Chapter 19
Management Systems: Activity-Based, Just-In-Time, and Quality Management Systems

Review Questions

1. What is the formula to compute the predetermined overhead allocation rate?

The formula to compute the predetermined overhead allocation rate is: Total estimated overhead costs / Total estimated quantity of the overhead allocation base.

2. How is the predetermined overhead allocation rate used to allocate overhead?

The predetermined overhead rate is used to allocate estimated overhead cost to products and services by multiplying the rate by the actual quantity of the allocation base used by the product or service.

3. Describe how a single plantwide overhead allocation rate is used.

Using a single plantwide rate is the traditional method of allocating overhead costs and is the simplest method. In this method, the company calculates the predetermined overhead allocation rate before the period begins by selecting one allocation base and uses the same allocation base to allocate overhead to all units.

4. Why is using a single plantwide overhead allocation rate not always accurate?

Using a single plantwide overhead allocation rate is not always accurate because it is based on only one allocation base and uses that same allocation base to allocate overhead to all products. The allocation base selected might not accurately reflect the way products actually use a company's resources (there might not be a direct cause-and-effect relationship with overhead costs). In contrast, activity-based costing (ABC) identifies multiple activities, each with its own allocation base, to more accurately reflect the way products actually use a company's resources (activities). Thus ABC costs are closer to the true cost of making products. One should feel more comfortable making decisions using ABC cost data.

5. Why is the use of departmental overhead allocation rates considered a refinement over the use of a single plantwide overhead allocation rate?

Using departmental overhead allocation rates is considered a refinement over using a single plantwide overhead allocation rate because it is not based on only one allocation base. Departmental overhead allocation rates are used to allocate overhead to the products that are worked on in each department. The allocation base selected for each department more accurately reflects the way products actually use each department's resources.

6. What is activity-based management? How is it different from activity-based costing?

Activity-based management uses activity-based cost information to make decisions that improve customer satisfaction while also increasing profits. Activity-based costing focuses on activities as the fundamental cost objects. The costs of the activities then become the building blocks for allocating overhead costs to products and services.

7. How many cost pools are in an activity-based costing system?

An activity-based costing system identifies activities and their corresponding costs (and allocation bases) to reflect the way products and services actually use a company's resources. The number of activities identified and their corresponding cost pools should be sufficient to reflect the way products and services actually use a company's resources, but should not be so many as to create excessive complexity. With complexity comes more detailed information which increases the likelihood of better decisions. However, at some point the cost of obtaining more detailed information outweighs the benefits received.

8. What are the four steps to developing an activity-based costing system?

The four steps to developing an activity-based costing system are:

Step 1: Identify activities and estimate their total indirect costs.
Step 2: Identify the allocation base for each activity and estimate the total quantity of each allocation base.
Step 3: Compute the predetermined overhead allocation rate for each activity.
Step 4: Allocate indirect costs to the cost object.

9. Why is ABC usually considered more accurate than traditional costing methods?

ABC is usually considered more accurate than traditional costing systems because ABC considers the resources (activities) each product actually uses.

10. List two ways managers can use ABM to make decisions.

Managers can use ABM to make pricing and product mix decisions and cost management decisions, such as computing target prices and target costs.

11. Define value engineering. How is it used to control costs?

Value engineering is reevaluating activities to reduce costs while still meeting customer needs. Most companies adopt ABC to get better product cost information for pricing and product mix decisions, however they often benefit more by cutting costs. ABC and value engineering can work together. Value engineering requires the following cross-functional teams: marketers to identify customer needs, engineers to design more efficient products, and accountants to estimate costs.

12. Explain the difference between target price and target cost.

Target price is the amount customers are willing to pay for a product or service. Target cost is the maximum cost to develop, produce, and deliver the product or service and earn the desired net profit (target price minus desired net profit).

13. How can ABM be used by service companies?

ABM is not just for manufacturing companies. ABM can be used in determining the cost of services as well as products. Service companies use the same four steps to develop an ABM system and then use the results to make management decisions.

14. What is a just-in-time management system?

A just-in-time management system is a cost management system in which a company produces products just in time to satisfy customer needs. Suppliers deliver raw materials just in time to begin production, and finished units are completed just in time for delivery to customers.

15. Explain how the work cell manufacturing layout increases productivity.

Production in JIT management systems is completed in self-contained work cells. A work cell is an area in which everything needed to complete a manufacturing process is readily available. Each work cell includes the machinery and labor resources to manufacture a product. Employees work in a team in the work cell and are empowered to complete the work without supervision. Workers complete a small batch of units and are responsible for inspecting quality throughout the process. As the completed product moves out of the work cell, the suppliers deliver more materials to the work cell just in time to keep production moving along. Productivity is increased because there is less movement of products, less inventory, and more space available in the production facility.

16. What are the inventory accounts used in JIT costing?

A JIT costing system uses a Finished Goods Inventory account, but combines Raw Materials Inventory and Work-in-Process Inventory into a single account called Raw and In-Process Inventory. Direct labor and manufacturing overhead are combined into a single Conversion Costs account.

17. How is the Conversion Costs account used in JIT costing?

In a JIT costing system, direct labor and manufacturing overhead costs are combined into a single Conversion Costs account. The Conversion Costs account is a temporary account that works just like the Manufacturing Overhead account. Actual conversion costs accumulate as debits in the Conversion Costs account and allocated conversion costs are credited to the account as units are completed.

18. Why is JIT costing sometimes called backflush costing?

JIT costing is sometimes called backflush costing because it seems to work backwards. JIT costing starts with output that has been completed and then assigns manufacturing costs to units sold and to inventories.

19. Which accounts are adjusted for the underallocated or overallocated overhead in JIT costing?

The Conversion Costs account is a temporary account. Actual conversion costs accumulate as debits in the Conversion Costs account and allocated conversion costs are credited to the account as units are completed. Accountants adjust any underallocated or overallocated conversion costs to the Cost of Goods Sold account at the end of the period, just as they do for underallocated or overallocated manufacturing overhead.

20. What is the purpose of quality management systems?

Quality management systems help managers improve the business's performance by providing quality products and services, which should result in increased customer satisfaction and increased profits.

21. List and define the four types of quality costs.

The four types of quality costs and their definitions are as follows:

- Prevention costs – costs incurred to avoid poor-quality goods or services.
- Appraisal costs – costs incurred to detect poor-quality raw materials, goods, or services.
- Internal failure costs – costs incurred when the company detects and corrects poor-quality goods or services before delivery to customers.
- External failure costs – costs incurred after the company delivers poor-quality goods or services to customers and then has to make things right with the customer.

22. "Prevention is much cheaper than external failure." Do you agree with this statement? Why or why not?

I agree with the statement "Prevention is much cheaper than external failure." Most prevention costs are incurred in the R&D stage of the value chain. In contrast, most appraisal and internal failure costs are incurred while the product is being made; thus, they ultimately become part of the finished product. External failure causes an increase in customer service costs and it could cause lost sales due to unhappy customers. External failure costs ultimately affect warranty expense claims or worse, potential lawsuit liability exposure.

23. What are quality improvement programs?

Quality improvement programs help managers improve the business's performance by providing quality products and services, which should result in increased customer satisfaction and increased profits. Continuous improvement is the primary goal of quality management systems, and it is monitored in many ways. For quality improvement programs, companies compare the costs of any changes they want to make against the benefits of the changes as one measure that aids decision making (determine if the benefits exceed the costs). They want to assess whether or not the savings from decreased internal and external failure costs exceed the additional prevention and appraisal costs from undertaking a quality improvement program.

24. Why are some quality costs hard to measure?

Some quality costs are hard to measure because they don't appear in a company's accounting records; for example, lost profits due to unhappy customers. Therefore, quality management systems use many nonfinancial metrics to measure success or failure (e.g. the number of customer complaints and the volume of incoming customer service phone calls).

Short Exercises

S19-1 Computing single plantwide overhead allocation rates

Learning Objective 1

The Oakman Company manufactures products in two departments: Mixing and Packaging. The company allocates manufacturing overhead using a single plantwide rate with direct labor hours as the allocation base. Estimated overhead costs for the year are $810,000, and estimated direct labor hours are 360,000. In October, the company incurred 20,000 direct labor hours.

Requirements

1. Compute the predetermined overhead allocation rate. Round to two decimal places.

2. Determine the amount of overhead allocated in October.

SOLUTION

Requirement 1

$$\text{Predetermined Overhead Allocation Rate} = \frac{\text{Total estimated overhead costs}}{\text{Total estimated quantity of the overhead allocation base}}$$

$$= \frac{\$810{,}000 \text{ total estimated overhead costs}}{360{,}000 \text{ total estimated direct labor hours}}$$

$$= \$2.25 \text{ per DLHr}$$

Requirement 2

Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
$2.25 per DLHr	×	20,000 DLHr	=	$45,000

S19-2 Computing departmental overhead allocation rates

Learning Objective 1

The Oakman Company (see Short Exercise S19-1) has refined its allocation system by separating manufacturing overhead costs into two cost pools—one for each department. The estimated costs for the Mixing Department, $510,000, will be allocated based on direct labor hours, and the estimated direct labor hours for the year are 170,000. The estimated costs for the Packaging Department, $300,000, will be allocated based on machine hours, and the estimated machine hours for the year are 40,000. In October, the company incurred 38,000 direct labor hours in the Mixing Department and 10,000 machine hours in the Packaging Department.

Requirements

1. Compute the predetermined overhead allocation rates. Round to two decimal places.
2. Determine the total amount of overhead allocated in October.

SOLUTION

Requirement 1

Predetermined Overhead Allocation Rate	=	Total estimated overhead costs / Total estimated quantity of the overhead allocation base		
Mixing Department		$510,000 total estimated overhead costs / 170,000 total estimated direct labor hours	=	$3.00 per DLHr
Packaging Department		$300,000 total estimated overhead costs / 40,000 total estimated machine hours	=	$7.50 per MHr

Requirement 2

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Mixing Department	$3.00 per DLHr	×	38,000 DLHr	=	$ 114,000
Packaging Department	$7.50 per MHr	×	10,000 MHr	=	75,000
Total					$ 189,000

S19-3 Using activity-based costing

Learning Objective 2

Activity-based costing requires four steps. List the four steps in the order they are performed.

SOLUTION

Step 1: Identify activities and estimate their total indirect costs.
Step 2: Identify the allocation base for each activity and estimate the total quantity of each allocation base.
Step 3: Compute the predetermined overhead allocation rate for each activity.
Step 4: Allocate indirect costs to the cost object.

S19-4 Calculating costs using traditional and activity-based systems

Learning Objectives 1, 2

Bubba and Danny are college friends planning a skiing trip to Killington before the new year. They estimated the following for the trip:

	Estimated Costs	Allocation Base	Activity Allocation	
			Bubba	Danny
Food	$ 400	Pounds of food eaten	24	26
Skiing	300	Number of lift tickets	2	0
Lodging	280	Number of nights	2	2
	$ 980			

Requirements

1. Bubba suggests that the costs be shared equally. Calculate the amount each person would pay.
2. Danny does not like the idea of sharing the costs equally because he plans to stay in the room rather than ski. Danny suggests that each type of cost be allocated to each person based on the above-listed allocation bases. Using the activity allocation for each person, calculate the amount that each person would pay based on his own consumption of the activity.

