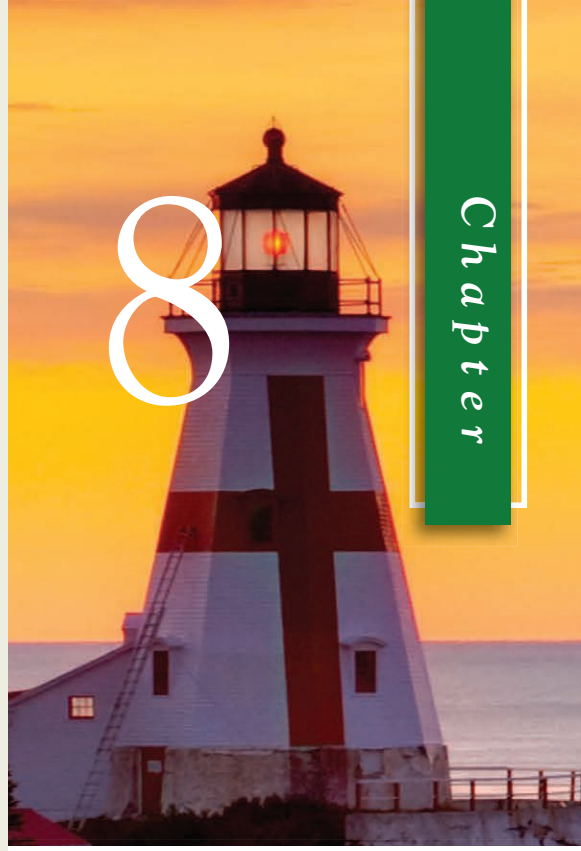
Data regarding the expected production of Mona Loa and Malaysian coffee are presented below.

	Mona Loa	Malaysian
Expected sales	100,000 pounds	2,000 pounds
Batch size	10,000 pounds	500 pounds
Setups	3 per batch	3 per batch
Purchase order size	20,000 pounds	500 pounds
Roasting time per 100 pounds	1.0 hour	1.0 hour
Blending time per 100 pounds	0.5 hour	0.5 hour
Packaging time per 100 pounds	0.1 hour	0.1 hour

Required:

1. Using direct labor-hours as the base for assigning manufacturing overhead cost to products, do the following:
   a. Determine the predetermined overhead rate that will be used during the year.
   b. Determine the unit product cost of one pound of Mona Loa coffee and one pound of Malaysian coffee.
2. Using activity-based costing as the basis for assigning manufacturing overhead cost to products, do the following:
   a. Determine the total amount of manufacturing overhead cost assigned to the Mona Loa coffee and to the Malaysian coffee for the year.
   b. Using the data developed in (2a) above, compute the amount of manufacturing overhead cost per pound of Mona Loa coffee and Malaysian coffee. Round all computations to the nearest whole cent.
   c. Determine the unit product cost of one pound of Mona Loa coffee and one pound of Malaysian coffee.
3. Write a brief memo to the president of CBI explaining what you have found in (1) and (2) above and discussing the implications to the company of using direct labor as the base for assigning manufacturing overhead cost to products.

(CMA, adapted)



Chapter 8

Profit Planning

Planning for a Crisis—Civil War Preservation Trust

BUSINESS FOCUS

The Civil War Preservation Trust (CWPT) is a private, nonprofit organization with 70,000 members that works to preserve the nation's remaining Civil War battlefields—many of which are threatened by commercial development such as shopping centers, houses, industrial parks, and casinos. To forestall development, the CWPT typically purchases the land or development rights to the land. The CWPT has saved over 25,000 acres from development, including, for example, 698 acres of battlefield at Gettysburg.

CWPT's management team was particularly concerned about the budget proposal for 2009, which was to be presented to the board of directors in the fall of 2008. The CWPT is wholly supported by contributions from its members and many of those members had been adversely affected by the ongoing financial crisis that followed the collapse of the subprime mortgage market. Consequently, the funds that would be available for operations in 2009 were particularly difficult to predict. Accordingly, the budget for 2009 contained three variations based on progressively pessimistic economic assumptions. The more pessimistic budgets were called contingent budgets. As 2008 progressed and member contributions declined somewhat from previous levels, CWPT switched to the first contingent budget. This contingent budget required a number of actions to reduce costs including a hiring freeze and a salary freeze, but maintained an aggressive program of protecting battlefield acreage through purchases of land and development rights. Fortunately, the CWPT did not have to switch to the most pessimistic budget—which would have involved layoffs and other extraordinary cost-saving measures.

Instead of reacting in a panic mode to unfavorable developments, CWPT used the budgeting process to carefully plan in advance for a number of possible contingencies. ■

Sources: Communications with James Lighthizer, president, and David Duncan, director of membership and development, Civil War Preservation Trust; and the CWPT website, civilwar.org.

LEARNING OBJECTIVES

After studying Chapter 8, you should be able to:

- **LO1** Understand why organizations budget and the processes they use to create budgets.
- **LO2** Prepare a sales budget, including a schedule of expected cash collections.
- **LO3** Prepare a production budget.
- **LO4** Prepare a direct materials budget, including a schedule of expected cash disbursements for purchases of materials.
- **LO5** Prepare a direct labor budget.
- **LO6** Prepare a manufacturing overhead budget.
- **LO7** Prepare a selling and administrative expense budget.
- **LO8** Prepare a cash budget.
- **LO9** Prepare a budgeted income statement.
- **LO10** Prepare a budgeted balance sheet.

In this chapter, we focus on the steps taken by businesses to achieve their planned levels of profits—a process called *profit planning*. Profit planning is accomplished by preparing a number of budgets that together form an integrated business plan known as the *master budget*. The master budget is an essential management tool that communicates management's plans throughout the organization, allocates resources, and coordinates activities.

The Basic Framework of Budgeting

LEARNING OBJECTIVE 1
Understand why organizations budget and the processes they use to create budgets.

A **budget** is a detailed plan for the future that is usually expressed in formal quantitative terms. Individuals sometimes create household budgets that balance their income and expenditures for food, clothing, housing, and so on while providing for some savings. Once the budget is established, actual spending is compared to the budget to make sure the plan is being followed. Companies use budgets in a similar way, although the amount of work and underlying details far exceed a personal budget.

Budgets are used for two distinct purposes—*planning* and *control*. **Planning** involves developing goals and preparing various budgets to achieve those goals. **Control** involves gathering feedback to ensure that the plan is being properly executed or modified as circumstances change. To be effective, a good budgeting system must provide for both planning and control. Good planning without effective control is a waste of time and effort.

Advantages of Budgeting

Organizations realize many benefits from budgeting, including:

1. Budgets *communicate* management's plans throughout the organization.
2. Budgets force managers to *think about* and *plan* for the future. In the absence of the necessity to prepare a budget, many managers would spend all of their time dealing with day-to-day emergencies.
3. The budgeting process provides a means of *allocating resources* to those parts of the organization where they can be used most effectively.
4. The budgeting process can uncover potential *bottlenecks* before they occur.
5. Budgets *coordinate* the activities of the entire organization by *integrating* the plans of its various parts. Budgeting helps to ensure that everyone in the organization is pulling in the same direction.
6. Budgets define goals and objectives that can serve as *benchmarks* for evaluating subsequent performance.

IN BUSINESS

EXECUTING STRATEGY WITH BUDGETS

Robert DeMartini, the CEO of New Balance, set a goal of tripling his company's revenues to $3 billion in four years. He tripled the company's annual advertising budget and doubled its consumer research budget in an effort to attract more young customers. These decisions represented a strategic shift for New Balance, which usually spends less than $20 million per year in advertising compared to competitors such as Nike and Adidas, which annually invest $184 million and $80 million, respectively.

One reason companies prepare budgets is to allocate resources across departments in a manner that supports strategic priorities. DeMartini used the budget to send a clear signal that his marketing department was expected to play a huge role in achieving the company's revenue growth targets. As time progresses, he will compare the company's actual revenue growth from young consumers to the marketing department's expenditures to see if his strategy is working or requires adjustment.

Source: Stephanie Kang, "New Balance Steps up Marketing Drive," *The Wall Street Journal*, March 21, 2008, p. B3.

Responsibility Accounting

Most of what we say in this chapter and in the next three chapters is concerned with *responsibility accounting*. The basic idea underlying **responsibility accounting** is that a manager should be held responsible for those items—and *only* those items—that the manager can actually control to a significant extent. Each line item (i.e., revenue or cost) in the budget is the responsibility of a manager who is held responsible for subsequent deviations between budgeted goals and actual results. In effect, responsibility accounting *personalizes* accounting information by holding individuals responsible for revenues and costs. This concept is central to any effective profit planning and control system. Someone must be held responsible for each cost or else no one will be responsible and the cost will inevitably grow out of control.

What happens if actual results do not measure up to the budgeted goals? The manager is not necessarily penalized. However, the manager should take the initiative to correct any unfavorable discrepancies, should understand the source of significant favorable or unfavorable discrepancies, and should be prepared to explain the reasons for discrepancies to higher management. The point of an effective responsibility accounting system is to make sure that nothing "falls through the cracks," that the organization reacts quickly and appropriately to deviations from its plans, and that the organization learns from the feedback it gets by comparing budgeted goals to actual results. The point is *not* to penalize individuals for missing targets.

IN BUSINESS

NEW YORK CITY MAYOR BENEFITS FROM BUDGETS

Michael Bloomberg, the mayor of New York City, makes annual budget presentations to his fellow elected officials, the city council, and the media. Historically, the city's mayors had delegated these types of presentations to one of their budget directors; however, Bloomberg believes that by investing his time in explaining the factors influencing the city's economy, his constituents will gain a better understanding of his fiscal priorities. This, in turn, helps improve his negotiations with the city council and his relationships with various advocacy groups. The mayor also makes his entire budget available online so that New Yorkers can scrutinize budgeting details, such as the cost of running specific government agencies.

Source: Tom Lowry, "The CEO Mayor," *BusinessWeek*, June 25, 2007, pp. 58–64.

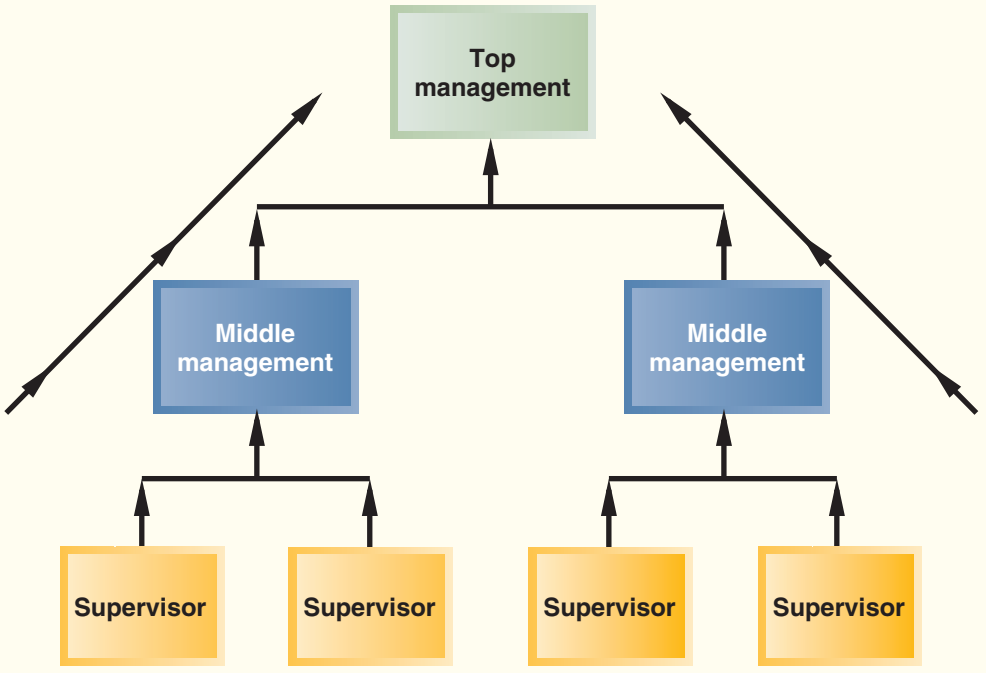
Choosing a Budget Period

Operating budgets ordinarily cover a one-year period corresponding to the company's fiscal year. Many companies divide their budget year into four quarters. The first quarter is then subdivided into months, and monthly budgets are developed. The last three quarters may be carried in the budget as quarterly totals only. As the year progresses, the figures for the second quarter are broken down into monthly amounts, then the third-quarter figures are broken down, and so forth. This approach has the advantage of requiring periodic review and reappraisal of budget data throughout the year.