SOLUTION

Requirement 1

Cost per person = $980 total cost / 2 people
= $490 per person

S19-4, cont.
Requirement 2

		Bubba	+	Danny	=	Total
Total pounds of food eaten	=	24 pounds	+	26 pounds	=	50 pounds
Total number of lift tickets	=	3 tickets	+	0 tickets	=	3 tickets
Total number of nights	=	2 nights	+	2 nights	=	4 nights

$$\text{Predetermined Overhead Allocation Rate} = \frac{\text{Total estimated cost}}{\text{Total estimated quantity of the allocation base}}$$

Food	$\frac{\$400}{50 \text{ pounds}}$	=	$8 per pound
Skiing	$\frac{\$300}{2 \text{ tickets}}$	=	$150 per ticket
Lodging	$\frac{\$280}{4 \text{ nights}}$	=	$70 per night

	Predetermined Overhead Allocation Rate	×	Quantity of the Allocation Base Used	=	Allocated Cost
Bubba					
Food	$8 per pound	×	24 pounds	=	$ 192
Skiing	$150 per ticket	×	2 tickets	=	300
Lodging	$70 per night	×	2 nights	=	140
Total cost					$ 632
Danny					
Food	$8 per pound	×	26 pounds	=	$ 208
Skiing	$100 per ticket	×	0 tickets	=	0
Lodging	$70 per night	×	2 nights	=	140
Total cost					$ 348

S19-5 Computing indirect manufacturing costs per unit

Learning Objective 2

Darby Corp. is considering the use of activity-based costing. The following information is provided for the production of two product lines:

Activity	**Cost**	**Allocation Base**
Setup	$ 105,000	Number of setups
Machine maintenance	60,000	Number of machine hours
Total indirect manufacturing costs	$ 165,000	

	Product A	**Product B**	**Total**
Direct labor hours	7,000	5,000	12,000
Number of setups	30	170	200
Number of machine hours	1,600	2,400	4,000

Darby plans to produce 375 units of Product A and 250 units of Product B. Compute the ABC indirect manufacturing cost per unit for each product.

SOLUTION

$$\text{Predetermined Overhead Allocation Rate} = \frac{\text{Total estimated overhead costs}}{\text{Total estimated quantity of the overhead allocation base}}$$

Setup	$\frac{\$105{,}000 \text{ total estimated overhead costs}}{200 \text{ total estimated setups}}$	=	$525.00 per setup
Machine maintenance	$\frac{\$60{,}000 \text{ total estimated overhead costs}}{4{,}000 \text{ total estimated machine hours}}$	=	$15.00 per MHr

S19-5, cont.

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Product A					
Setup	$525.00 per setup	×	30 setups	=	$ 15,750
Machine maintenance	$15.00 per MHr	×	1,600 MHr	=	24,000
Total manufacturing overhead costs					$ 39,750
÷ Number of units					÷ 375 units
Manufacturing overhead cost per unit					$ 106.00
Product B					
Setup	$525.00 per setup	×	170 setups	=	$ 89,250
Machine maintenance	$15.00 per MHr	×	2,400 MHr	=	36,000
Total manufacturing overhead costs					$ 125,250
÷ Number of units					÷ 250 units
Manufacturing overhead cost per unit					$ 501.00

S19-6 Computing indirect manufacturing costs per unit, traditional and ABC

Learning Objectives 1, 2

The following information is provided for Orbit Antenna Corp., which manufactures two products: Lo-Gain antennas and Hi-Gain antennas for use in remote areas.

Activity	**Cost**	**Allocation Base**	
Setup	$ 58,000	Number of setups	
Machine maintenance	30,000	Number of machine hours	
Total indirect manufacturing costs	$ 88,000		
	Lo-Gain	**Hi-Gain**	**Total**
Direct labor hours	1,200	3,800	5,000
Number of setups	40	40	80
Number of machine hours	3,000	2,000	5,000

Orbit Antenna plans to produce 125 Lo-Gain antennas and 225 Hi-Gain antennas.

Requirements

1. Compute the indirect manufacturing cost per unit using direct labor hours for the single plantwide predetermined overhead allocation rate.

2. Compute the ABC indirect manufacturing cost per unit for each product.

S19-6, cont.

SOLUTION

Requirement 1

$$\text{Predetermined Overhead Allocation Rate} = \frac{\text{Total estimated overhead costs}}{\text{Total estimated quantity of the overhead allocation base}}$$

$$= \frac{\$88{,}000 \text{ total estimated overhead costs}}{5{,}000 \text{ total estimated direct labor hours}}$$

$$= \$17.60 \text{ per DLHr}$$

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Lo-Gain antennas	$17.60 per DLHr	×	1,200 DLHr	=	$ 21,120
÷ Number of units					÷ 125 units
Manufacturing overhead cost per unit					$ 168.96
Hi-Gain antennas	$17.60 per DLHr	×	3,800 DLHr	=	$ 66,880
÷ Number of units					÷ 225 units
Manufacturing overhead cost per unit					$ 297.24

S19-6, cont.
Requirement 2

Predetermined Overhead Allocation Rate	=	Total estimated overhead costs / Total estimated quantity of the overhead allocation base	
Setup		$58,000 total estimated overhead costs / 80 total estimated setups	= $725 per setup
Machine maintenance		$30,000 total estimated overhead costs / 5,000 total estimated machine hours	= $6 per MHr

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Lo-Gain antennas					
Setup	$725 per setup	×	40 setups	=	$ 29,000
Machine maintenance	$6 per MHr	×	3,000 MHr	=	18,000
Total manufacturing overhead costs					$ 47,000
÷ Number of units					÷ 125 units
Manufacturing overhead cost per unit					$ 376.00
Hi-Gain antennas					
Setup	$725 per setup	×	40 setups	=	$ 29,000
Machine maintenance	$6 per MHr	×	2,000 MHr	=	12,000
Total manufacturing overhead costs					$ 41,000
÷ Number of units					÷ 225 units
Manufacturing overhead cost per unit					$ 182.22

S19-7 Using ABC to compute product costs per unit

Learning Objective 2

Jaunkas Corp. manufactures mid-fi and hi-fi stereo receivers. The following data have been summarized:

	Mid-Fi	Hi-Fi
Direct materials cost per unit	$ 400	$ 1,800
Direct labor cost per unit	600	400
Indirect manufacturing cost per unit	?	?

Indirect manufacturing cost information includes the following:

Activity	Predetermined Overhead Allocation Rate	Mid-Fi	Hi-Fi
Setup	$ 1,400 per setup	36 setups	36 setups
Inspections	$ 700 per inspection hour	35 inspection hours	20 inspection hours
Machine maintenance	$ 13 per machine hour	1,900 machine hours	1,150 machine hours

The company plans to manufacture 125 units of the mid-fi receivers and 250 units of the hi-fi receivers. Calculate the product cost per unit for both products using activity-based costing.

S19-7, cont.

SOLUTION

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Mid-Fi receivers					
Setup	$1,400 per setup	×	36 setups	=	$ 50,400
Inspections	$700 per inspection hour	×	35 inspection hours	=	24,500
Machine maintenance	$13 per MHr	×	1,900 MHr	=	24,700
Total manufacturing overhead costs					$ 99,600
÷ Number of units					÷ 125 units
Manufacturing overhead cost per unit					$ 796.80
Hi-Fi receivers					
Setup	$1,400 per setup	×	36 setups	=	$ 50,400
Inspections	$700 per inspection hour	×	20 inspection hours	=	14,000
Machine maintenance	$13 per MHr	×	1,150 MHr	=	14,950
Total manufacturing overhead costs					$ 79,350
÷ Number of units					÷ 250 units
Manufacturing overhead cost per unit					$ 317.40

	Mid-Fi receivers	Hi-Fi receivers
Direct materials cost per unit	$ 400.00	$ 1,800.00
Direct labor cost per unit	600.00	400.00
Manufacturing overhead cost per unit	796.80	317.40
Total product cost per unit	$ 1,796.80	$ 2,517.40

S19-8 Using ABC to compute product costs per unit

Learning Objective 2

Spectrum Corp. makes two products: C and D. The following data have been summarized:

	Product C	Product D
Direct materials cost per unit	$ 600	$ 2,400
Direct labor cost per unit	300	200
Indirect manufacturing cost per unit	?	?

Indirect manufacturing cost information includes the following:

Activity	Predetermined Overhead Allocation Rate	Product C	Product D
Setup	$ 1,500 per setup	35 setups	76 setups
Machine maintenance	$ 10 per MHr	1,500 MHr	3,700 MHr

The company plans to manufacture 250 units of each product. Calculate the product cost per unit for Products C and D using activity-based costing.

S19-8, cont.

SOLUTION

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Product C					
Setup	$1,500 per setup	×	35 setups	=	$ 52,500
Machine maintenance	$10 per MHr	×	1,500 MHr	=	15,000
Total manufacturing overhead costs					$ 67,500
÷ Number of units					÷ 250 units
Manufacturing overhead cost per unit					$ 270.00
Product D					
Setup	$1,500 per setup	×	76 setups	=	$ 114,000
Machine maintenance	$10 per MHr	×	3,700 MHr	=	37,000
Total manufacturing overhead costs					$ 151,000
÷ Number of units					÷ 250 units
Manufacturing overhead cost per unit					$ 604.00

	Product C	Product D
Direct materials cost per unit	$ 600.00	$ 2,400.00
Direct labor cost per unit	300.00	200.00
Manufacturing overhead cost per unit	270.00	604.00
Total product cost per unit	$ 1,170.00	$ 3,204.00

Note: Short Exercise S19-8 must be completed before attempting Short Exercise S19-9.

S19-9 Using ABM to achieve target profit

Learning Objective 3

Refer to Short Exercise S19-8. Spectrum Corp. desires a 25% target gross profit after covering all product costs. Considering the total product costs assigned to the Products C and D in Short Exercise S19-8, what would Spectrum have to charge the customer to achieve that gross profit? Round to two decimal places.

SOLUTION

Desired gross profit per unit	=	Required sales price per unit	–	Product cost per unit
Required sales price per unit × 25%	=	Required sales price per unit	–	Product cost per unit

Thus:

	Required sales price per unit	=	Product cost per unit	/	75%		
Product C:		=	$1,170[(a)]	/	75%	=	$1,560
Product D:		=	$3,204[(a)]	/	75%	=	$4,272

[(a)] Calculated in S19-8.