Continuous or *perpetual budgets* are sometimes used. A **continuous** or **perpetual budget** is a 12-month budget that rolls forward one month (or quarter) as the current month (or quarter) is completed. In other words, one month (or quarter) is added to the end of the budget as each month (or quarter) comes to a close. This approach keeps managers focused at least one year ahead so that they do not become too narrowly focused on short-term results.

In this chapter, we will look at one-year operating budgets. However, using basically the same techniques, operating budgets can be prepared for periods that extend over many years. It may be difficult to accurately forecast sales and other data much beyond

EXHIBIT 8–1
The Initial Flow of Budget Data in a Participative Budgeting System



The initial flow of budget data in a participative budgeting system is from lower levels of responsibility to higher levels of responsibility. Each person with responsibility for cost control will prepare his or her own budget estimates and submit them to the next higher level of management. These estimates are reviewed and consolidated as they move upward in the organization.

a year, but even rough estimates can be invaluable in uncovering potential problems and opportunities that would otherwise be overlooked.

The Self-Imposed Budget

The success of a budget program is largely determined by the way a budget is developed. Oftentimes, the budget is imposed from above, with little participation by lower-level managers. However, in the most successful budget programs, managers actively participate in preparing their own budgets. Imposing expectations from above and then penalizing employees who do not meet those expectations will generate resentment rather than cooperation and commitment. In fact, many managers believe that being empowered to create their own *self-imposed budgets* is the most effective method of budget preparation. A **self-imposed budget** or **participative budget,** as illustrated in Exhibit 8–1, is a budget that is prepared with the full cooperation and participation of managers at all levels.

Self-imposed budgets have a number of advantages:

1. Individuals at all levels of the organization are recognized as members of the team whose views and judgments are valued by top management.
2. Budget estimates prepared by front-line managers are often more accurate and reliable than estimates prepared by top managers who have less intimate knowledge of markets and day-to-day operations.
3. Motivation is generally higher when individuals participate in setting their own goals than when the goals are imposed from above. Self-imposed budgets create commitment.
4. A manager who is not able to meet a budget that has been imposed from above can always say that the budget was unrealistic and impossible to meet. With a self-imposed budget, this excuse is not available.

One important limitation of self-imposed budgeting is that lower-level managers may allow too much *budgetary slack.* Because the manager who creates the budget will be held accountable for actual results that deviate from the budget, the manager will have a natural tendency to submit a budget that is easy to attain (i.e., the manager will build slack into the budget). For this reason, budgets prepared by lower-level managers should be scrutinized by higher levels of management. Questionable items should be discussed and modified as appropriate. Without such a review, self-imposed budgets may be too slack, resulting in suboptimal performance.

As these comments suggest, all levels in the organization should work together to produce the budget. Lower-level managers are more familiar with day-to-day operations than top managers. Top managers should have a more strategic perspective than lower-level managers. Each level of responsibility in an organization should contribute its unique knowledge and perspective in a cooperative effort to develop an integrated budget. Nevertheless, a self-imposed approach to setting budgets works best when all managers understand the organization's strategy. Otherwise, the budgets proposed by the lower-level managers will lack coherent direction. In later chapters, we discuss in greater detail how a company can go about formulating its strategy and communicating it throughout the organization.

Unfortunately, most companies do not follow the budgeting process we have described. Typically, top managers initiate the budgeting process by issuing profit targets. Lower-level managers are directed to prepare budgets that meet those targets. The difficulty is that the targets set by top managers may be unrealistically high or may allow too much slack. If the targets are too high and employees know they are unrealistic, motivation will suffer. If the targets allow too much slack, waste will occur. Unfortunately, top managers are often not in a position to know whether the targets are appropriate. Admittedly, a self-imposed budgeting system may lack sufficient strategic direction and lower-level managers may be tempted to build slack into their budgets. Nevertheless, because of the motivational advantages of self-imposed budgets, top managers should be cautious about imposing inflexible targets from above.

Human Factors in Budgeting

The success of a budget program also depends on the degree to which top management accepts the budget program as a vital part of the company's activities and the way in which top management uses budgeted data.

If a budget program is to be successful, it must have the complete acceptance and support of the persons who occupy key management positions. If lower or middle managers sense that top management is lukewarm about budgeting, or if they sense that top management simply tolerates budgeting as a necessary evil, then their own attitudes will reflect a similar lack of enthusiasm. Budgeting is hard work, and if top management is not enthusiastic about and committed to the budget program, then it is unlikely that anyone else in the organization will be either.

In administering the budget program, it is particularly important that top management not use the budget to pressure or blame employees. Using budgets in such negative ways will breed hostility, tension, and mistrust rather than cooperation and productivity. Unfortunately, the budget is too often used as a pressure device and excessive emphasis is placed on "meeting the budget" under all circumstances. Rather than being used as a weapon, the budget should be used as a positive instrument to assist in establishing goals, measuring operating results, and isolating areas that need attention.

The human aspects of budgeting are extremely important. The remainder of the chapter deals with technical aspects of budgeting, but do not lose sight of the human aspects. The purpose of the budget is to motivate people and to coordinate their efforts. This purpose is undermined if managers become preoccupied with the technical aspects, or if the budget is used in a rigid and inflexible manner to control people.

How challenging should budget targets be? Some experts argue that budget targets should be very challenging and should require managers to stretch to meet goals. Even the most capable managers may have to scramble to meet such a "stretch budget" and

they may not always succeed. In practice, most companies set their budget targets at a "highly achievable" level. A highly achievable budget may be challenging, but it can almost always be met by competent managers exerting reasonable effort.

Bonuses based on meeting and exceeding budgets are often a key element of management compensation. Typically, no bonus is paid unless the budget is met. The bonus often increases when the budget target is exceeded, but the bonus is usually capped out at some level. For obvious reasons, managers who have such a bonus plan or whose performance is evaluated based on meeting budget targets usually prefer to be evaluated based on highly achievable budgets rather than on stretch budgets. Moreover, highly achievable budgets may help build a manager's confidence and generate greater commitment to the budget. And finally, highly achievable budgets may result in less undesirable behavior at the end of budgetary periods by managers who are intent on earning their bonuses.

IN BUSINESS

BIASING FORECASTS

A manager's compensation is often tied to the budget. Typically, no bonus is paid unless a minimum performance hurdle such as 80% of the budget target is attained. Once that hurdle is passed, the manager's bonus increases until a cap is reached. That cap is often set at 120% of the budget target.

This common method of tying a manager's compensation to the budget has some serious negative side effects. For example, a marketing manager for a big beverage company intentionally grossly understated demand for the company's products for an upcoming major holiday so that the budget target for revenues would be low and easy to beat. Unfortunately, the company tied its production to this biased forecast and ran out of products to sell during the height of the holiday selling season.

As another example, near the end of the year another group of managers announced a price increase of 10% effective January 2 of the following year. Why would they do this? By announcing this price increase, managers hoped that customers would order before the end of the year, helping managers meet their sales targets for the current year. Sales in the following year would, of course, drop. What trick would managers pull to meet their sales targets next year in the face of this drop in demand?

Sources: Michael C. Jensen, "Corporate Budgeting Is Broken—Let's Fix It," *Harvard Business Review*, November 2001; and Michael C. Jensen, "Why Pay People to Lie?" *The Wall Street Journal*, January 8, 2001, p. A32.

The Budget Committee

A standing **budget committee** is usually responsible for overall policy relating to the budget program and for coordinating the preparation of the budget itself. This committee may consist of the president; vice presidents in charge of various functions such as sales, production, and purchasing; and the controller. Difficulties and disputes relating to the budget are resolved by the budget committee. In addition, the budget committee approves the final budget.

Disputes can (and do) erupt over budget matters. Because budgets allocate resources, the budgeting process determines to a large extent which departments get more resources and which get less. Also, the budget sets the benchmarks used to evaluate managers and their departments. Therefore, it should not be surprising that managers take the budgeting process very seriously and invest considerable energy and emotion in ensuring that their interests, and those of their departments, are protected. Because of this, the budgeting process can easily degenerate into interoffice arguments in which the ultimate goal of working together toward common goals is forgotten.

Running a successful budgeting program that avoids interoffice battles requires considerable interpersonal skills in addition to purely technical skills. But even the best interpersonal skills will fail if, as discussed earlier, top management uses the budget process to inappropriately pressure employees or to assign blame.

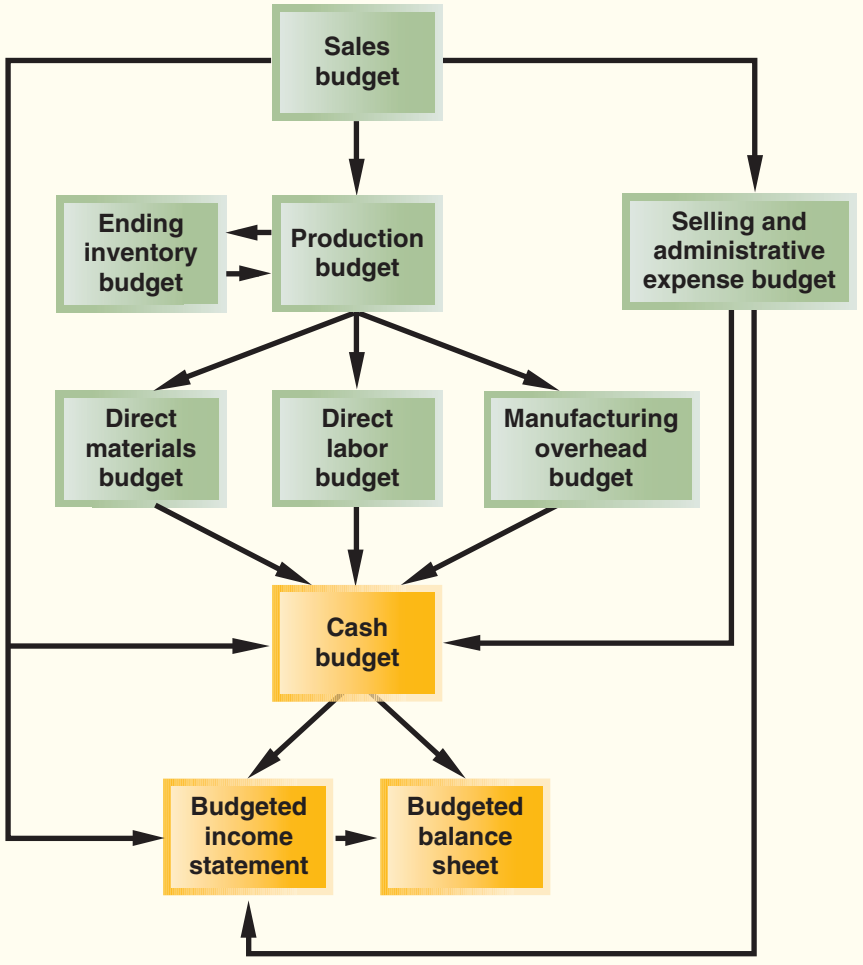


EXHIBIT 8–2
The Master Budget Interrelationships

The Master Budget: An Overview

The **master budget** consists of a number of separate but interdependent budgets that formally lay out the company's sales, production, and financial goals. The master budget culminates in a cash budget, a budgeted income statement, and a budgeted balance sheet. Exhibit 8–2 provides an overview of the various parts of the master budget and how they are related.

The first step in the budgeting process is the preparation of the **sales budget,** which is a detailed schedule showing the expected sales for the budget period. An accurate sales budget is the key to the entire budgeting process. As illustrated in Exhibit 8–2, all other parts of the master budget depend on the sales budget. If the sales budget is inaccurate, the rest of the budget will be inaccurate. The sales budget is based on the company's sales forecast, which may require the use of sophisticated mathematical models and statistical tools. We will not go into the details of how sales forecasts are made. This is a subject that is most appropriately covered in marketing courses.

The sales budget helps determine how many units need to be produced. Thus, the production budget is prepared after the sales budget. The production budget in turn is used to determine the budgets for manufacturing costs including the direct materials budget, the direct labor budget, and the manufacturing overhead budget. These budgets are then combined with data from the sales budget and the selling and administrative expense budget to determine the *cash budget.* A **cash budget** is a detailed plan showing how cash resources will be acquired and used. Observe from Exhibit 8–2 that all of the operating budgets have an impact on the cash budget. After the cash budget is prepared, the budgeted income statement and then the budgeted balance sheet can be prepared.

Preparing the Master Budget

MANAGERIAL ACCOUNTING IN ACTION

The Issue

Tom Wills is the majority stockholder and chief executive officer of Hampton Freeze, Inc., a company he started in 2010. The company makes premium popsicles using only natural ingredients and featuring exotic flavors such as tangy tangerine and minty mango. The company's business is highly seasonal, with most of the sales occurring in spring and summer.