S19-10 Using ABM in a service company

Learning Objective 4

Haworth Company is a management consulting firm. The company expects to incur $167,500 of indirect costs this year. Indirect costs are allocated based on the following activities:

Activity	Estimated Cost	Allocation Base	Estimated Quantity of Allocation Base	Predetermined Overhead Allocation Rate
Site visits	$ 45,000	Number of visits	900 visits	$ 50 per visit
Documentation preparation	122,500	Number of pages	3,500 pages	$ 35 per page
Total indirect costs	$ 167,500			

Haworth bills clients at 120% of the direct labor costs. The company has estimated direct labor costs at $240 per hour. Last month, Haworth completed a consulting job for Client 76 and used the following resources:

Allocation Base	Client 76
Direct labor hours	60
Visits	5
Pages	50

Determine the total cost of the consulting job and the operating income earned.

S19-10, cont.

SOLUTION

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Overhead Cost
Site visits	$50 per visit	×	5 visits	=	$ 250
Documentation preparation	$35 per page	×	50 pages	=	1,750
Total					$ 2,000

Direct Labor Rate per DLHr	×	Number of DLHr worked	=	Total Direct Labor Cost
$240 per DLHr	×	60 DLHr	=	$14,400

Total direct labor cost	$ 14,400
Total overhead cost	2,000
Total cost	$ 16,400

Service revenue = $ 14,400 total direct labor cost × 120% = $ 17,280

Operating income = $17,280 service revenue – $16,400 total cost = $880

Note: Short Exercise S19-10 must be completed before attempting Short Exercise S19-11.

S19-11 Using ABM in a service company

Learning Objective 4

Refer to Short Exercise S19-10. Haworth desires a 20% target operating income after covering all costs. Considering the total costs assigned to the Client 76 job in Short Exercise S19-10, what would Haworth have to charge the customer to achieve that operating income? Round to two decimal places.

SOLUTION

Desired operating income	=	Required service revenue	–	Total cost
Required service revenue × 20%	=	Required service revenue	–	Total cost

Thus:

Required service revenue	=	Total cost	/	80%		
	=	$16,400[(a)]	/	80%	=	$20,500

[(a)] Calculated in S19-10.

S19-12 Identifying just-in-time characteristics

Learning Objective 5

Consider the following characteristics of either a JIT production system or a traditional production system. Indicate whether each is characteristic of a JIT production system or a traditional production system.

a. Products are produced in large batches.

b. Large stocks of finished goods protect against lost sales if customer demand is higher than expected.

c. Suppliers make frequent deliveries of small quantities of raw materials.

d. Employees do a variety of jobs, including maintenance and setups as well as operating machines.

e. Machines are grouped into self-contained production cells or production lines.

f. Machines are grouped according to function. For example, all cutting machines are located in one area.

g. The final operation in the production sequence "pulls" parts from the preceding operation.

h. Each employee is responsible for inspecting his or her own work.

i. Management works with suppliers to ensure defect-free raw materials.

S19-12, cont.

SOLUTION

a. Traditional production system
b. Traditional production system
c. JIT production system
d. JIT production system
e. JIT production system
f. Traditional production system
g. JIT production system
h. JIT production system
i. JIT production system

S19-13 Recording JIT costing journal entries

Learning Objective 5

Prime Products uses a JIT management system to manufacture trading pins. The standard cost per pin is $2 for direct materials and $3 for conversion costs. Last month, Prime recorded the following data:

Number of pins completed	4,100 pins
Number of pins sold (on account at $7 each)	3,700 pins
Raw material purchases (on account)	$ 7,000
Conversion costs	$ 14,500

Use JIT costing to prepare journal entries for the month, including the entry to adjust the Conversion Costs account.

S19-13, cont.

SOLUTION

Date	Accounts and Explanation	Debit	Credit
	Raw and In-Process Inventory	7,000	
	Accounts Payable		7,000
	Conversion Costs	14,500	
	Wages Payable, Accumulated Depreciation, etc.		14,500
	Finished Goods Inventory	20,500	
	Raw and In-Process Inventory (4,100 pins × $2/pin)		8,200
	Conversion Costs (4,100 pins × $3/pin)		12,300
	Accounts Receivable (3,700 pins × $7/pin)	25,900	
	Sales Revenue		25,900
	Cost of Goods Sold (3,700 pins × $5/pin)	18,500	
	Finished Goods Inventory		18,500
	Cost of Goods Sold ($14,500 – $12,300)	2,200	
	Conversion Costs		2,200

S19-14 Matching cost-of-quality examples to categories

Learning Objective 6

Stegall, Inc. manufactures motor scooters. For each of the following examples of quality costs, indicate which of the following quality cost categories each example represents: prevention costs, appraisal costs, internal failure costs, or external failure costs.

1. Preventive maintenance on machinery
2. Direct materials, direct labor, and manufacturing overhead incurred to rework a defective scooter that is detected in-house through inspection
3. Lost profits from lost sales if the company's reputation is hurt because customers previously purchased a poor-quality scooter
4. Cost of inspecting raw materials, such as chassis and wheels
5. Working with suppliers to achieve on-time delivery of defect-free raw materials
6. Cost of warranty repairs on a scooter that malfunctions at a customer's location
7. Costs of testing durability of vinyl
8. Cost to reinspect reworked scooters

S19-14, cont.

SOLUTION

1. Prevention costs
2. Internal failure costs
3. External failure costs
4. Appraisal costs
5. Prevention costs
6. External failure costs
7. Appraisal costs
8. Internal failure costs

Exercises

E19-15 Computing and using single plantwide overhead allocation rate

Learning Objective 1

Basic $322,000

Koehler makes handheld calculators in two models: basic and professional. Koehler estimated $721,000 of manufacturing overhead and 515,000 machine hours for the year. The basic model actually consumed 230,000 machine hours, and the professional model consumed 285,000 machine hours.

Compute the predetermined overhead allocation rate using machine hours (MHr) as the allocation base. How much overhead is allocated to the basic model? To the professional model?

SOLUTION

$$\text{Predetermined Overhead Allocation Rate} = \frac{\text{Total estimated overhead costs}}{\text{Total estimated quantity of the overhead allocation base}}$$

$$= \frac{\$721{,}000 \text{ total estimated overhead costs}}{515{,}000 \text{ total estimated machine hours}}$$

$$= \$1.40 \text{ per MHr}$$

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Basic model	$1.40 per MHr	×	230,000 MHr	=	$ 322,000
Professional model	$1.40 per MHr	×	285,000 MHr	=	$ 399,000

E19-16 Computing and using departmental overhead allocation rates

Learning Objective 1

Professional, total OH $477,500

Koehler (see Exercise E19-15) makes handheld calculators in two models—basic and professional—and wants to refine its costing system by allocating overhead using departmental rates. The estimated $721,000 of manufacturing overhead has been divided into two cost pools: Assembly Department and Packaging Department. The following data have been compiled:

	Assembly Department	**Packaging Department**	**Total**
Overhead costs	$ 456,500	$ 264,500	$ 721,000
Machine hours:			
Basic Model	185,000 MHr	45,000 MHr	230,000 MHr
Professional Model	230,000 MHr	55,000 MHr	285,000 MHr
Total	415,000 MHr	100,000 MHr	515,000 MHr
Direct labor hours:			
Basic Model	20,000 DLHr	50,000 DLHr	70,000 DLHr
Professional Model	105,125 DLHr	280,625 DLHr	385,750 DLHr
Total	125,125 DLHr	330,625 DLHr	455,750 DLHr

Compute the predetermined overhead allocation rates using machine hours as the allocation base for the Assembly Department and direct labor hours for the Packaging Department. How much overhead is allocated to the basic model? To the professional model? Round allocation rates to two decimal places and allocated costs to whole dollars.

SOLUTION

Predetermined Overhead Allocation Rate	=	Total estimated overhead costs / Total estimated quantity of the overhead allocation base

Assembly Dept.	$456,500 total estimated overhead costs / 415,000 total estimated machine hours	=	$1.10 per MHr
Packaging Dept.	$264,500 total estimated overhead costs / 330,625 total estimated direct labor hours	=	$0.80 per DLHr

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Assembly Dept.					
Basic Model	$1.10 per MHr	×	185,000 MHr	=	$ 203,500
Professional Model	$1.10 per MHr	×	230,000 MHr	=	253,000
Total manufacturing overhead cost					$ 456,500
Packaging Dept.					
Basic Model	$0.80 per DLHr	×	50,000 DLHr	=	$ 40,000
Professional Model	$0.80 per DLHr	×	280,625 DLHr	=	224,500
Total manufacturing overhead cost					$ 264,500

	Basic Model	Professional Model
Manufacturing overhead – Assembly Dept.	$203,500	$ 253,000
Manufacturing overhead – Packaging Dept.	40,000	224,500
Total manufacturing overhead cost	$ 243,500	$ 477,500

Note: Exercises E19-15 and E19–16 must be completed before attempting Exercise E19-17.

E19-17 Computing and using activity-based costing overhead allocation rates

Learning Objectives 2, 3

1. Total MOH Basic $256,000

Koehler (see Exercise E19-15 and Exercise E19-16) makes handheld calculators in two models—basic and professional—and wants to further refine its costing system by allocating overhead using activity-based costing. The estimated $721,000 of manufacturing overhead has been divided into three primary activities: Materials Handling, Machine Setup, and Insertion of Parts. The following data have been compiled:

	Materials Handling	**Machine Setup**	**Insertion of Parts**	**Total**
Overhead costs	$ 45,000	$ 136,000	$ 540,000	$ 721,000
Allocation base	Number of parts	Number of setups	Number of parts	
Expected usage:				
Basic Model	32 parts per calculator	24 setups per year	32 parts per calculator	
Professional Model	58 parts per calculator	44 setups per year	58 parts per calculator	

Requirement 1

Koehler expects to produce 200,000 basic models and 200,000 professional models. Compute the predetermined overhead allocation rates using activity-based costing. How much overhead is allocated to the basic model? To the professional model?

Requirement 2

Compare your answers for Exercise E19-15, Exercise E19-16, and Exercise E19-17. What conclusions can you draw?

E19-17, cont.

SOLUTION

Requirement 1

	Number of Parts	Number of Setups
Basic Model (32 parts per calculator × 200,000 calculators)	6,400,000	24
Professional Model (58 parts per calculator × 200,000 calculators)	11,600,000	44
Totals	18,000,000	68

$$\text{Predetermined Overhead Allocation Rate} = \frac{\text{Total estimated overhead costs}}{\text{Total estimated quantity of the overhead allocation base}}$$

Materials Handling	$\frac{\$45{,}000 \text{ total estimated overhead costs}}{18{,}000{,}000 \text{ total parts}}$	=	$0.0025 per part
Machine Setup	$\frac{\$136{,}000 \text{ total estimated overhead costs}}{68 \text{ total setups}}$	=	$2,000 per setup
Insertion of Parts	$\frac{\$540{,}000 \text{ total estimated overhead costs}}{18{,}000{,}000 \text{ total parts}}$	=	$0.03 per part

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Materials Handling					
Basic Model	$0.0025 per part	×	6,400,000 parts	=	$ 16,000
Professional Model	$0.0025 per part	×	11,600,000 parts	=	29,000
Total MOH					$ 45,000
Machine Setup					
Basic Model	$2,000 per setup	×	24 setups	=	$ 48,000
Professional Model	$2,000 per setup	×	44 setups	=	88,000
Total MOH					$ 136,000
Insertion of Parts					
Basic Model	$0.03 per part	×	6,400,000 parts	=	$ 192,000
Professional Model	$0.03 per part	×	11,600,000 parts	=	348,000
Total MOH					$ 540,000

E19-17, cont.
Requirement 1, cont.

	Basic Model	Professional Model
Manufacturing overhead – Materials Handling	$ 16,000	$ 29,000
Manufacturing overhead – Machine Setup	48,000	88,000
Manufacturing overhead – Insertion of Parts	192,000	348,000
Total manufacturing overhead cost	$ 256,000	$ 465,000

Requirement 2

Total and per unit manufacturing overhead allocated to each model:

	Basic Model		**Professional Model**	
	Total	**Per Unit (Total ÷ 200,000 units)**	**Total**	**Per Unit (Total ÷ 200,000 units)**
Single plantwide allocation rate	$ 322,000	$ 1.61	$ 399,000	$ 2.00
Multiple department allocations rates	243,500	1.22	477,500	2.39
Activity-based allocation rates	256,000	1.28	465,000	2.33

With each refinement of the overhead allocation system, the company has more accurate costs. The allocation using activity-based costing is the most accurate because it considers the resources used by each model. Management can now see that the basic model cost less than expected and the professional model cost more than expected to produce. This information can be used in pricing and product mix decisions.

E19-18 Computing product costs in an activity-based costing system

Learning Objective 2

1. POHR machine setup $310 per setup

Franklin, Inc. uses activity-based costing to account for its chrome bumper manufacturing process. Company managers have identified four manufacturing activities: materials handling, machine setup, insertion of parts, and finishing. The budgeted activity costs for 2018 and their allocation bases are as follows:

Activity	Total Budgeted Cost	Allocation Base
Materials handling	$ 12,000	Number of parts
Machine setup	3,100	Number of setups
Insertion of parts	42,000	Number of parts
Finishing	86,000	Finishing direct labor hours
Total	$ 143,100	

Franklin expects to produce 500 chrome bumpers during the year. The bumpers are expected to use 4,000 parts, require 10 setups, and consume 1,000 hours of finishing time.

Requirements

1. Compute the predetermined overhead allocation rate for each activity.

2. Compute the expected indirect manufacturing cost of each bumper.

E19-18, cont.

SOLUTION

Requirement 1

Predetermined Overhead Allocation Rate	=	Total estimated overhead costs / Total estimated quantity of the overhead allocation base	
Materials handling		$12,000 total estimated overhead costs / 4,000 total estimated parts	= $3.00 per part
Machine setup		$3,100 total estimated overhead costs / 10 total estimated setups	= $310 per setup
Insertion of parts		$42,000 total estimated overhead costs / 4,000 total estimated parts	= $10.50 per part
Finishing		$86,000 total estimated overhead costs / 1,000 total estimated finishing direct labor hours	= $86 per finishing DLHr

Requirement 2

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Materials handling	$3.00 per part	×	4,000 parts	=	$ 12,000
Machine setup	$310 per setup	×	10 setups	=	3,100
Insertion of parts	$10.50 per part	×	4,000 parts	=	42,000
Finishing	$86 per finishing DLHr	×	1,000 finishing DLHr	=	86,000
Total manufacturing overhead costs					$ 143,100
÷ Number of bumpers					÷ 500 bumpers
Manufacturing overhead cost per bumper					$ 286.20

E19-19 Computing product costs in an activity-based costing system

Learning Objective 2

2. OH cost per unit $1,685

Turbo Champs Corp. uses activity-based costing to account for its motorcycle manufacturing process. Company managers have identified three supporting manufacturing activities: inspection, machine setup, and machine maintenance. The budgeted activity costs for 2018 and their allocation bases are as follows:

Activity	Total Budgeted Cost	Allocation Base
Inspections	$ 5,700	Number of inspections
Machine setup	22,000	Number of setups
Machine maintenance	6,000	Finishing of machine hours
Total	$ 33,700	

Turbo Champs expects to produce 20 custom-built motorcycles for the year. The motorcycles are expected to require 100 inspections, 40 setups, and 100 machine hours.

Requirements

1. Compute the predetermined overhead allocation rate for each activity.

2. Compute the expected indirect manufacturing cost of each motorcycle.

SOLUTION

Requirement 1

$$\text{Predetermined Overhead Allocation Rate} = \frac{\text{Total estimated overhead costs}}{\text{Total estimated quantity of the overhead allocation base}}$$

Inspection	$\frac{\$5{,}700 \text{ total estimated overhead costs}}{100 \text{ total estimated inspections}}$	=	$57 per inspection
Machine setup	$\frac{\$22{,}000 \text{ total estimated overhead costs}}{40 \text{ total estimated setups}}$	=	$550 per setup
Machine maintenance	$\frac{\$6{,}000 \text{ total estimated overhead costs}}{100 \text{ total estimated machine hours}}$	=	$60 per machine hour

E19-19, cont.
Requirement 2

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Inspection	$57 per inspection	×	100 inspections	=	$ 5,700
Machine setup	$550 per setup	×	40 setups	=	22,000
Machine maintenance	$60 per MHr	×	100 MHr	=	6,000
Total manufacturing overhead costs					$ 33,700
÷ Number of motorcycles					÷ 20 motorcycles
Manufacturing overhead cost per motorcycle					$ 1,685

E19-20 Computing product costs in traditional and activity-based costing systems

Learning Objectives 1, 2

3. Standard $224.40

Eason Company manufactures wheel rims. The controller expects the following ABC allocation rates for 2018:

Activity	Allocation Base	Predetermined Overhead Allocation Rate
Materials handling	Number of parts	$ 4.00 per part
Machine setup	Number of setups	400.00 per setup
Insertion of parts	Number of parts	26.00 per part
Finishing	Number of finishing hours	90.00 per hour

Eason produces two wheel rim models: standard and deluxe. Expected data for 2018 are as follows:

	Standard	Deluxe
Parts per rim	4.0	7.0
Setups per 500 rims	18.0	18.0
Finishing hours per rim	1.0	5.5
Total direct hours per rim	5.0	6.0

The company expects to produce 500 units of each model during the year.

Requirements

1. Compute the total estimated indirect manufacturing cost for 2018.
2. Prior to 2018, Eason used a single plantwide overhead allocation rate system with direct labor hours as the allocation base. Compute the predetermined overhead allocation rate based on direct labor hours for 2018. Use this rate to determine the estimated indirect manufacturing cost per wheel rim for each model, to the nearest cent.
3. Compute the estimated ABC indirect manufacturing cost per unit of each model for 2018. Carry each cost to the nearest cent.

E19-20, cont.

SOLUTION

Requirement 1

	Predetermined Overhead Allocation Rate	×	Total estimated quantity of the overhead allocation base	=	Total estimated overhead costs
Materials handling	$4.00 per part	×	[(4.0 parts + 7.0 parts) × 500 rims]		
	$4.00 per part	×	[11.00 parts × 500 rims]		
	$4.00 per part	×	5,500 parts for 500 rims	=	$ 22,000
Machine setup	$400.00 per setup	×	[18.0 setups + 18.0 setups]		
	$400.00 per setup	×	36.0 setups for 500 rims	=	14,400
Insertion of parts	$26.00 per part	×	[(4.0 parts + 7.0 parts) × 500 rims]		
	$26.00 per part	×	[11.0 parts × 500 rims]		
	$26.00 per part	×	5,500 parts for 500 rims	=	143,000
Finishing	$90.00 per finishing Hr	×	[(1.0 finishing Hr + 5.5 finishing Hr) × 500 rims]		
	$90.00 per finishing Hr	×	[6.5 finishing Hr × 500 rims]		
	$90.00 per finishing Hr	×	3,250 finishing Hr for 500 rims	=	292,500
Total estimated overhead costs					$ 471,900

E19-20, cont.
Requirement 2

Total estimated direct labor hours (DLHr)	=	Estimated DLHr per rim	×	500 rims
	=	[5.0 DLHr per standard rim + 6.0 DLHr per deluxe rim]	×	500 rims
	=	11.0 DLHr per rim	×	500 rims
	=	5,500 DLHr		

Predetermined Overhead Allocation Rate	=	Total estimated overhead costs / Total estimated quantity of the overhead allocation base
	=	$471,900 total estimated overhead costs[(a)] / 5,500 total estimated DLHr
	=	$85.80 per DLHr

[(a)] Calculated in Requirement 1.

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Standard rims					
Manufacturing overhead cost per rim	$85.80 per DLHr	×	5.0 DLHr	=	$429.00
Deluxe rims					
Manufacturing overhead cost per rim	$85.80 per DLHr	×	6.0 DLHr	=	$514.80

E19-20, cont.
Requirement 3

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used per Rim	=	Allocated Manufacturing Overhead Cost per Rim
Standard rims					
Materials handling	$4.00 per part	×	4.0 parts	=	$ 16.00
Machine setup	$400.00 per setup	×	[18.0 setups per 500 rims / 500 rims]	=	14.40
Insertion of parts	$26.00 per part	×	4.0 parts	=	104.00
Finishing	$90.00 per finishing hour	×	1.0 finishing hours	=	90.00
Manufacturing overhead cost per rim					$ 224.40
Deluxe rims					
Materials handling	$4.00 per part	×	7.0 parts	=	$ 28.00
Machine setup	$400.00 per setup	×	[18.0 setups per 500 rims / 500 rims]	=	14.40
Insertion of parts	$26.00 per part	×	7.0 parts	=	182.00
Finishing	$90.00 per finishing hour	×	5.5 finishing hours	=	495.00
Manufacturing overhead cost per rim					$ 719.40

Note: Exercise E19-20 must be completed before attempting Exercise E19-21.

E19-21 Using activity-based costing to make decisions

Learning Objectives 1, 2, 3

1. Deluxe GP $120.60

Refer to Exercise E19-20. For 2019, Eason's managers have decided to use the same indirect manufacturing costs per wheel rim that they computed in 2018 using activity-based costing. In addition to the unit indirect manufacturing costs, the following data are expected for the company's standard and deluxe models for 2019:

	Standard	**Deluxe**
Sales price	$ 800.00	$ 940.00
Direct materials	31.00	48.00
Direct labor	45.00	52.00

Because of limited machine hour capacity, Eason can produce *either* 2,000 standard rims *or* 2,000 deluxe rims.

Requirements

1. If Eason's managers rely on the ABC unit cost data computed in Exercise E19-20, which model will they produce? Carry each cost to the nearest cent. (Ignore selling and administrative expenses for this calculation.)
2. If the managers rely on the single plantwide overhead allocation rate cost data, which model will they produce?
3. Which course of action will yield more income for Eason?