In 2011, the company's second year of operations, a major cash crunch in the first and second quarters almost forced the company into bankruptcy. In spite of this cash crunch, 2011 turned out to be a very successful year in terms of both cash flow and net income. Partly as a result of that harrowing experience, Tom decided toward the end of 2011 to hire a professional financial manager. Tom interviewed several promising candidates for the job and settled on Larry Giano, who had considerable experience in the packaged foods industry. In the job interview, Tom questioned Larry about the steps he would take to prevent a recurrence of the 2011 cash crunch:

Tom: As I mentioned earlier, we are going to end 2011 with a very nice profit. What you may not know is that we had some very big financial problems this year.
Larry: Let me guess. You ran out of cash sometime in the first or second quarter.
Tom: How did you know?
Larry: Most of your sales are in the second and third quarter, right?
Tom: Sure, everyone wants to buy popsicles in the spring and summer, but nobody wants them when the weather turns cold.
Larry: So you don't have many sales in the first quarter?
Tom: Right.
Larry: And in the second quarter, which is the spring, you are producing like crazy to fill orders?
Tom: Sure.
Larry: Do your customers, the grocery stores, pay you the day you make your deliveries?
Tom: Are you kidding? Of course not.
Larry: So in the first quarter, you don't have many sales. In the second quarter, you are producing like crazy, which eats up cash, but you aren't paid by your customers until long after you have paid your employees and suppliers. No wonder you had a cash problem. I see this pattern all the time in food processing because of the seasonality of the business.
Tom: So what can we do about it?
Larry: The first step is to predict the magnitude of the problem before it occurs. If we can predict early in the year what the cash shortfall is going to be, we can go to the bank and arrange for credit before we really need it. Bankers tend to be leery of panicky people who show up begging for emergency loans. They are much more likely to make the loan if you look like you are in control of the situation.
Tom: How can we predict the cash shortfall?
Larry: You can put together a cash budget. While you're at it, you might as well do a master budget. You'll find it is well worth the effort.
Tom: I don't like budgets. They are too confining. My wife budgets everything at home, and I can't spend what I want.
Larry: Can I ask a personal question?
Tom: What?
Larry: Where did you get the money to start this business?
Tom: Mainly from our family's savings. I get your point. We wouldn't have had the money to start the business if my wife hadn't been forcing us to save every month.

Larry: Exactly. I suggest you use the same discipline in your business. It is even more important here because you can't expect your employees to spend your money as carefully as you would.

With the full backing of Tom Wills, Larry Giano set out to create a master budget for the company for the year 2012. In his planning for the budgeting process, Larry drew up the following list of documents that would be a part of the master budget:

1. A sales budget, including a schedule of expected cash collections.
2. A production budget (a merchandise purchases budget would be used in a merchandising company).
3. A direct materials budget, including a schedule of expected cash disbursements for purchases of materials.
4. A direct labor budget.
5. A manufacturing overhead budget.
6. An ending finished goods inventory budget.
7. A selling and administrative expense budget.
8. A cash budget.
9. A budgeted income statement.
10. A budgeted balance sheet.

Larry felt it was important to have everyone's cooperation in the budgeting process, so he asked Tom to call a companywide meeting to explain the budgeting process. At the meeting there was initially some grumbling, but Tom was able to convince nearly everyone of the necessity for planning and getting better control over spending. It helped that the cash crisis earlier in the year was still fresh in everyone's minds. As much as some people disliked the idea of budgets, they liked their jobs more.

In the months that followed, Larry worked closely with all of the managers involved in the master budget, gathering data from them and making sure that they understood and fully supported the parts of the master budget that would affect them. In subsequent years, Larry hoped to turn the whole budgeting process over to the managers and to take a more advisory role.

The interdependent documents that Larry Giano prepared for Hampton Freeze are Schedules 1 through 10 of the company's master budget. In this section, we will study these schedules.

The Sales Budget

LEARNING OBJECTIVE 2
Prepare a sales budget, including a schedule of expected cash collections.

The sales budget is the starting point in preparing the master budget. As shown earlier in Exhibit 8–2, all other items in the master budget, including production, purchases, inventories, and expenses, depend on it.

The sales budget is constructed by multiplying budgeted unit sales by the selling price. Schedule 1 contains the quarterly sales budget for Hampton Freeze for the year 2012. Notice from the schedule that the company plans to sell 100,000 cases of popsicles during the year, with sales peaking in the third quarter.

A schedule of expected cash collections, such as the one that appears in the bottom portion of Schedule 1, is prepared after the sales budget. This schedule will be needed later to prepare the cash budget. Cash collections consist of collections on credit sales made to customers in prior periods plus collections on sales made in the current budget period. At Hampton Freeze, all sales are on credit; furthermore, experience has shown that 70% of sales are collected in the quarter in which the sale is made and the remaining 30% are collected in the following quarter. For example, 70% of the first quarter sales of $200,000 (or $140,000) is collected during the first quarter and 30% (or $60,000) is collected during the second quarter.

SCHEDULE 1

	A	B	C	D	E	F
1	**Hampton Freeze, Inc.**					
2	**Sales Budget**					
3	**For the Year Ended December 31, 2012**					
4						
5		*Quarter*				
6		*1*	*2*	*3*	*4*	*Year*
7	Budgeted sales in cases	10,000	30,000	40,000	20,000	100,000
8	Selling price per case	$ 20.00	$ 20.00	$ 20.00	$ 20.00	$ 20.00
9	Total sales	$200,000	$600,000	$800,000	$400,000	$ 2,000,000
10						
11	Percentage of sales collected in the period of the sale			70%		
12	Percentage of sales collected in the period after the sale			30%		
13		70%	30%			
14	**Schedule of Expected Cash Collections**					
15	Accounts receivable, beginning balance[1]	$ 90,000				$ 90,000
16	First-quarter sales[2]	140,000	$ 60,000			200,000
17	Second-quarter sales[3]		420,000	$ 180,000		600,000
18	Third-quarter sales[4]			560,000	$ 240,000	800,000
19	Fourth-quarter sales[5]	-	-	-	280,000	280,000
20	Total cash collections[6]	$230,000	$480,000	$740,000	$520,000	$ 1,970,000
21						

Schedule 1 | Schedule 2 | Schedule 3 | Schedule 4 | Schedule 5 | Sch

[1]Cash collections from last year's fourth-quarter sales. See the beginning-of-year balance sheet on page 357.
[2]$200,000 × 70%; $200,000 × 30%.
[3]$600,000 × 70%; $600,000 × 30%.
[4]$800,000 × 70%; $800,000 × 30%.
[5]$400,000 × 70%.
[6]Uncollected fourth-quarter sales ($120,000) appear as accounts receivable on the company's end-of-year budgeted balance sheet (see Schedule 10 on page 358).

IN BUSINESS

THE IMPORTANCE OF SALES RISK MANAGEMENT

David Flynn founded Amistad Media Group in 1994 to help companies market themselves to growing Hispanic communities in places such as Nebraska, Kansas, and North Carolina. While Amistad's sales steadily grew to a peak of $49 million in 2003, its customer base had not grown much in nine years. In fact, just two companies generated the bulk of Amistad's sales—Novamex and the U.S. Army. When the U.S. Army dropped Amistad as a supplier in 2005, the company's sales plummeted and it was bankrupt by 2006.

Amistad's demise highlights the importance of evaluating a company's sales forecast not only in terms of dollars, but also in terms of the number of customers served. Small companies in particular should seek to diversify their customer base, thereby reducing the risk that losing one or two customers will put them out of business.

Source: Patrick Cliff, "Adios to a Pioneering Hispanic Marketing Firm," *Inc.* Magazine, May, 2006, p. 34.

The Production Budget

LEARNING OBJECTIVE 3
Prepare a production budget.

The production budget is prepared after the sales budget. The **production budget** lists the number of units that must be produced to satisfy sales needs and to provide for the desired ending inventory. Production needs can be determined as follows:

Budgeted unit sales	XXXX
Add desired ending inventory of finished goods	XXXX
Total needs	XXXX
Less beginning inventory of finished goods	XXXX
Required production	XXXX

Note that production requirements are influenced by the desired level of the ending inventory. Inventories should be carefully planned. Excessive inventories tie up funds and create storage problems. Insufficient inventories can lead to lost sales or last-minute, high-cost production efforts. At Hampton Freeze, management believes that an ending inventory equal to 20% of the next quarter's sales strikes the appropriate balance.

Schedule 2 contains the production budget for Hampton Freeze. The first row in the production budget contains the budgeted sales, which have been taken directly from the sales budget (Schedule 1). The total needs for the first quarter are determined by adding together the budgeted sales of 10,000 cases for the quarter and the desired ending inventory of 6,000 cases. As discussed above, the ending inventory is intended to provide some cushion in the event that problems develop in production or sales increase unexpectedly. Because the budgeted sales for the second quarter are 30,000 cases and management would like the ending inventory in each quarter to equal 20% of the following quarter's sales, the desired ending inventory for the first quarter is 6,000 cases (20% of 30,000 cases). Consequently, the total needs for the first quarter are 16,000 cases. However, because the company already has 2,000 cases in beginning inventory, only 14,000 cases need to be produced in the first quarter.

Pay particular attention to the Year column to the right of the production budget in Schedule 2. In some cases (e.g., budgeted sales, total needs, and required production), the amount listed for the year is the sum of the quarterly amounts for the item. In other cases

SCHEDULE 2

Hampton Freeze, Inc.
Production Budget
For the Year Ended December 31, 2012

	Quarter				Assumed
	1	2	3	4	Year
Budgeted sales in cases (Schedule 1)	10,000	30,000	40,000	20,000	100,000
Add desired ending inventory of finished goods*	6,000	8,000	4,000	3,000	3,000
Total needs	16,000	38,000	44,000	23,000	103,000
Less beginning inventory of finished goods†	2,000	6,000	8,000	4,000	2,000
Required production in cases	14,000	32,000	36,000	19,000	101,000

20% 20% 20%

Schedule 2 | Schedule 3 | Schedule 4 | Schedule 5 | Schedule 6

*Twenty percent of the next quarter's sales. The ending inventory of 3,000 cases is assumed.
†The beginning inventory in each quarter is the same as the prior quarter's ending inventory.

(e.g., desired ending inventory of finished goods and beginning inventory of finished goods), the amount listed for the year is not simply the sum of the quarterly amounts. From the standpoint of the entire year, the beginning finished goods inventory is the same as the beginning finished goods inventory for the first quarter—it is *not* the sum of the beginning finished goods inventories for all quarters. Similarly, from the standpoint of the entire year, the ending finished goods inventory is the same as the ending finished goods inventory for the fourth quarter—it is *not* the sum of the ending finished goods inventories for all four quarters. It is important to pay attention to such distinctions in all of the schedules that follow.

Inventory Purchases—Merchandising Company

Hampton Freeze prepares a production budget because it is a *manufacturing* company. If it were a *merchandising* company, instead it would prepare a **merchandise purchases budget** showing the amount of goods to be purchased from suppliers during the period.

The format of the merchandise purchases budget is shown below:

Budgeted cost of goods sold	XXXXX
Add desired ending merchandise inventory	XXXXX
Total needs	XXXXX
Less beginning merchandise inventory	XXXXX
Required purchases	XXXXX

A merchandising company would prepare a merchandise purchases budget such as the one above for each item carried in stock. The merchandise purchases budget can be expressed in dollars (as shown above) or in units. The top line of a merchandise purchases budget based on units would say Budgeted unit sales instead of Budgeted cost of goods sold.