E19-21, cont.

SOLUTION

Requirement 1

If Eason's managers rely on the ABC unit cost data calculated in E19-20, they will choose to produce the standard rims because gross profit per standard rim is $499.60 compared to only $120.60 per deluxe rim.

	Standard rims	Deluxe rims
Direct materials cost per rim	$ 31.00	$ 48.00
Direct labor cost per rim	45.00	52.00
Manufacturing overhead cost per rim[(a)]	224.40	719.40
Total manufacturing cost per rim	$ 300.40	$ 819.40

[(a)] Calculated in E19-20, Requirement 3.

	Standard rims	Deluxe rims
Sales price per rim	$ 800.00	$ 940.00
Total manufacturing cost per rim	300.40	819.40
Gross profit per rim	$ 499.60	$ 120.60

Requirement 2

If Eason's managers rely on the single plantwide overhead allocation rate cost data calculated in E19-20, they will choose to produce the deluxe rims because gross profit per deluxe rim is $325.20 compared to only $295.00 per standard rim.

	Standard rims	Deluxe rims
Direct materials cost per rim	$ 31.00	$ 48.00
Direct labor cost per rim	45.00	52.00
Manufacturing overhead cost per rim[(b)]	429.00	514.80
Total manufacturing cost per rim	$ 505.00	$ 614.80

[(b)] Calculated in E19-20, Requirement 2.

	Standard rims	Deluxe rims
Sales price per rim	$ 800.00	$ 940.00
Total manufacturing cost per rim	505.00	614.80
Gross profit per rim	$ 295.00	$ 325.20

E19-21, cont.

Requirement 3

Producing the standard rims will yield more income for Eason because activity-based costing allocation of manufacturing overhead is more accurate than single plantwide rate allocation of manufacturing overhead. Activity-based costing considers the resources (activities) each model actually uses. Because single plantwide rate allocation doesn't reflect the way products actually use the company's resources (activities), while the ABC system does, the ABC system costs are closer to the true cost of making each product. Thus, one should favor, and feel more comfortable, making decisions using cost data from the ABC system.

Note: Exercises E19-20 and E19-21 must be completed before attempting Exercise E19-22.

E19-22 Using activity-based management and target costing

Learning Objective 3

OH cost per unit $524.40

Refer to Exercises E19-20 and E19-21. Controller Michael Bender is surprised by the increase in cost of the deluxe model under ABC. Market research shows that for the deluxe rim to provide a reasonable profit, Eason will have to meet a target manufacturing cost of $625.00 per rim. A value engineering study by Eason's employees suggests that modifications to the finishing process could cut finishing cost from $90.00 to $60.00 per hour and reduce the finishing direct labor hours per deluxe rim from 5.50 hours to 5.0 hours. Direct materials would remain unchanged at $48.00 per rim, as would direct labor at $52.00 per rim. The materials handling, machine setup, and insertion of parts activity costs also would remain the same.

Would implementing the value engineering recommendation enable Eason to achieve its target cost for the deluxe rim?

SOLUTION

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used per Rim	=	Allocated Manufacturing Overhead Cost per Rim
Materials handling	$4.00 per part	×	7.0 parts	=	$ 28.00
Machine setup	$400.00 per setup	×	[18.00 setups per 500 rims / 500 rims]	=	14.40
Insertion of parts	$26.00 per part	×	7.0 parts	=	182.00
Finishing	$60.00 per finishing hour	×	5.0 finishing hours	=	300.00
Manufacturing overhead cost per rim					$ 524.40

Direct materials cost per rim	$ 48.00
Direct labor cost per rim	52.00
Manufacturing overhead cost per rim	524.40
Total manufacturing cost per rim	$ 624.40

Yes. Implementing the value engineering recommendation would result in manufacturing cost per deluxe rim of $624.40, which is lower than its target manufacturing cost of $625.00 per deluxe rim.

E19-23 Using activity-based costing to make decisions

Learning Objectives 1, 2, 3

1. Cost per collar $10.62

Treat Dog Collars uses activity-based costing. Treat's system has the following features:

Activity	Allocation Base	Predetermined Overhead Allocation Rate
Purchasing	Number of purchase orders	$ 60.00 per purchase order
Assembling	Number of parts	0.36 per part
Packaging	Number of finished collars	0.19 per collar

Each collar has three parts, direct materials cost is $5.00 per collar, and direct labor cost is $4.00 per collar. Suppose Animal Hut has asked for a bid on 30,000 dog collars. Treat will issue a total of 175 purchase orders if Animal Hut accepts Treat's bid.

Requirements

1. Compute the total estimated cost Treat will incur to purchase the needed materials and then assemble and package 30,000 dog collars. Also compute the cost per collar.
2. For bidding, Treat adds a 40% markup to total cost. What total price will the company bid for the entire Animal Hut order?
3. Suppose that instead of an ABC system, Treat has a traditional product costing system that allocates indirect costs at the rate of $9.50 per direct labor hour. The dog collar order will require 9,000 direct labor hours. What total price will Treat bid using this system's total cost?
4. Use your answers to Requirements 2 and 3 to explain how ABC can help Treat make a better decision about the bid price it will offer Animal Hut.

E19-23, cont.

SOLUTION

Requirement 1

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Purchasing	$60.00 per purchase order	×	175 purchase orders	=	$ 10,500
Assembling	$0.36 per part	×	3 parts per collar × 30,000 collars	=	32,400
Packaging	$0.19 per collar	×	30,000 collars	=	5,700
Total manufacturing overhead cost					$ 48,600

Total direct materials cost = $5.00 per collar × 30,000 collars = $150,000

Total direct labor cost = $4.00 per collar × 30,000 collars = $120,000

Total direct materials cost	$ 150,000
Total direct labor cost	120,000
Total manufacturing overhead cost	48,600
Total cost	$ 318,600
÷ Number of collars	÷ 30,000 collars
Cost per collar	$ 10.62

Requirement 2

Total bid price = $318,600 total cost × 140% markup = $446,040

E19-23, cont.
Requirement 3

Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
$9.50 per DLHr	×	9,000 DLHr	=	$85,500

Total direct materials cost	$ 150,000 [(b)]
Total direct labor cost	120,000 [(b)]
Total manufacturing overhead cost	85,500
Total cost	$ 355,500

[(b)] Calculated in Requirement 1.

Total bid price = $355,500 total cost × 140% markup = $497,700

Requirement 4

Activity-based costing allocation of manufacturing overhead is more accurate than traditional single plantwide rate allocation of manufacturing overhead. Activity-based costing considers the resources (activities) the product actually uses. Because single plantwide rate allocation doesn't reflect the way products actually use the company's resources (activities), while the ABC system does, the ABC system costs are closer to the true cost of making each product. Thus, one should favor, and feel more comfortable, making decisions using cost data from the ABC system.

The total price that Treat would bid for the entire Animal Hut order would be $51,660 higher using traditional product costing ($497,700 –$446,040). Thus, Treat would have a better chance of winning the bid using activity-based product costing.

E19-24 Allocating indirect costs and computing income, service company

Learning Objective 4

2. Total OH cost $27,200

Western, Inc. is a technology consulting firm focused on Web site development and integration of Internet business applications. The president of the company expects to incur $640,000 of indirect costs this year, and she expects her firm to work 4,000 direct labor hours. Western's systems consultants provide direct labor at a rate of $280 per hour. Clients are billed at 160% of direct labor cost. Last month, Western's consultants spent 170 hours on Halbert's engagement.

Requirements

1. Compute Western's predetermined overhead allocation rate per direct labor hour.
2. Compute the total cost assigned to the Halbert engagement.
3. Compute the operating income from the Halbert engagement.

SOLUTION

Requirement 1

$$\text{Predetermined Overhead Allocation Rate} = \frac{\text{Total estimated overhead costs}}{\text{Total estimated quantity of the overhead allocation base}}$$

$$= \frac{\$640{,}000 \text{ total estimated overhead costs}}{4{,}000 \text{ total estimated direct labor hours}}$$

$$= \$160 \text{ per DLHr}$$

E19-24, cont.
Requirement 2

Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Overhead Cost
$160 per DLHr	×	170 DLHr	=	$27,200

Direct Labor Rate per DLHr	×	Number of DLHr worked	=	Total Direct Labor Cost
$280 per DLHr	×	170 DLHr	=	$47,600

Total direct labor cost	$ 47,600
Total overhead cost	27,200
Total cost	$ 74,800

Requirement 3

Service revenue = $47,600 total direct labor cost × 160%
= $76,160

Operating income = $76,160 service revenue – $74,800 total cost
= $1,360

Note: Exercise E19-24 must be completed before attempting Exercise E19-25.

E19-25 Computing ABC allocation rates, service company

Learning Objective 4

POHR training $106 per DLHr

Refer to Exercise E19-24. The president of Western suspects that her allocation of indirect costs could be giving misleading results, so she decides to develop an ABC system. She identifies three activities: documentation preparation, information technology support, and training. She figures that documentation costs are driven by the number of pages, information technology support costs are driven by the number of software applications used, and training costs are driven by the number of direct labor hours worked. Estimates of the costs and quantities of the allocation bases follow:

Activity	Estimated Cost	Allocation Base	Estimated Quantity of Allocation Base
Documentation preparation	$ 65,850	Pages	1,317 pages
Information technology support	150,150	Applications used	715 applications
Training	424,000	Direct labor hours	4,000 hours
Total indirect costs	$ 640,000		

Compute the predetermined overhead allocation rate for each activity. Round to the nearest dollar.

SOLUTION

$$\text{Predetermined Overhead Allocation Rate} = \frac{\text{Total estimated overhead costs}}{\text{Total estimated quantity of the overhead allocation base}}$$

Document preparation	$\frac{\$65{,}850 \text{ total estimated overhead costs}}{1{,}317 \text{ total estimated pages}}$	=	$50 per page
Information technology support	$\frac{\$150{,}150 \text{ total estimated overhead costs}}{715 \text{ total estimated applications}}$	=	$210 per application
Training	$\frac{\$424{,}000 \text{ total estimated overhead costs}}{4{,}000 \text{ total estimated direct labor hours}}$	=	$106 per DLHr

Note: Exercises E19-24 and E19-25 must be completed before attempting Exercise E19-26.

E19-26 Using ABC to allocate costs and compute profit, service company

Learning Objective 4

1. Total OH cost $50,320

Refer to Exercises E19-24 and E19-25. Suppose Western's direct labor rate was $280 per hour. The Halbert engagement used the following resources last month:

Allocation Base	Halbert
Direct labor hours	170
Pages	310
Applications used	80

Requirements

1. Compute the cost assigned to the Halbert engagement, using the ABC system.

2. Compute the operating income or loss from the Halbert engagement, using the ABC system.

E19-26, cont.