The Direct Materials Budget

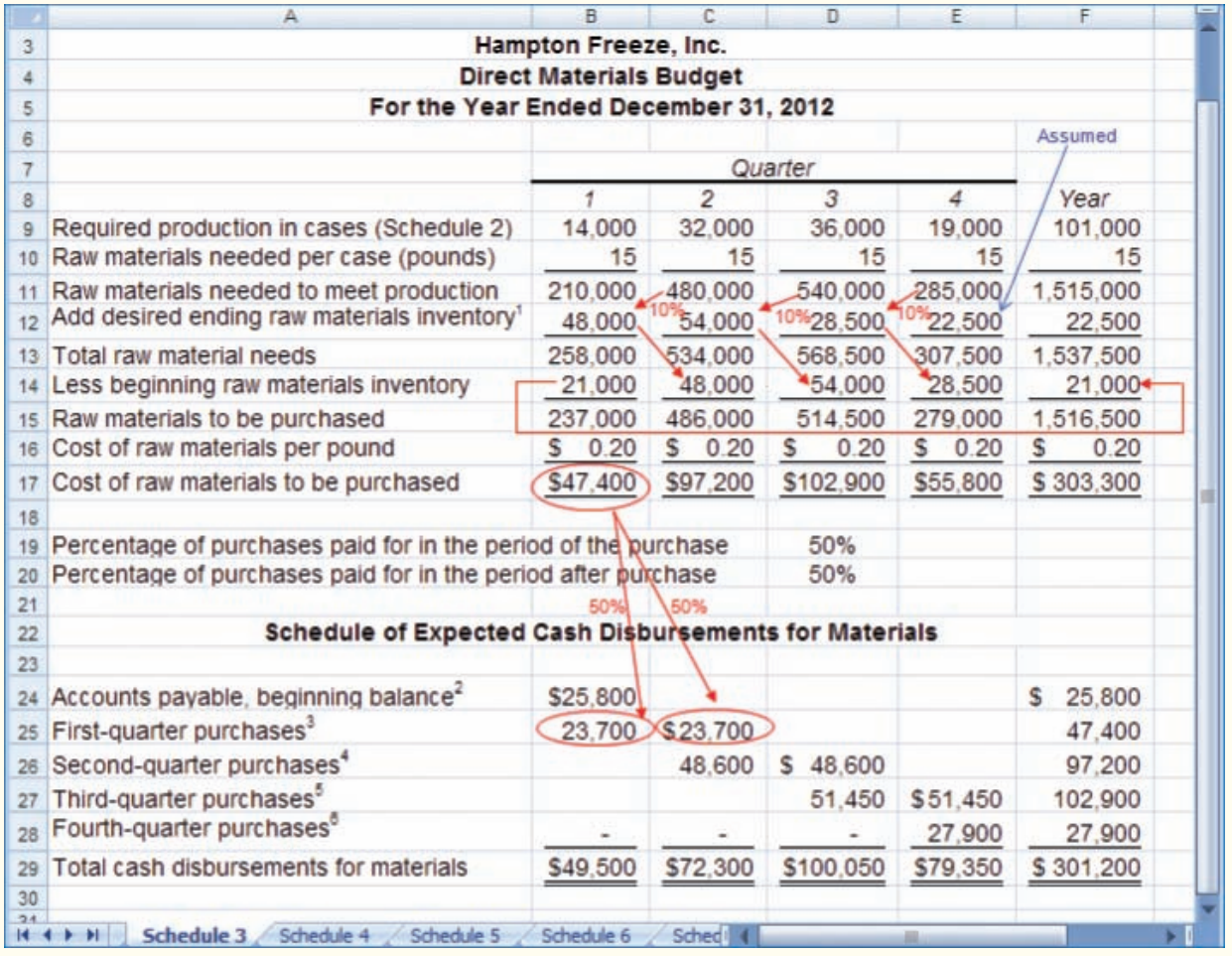
LEARNING OBJECTIVE 4
Prepare a direct materials budget, including a schedule of expected cash disbursements for purchases of materials.

A direct materials budget is prepared after the production requirements have been computed. The **direct materials budget** details the raw materials that must be purchased to fulfill the production budget and to provide for adequate inventories. The required purchases of raw materials are computed as follows:

Required production in units of finished goods	XXXXX
Raw materials required per unit of finished goods	XXXXX
Raw materials needed to meet the production schedule	XXXXX
Add desired ending raw materials inventory	XXXXX
Total raw material needs	XXXXX
Less beginning raw materials inventory	XXXXX
Raw materials to be purchased	XXXXX
Unit cost of raw materials	XXXXX
Cost of raw materials to be purchased	XXXXX

Schedule 3 contains the direct materials budget for Hampton Freeze. The only raw material included in that budget is high fructose sugar, which is the major ingredient in popsicles other than water. The remaining raw materials are relatively insignificant and are included in variable manufacturing overhead. As with finished goods, management

SCHEDULE 3



Hampton Freeze, Inc.
Direct Materials Budget
For the Year Ended December 31, 2012

	Quarter				Assumed
	1	2	3	4	Year
Required production in cases (Schedule 2)	14,000	32,000	36,000	19,000	101,000
Raw materials needed per case (pounds)	15	15	15	15	15
Raw materials needed to meet production	210,000	480,000	540,000	285,000	1,515,000
Add desired ending raw materials inventory[1]	48,000	54,000	28,500	22,500	22,500
Total raw material needs	258,000	534,000	568,500	307,500	1,537,500
Less beginning raw materials inventory	21,000	48,000	54,000	28,500	21,000
Raw materials to be purchased	237,000	486,000	514,500	279,000	1,516,500
Cost of raw materials per pound	$ 0.20	$ 0.20	$ 0.20	$ 0.20	$ 0.20
Cost of raw materials to be purchased	$47,400	$97,200	$102,900	$55,800	$ 303,300
Percentage of purchases paid for in the period of the purchase			50%		
Percentage of purchases paid for in the period after purchase			50%		

Schedule of Expected Cash Disbursements for Materials

Accounts payable, beginning balance[2]	$25,800				$ 25,800
First-quarter purchases[3]	23,700	$23,700			47,400
Second-quarter purchases[4]		48,600	$ 48,600		97,200
Third-quarter purchases[5]			51,450	$51,450	102,900
Fourth-quarter purchases[6]	-	-	-	27,900	27,900
Total cash disbursements for materials	$49,500	$72,300	$100,050	$79,350	$ 301,200

[1]Ten percent of the next quarter's production needs. For example, the second-quarter production needs are 480,000 pounds. Therefore, the desired ending inventory for the first quarter would be 10% × 480,000 pounds = 48,000 pounds. The ending inventory of 22,500 pounds for the fourth quarter is assumed.
[2]Cash payments for last year's fourth-quarter material purchases. See the beginning-of-year balance sheet on page 357.
[3]$47,400 × 50%; $47,400 × 50%.
[4]$97,200 × 50%; $97,200 × 50%.
[5]$102,900 × 50%; $102,900 × 50%.
[6]$55,800 × 50%. Unpaid fourth-quarter purchases ($27,900) appear as accounts payable on the company's end-of-year budgeted balance sheet (see Schedule 10 on page 358).

would like to maintain some inventories of raw materials to act as a cushion. In this case, management would like to maintain ending inventories of sugar equal to 10% of the following quarter's production needs.

The first line in the direct materials budget contains the required production for each quarter, which is taken directly from the production budget (Schedule 2). Looking at the first quarter, because the production schedule calls for production of 14,000 cases of popsicles and each case requires 15 pounds of sugar, the total production needs are 210,000 pounds of sugar (14,000 cases × 15 pounds per case). In addition, management wants to have ending inventories of 48,000 pounds of sugar, which is 10% of the following quarter's needs of 480,000 pounds. Consequently, the total needs are 258,000 pounds (210,000 pounds for the current quarter's production plus 48,000 pounds for the desired ending inventory). However, because the company already has

21,000 pounds in beginning inventory, only 237,000 pounds of sugar (258,000 pounds − 21,000 pounds) will need to be purchased. Finally, the cost of the raw materials purchases is determined by multiplying the amount of raw material to be purchased by its unit cost. In this case, because 237,000 pounds of sugar need to be purchased during the first quarter and sugar costs $0.20 per pound, the total cost will be $47,400 (237,000 pounds × $0.20 per pound).

As with the production budget, the amounts listed under the Year column are not always the sum of the quarterly amounts. The desired ending raw materials inventory for the year is the same as the desired ending raw materials inventory for the fourth quarter. Likewise, the beginning raw materials inventory for the year is the same as the beginning raw materials inventory for the first quarter.

The direct materials budget (or the merchandise purchases budget for a merchandising company) is usually accompanied by a schedule of expected cash disbursements for raw materials (or merchandise purchases). This schedule is needed to prepare the overall cash budget. Disbursements for raw materials (or merchandise purchases) consist of payments for purchases on account in prior periods plus any payments for purchases in the current budget period. Schedule 3 contains such a schedule of cash disbursements for Hampton Freeze.

Ordinarily, companies do not immediately pay their suppliers. At Hampton Freeze, the policy is to pay for 50% of purchases in the quarter in which the purchase is made and 50% in the following quarter, so while the company intends to purchase $47,400 worth of sugar in the first quarter, the company will only pay for half, $23,700, in the first quarter and the other half will be paid in the second quarter. The company will also pay $25,800 in the first quarter for sugar that was purchased on account in the previous quarter, but not yet paid for. This is the beginning balance in the accounts payable. Therefore, the total cash disbursements for sugar in the first quarter are $49,500—the $25,800 payment for sugar acquired in the previous quarter plus the $23,700 payment for sugar acquired during the first quarter.

The Direct Labor Budget

LEARNING OBJECTIVE 5
Prepare a direct labor budget.

The **direct labor budget** shows the direct labor-hours required to satisfy the production budget. By knowing in advance how much labor time will be needed throughout the budget year, the company can develop plans to adjust the labor force as the situation requires. Companies that neglect to budget run the risk of facing labor shortages or having to hire and lay off workers at awkward times. Erratic labor policies lead to insecurity, low morale, and inefficiency.

The direct labor budget for Hampton Freeze is shown in Schedule 4. The first line in the direct labor budget consists of the required production for each quarter, which is taken directly from the production budget (Schedule 2). The direct labor requirement for each quarter is computed by multiplying the number of units to be produced in that quarter by the number of direct labor-hours required to make a unit. For example, 14,000 cases are to be produced in the first quarter and each case requires 0.40 direct labor-hour, so a total of 5,600 direct labor-hours (14,000 cases × 0.40 direct labor-hour per case) will be required in the first quarter. The direct labor requirements can then be translated into budgeted direct labor costs. How this is done will depend on the company's labor policy. In Schedule 4, Hampton Freeze has assumed that the direct labor force will be adjusted as the work requirements change from quarter to quarter. In that case, the direct labor cost is computed by simply multiplying the direct labor-hour requirements by the direct labor rate per hour. For example, the direct labor cost in the first quarter is $84,000 (5,600 direct labor-hours × $15 per direct labor-hour).

However, many companies have employment policies or contracts that prevent them from laying off and rehiring workers as needed. Suppose, for example, that Hampton Freeze has 25 workers who are classified as direct labor, but each of them is guaranteed at least 480 hours of pay each quarter at a rate of $15 per hour. In that case, the minimum direct labor cost for a quarter would be as follows:

$$25 \text{ workers} \times 480 \text{ hours per worker} \times \$15 \text{ per hour} = \$180{,}000$$

SCHEDULE 4

	A	B	C	D	E	F
1	**Hampton Freeze, Inc.**					
2	**Direct Labor Budget**					
3	**For the Year Ended December 31, 2012**					
4						
5		*Quarter*				
6		*1*	*2*	*3*	*4*	*Year*
7	Required production in cases (Schedule 2)	14,000	32,000	36,000	19,000	101,000
8	Direct labor-hours per case	0.40	0.40	0.40	0.40	0.40
9	Total direct labor-hours needed	5,600	12,800	14,400	7,600	40,400
10	Direct labor cost per hour	$ 15.00	$ 15.00	$ 15.00	$ 15.00	$ 15.00
11	Total direct labor cost*	$ 84,000	$ 192,000	$ 216,000	$ 114,000	$ 606,000
12						

Schedule 1 | Schedule 2 | Schedule 3 | **Schedule 4** | Schedule 5 | Sche

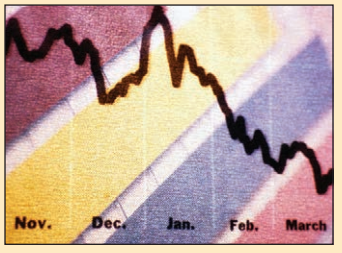
*This schedule assumes that the direct labor workforce will be fully adjusted to the total direct labor-hours needed each quarter.

Note that in this case the direct labor costs for the first and fourth quarters would have to be increased to $180,000.

IN BUSINESS

MANAGING LABOR COSTS IN A DIFFICULT ECONOMY

When the economy sours, many companies choose to lay off employees. While this tactic lowers costs in the short run, it also lowers the morale and productivity of retained employees, sacrifices the institutional knowledge possessed by terminated employees, and increases future recruiting and training costs. Hypertherm Inc. has not fired a permanent employee since its founding in 1968, instead responding to economic hardship by eliminating overtime, cutting temporary staff, delaying capital investments, shifting cross-trained employees to new job responsibilities, and implementing a four-day work week. Hypertherm's employees regularly share their process improvement ideas with the company because they know if they eliminate non–value-added portions of their job responsibilities the company will redeploy them rather than eliminate non–value-added labor costs by firing them.



Source: Cari Tuna, "Some Firms Cut Costs Without Resorting to Layoffs," *The Wall Street Journal*, December 15, 2008, p. B4.

The Manufacturing Overhead Budget

LEARNING OBJECTIVE 6
Prepare a manufacturing overhead budget.

The **manufacturing overhead budget** lists all costs of production other than direct materials and direct labor. Schedule 5 shows the manufacturing overhead budget for Hampton Freeze. At Hampton Freeze, manufacturing overhead is separated into variable and fixed components. The variable component is $4 per direct labor-hour and the fixed component is $60,600 per quarter. Because the variable component of manufacturing overhead depends on direct labor, the first line in the manufacturing overhead budget consists of the budgeted direct labor-hours from the direct labor budget (Schedule 4). The budgeted direct labor-hours in each quarter are multiplied by the variable rate to determine the variable component of manufacturing overhead. For example, the variable manufacturing overhead for the first quarter is $22,400 (5,600 direct labor-hours × $4.00 per direct labor-hour). This is added to the fixed manufacturing overhead for the quarter to determine the total manufacturing overhead for the quarter of $83,000 ($22,400 + $60,600).

A few words about fixed costs and the budgeting process are in order. In most cases, fixed costs are the costs of supplying capacity to make products, process purchase orders, handle customer calls, and so on. The amount of capacity that will be required depends

SCHEDULE 5

	A	B	C	D	E	F
1	**Hampton Freeze, Inc.**					
2	**Manufacturing Overhead Budget**					
3	**For the Year Ended December 31, 2012**					
4						
5		*Quarter*				
6		*1*	*2*	*3*	*4*	*Year*
7	Budgeted direct labor-hours (Schedule 4)	5,600	12,800	14,400	7,600	40,400
8	Variable manufacturing overhead rate	$ 4.00	$ 4.00	$ 4.00	$ 4.00	$ 4.00
9	Variable manufacturing overhead	$ 22,400	$ 51,200	$ 57,600	$ 30,400	$ 161,600
10	Fixed manufacturing overhead	60,600	60,600	60,600	60,600	242,400
11	Total manufacturing overhead	83,000	111,800	118,200	91,000	404,000
12	Less depreciation	15,000	15,000	15,000	15,000	60,000
13	Cash disbursements for manufacturing overhead	$ 68,000	$ 96,800	$ 103,200	$ 76,000	$ 344,000
14						
15	Total manufacturing overhead (a)					$ 404,000
16	Budgeted direct labor-hours (b)					40,400
17	Predetermined overhead rate for the year (a)÷(b)					$ 10.00
18						

Schedule 1 | Schedule 2 | Schedule 3 | Schedule 4 | **Schedule 5** | Schedule

on the expected level of activity for the period. If the expected level of activity is greater than the company's current capacity, then fixed costs may have to be increased. Or, if the expected level is appreciably below the company's current capacity, then it may be desirable to decrease fixed costs if possible. However, once the level of the fixed costs has been determined in the budget, the costs really are fixed. The time to adjust fixed costs is during the budgeting process. An activity-based costing system can help to determine the appropriate level of fixed costs at budget time by answering questions like, "How many clerks will we need to process the anticipated number of purchase orders next year?" For simplicity, in all of the budgeting examples in this book assume that the appropriate levels of fixed costs have already been determined.

The last line of Schedule 5 for Hampton Freeze shows the budgeted cash disbursements for manufacturing overhead. Because some of the overhead costs are not cash outflows, the total budgeted manufacturing overhead costs must be adjusted to determine the cash disbursements for manufacturing overhead. At Hampton Freeze, the only significant noncash manufacturing overhead cost is depreciation, which is $15,000 per quarter. These noncash depreciation charges are deducted from the total budgeted manufacturing overhead to determine the expected cash disbursements. Hampton Freeze pays all overhead costs involving cash disbursements in the quarter incurred. Note that the company's predetermined overhead rate for the year is $10 per direct labor-hour, which is determined by dividing the total budgeted manufacturing overhead for the year by the total budgeted direct labor-hours for the year.

The Ending Finished Goods Inventory Budget

After completing Schedules 1–5, Larry Giano had all of the data he needed to compute unit product costs. This computation was needed for two reasons: first, to determine cost of goods sold on the budgeted income statement; and second, to value ending inventories. The cost of unsold units is computed on the **ending finished goods inventory budget.**

Larry Giano considered using variable costing to prepare Hampton Freeze's budget statements, but he decided to use absorption costing instead because the bank would very likely require absorption costing. He also knew that it would be easy to convert the absorption costing financial statements to a variable costing basis later. At this point, the primary concern was to determine what financing, if any, would be required in 2012 and then to arrange for that financing from the bank.

SCHEDULE 6

	A	B	C	D	E	F	G	H
1	**Hampton Freeze, Inc.**							
2	**Ending Finished Goods Inventory Budget**							
3	**(absorption costing basis)**							
4	**For the Year Ended December 31, 2012**							
5								
6	*Item*	*Quantity*			*Cost*			*Total*
7	Production cost per case:							
8	Direct materials	15.00	pounds		$ 0.20	per pound		$ 3.00
9	Direct labor	0.40	hours		$15.00	per hour		6.00
10	Manufacturing overhead	0.40	hours		$10.00	per hour		4.00
11	Unit product cost							$ 13.00
12								
13	Budgeted finished goods inventory:							
14	Ending finished goods inventory in cases (Schedule 2)							3,000
15	Unit product cost (see above)							$ 13.00
16	Ending finished goods inventory in dollars							$ 39,000
17								

Schedule 6 | Schedule 7 | Schedule 8 | Schedule 9 | Schedule 1

The unit product cost computations are shown in Schedule 6. For Hampton Freeze, the absorption costing unit product cost is $13 per case of popsicles—consisting of $3 of direct materials, $6 of direct labor, and $4 of manufacturing overhead. The manufacturing overhead is applied to units of product at the rate of $10 per direct labor-hour. The budgeted carrying cost of the ending inventory is $39,000.

The Selling and Administrative Expense Budget

LEARNING OBJECTIVE 7
Prepare a selling and administrative expense budget.

The **selling and administrative expense budget** lists the budgeted expenses for areas other than manufacturing. In large organizations, this budget would be a compilation of many smaller, individual budgets submitted by department heads and other persons responsible for selling and administrative expenses. For example, the marketing manager would submit a budget detailing the advertising expenses for each budget period.

Schedule 7 contains the selling and administrative expense budget for Hampton Freeze. Like the manufacturing overhead budget, the selling and administrative expense budget is divided into variable and fixed cost components. In the case of Hampton Freeze, the variable selling and administrative expense is $1.80 per case. Consequently, budgeted sales in cases for each quarter are entered at the top of the schedule. These data are taken from the sales budget (Schedule 1). The budgeted variable selling and administrative expenses are determined by multiplying the budgeted cases sold by the variable selling and administrative expense per case. For example, the budgeted variable selling and administrative expense for the first quarter is $18,000 (10,000 cases × $1.80 per case). The fixed selling and administrative expenses (all given data) are then added to the variable selling and administrative expenses to arrive at the total budgeted selling and administrative expenses. Finally, to determine the cash disbursements for selling and administrative items, the total budgeted selling and administrative expense is adjusted by subtracting any noncash selling and administrative expenses (in this case, just depreciation).[1]

[1] Other adjustments might need to be made for differences between cash flows on the one hand and revenues and expenses on the other hand. For example, if property taxes are paid twice a year in installments of $8,000 each, the expense for property tax would have to be "backed out" of the total budgeted selling and administrative expenses and the cash installment payments added to the appropriate quarters to determine the cash disbursements. Similar adjustments might also need to be made in the manufacturing overhead budget. We generally ignore these complications in this chapter.

SCHEDULE 7

	A	B	C	D	E	F
1	**Hampton Freeze, Inc.**					
2	**Selling and Administrative Expense Budget**					
3	**For the Year Ended December 31, 2012**					
4						
5		*Quarter*				
6		*1*	*2*	*3*	*4*	*Year*
7	Budgeted sales in cases (Schedule 1)	10,000	30,000	40,000	20,000	100,000
8	Variable selling and administrative expense per case	$ 1.80	$ 1.80	$ 1.80	$ 1.80	$ 1.80
9	Variable selling and administrative expense	$ 18,000	$ 54,000	$ 72,000	$ 36,000	$180,000
10	Fixed selling and administrative expenses:					
11	Advertising	20,000	20,000	20,000	20,000	80,000
12	Executive salaries	55,000	55,000	55,000	55,000	220,000
13	Insurance	10,000	10,000	10,000	10,000	40,000
14	Property taxes	4,000	4,000	4,000	4,000	16,000
15	Depreciation	10,000	10,000	10,000	10,000	40,000
16	Total fixed selling and administrative expenses	99,000	99,000	99,000	99,000	396,000
17	Total selling and administrative expenses	117,000	153,000	171,000	135,000	576,000
18	Less depreciation	10,000	10,000	10,000	10,000	40,000
19	Cash disbursements for selling and administrative expenses	$107,000	$143,000	$161,000	$125,000	$536,000
20						

Schedule 6 | Schedule 7 | Schedule 8 | Schedule 9 | Schedule 10

IN BUSINESS

CANON INVESTS IN RESEARCH AND DEVELOPMENT

When Canon Inc., the world's leading digital camera manufacturer, prepares the research and development (R&D) portion of its selling and administrative expense budget, the focus is on making long-run investments to grow sales rather than cutting costs to maximize short-run profits. In 2005, Canon spent 8% of its sales on R&D while many of its competitors spent 6% to 7.5% of their sales on R&D. Canon's CEO Fujio Mitarai described his company's R&D philosophy by saying "we have to plant the seeds for the next decade and beyond." Indeed, Canon's seeds have blossomed as the company has secured more than 17,000 patents since 1995—second only to IBM. Canon's commitment to R&D helps explain why its digital cameras are delivering healthy earnings at a time when many of its competitors are losing money.

Source: Ian Rowley, Hiroko Tashiro, and Louise Lee, "Canon: Combat-Ready," *BusinessWeek*, September 5, 2005, pp. 48–49.

The Cash Budget

LEARNING OBJECTIVE 8
Prepare a cash budget.

As illustrated in Exhibit 8–2, the cash budget combines much of the data developed in the preceding steps. It is a good idea to review Exhibit 8–2 to get the big picture firmly in your mind before moving on.

The cash budget is composed of four major sections:

1. The receipts section.
2. The disbursements section.
3. The cash excess or deficiency section.
4. The financing section.

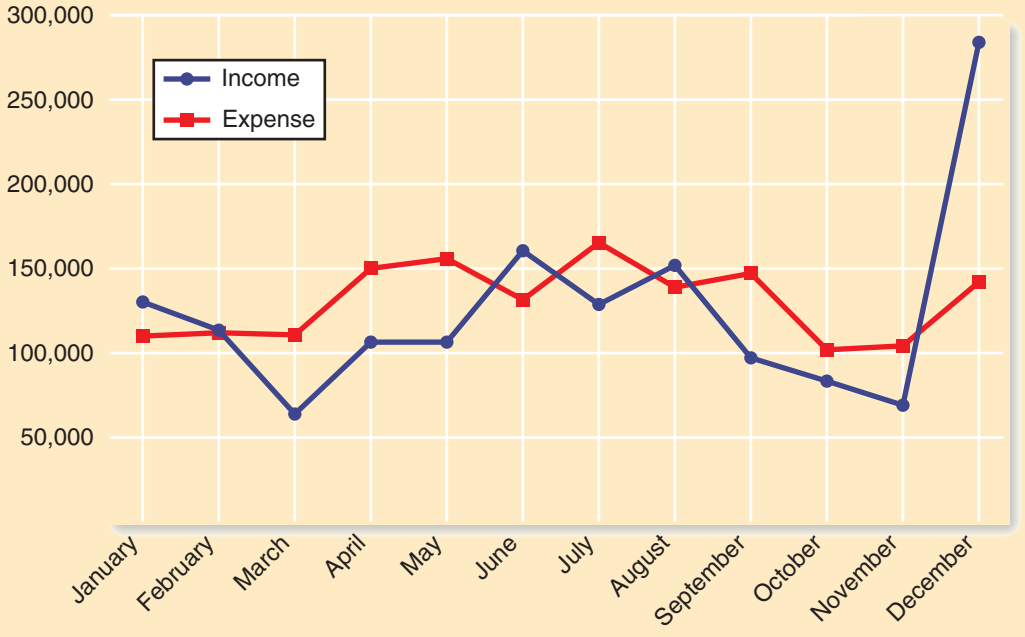
The receipts section lists all of the cash inflows, except from financing, expected during the budget period. Generally, the major source of receipts is from sales.

IN BUSINESS

MISMATCHED CASH FLOWS—CLIMBING THE HILLS AND VALLEYS

The Washington Trails Association (WTA) is a private, nonprofit organization primarily concerned with protecting and maintaining hiking trails in the state of Washington. Some 2,000 WTA volunteer workers donate more than 80,000 hours per year maintaining trails in rugged landscapes on federal, state, and private lands. The organization is supported by membership dues, voluntary contributions, grants, and some contract work for government.

The organization's income and expenses are erratic—although somewhat predictable—over the course of the year as shown in the chart below. Expenses tend to be highest in the spring and summer when most of the trail maintenance work is done. However, income spikes in December well after the expenses have been incurred. With cash outflows running ahead of cash inflows for much of the year, it is very important for the WTA to carefully plan its cash budget and to maintain adequate cash reserves to be able to pay its bills.