SOLUTION

Requirement 1

	Predetermined Overhead Allocation Rate[(a)]	×	Actual Quantity of the Allocation Base Used	=	Allocated Overhead Cost
Document preparation	$50 per page	×	310 pages	=	$ 15,500
Information technology support	$210 per application	×	80 applications	=	16,800
Training	$106 per DLHr	×	170 DLHr	=	18,020
Total overhead cost					$ 50,320

[(a)] Calculated in E19-25.

Direct Labor Rate per DLHr	×	Number of DLHr worked	=	Total Direct Labor Cost
$280 per DLHr	×	170 DLHr	=	$47,600

Total direct labor cost	$ 47,600
Total overhead cost	50,320
Total cost	$ 97,920

Requirement 2

Service revenue = $47,600 total direct labor cost × 160%
= $76,160

Operating income (loss) = $76,160 service revenue – $97,920 total cost
= ($21,760)

Note: Exercise E19-26 must be completed before attempting Exercise E19-27.

E19-27 Using ABC to achieve target profit, service company

Learning Objective 4

$122,400

Refer to Exercise E19-26. Western desires a 20% target net profit after covering all costs. Considering the total costs assigned to the Halbert engagement in Exercise E19-26, what would Western have to charge the customer to achieve that net profit? Round to two decimal places.

SOLUTION

Desired net profit	=	Required service revenue	–	Total cost
Required service revenue × 20%	=	Required service revenue	–	Total cost

Thus:

Required service revenue	=	Total cost	/	80%
	=	$97,920[(a)]	/	80%
	=	$122,400		

[(a)] Calculated in E19-26.

E19-28 Recording manufacturing costs in a JIT costing system

Learning Objective 5

1. COGS $21,780 DR

Lally, Inc. produces universal remote controls. Lally uses a JIT costing system. One of the company's products has a standard direct materials cost of $9 per unit and a standard conversion cost of $35 per unit. During January 2018, Lally produced 500 units and sold 495 units on account at $45 each. It purchased $4,800 of direct materials on account and incurred actual conversion costs totaling $14,000.

Requirements

1. Prepare summary journal entries for January.
2. The January 1, 2018, balance of the Raw and In-Process Inventory account was $70. Use a T-account to find the January 31 balance.
3. Use a T-account to determine whether conversion costs are overallocated or underallocated for the month. By how much? Prepare the journal entry to adjust the Conversion Costs account.

SOLUTION

Requirement 1

Date	Accounts and Explanation	Debit	Credit
	Raw and In-Process Inventory	4,800	
	Accounts Payable		4,800
	Conversion Costs	14,000	
	Wages Payable, Accumulated Depreciation, etc.		14,000
	Finished Goods Inventory	22,000	
	Raw and In-Process Inventory (500 units × $9/unit)		4,500
	Conversion Costs (500 units × $35/unit)		17,500
	Accounts Receivable (495 units × $45/unit)	22,275	
	Sales Revenue		22,275
	Cost of Goods Sold (495 units × $44/unit)	21,780	
	Finished Goods Inventory		21,780

Requirement 2

Raw and In-Process Inventory

Jan. 1	70	4,500
	4,800	
Jan. 31	370	

E19-28, cont.
Requirement 3

Conversion costs are overallocated by $3,500.

Conversion Costs	
14,000	17,500
	3,500 Jan. 31

Date	Accounts and Explanation	Debit	Credit
	Conversion Costs	3,500	
	Cost of Goods Sold		3,500

E19-29 Recording manufacturing costs in a JIT costing system

Learning Objective 5

1. R&IP $7,500 CR

Gateway produces electronic calculators. Suppose Gateway's standard cost per calculator is $25 for direct materials and $68 for conversion costs. The following data apply to August activities:

Direct materials purchased (on account)	$ 8,300
Conversion costs incurred	20,500
Number of calculators produced	300 calculators
Number of calculators sold (on account, at $105 each)	295 calculators

Requirements

1. Prepare summary journal entries for August using JIT costing, including the entry to adjust the Conversion Costs account.

2. The beginning balance of Finished Goods Inventory was $1,300. Use a T-account to find the ending balance of Finished Goods Inventory.

E19-29, cont.
SOLUTION

Requirement 1

Date	Accounts and Explanation	Debit	Credit
	Raw and In-Process Inventory	8,300	
	Accounts Payable		8,300
	Conversion Costs	20,500	
	Wages Payable, Accumulated Depreciation, etc.		20,500
	Finished Goods Inventory	27,900	
	Raw and In-Process Inventory (300 units × $25/unit)		7,500
	Conversion Costs (300 units × $68/unit)		20,400
	Accounts Receivable (295 units × $105/unit)	30,975	
	Sales Revenue		30,975
	Cost of Goods Sold (295 units × $93/unit)	27,435	
	Finished Goods Inventory		27,435
	Cost of Goods Sold ($20,500 – $20,400)	100	
	Conversion Costs		100

Requirement 2

Finished Goods Inventory

Aug. 1	1,300	27,435
	27,900	
Aug. 31	1,765	

E19-30 Classifying quality costs

Learning Objective 6

Total external failure costs $118,000

Darrel & Co. makes electronic components. Chris Darrel, the president, recently instructed Vice President Jim Bruegger to develop a total quality control program. "If we don't at least match the quality improvements our competitors are making," he told Bruegger, "we'll soon be out of business." Bruegger began by listing various "costs of quality" that Darrel incurs. The first six items that came to mind were:

a. Costs incurred by Darrel customer representatives traveling to customer sites to repair defective products, $13,000.

b. Lost profits from lost sales due to reputation for less-than-perfect products, $35,000.

c. Costs of inspecting components in one of Darrel's production processes, $40,000.

d. Salaries of engineers who are redesigning components to withstand electrical overloads, $65,000.

e. Costs of reworking defective components after discovery by company inspectors, $50,000.

f. Costs of electronic components returned by customers, $70,000.

Classify each item as a prevention cost, an appraisal cost, an internal failure cost, or an external failure cost. Then determine the total cost of quality by category.

SOLUTION

	Prevention Cost	Appraisal Cost	Internal Failure Cost	External Failure Cost
a.				$ 13,000
b.				35,000
c.		$ 40,000		
d.	$ 65,000			
e.			$ 50,000	
f.				70,000
Total	$ 65,000	$ 40,000	$ 50,000	$ 118,000

E19-31 Classifying quality costs and using these costs to make decisions

Learning Objective 6

2. Total cost to undertake $192,000

Clason, Inc. manufactures door panels. Suppose Clason is considering spending the following amounts on a new total quality management (TQM) program:

Strength-testing one item from each batch of panels	$ 68,000
Training employees in TQM	27,000
Training suppliers in TQM	39,000
Identifying suppliers who commit to on-time delivery of perfect-quality materials	58,000

Clason expects the new program would save costs through the following:

Avoid lost profits from lost sales due to disappointed customers	$ 86,000
Avoid rework and spoilage	63,000
Avoid inspection of raw materials	57,000
Avoid warranty costs	15,000

Requirements

1. Classify each cost as a prevention cost, an appraisal cost, an internal failure cost, or an external failure cost.
2. Should Clason implement the new quality program? Give your reason.

E19-31, cont.

SOLUTION

Requirements 1 and 2

Undertake the New TQM Program		
Prevention		
Training employees in TQM	$ 27,000	
Training suppliers in TQM	39,000	
Identifying suppliers who commit to on-time delivery of perfect-quality materials	58,000	
Total prevention costs		$ 124,000
Appraisal		
Strength-testing one item from each batch of panels	68,000	
Total appraisal costs		68,000
Total costs of undertaking the new TQM program		$ 192,000
Do Not Undertake the New TQM Program		
Appraisal		
Avoid inspection of raw materials	$ 57,000	
Total appraisal costs		$ 57,000
Internal Failure		
Avoid rework and spoilage	63,000	
Total internal failure costs		63,000
External Failure		
Avoid lost profits from lost sales due to disappointed customers	86,000	
Avoid warranty costs	15,000	
Total external failure costs		101,000
Total costs of not undertaking the new TQM program		$ 221,000

Clason should implement the new TQM program. The total cost of undertaking the new TQM program ($192,000) is less than the total cost of not undertaking the new TQM program ($221,000) by $29,000. Clason would save $29,000 by undertaking the program.

E19-32 Classifying quality costs and using these costs to make decisions

Learning Objective 6

2. Total cost to undertake $2,305,000

Loiselle manufactures high-quality speakers. Suppose Loiselle is considering spending the following amounts on a new quality program:

Additional 20 minutes testing for each speaker	$ 625,000
Negotiating and training suppliers to obtain higher-quality materials and on-time delivery	430,000
Redesigning the speakers to make them easier to manufacture	1,250,000

Loiselle expects this quality program to save costs as follows:

Reduce warranty repair costs	$ 275,000
Avoid inspection of raw materials	580,000
Avoid rework because of fewer defective units	825,000

It also expects this program to avoid lost profits from the following:

Lost profits due to disappointed customers	$ 920,000
Lost production time due to rework	278,000

Requirements

1. Classify each of these costs into one of the four categories of quality costs (prevention, appraisal, internal failure, or external failure).
2. Should Loiselle implement the quality program? Give your reasons.

E19-32, cont.

SOLUTION

Requirements 1 and 2

Undertake the New Quality Program		
Prevention		
Negotiating and training suppliers to obtain higher-quality materials and on-time delivery	$ 430,000	
Redesigning the speakers to make them easier to manufacture	1,250,000	
Total prevention costs		$ 1,680,000
Appraisal		
Additional 20 minutes testing for each speaker	625,000	
Total appraisal costs		625,000
Total costs of undertaking the new quality program		$ 2,305,000

Do Not Undertake the New Quality Program		
Appraisal		
Avoid inspection of raw materials	$ 580,000	
Total appraisal costs		$ 580,000
Internal Failure		
Avoid rework because of fewer defective units	825,000	
Lost production time due to rework	278,000	
Total internal failure costs		1,103,000
External Failure		
Reduce warranty repair costs	275,000	
Lost profits due to disappointed customers	920,000	
Total external failure costs		1,195,000
Total costs of not undertaking the new quality program		$ 2,878,000

Loiselle should implement the new quality program. The total cost of undertaking the new quality program ($2,305,000) is less than the total cost of not undertaking the new quality program ($2,878,000) by $573,000. Loiselle would save $573,000 by undertaking the program.