Note: Total income and total expense are approximately equal over the course of the year.

Sources: Conversation with Elizabeth Lunney, President of the Washington Trails Association; WTA documents; and the WTA website www.wta.org.

The disbursements section summarizes all cash payments that are planned for the budget period. These payments include raw materials purchases, direct labor payments, manufacturing overhead costs, and so on, as contained in their respective budgets. In addition, other cash disbursements such as equipment purchases and dividends are listed.

The cash excess or deficiency section is computed as follows:

Cash balance, beginning	XXXX
Add receipts	XXXX
Total cash available	XXXX
Less disbursements	XXXX
Excess (deficiency) of cash available over disbursements	XXXX

SCHEDULE 8

	A	B	C	D	E	F	G
1	**Hampton Freeze, Inc.**						
2	**Cash Budget**						
3	**For the Year Ended December 31, 2012**						
4							
5			*Quarter*				
6		*Schedule*	*1*	*2*	*3*	*4*	*Year*
7	Cash balance, beginning		$ 42,500	$ 36,000	$ 33,900	$ 165,650	$ 42,500
8	Add receipts:						
9	Collections from customers	1	230,000	480,000	740,000	520,000	1,970,000
10	Total cash available		272,500	516,000	773,900	685,650	2,012,500
11	Less disbursements:						
12	Direct materials	3	49,500	72,300	100,050	79,350	301,200
13	Direct labor	4	84,000	192,000	216,000	114,000	606,000
14	Manufacturing overhead	5	68,000	96,800	103,200	76,000	344,000
15	Selling and administrative	7	107,000	143,000	161,000	125,000	536,000
16	Equipment purchases		50,000	40,000	20,000	20,000	130,000
17	Dividends		8,000	8,000	8,000	8,000	32,000
18	Total disbursements		366,500	552,100	608,250	422,350	1,949,200
19	Excess (deficiency) of cash available over disbursements		(94,000)	(36,100)	165,650	263,300	63,300
20	Financing:						
21	Borrowings (at the beginnings of quarters)		130,000	70,000	-	-	200,000
22	Repayments (at end of the year)		-	-	-	(200,000)	(200,000)
23	Interest		-	-	-	(21,900)	(21,900)
24	Total financing		130,000	70,000	-	(221,900)	(21,900)
25	Cash balance, ending		$ 36,000	$ 33,900	$ 165,650	$ 41,400	$ 41,400
26							

Schedule 6 | Schedule 7 | **Schedule 8** | Schedule 9 | Schedule 10

If a cash deficiency exists during any budget period, the company will need to borrow funds. If there is a cash excess during any budget period, funds borrowed in previous periods can be repaid or the excess funds can be invested.

The financing section details the borrowings and repayments projected to take place during the budget period. It also lists interest payments that will be due on money borrowed.[2]

The cash balances at both the beginning and end of the year may be adequate even though a serious cash deficit occurs at some point during the year. Consequently, the cash budget should be broken down into time periods that are short enough to capture major fluctuations in cash balances. While a monthly cash budget is most common, some organizations budget cash on a weekly or even daily basis. Larry Giano has prepared a quarterly cash budget for Hampton Freeze that can be further refined as necessary. This budget appears in Schedule 8. The cash budget builds on the earlier schedules and on additional data that are provided below:

- The beginning cash balance is $42,500.
- Management plans to spend $130,000 during the year on equipment purchases: $50,000 in the first quarter; $40,000 in the second quarter; $20,000 in the third quarter; and $20,000 in the fourth quarter.
- The board of directors has approved cash dividends of $8,000 per quarter.
- Management would like to have a cash balance of at least $30,000 at the beginning of each quarter for contingencies.

[2] The format for the statement of cash flows, which is discussed in a later chapter, may also be used for the cash budget.

- Hampton Freeze has an agreement with a local bank that allows the company to borrow in increments of $10,000 at the beginning of each quarter, up to a total loan balance of $250,000. The interest rate on these loans is 1% per month, and for simplicity, we will assume that interest is not compounded. The company would, as far as it is able, repay the loan plus accumulated interest at the end of the year.

The cash budget is prepared one quarter at a time, starting with the first quarter. Larry began the cash budget by entering the beginning balance of cash for the first quarter of $42,500—a number that is given on the previous page. Receipts—in this case, just the $230,000 in cash collections from customers—are added to the beginning balance to arrive at the total cash available of $272,500. Because the total disbursements are $366,500 and the total cash available is only $272,500, there is a shortfall of $94,000. Because management would like to have a beginning cash balance of at least $30,000 for the second quarter, the company will need to borrow at least $124,000.

Required Borrowings at the Beginning of the First Quarter	
Desired ending cash balance	$ 30,000
Plus deficiency of cash available over disbursements	94,000
Minimum required borrowings	$124,000

Recall that the bank requires that loans be made in increments of $10,000. Because Hampton Freeze needs to borrow at least $124,000, it will have to borrow $130,000.

The second quarter of the cash budget is handled similarly. Note that the ending cash balance for the first quarter is brought forward as the beginning cash balance for the second quarter. Also note that additional borrowing is required in the second quarter because of the continued cash shortfall.

Required Borrowings at the Beginning of the Second Quarter	
Desired ending cash balance	$30,000
Plus deficiency of cash available over disbursements	36,100
Minimum required borrowings	$66,100

Again, recall that the bank requires that loans be made in increments of $10,000. Because Hampton Freeze needs to borrow at least $66,100 at the beginning of the second quarter, the company will have to borrow $70,000 from the bank.

In the third quarter, the cash flow situation improves dramatically and the excess of cash available over disbursements is $165,650. Therefore, the company will end the quarter with ample cash and no further borrowing is necessary.

At the end of the fourth quarter, the loan and accumulated interest must be repaid. The accumulated interest can be computed as follows:

Interest on $130,000 borrowed at the beginning of the first quarter:	
$130,000 × 0.01 per month × 12 months*	$15,600
Interest on $70,000 borrowed at the beginning of the second quarter:	
$70,000 × 0.01 per month × 9 months*	6,300
Total interest accrued to the end of the fourth quarter	$21,900

*Simple, rather than compounded, interest is assumed for simplicity.

Note that the loan repayment of $200,000 ($130,000 + $70,000) appears in the financing section for the fourth quarter along with the interest payment of $21,900 computed above.

As with the production and raw materials budgets, the amounts under the Year column in the cash budget are not always the sum of the amounts for the four quarters. In particular, the beginning cash balance for the year is the same as the beginning cash balance for the first quarter and the ending cash balance for the year is the same as the ending cash balance for the fourth quarter. Also note the beginning cash balance in any quarter is the same as the ending cash balance for the previous quarter.

IN BUSINESS

NEW INSPECTIONS PINCH CASH FLOWS

Herald Metal and Plastic Works is a Chinese toy manufacturer that produces Star Wars action figures and G.I. Joes for Hasbro Inc. in the United States. The company used to ship its toys to America immediately after they rolled off the production line. However, this changed when American consumers discovered that some Chinese companies were using poisonous lead-based paint in their manufacturing processes. The Chinese government now requires toy manufacturers to store finished goods in warehouses for anywhere from three weeks to two months until its inspectors certify them for export.

Herald Metal and Plastic Works borrows money from lenders to buy raw materials and pay laborers to make its toys. The company is struggling to repay its loans because the government's inspection process delays cash receipts from customers.

Source: Chi-Chu Tschang, "Bottlenecks in Toyland," *BusinessWeek*, October 15, 2007, p. 52.

The Budgeted Income Statement

LEARNING OBJECTIVE 9
Prepare a budgeted income statement.

A budgeted income statement can be prepared from the data developed in Schedules 1–8. *The budgeted income statement is one of the key schedules in the budget process.* It shows the company's planned profit and serves as a benchmark against which subsequent company performance can be measured.

Schedule 9 contains the budgeted income statement for Hampton Freeze.

SCHEDULE 9

	A	B	C
1	**Hampton Freeze, Inc.**		
2	**Budgeted Income Statement**		
3	**For the Year Ended December 31, 2012**		
4			
5		*Schedules*	
6	Sales	1	$ 2,000,000
7	Cost of goods sold*	1,6	1,300,000
8	Gross margin		700,000
9	Selling and administrative expenses	7	576,000
10	Net operating Income		124,000
11	Interest expense	8	21,900
12	Net Income		$ 102,100
13			

Schedule 8 | Schedule 9 | Schedule 10

*100,000 cases sold × $13 per case = $1,300,000.

The Budgeted Balance Sheet

LEARNING OBJECTIVE 10
Prepare a budgeted balance sheet.

The budgeted balance sheet is developed using data from the balance sheet from the beginning of the budget period and data contained in the various schedules. Hampton Freeze's budgeted balance sheet is presented in Schedule 10. Some of the data on the budgeted balance sheet have been taken from the company's previous end-of-year balance sheet for 2011 which appears below:

Hampton Freeze, Inc.
Balance Sheet
December 31, 2011

Assets		
Current assets:		
Cash	$ 42,500	
Accounts receivable	90,000	
Raw materials inventory (21,000 pounds)	4,200	
Finished goods inventory (2,000 cases)	26,000	
Total current assets		$162,700
Plant and equipment:		
Land	80,000	
Buildings and equipment	700,000	
Accumulated depreciation	(292,000)	
Plant and equipment, net		488,000
Total assets		$650,700
Liabilities and Stockholders' Equity		
Current liabilities:		
Accounts payable (raw materials)		$ 25,800
Stockholders' equity:		
Common stock, no par	$175,000	
Retained earnings	449,900	
Total stockholders' equity		624,900
Total liabilities and stockholders' equity		$650,700

After completing the master budget, Larry Giano took the documents to Tom Wills, chief executive officer of Hampton Freeze, for his review.

Larry: Here's the budget. Overall, the net income is excellent, and the net cash flow for the entire year is positive.

Tom: Yes, but I see on this cash budget that we have the same problem with negative cash flows in the first and second quarters that we had last year.

Larry: That's true. I don't see any way around that problem. However, there is no doubt in my mind that if you take this budget to the bank today, they'll approve an open line of credit that will allow you to borrow enough to make it through the first two quarters without any problem.

Tom: Are you sure? They didn't seem very happy to see me last year when I came in for an emergency loan.

Larry: Did you repay the loan on time?

Tom: Sure.

Larry: I don't see any problem. You won't be asking for an emergency loan this time. The bank will have plenty of warning. And with this budget, you have a solid plan that shows when and how you are going to pay off the loan. Trust me, they'll go for it.

MANAGERIAL ACCOUNTING IN ACTION
The Wrap-up

SCHEDULE 10

	A	B	C	D	E
1	**Hampton Freeze, Inc.**				
2	**Budgeted Balance Sheet**				
3	**December 31, 2012**				
4					
5	*Assets*				
6	Current assets:				
7	Cash	$ 41,400	(a)		
8	Accounts receivable	120,000	(b)		
9	Raw materials inventory	4,500	(c)		
10	Finished goods inventory	39,000	(d)		
11	Total current assets			$ 204,900	
12	Plant and equipment:				
13	Land	80,000	(e)		
14	Buildings and equipment	830,000	(f)		
15	Accumulated depreciation	(392,000)	(g)		
16	Plant and equipment, net			518,000	
17	Total assets			$ 722,900	
18					
19	*Liabilities and Stockholders' Equity*				
20	Current liabilities:				
21	Accounts payable (raw materials)			$ 27,900	(h)
22	Stockholders' equity:				
23	Common stock, no par	$ 175,000	(i)		
24	Retained earnings	520,000	(j)		
25	Total stockholders' equity			695,000	
26	Total liabilities and stockholders' equity			$ 722,900	
27					

Schedule 9 | Schedule 10

Explanation of December 31, 2012, balance sheet figures:

(a) The ending cash balance, as projected by the cash budget in Schedule 8.

(b) Thirty percent of fourth-quarter sales, from Schedule 1 ($400,000 × 30% = $120,000).

(c) From Schedule 3, the ending raw materials inventory will be 22,500 pounds. This material costs $0.20 per pound. Therefore, the ending inventory in dollars will be 22,500 pounds × $0.20 per pound = $4,500.

(d) From Schedule 6.

(e) From the December 31, 2011, balance sheet (no change).

(f) The December 31, 2011, balance sheet indicated a balance of $700,000. During 2012, $130,000 of additional equipment will be purchased (see Schedule 8), bringing the December 31, 2012, balance to $830,000.

(g) The December 31, 2011, balance sheet indicated a balance of $292,000. During 2012, $100,000 of depreciation will be taken ($60,000 on Schedule 5 and $40,000 on Schedule 7), bringing the December 31, 2012, balance to $392,000.

(h) One-half of the fourth-quarter raw materials purchases, from Schedule 3.

(i) From the December 31, 2011, balance sheet (no change).

(j)

December 31, 2011, balance	$449,900
Add net income, from Schedule 9	102,100
	552,000
Deduct dividends paid, from Schedule 8	32,000
December 31, 2012, balance	$520,000

IN BUSINESS

MOVING BEYOND EXCEL TO THE WEB

While research shows that two-thirds of U.S. companies still rely on Microsoft Excel for their budgeting process, some companies are evolving to a more technologically advanced approach. For example, Hendrick Motorsports has vaulted to the top of the NASCAR racing circuit thanks in part to its new budgeting process. Scott Lampe, Hendrick's CFO, discarded Excel in favor of Forecaster, a web-based budgeting program. He commented "with a spreadsheet, you can build the model the way you want it . . . The problem is, only you understand that model. Then you have to explain it to everyone, one at a time." The web-based approach enables Lampe to involve his crew chiefs, chassis guys, and engine guys in the budgeting process.

The Facilities & Operations (F&O) Business Office of the Battelle, Pacific Northwest National Laboratory has over 130 budget activities—each of which requires the preparation of an annual budget. In 2001, F&O replaced its spreadsheet-driven budget with a web-based approach. The new system enables F&O "management and their support staff to directly input their business plan and budget requests, eliminating the need for central business planning and budgeting staff to upload the numerous budget requests and subsequent changes." The web-based budgeting system saves F&O personnel more than 500 hours that were previously spent preparing Excel spreadsheets and uploading data.

Sources: John Goff, "In The Fast Lane," *CFO*, December 2004, pp. 53–58; Peter T. Smith, Craig A. Goranson, and Mary F. Astley, "Intranet Budgeting Does the Trick," *Strategic Finance*, May 2003, pp. 30–33.

Summary

This chapter describes the budgeting process and shows how the various operating budgets relate to each other. The sales budget is the foundation for profit planning. Once the sales budget has been set, the production budget and the selling and administrative expense budget can be prepared because they depend on how many units are to be sold. The production budget determines how many units are to be produced, so after it is prepared, the various manufacturing cost budgets can be prepared. All of these budgets feed into the cash budget and the budgeted income statement and balance sheet. The parts of the master budget are connected in many ways. For example, the schedule of expected cash collections, which is completed in connection with the sales budget, provides data for both the cash budget and the budgeted balance sheet.

The material in this chapter is just an introduction to budgeting and profit planning. In later chapters, we will see how budgets are used to control day-to-day operations and how they are used in performance evaluation.

Review Problem: Budget Schedules

Mynor Corporation manufactures and sells a seasonal product that has peak sales in the third quarter. The following information concerns operations for Year 2—the coming year—and for the first two quarters of Year 3:

a. The company's single product sells for $8 per unit. Budgeted sales in units for the next six quarters are as follows (all sales are on credit):

	Year 2 Quarter				Year 3 Quarter	
	1	2	3	4	1	2
Budgeted unit sales	40,000	60,000	100,000	50,000	70,000	80,000

b. Sales are collected in the following pattern: 75% in the quarter the sales are made, and the remaining 25% in the following quarter. On January 1, Year 2, the company's balance sheet showed $65,000 in accounts receivable, all of which will be collected in the first quarter of the year. Bad debts are negligible and can be ignored.
c. The company desires an ending finished goods inventory at the end of each quarter equal to 30% of the budgeted unit sales for the next quarter. On December 31, Year 1, the company had 12,000 units on hand.
d. Five pounds of raw materials are required to complete one unit of product. The company requires ending raw materials inventory at the end of each quarter equal to 10% of the following quarter's production needs. On December 31, Year 1, the company had 23,000 pounds of raw materials on hand.
e. The raw material costs $0.80 per pound. Raw material purchases are paid for in the following pattern: 60% paid in the quarter the purchases are made, and the remaining 40% paid in the following quarter. On January 1, Year 2, the company's balance sheet showed $81,500 in accounts payable for raw material purchases, all of which will be paid for in the first quarter of the year.

Required:

Prepare the following budgets and schedules for the year, showing both quarterly and total figures:
1. A sales budget and a schedule of expected cash collections.
2. A production budget.
3. A direct materials budget and a schedule of expected cash payments for purchases of materials.

Solution to Review Problem

1. The sales budget is prepared as follows:

	Year 2 Quarter				
	1	2	3	4	Year
Budgeted unit sales	40,000	60,000	100,000	50,000	250,000
Selling price per unit	× $8	× $8	× $8	× $8	× $8
Total sales	$320,000	$480,000	$800,000	$400,000	$2,000,000

Based on the budgeted sales above, the schedule of expected cash collections is prepared as follows:

	Year 2 Quarter				
	1	2	3	4	Year
Accounts receivable, beginning balance	$ 65,000				$ 65,000
First-quarter sales ($320,000 × 75%, 25%)	240,000	$ 80,000			320,000
Second-quarter sales ($480,000 × 75%, 25%)		360,000	$120,000		480,000
Third-quarter sales ($800,000 × 75%, 25%)			600,000	$200,000	800,000
Fourth-quarter sales ($400,000 × 75%)				300,000	300,000
Total cash collections	$305,000	$440,000	$720,000	$500,000	$1,965,000

2. Based on the sales budget in units, the production budget is prepared as follows:

	Year 2 Quarter					Year 3 Quarter	
	1	2	3	4	Year	1	2
Budgeted unit sales	40,000	60,000	100,000	50,000	250,000	70,000	80,000
Add desired ending finished goods inventory*	18,000	30,000	15,000	21,000†	21,000	24,000	
Total needs	58,000	90,000	115,000	71,000	271,000	94,000	
Less beginning finished goods inventory	12,000	18,000	30,000	15,000	12,000	21,000	
Required production	46,000	72,000	85,000	56,000	259,000	73,000	

*30% of the following quarter's budgeted sales in units.
†30% of the budgeted Year 3 first-quarter sales.

3. Based on the production budget, raw materials will need to be purchased during the year as follows:

	Year 2 Quarter					Year 3 Quarter
	1	2	3	4	Year 2	1
Required production (units)	46,000	72,000	85,000	56,000	259,000	73,000
Raw materials needed per unit (pounds)	× 5	× 5	× 5	× 5	× 5	× 5
Production needs (pounds)	230,000	360,000	425,000	280,000	1,295,000	365,000
Add desired ending inventory of raw materials (pounds)*	36,000	42,500	28,000	36,500†	36,500	
Total needs (pounds)	266,000	402,500	453,000	316,500	1,331,500	
Less beginning inventory of raw materials (pounds)	23,000	36,000	42,500	28,000	23,000	
Raw materials to be purchased (pounds)	243,000	366,500	410,500	288,500	1,308,500	
Cost of raw materials per pound	× $0.80	× $0.80	× $0.80	× $0.80	× $0.80	
Cost of raw materials to be purchased	$194,400	$293,200	$328,400	$230,800	$1,046,800	

*10% of the following quarter's production needs in pounds.
†10% of the Year 3 first-quarter production needs in pounds.

Based on the raw material purchases above, expected cash payments are computed as follows:

	Year 2 Quarter				
	1	2	3	4	Year 2
Accounts payable, beginning balance	$ 81,500				$ 81,500
First-quarter purchases ($194,400 × 60%, 40%)	116,640	$ 77,760			194,400
Second-quarter purchases ($293,200 × 60%, 40%)		175,920	$117,280		293,200
Third-quarter purchases ($328,400 × 60%, 40%)			197,040	$131,360	328,400
Fourth-quarter purchases ($230,800 × 60%)				138,480	138,480
Total cash disbursements	$198,140	$253,680	$314,320	$269,840	$1,035,980

Glossary

Budget A detailed plan for the future that is usually expressed in formal quantitative terms. (p. 336)

Budget committee A group of key managers who are responsible for overall budgeting policy and for coordinating the preparation of the budget. (p. 340)

Cash budget A detailed plan showing how cash resources will be acquired and used over a specific time period. (p. 341)

Continuous budget A 12-month budget that rolls forward one month as the current month is completed. (p. 337)

Control The process of gathering feedback to ensure that a plan is being properly executed or modified as circumstances change. (p. 336)

Direct labor budget A detailed plan that shows the direct labor-hours required to fulfill the production budget. (p. 348)

Direct materials budget A detailed plan showing the amount of raw materials that must be purchased to fulfill the production budget and to provide for adequate inventories. (p. 346)

Ending finished goods inventory budget A budget showing the dollar amount of unsold finished goods inventory that will appear on the ending balance sheet. (p. 350)

Manufacturing overhead budget A detailed plan showing the production costs, other than direct materials and direct labor, that will be incurred over a specified time period. (p. 349)
Master budget A number of separate but interdependent budgets that formally lay out the company's sales, production, and financial goals and that culminates in a cash budget, budgeted income statement, and budgeted balance sheet. (p. 341)
Merchandise purchases budget A detailed plan used by a merchandising company that shows the amount of goods that must be purchased from suppliers during the period. (p. 346)
Participative budget See *Self-imposed budget.* (p. 338)
Perpetual budget See *Continuous budget.* (p. 337)
Planning Developing goals and preparing budgets to achieve those goals. (p. 336)
Production budget A detailed plan showing the number of units that must be produced during a period in order to satisfy both sales and inventory needs. (p. 344)
Responsibility accounting A system of accountability in which managers are held responsible for those items of revenue and cost—and only those items—over which they can exert significant control. The managers are held responsible for differences between budgeted and actual results. (p. 337)
Sales budget A detailed schedule showing expected sales expressed in both dollars and units. (p. 341)
Self-imposed budget A method of preparing budgets in which managers prepare their own budgets. These budgets are then reviewed by higher-level managers, and any issues are resolved by mutual agreement. (p. 338)
Selling and administrative expense budget A detailed schedule of planned expenses that will be incurred in areas other than manufacturing during a budget period. (p. 351)

Questions

8–1 What is a budget? What is budgetary control?
8–2 Discuss some of the major benefits to be gained from budgeting.
8–3 What is meant by the term *responsibility accounting?*
8–4 What is a master budget? Briefly describe its contents.
8–5 Why is the sales forecast the starting point in budgeting?
8–6 "As a practical matter, planning and control mean exactly the same thing." Do you agree? Explain.
8–7 Describe the flow of budget data in an organization. Who are the participants in the budgeting process, and how do they participate?
8–8 What is a self-imposed budget? What are the major advantages of self-imposed budgets? What caution must be exercised in their use?
8–9 How can budgeting assist a company in planning its workforce staffing levels?
8–10 "The principal purpose of the cash budget is to see how much cash the company will have in the bank at the end of the year." Do you agree? Explain.

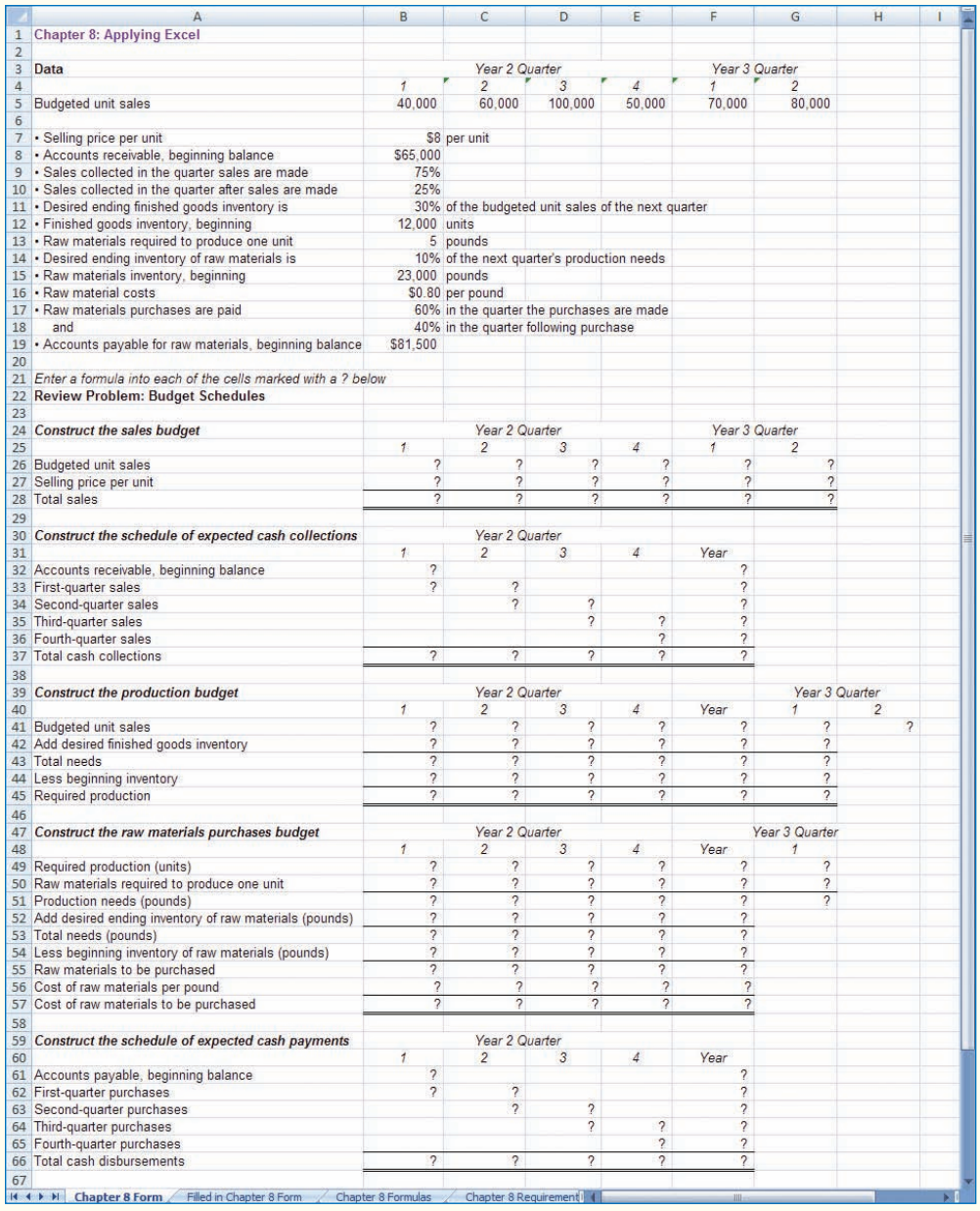
Multiple-choice questions are provided on the text website at www.mhhe.com/garrison14e.