Problems (Group A)

P19-33A Comparing costs from ABC and single-rate systems

Learning Objectives 1, 2

3. Travel packs $1.80

Willitte Pharmaceuticals manufactures an over-the-counter allergy medication. The company sells both large commercial containers of 1,000 capsules to health care facilities and travel packs of 20 capsules to shops in airports, train stations, and hotels. The following information has been developed to determine if an activity-based costing system would be beneficial:

Activity	Estimated Indirect Cost	Allocation Base	Estimated Quantity of Allocation Base
Materials handling	$ 95,000	Number of kilos	19,000 kilos
Packaging	200,000	Number of machine hours	5,000 hours
Quality assurance	112,500	Number of samples	1,875 samples
Total indirect costs	$ 407,500		

Actual production information includes the following:

	Commercial Containers	Travel Packs
Units produced	2,400 containers	50,000 packs
Weight in kilos	9,600	5,000
Machine hours	1,680	500
Number of samples	240	750

Requirements

1. Willitte's original single plantwide overhead allocation rate costing system allocated indirect costs to products at $81.50 per machine hour. Compute the total indirect costs allocated to the commercial containers and to the travel packs under the original system. Then compute the indirect cost per unit for each product. Round to two decimal places.
2. Compute the predetermined overhead allocation rate for each activity.
3. Use the predetermined overhead allocation rates to compute the activity-based costs per unit of the commercial containers and the travel packs. Round to two decimal places. (*Hint*: First compute the total activity-based costs allocated to each product line, and then compute the cost per unit.)
4. Compare the indirect activity-based costs per unit to the indirect costs per unit from the traditional system. How have the unit costs changed? Explain why the costs changed.

P19-33A, cont.

SOLUTION

Requirement 1

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Commercial containers					
Total indirect costs	$81.50 per MHr	×	1,680 MHr	=	$ 136,920
÷ Number of units					÷ 2,400 units
Indirect cost per unit					$ 57.05
Travel packs					
Total indirect costs	$81.50 per MHr	×	500 MHr	=	$ 40,750
÷ Number of units					÷ 50,000 units
Indirect cost per unit					$ 0.82

Requirement 2

$$\text{Predetermined Overhead Allocation Rate} = \frac{\text{Total estimated overhead costs}}{\text{Total estimated quantity of the overhead allocation base}}$$

Materials handling	$\frac{\$95{,}000 \text{ total estimated overhead costs}}{19{,}000 \text{ total estimated kilos}}$	=	$5 per kilo
Packaging	$\frac{\$200{,}000 \text{ total estimated overhead costs}}{5{,}000 \text{ total estimated machine hours}}$	=	$40 per MHr
Quality assurance	$\frac{\$112{,}500 \text{ total estimated overhead costs}}{1{,}875 \text{ total estimated samples}}$	=	$60 per sample

P19-33A, cont.
Requirement 3

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Commercial containers					
Materials handling	$5 per kilo	×	9,600 kilos	=	$ 48,000
Packaging	$40 per MHr	×	1,680 MHr	=	67,200
Quality assurance	$60 per sample	×	240 samples	=	14,400
Total activity-based costs					$ 129,600
÷ Number of units					÷ 2,400 units
Activity-based cost per unit					$ 54.00
Travel packs					
Materials handling	$5 per kilo	×	5,000 kilos	=	$ 25,000
Packaging	$40 per MHr	×	500 MHr	=	20,000
Quality assurance	$60 per sample	×	750 samples	=	45,000
Total activity-based costs					$ 90,000
÷ Number of units					÷ 50,000 units
Activity-based cost per unit					$ 1.80

P19-33A, cont.
Requirement 4

Comparison of manufacturing overhead cost per unit:

	Traditional System		ABC System		Difference
Commercial Containers	$ 57.05 per unit[(a)]	−	$ 54.00 per unit[(b)]	=	$3.05
Travel packs	$ 0.82 per unit[(a)]	−	$ 1.80 per unit[(b)]	=	($0.98)

[(a)] Calculated in Requirement 1.
[(b)] Calculated in Requirement 3.

The traditional (original) costing system doesn't reflect the way the two products actually use the company's resources (activities), while the ABC system does.

Relative to the ABC system, the traditional costing system over-costs the commercial containers (by $3.05 per unit) and under-costs the travel packs (by $0.98). The traditional costing system allocates manufacturing overhead costs based solely on machine hours, using a single predetermined overhead allocation rate of $81.50 per machine hour.

Because the traditional costing system doesn't reflect the way the two products actually use the company's resources (activities), while the ABC system does, the ABC system costs are closer to the true cost of making each product. Thus, one should feel more comfortable making decisions using cost data from the ABC system.

P19-34A Computing product costs in an ABC system

Learning Objective 2

1. Total activity-based costs $83.10

The Alright Manufacturing Company in Rochester, Minnesota, assembles and tests electronic components used in smartphones. Consider the following data regarding component T24 (amounts are per unit):

Direct materials cost	$ 80.00
Direct labor cost	20.00
Activity-based costs allocated	?
Total manufacturing product cost	?

The activities required to build the component follow:

Activity	Allocation Base	Cost Allocated to Each Unit				
Start station	Number of raw component chassis	4	×	$ 1.50	=	$ 6.00
Dip insertion	Number of dip insertions	?	×	0.30	=	9.60
Manual insertion	Number of manual insertions	10	×	0.50	=	?
Wave solder	Number of components soldered	4	×	1.90	=	7.60
Backload	Number of backload insertions	7	×	?	=	4.20
Test	Number of testing hours	0.43	×	90.00	=	?
Defect analysis	Number of defect analysis hours	0.15	×	?	=	12.00
Total activity-based costs						$?

Requirements

1. Complete the missing items for the two tables.

2. Why might managers favor this ABC system instead of Alright's older system, which allocated all manufacturing overhead costs on the basis of direct labor hours?

P19-34A, cont.

SOLUTION

Requirement 1

Activity	Allocation Base			Cost Allocated to each Unit		
Start station	Number of raw component chassis	4	×	$ 1.50	=	$ 6.00
Dip insertion	Number of dip insertions	**32**[(a)]	×	0.30	=	9.60
Manual insertion	Number of manual insertions	10	×	0.50	=	**5.00**[(b)]
Wave solder	Number of components soldered	4	×	1.90	=	7.60
Backload	Number of backload insertions	7	×	**0.60**[(c)]	=	4.20
Test	Number of testing hours	0.43	×	90.00	=	**38.70**[(d)]
Defect analysis	Number of defect analysis hours	0.15	×	**80.00**[(e)]	=	12.00
Total activity-based costs						**$ 83.10**[(f)]

Direct materials cost	$ 80.00
Direct labor cost	20.00
Activity-based costs allocated	83.10[(f)]
Total manufacturing product cost	$ 183.10

Calculations:

(a) $9.60 / $0.30 = 32
(b) 10 × $0.50 = $5.00
(c) $4.20 / 7 = $0.60
(d) 0.43 × $90.00 = $38.70
(e) $12.00 / 0.15 = $80.00
(f) Sum of column

Requirement 2

Because the traditional (older) costing system doesn't reflect the way products actually use the company's resources (activities), while the ABC system does, the ABC system costs are closer to the true cost of making products. Thus, one should favor, and feel more comfortable, making decisions using cost data from the ABC system.

P19-35A Computing product costs in an ABC system

Learning Objectives 2, 3

1. Standard $62 per unit

Oscar, Inc. manufactures bookcases and uses an activity-based costing system. Oscar's activity areas and related data follow:

Activity	Budgeted Cost of Activity	Allocation Base	Predetermined Overhead Allocation Rate
Materials handling	$ 240,000	Number of parts	$ 1.00
Assembly	3,500,000	Number of assembling direct labor hours	17.00
Finishing	190,000	Number of finished units*	4.50

*Refers to number of units receiving the finishing activity, not the number of units transferred to Finished Goods Inventory

Oscar produced two styles of bookcases in October: the standard bookcase and an unfinished bookcase, which has fewer parts and requires no finishing. The totals for quantities, direct materials costs, and other data follow:

Product	Total Units Produced	Total Direct Materials Costs	Total Direct Labor Costs	Total Number of Parts	Total Assembling Direct Labor Hours
Standard bookcase	7,000	$ 91,000	$ 105,000	28,000	10,500
Unfinished bookcase	7,500	82,500	75,000	22,500	7,500

Requirements

1. Compute the manufacturing product cost per unit of each type of bookcase.
2. Suppose that pre-manufacturing activities, such as product design, were assigned to the standard bookcases at $5 each and to the unfinished bookcases at $3 each. Similar analyses were conducted of post-manufacturing activities such as distribution, marketing, and customer service. The post-manufacturing costs were $20 per standard bookcase and $18 per unfinished bookcase. Compute the full product costs per unit.
3. Which product costs are reported in the external financial statements? Which costs are used for management decision making? Explain the difference.
4. What price should Oscar's managers set for unfinished bookcases to earn a net profit of $19 per bookcase?

P19-35A, cont.

SOLUTION

Requirement 1

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Standard bookcases					
Materials handling	$1.00 per part	×	28,000 parts	=	$ 28,000
Assembly	$17.00 per DLHr	×	10,500 DLHr	=	178,500
Finishing	$4.50 per finished unit	×	7,000 finished units	=	31,500
Total manufacturing overhead cost					$ 238,000
Unfinished bookcases					
Materials handling	$1.00 per part	×	22,500 parts	=	$ 22,500
Assembly	$17.00 per DLHr	×	7,500 DLHr	=	127,500
Finishing	$4.50 per finished unit	×	0 finished units	=	0
Total manufacturing overhead cost					$ 150,000

	Standard bookcases	Unfinished bookcases
Total direct materials cost	$ 91,000	$ 82,500
Total direct labor cost	105,000	75,000
Total manufacturing overhead cost	238,000	150,000
Total manufacturing product cost	$ 434,000	$ 307,500
÷ Number of units	÷ 7,000 units	÷ 7,500 units
Manufacturing product cost per unit	$ 62	$ 41

P19-35A, cont.
Requirement 2

	Standard bookcases	Unfinished bookcases
Pre-manufacturing costs per unit	$ 5	$ 3
Manufacturing product costs per unit [(a)]	62	41
Post-manufacturing costs per unit	20	18
Full product costs per unit	$ 87	$ 62

[(a)] Calculated in Requirement 1.

Requirement 3

Manufacturing product costs are reported in the external financial statements in the inventory accounts on the balance sheet and Cost of Goods Sold on the income statement. Full product costs are used for management decision making. Full product costs include the costs of pre-manufacturing and post-manufacturing activities that are expensed when incurred for external financial reporting.

Requirement 4

Sales price per unit	=	Full product cost	+	Net profit
	=	$62[(b)]	+	$19
	=	$81		

[(b)] Calculated in Requirement 2.

P19-36A Using ABC in a service company

Learning Objective 4

1. Total OH cost $890

Blanchette Plant Service completed a special landscaping job for Kerry Company. Blanchette uses ABC and has the following predetermined overhead allocation rates:

Activity	Allocation Base	Predetermined Overhead Allocation Rate
Designing	Number of designs	$ 290 per design
Planting	Number of plants	$ 20 per plant

The Kerry job included $750 in plants; $1,300 in direct labor; one design; and 30 plants.

Requirements

1. What is the total cost of the Kerry job?

2. If Kerry paid $3,540 for the job, what is the operating income or loss?

3. If Blanchette desires an operating income of 30% of cost, how much should the company charge for the Kerry job?

SOLUTION

Requirement 1

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Overhead Cost
Designing	$290 per design	×	1 design	=	$ 290
Planting	$20 per plant	×	30 plants	=	600
Total					$ 890

Total plant cost	$ 750
Total direct labor cost	1,300
Total overhead cost	890
Total cost	$ 2,940

P19-36A, cont.