Applying Excel

LEARNING OBJECTIVES 2, 3, 4

Available with McGraw-Hill's *Connect™ Accounting*.

The Excel worksheet form that appears on the next page is to be used to recreate the Review Problem on pages 359–361. Download the workbook containing this form from the Online Learning Center at www.mhhe.com/garrison14e. *On the website you will also receive instructions about how to use this worksheet form.*



	A	B	C	D	E	F	G	H	I
1	**Chapter 8: Applying Excel**								
2									
3	**Data**			Year 2 Quarter			Year 3 Quarter		
4		1	2	3	4	1	2		
5	Budgeted unit sales	40,000	60,000	100,000	50,000	70,000	80,000		
6									
7	• Selling price per unit	$8	per unit						
8	• Accounts receivable, beginning balance	$65,000							
9	• Sales collected in the quarter sales are made	75%							
10	• Sales collected in the quarter after sales are made	25%							
11	• Desired ending finished goods inventory is	30%	of the budgeted unit sales of the next quarter						
12	• Finished goods inventory, beginning	12,000	units						
13	• Raw materials required to produce one unit	5	pounds						
14	• Desired ending inventory of raw materials is	10%	of the next quarter's production needs						
15	• Raw materials inventory, beginning	23,000	pounds						
16	• Raw material costs	$0.80	per pound						
17	• Raw materials purchases are paid	60%	in the quarter the purchases are made						
18	and	40%	in the quarter following purchase						
19	• Accounts payable for raw materials, beginning balance	$81,500							
20									
21	*Enter a formula into each of the cells marked with a ? below*								
22	**Review Problem: Budget Schedules**								
23									
24	***Construct the sales budget***			Year 2 Quarter			Year 3 Quarter		
25		1	2	3	4	1	2		
26	Budgeted unit sales	?	?	?	?	?	?		
27	Selling price per unit	?	?	?	?	?	?		
28	Total sales	?	?	?	?	?	?		
29									
30	***Construct the schedule of expected cash collections***			Year 2 Quarter					
31		1	2	3	4	Year			
32	Accounts receivable, beginning balance	?				?			
33	First-quarter sales	?	?			?			
34	Second-quarter sales		?	?		?			
35	Third-quarter sales			?	?	?			
36	Fourth-quarter sales				?	?			
37	Total cash collections	?	?	?	?	?			
38									
39	***Construct the production budget***			Year 2 Quarter				Year 3 Quarter	
40		1	2	3	4	Year	1	2	
41	Budgeted unit sales	?	?	?	?	?	?	?	
42	Add desired finished goods inventory	?	?	?	?	?	?		
43	Total needs	?	?	?	?	?	?		
44	Less beginning inventory	?	?	?	?	?	?		
45	Required production	?	?	?	?	?	?		
46									
47	***Construct the raw materials purchases budget***			Year 2 Quarter			Year 3 Quarter		
48		1	2	3	4	Year	1		
49	Required production (units)	?	?	?	?	?	?		
50	Raw materials required to produce one unit	?	?	?	?	?	?		
51	Production needs (pounds)	?	?	?	?	?	?		
52	Add desired ending inventory of raw materials (pounds)	?	?	?	?	?			
53	Total needs (pounds)	?	?	?	?	?			
54	Less beginning inventory of raw materials (pounds)	?	?	?	?	?			
55	Raw materials to be purchased	?	?	?	?	?			
56	Cost of raw materials per pound	?	?	?	?	?			
57	Cost of raw materials to be purchased	?	?	?	?	?			
58									
59	***Construct the schedule of expected cash payments***			Year 2 Quarter					
60		1	2	3	4	Year			
61	Accounts payable, beginning balance	?				?			
62	First-quarter purchases	?	?			?			
63	Second-quarter purchases		?	?		?			
64	Third-quarter purchases			?	?	?			
65	Fourth-quarter purchases				?	?			
66	Total cash disbursements	?	?	?	?	?			
67									

Chapter 8 Form | Filled in Chapter 8 Form | Chapter 8 Formulas | Chapter 8 Requirement

You should proceed to the requirements below only after completing your worksheet.

Required:

1. Check your worksheet by changing the budgeted unit sales in Quarter 2 of Year 2 in cell C5 to 75,000 units. The total expected cash collections for the year should now be $2,085,000. If you do not get this answer, find the errors in your worksheet and correct them. Have the total cash disbursements for the year changed? Why or why not?
2. The company has just hired a new marketing manager who insists that unit sales can be dramatically increased by dropping the selling price from $8 to $7. The marketing manager would like to use the following projections in the budget:

Data	Year 2 Quarter				Year 3 Quarter	
	1	2	3	4	1	2
Budgeted unit sales	50,000	70,000	120,000	80,000	90,000	100,000
Selling price per unit	$7 per unit					

a. What are the total expected cash collections for the year under this revised budget?
b. What is the total required production for the year under this revised budget?
c. What is the total cost of raw materials to be purchased for the year under this revised budget?
d. What are the total expected cash disbursements for raw materials for the year under this revised budget?
e. After seeing this revised budget, the production manager cautioned that due to the current production constraint, a complex milling machine, the plant can produce no more than 90,000 units in any one quarter. Is this a potential problem? If so, what can be done about it?

Exercises

All applicable exercises are available with McGraw-Hill's *Connect™ Accounting*.

EXERCISE 8–1 Schedule of Expected Cash Collections [LO2]
Midwest Products is a wholesale distributor of leaf rakes. Thus, peak sales occur in August of each year as shown in the company's sales budget for the third quarter, given below:

	July	August	September	Total
Budgeted sales (all on account)	$600,000	$900,000	$500,000	$2,000,000

From past experience, the company has learned that 20% of a month's sales are collected in the month of sale, another 70% are collected in the month following sale, and the remaining 10% are collected in the second month following sale. Bad debts are negligible and can be ignored. May sales totaled $430,000, and June sales totaled $540,000.

Required:
1. Prepare a schedule of expected cash collections from sales, by month and in total, for the third quarter.
2. Assume that the company will prepare a budgeted balance sheet as of September 30. Compute the accounts receivable as of that date.

EXERCISE 8–2 Production Budget [LO3]
Crystal Telecom has budgeted the sales of its innovative mobile phone over the next four months as follows:

	Sales in Units
July	30,000
August	45,000
September	60,000
October	50,000

The company is now in the process of preparing a production budget for the third quarter. Past experience has shown that end-of-month finished goods inventories must equal 10% of the next month's sales. The inventory at the end of June was 3,000 units.

Required:
Prepare a production budget for the third quarter showing the number of units to be produced each month and for the quarter in total.

EXERCISE 8–3 Direct Materials Budget [LO4]

Micro Products, Inc., has developed a very powerful electronic calculator. Each calculator requires three small "chips" that cost $2 each and are purchased from an overseas supplier. Micro Products has prepared a production budget for the calculator by quarters for Year 2 and for the first quarter of Year 3, as shown below:

	Year 2				Year 3
	First	Second	Third	Fourth	First
Budgeted production, in calculators	60,000	90,000	150,000	100,000	80,000

The chip used in production of the calculator is sometimes hard to get, so it is necessary to carry large inventories as a precaution against stockouts. For this reason, the inventory of chips at the end of a quarter must equal 20% of the following quarter's production needs. A total of 36,000 chips will be on hand to start the first quarter of Year 2.

Required:

Prepare a direct materials budget for chips, by quarter and in total, for Year 2. At the bottom of your budget, show the dollar amount of purchases for each quarter and for the year in total.

EXERCISE 8–4 Direct Labor Budget [LO5]

The production manager of Junnen Corporation has submitted the following forecast of units to be produced for each quarter of the upcoming fiscal year.

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Units to be produced	5,000	4,400	4,500	4,900

Each unit requires 0.40 direct labor-hours and direct labor-hour workers are paid $11 per hour.

Required:

1. Construct the company's direct labor budget for the upcoming fiscal year, assuming that the direct labor workforce is adjusted each quarter to match the number of hours required to produce the forecasted number of units produced.
2. Construct the company's direct labor budget for the upcoming fiscal year, assuming that the direct labor workforce is *not* adjusted each quarter. Instead, assume that the company's direct labor workforce consists of permanent employees who are guaranteed to be paid for at least 1,800 hours of work each quarter. If the number of required direct labor-hours is less than this number, the workers are paid for 1,800 hours anyway. Any hours worked in excess of 1,800 hours in a quarter are paid at the rate of 1.5 times the normal hourly rate for direct labor.

EXERCISE 8–5 Manufacturing Overhead Budget [LO6]

The direct labor budget of Krispin Corporation for the upcoming fiscal year includes the following budgeted direct labor-hours.

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Budgeted direct labor-hours	5,000	4,800	5,200	5,400

The company's variable manufacturing overhead rate is $1.75 per direct labor-hour and the company's fixed manufacturing overhead is $35,000 per quarter. The only noncash item included in fixed manufacturing overhead is depreciation, which is $15,000 per quarter.

Required:

1. Construct the company's manufacturing overhead budget for the upcoming fiscal year.
2. Compute the company's manufacturing overhead rate (including both variable and fixed manufacturing overhead) for the upcoming fiscal year. Round off to the nearest whole cent.

EXERCISE 8–6 Selling and Administrative Expense Budget [LO7]

The budgeted unit sales of Haerve Company for the upcoming fiscal year are provided below:

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Budgeted unit sales	12,000	14,000	11,000	10,000

The company's variable selling and administrative expenses per unit are $2.75. Fixed selling and administrative expenses include advertising expenses of $12,000 per quarter, executive salaries of $40,000 per quarter, and depreciation of $16,000 per quarter. In addition, the company will make insurance payments of $6,000 in the 2nd Quarter and $6,000 in the 4th Quarter. Finally, property taxes of $6,000 will be paid in the 3rd Quarter.

Required:

Prepare the company's selling and administrative expense budget for the upcoming fiscal year.

EXERCISE 8–7 Cash Budget [LO8]

Forest Outfitters is a retailer that is preparing its budget for the upcoming fiscal year. Management has prepared the following summary of its budgeted cash flows:

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Total cash receipts	$340,000	$670,000	$410,000	$470,000
Total cash disbursements	$530,000	$450,000	$430,000	$480,000

The company's beginning cash balance for the upcoming fiscal year will be $50,000. The company requires a minimum cash balance of $30,000 and may borrow any amount needed from a local bank at a quarterly interest rate of 3%. The company may borrow any amount at the beginning of any quarter and may repay its loans, or any part of its loans, at the end of any quarter. Interest payments are due on any principal at the time it is repaid.

Required:

Prepare the company's cash budget for the upcoming fiscal year.

EXERCISE 8–8 Budgeted Income Statement [LO9]

Seattle Cat is the wholesale distributor of a small recreational catamaran sailboat. Management has prepared the following summary data to use in its annual budgeting process:

Budgeted unit sales	380
Selling price per unit	$1,850
Cost per unit	$1,425
Variable selling and administrative expenses (per unit)	$85
Fixed selling and administrative expenses (per year)	$105,000
Interest expense for the year	$11,000

Required:

Prepare the company's budgeted income statement using an absorption income statement format as shown in Schedule 9.