Requirement 2

Operating Income	=	$3,540 service revenue	–	$2,940 total cost
	=	$600		

Requirement 3

Required service revenue	=	$2,940 total cost	×	130%
	=	$3,822		

P19-37A Recording manufacturing costs for a JIT system

Learning Objective 5

3. $6,500

Low Range produces fleece jackets. The company uses JIT costing for its JIT production system.

Low Range has two inventory accounts: Raw and In-Process Inventory and Finished Goods Inventory. On March 1, 2018, the account balances were Raw and In-Process Inventory, $9,000; Finished Goods Inventory, $1,700.

The standard cost of a jacket is $40, composed of $12 direct materials plus $28 conversion costs. Data for March's activities follow:

Number of jackets completed	15,000
Number of jackets sold (on account, for $50 each)	14,600
Direct materials purchased (on account)	$ 177,500
Conversion costs incurred	$ 521,000

Requirements

1. What are the major features of a JIT production system such as that of Low Range?

2. Prepare summary journal entries for March. Underallocated or overallocated conversion costs are adjusted to Cost of Goods Sold monthly.

3. Use a T-account to determine the March 31, 2018, balance of Raw and In-Process Inventory.

P19-37A, cont.

SOLUTION

Requirement 1

A just-in-time management system is an inventory management system in which a company produces just in time to satisfy customer needs. Suppliers deliver raw materials just in time to begin production and finished units are completed just in time for delivery to customers.

Production in JIT systems is completed in self-contained work cells. A work cell is an area where everything needed to complete a manufacturing process is readily available. Each work cell includes the machinery and labor resources to manufacture a product. Employees work in a team in the work cell and are empowered to complete the work without supervision. Workers complete a small batch of units and are responsible for inspecting quality throughout the process. As the completed product moves out of the work cell, the suppliers deliver more materials to the work cell just in time to keep production moving along.

A JIT costing system uses a Finished Goods Inventory account, but combines Raw Materials Inventory and Work-in-Process Inventory into a single account called Raw and In-Process Inventory. And, direct labor and manufacturing overhead costs are combined into a single Conversion Costs account. The Conversion Costs account is a temporary account that works just like the Manufacturing Overhead account. Actual conversion costs accumulate as debits in the Conversion Costs account and allocated conversion costs are credited to the account as units are completed. Accountants adjust any underallocated or overallocated conversion costs to the Cost of Goods Sold account at the end of the period, just like they do for underallocated or overallocated manufacturing overhead.

JIT costing is sometimes called backflush costing because it seems to work backwards. JIT costing starts with output that has been completed and then assigns manufacturing costs to units sold and to inventories.

P19-37A, cont.

Requirement 2

Date	Accounts and Explanation	Debit	Credit
	Raw and In-Process Inventory	177,500	
	Accounts Payable		177,500
	Conversion Costs	521,000	
	Wages Payable, Accumulated Depreciation, etc.		521,000
	Finished Goods Inventory	600,000	
	Raw and In-Process Inventory (15,000 units × $12/unit)		180,000
	Conversion Costs (15,000 units × $28/unit)		420,000
	Accounts Receivable (14,600 units × $50/unit)	730,000	
	Sales Revenue		730,000
	Cost of Goods Sold (14,600 units × $40/unit)	584,000	
	Finished Goods Inventory		584,000
	Cost of Goods Sold ($521,000 – $420,000)	101,000	
	Conversion Costs		101,000

Requirement 3

Raw and In-Process Inventory

Mar. 1	9,000	
	177,500	180,000
Mar. 31	6,500	

P19-38A Analyzing costs of quality

Learning Objective 6

2. Net benefit $12,620

Stella, Inc. is using a costs-of-quality approach to evaluate design engineering efforts for a new skateboard. Stella's senior managers expect the engineering work to reduce appraisal, internal failure, and external failure activities. The predicted reductions in activities over the two-year life of the skateboards follow. Also shown are the predetermined overhead allocation rates for each activity.

Activity	Predicted Reduction in Activity Units	Predetermined Overhead Allocation Rate per Unit
Inspection of incoming raw materials	390	$ 44
Inspection of finished goods	390	19
Number of defective units discovered in-house	1,200	50
Number of defective units discovered by customers	325	72
Lost profits due to dissatisfied customers	75	102

Requirements

1. Calculate the predicted quality cost savings from the design engineering work.
2. Stella spent $103,000 on design engineering for the new skateboard. What is the net benefit of this "preventive" quality activity?
3. What major difficulty would Stella's managers have in implementing this costs-of-quality approach? What alternative approach could they use to measure quality improvement?

SOLUTION

Requirement 1

Activity	Predicted Reduction in Activity Units	×	Predetermined Overhead Allocation Rate per Unit	=	Predicted Quality Cost Savings
Inspection of incoming raw materials	390	×	$ 44	=	$ 17,160
Inspection of finished goods	390	×	19	=	7,410
Number of defective units discovered in-house	1,200	×	50	=	60,000
Number of defective units discovered by customers	325	×	72	=	23,400
Lost profits due to dissatisfied customers	75	×	102	=	7,650
Total					$ 115,620

P19-38A, cont.
Requirement 2

Total predicted quality cost savings	$ 115,620
Design engineering cost	(103,000)
Net benefit	$ 12,620

Requirement 3

Some quality costs are hard to measure because they don't appear in a company's accounting records; for example, lost profits due to unhappy customers. Therefore, quality management systems use many nonfinancial metrics to measure success or failure (e.g. the number of customer complaints and the volume of incoming customer service phone calls).

Problems (Group B)

P19-39B Comparing costs from ABC and single-rate systems

Learning Objectives 1, 2

1. Travel packs $1.40

Harcourt Pharmaceuticals manufactures an over-the-counter allergy medication. The company sells both large commercial containers of 1,000 capsules to health care facilities and travel packs of 20 capsules to shops in airports, train stations, and hotels. The following information has been developed to determine if an activity-based costing system would be beneficial:

Activity	Estimated Indirect Cost	Allocation Base	Estimated Quantity of Allocation Base
Materials handling	$ 96,000	Number of kilos	24,000 kilos
Packaging	210,000	Number of machine hours	3,000 hours
Quality assurance	114,000	Number of samples	1,900 samples
Total indirect costs	$ 420,000		

Other production information includes the following:

	Commercial Containers	Travel Packs
Units produced	2,800 containers	51,000 packs
Weight in kilos	9,800	5,100
Machine hours	1,960	510
Number of samples	560	765

Requirements

1. Harcourt's original single plantwide overhead allocation rate system allocated indirect costs to products at $140.00 per machine hour. Compute the total indirect costs allocated to the commercial containers and to the travel packs under the original system. Then compute the indirect cost per unit for each product. Round to two decimal places.
2. Compute the predetermined overhead allocation rate for each activity.
3. Use the predetermined overhead allocation rates to compute the activity-based costs per unit of the commercial containers and the travel packs. Round to two decimal places. (*Hint*: First compute the total activity-based costs allocated to each product line, and then compute the cost per unit.)
4. Compare the indirect activity-based costs per unit to the indirect costs per unit from the traditional system. How have the unit costs changed? Explain why the costs changed as they did.

P19-39B, cont.

SOLUTION

Requirement 1

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Commercial containers					
Total indirect costs	$140.00 per MHr	×	1,960 MHr	=	$ 274,400
÷ Number of units					÷ 2,800 units
Indirect cost per unit					$ 98.00
Travel packs					
Total indirect costs	$140.00 per MHr	×	510 MHr	=	$ 71,400
÷ Number of units					÷ 51,000 units
Indirect cost per unit					$ 1.40

Requirement 2

$$\text{Predetermined Overhead Allocation Rate} = \frac{\text{Total estimated overhead costs}}{\text{Total estimated quantity of the overhead allocation base}}$$

Materials handling	$\frac{\$96{,}000 \text{ total estimated overhead costs}}{24{,}000 \text{ total estimated kilos}}$	=	$4.00 per kilo
Packaging	$\frac{\$210{,}000 \text{ total estimated overhead costs}}{3{,}000 \text{ total estimated machine hours}}$	=	$70.00 per MHr
Quality assurance	$\frac{\$114{,}000 \text{ total estimated overhead costs}}{1{,}900 \text{ total estimated samples}}$	=	$60.00 per sample

P19-39B, cont.
Requirement 3

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Commercial containers					
Materials handling	$4.00 per kilo	×	9,800 kilos	=	$ 39,200
Packaging	$70.00 per MHr	×	1,960 MHr	=	137,200
Quality assurance	$60.00 per sample	×	560 samples	=	33,600
Total activity-based costs					$ 210,000
÷ Number of units					÷ 2,800 units
Activity-based cost per unit					$ 75.00
Travel packs					
Materials handling	$4.00 per kilo	×	5,100 kilos	=	$ 20,400
Packaging	$70.00 per MHr	×	510 MHr	=	35,700
Quality assurance	$60.00 per sample	×	765 samples	=	45,900
Total activity-based costs					$ 102,000
÷ Number of units					÷ 51,000 units
Activity-based cost per unit					$ 2.00

P19-39B, cont.
Requirement 4

Comparison of manufacturing overhead cost per unit:

	Traditional System		ABC System		Difference
Commercial Containers	$ 98.00 per unit[(a)]	−	$ 75.00 per unit[(b)]	=	$23.00
Travel packs	$ 1.40 per unit[(a)]	−	$ 2.00 per unit[(b)]	=	$(0.60)

[(a)] Calculated in Requirement 1
[(b)] Calculated in Requirement 3.

The traditional (original) costing system doesn't reflect the way the two products actually use the company's resources (activities), while the ABC system does.

Relative to the ABC system, the traditional costing system over-costs the commercial containers (by $23.00 per unit) and under-costs the travel packs (by $0.60 per unit). The traditional costing system allocates manufacturing overhead costs based solely on machine hours, using a single predetermined overhead allocation rate of $140.00 per machine hour.

Because the traditional costing system doesn't reflect the way the two products actually use the company's resources (activities), while the ABC system does, the ABC system costs are closer to the true cost of making each product. Thus, one should feel more comfortable making decisions using cost data from the ABC system.

P19-40B Computing product costs in an ABC system

Learning Objective 2

1. Total activity-based costs $58.90

The Alexander Manufacturing Company in Rochester, Minnesota, assembles and tests electronic components used in smartphones. Consider the following data regarding component T24 (amounts are per unit):

Direct materials cost	$ 81.00
Direct labor cost	21.00
Activity-based costs allocated	?
Total manufacturing product cost	?

The activities required to build the component follow:

Activity	Allocation Base	Cost Allocated to Each Unit				
Start station	Number of raw component chassis	3	×	$ 1.50	=	$ 4.50
Dip insertion	Number of dip insertions	?	×	0.50	=	14.50
Manual insertion	Number of manual insertions	13	×	0.40	=	?
Wave solder	Number of components soldered	3	×	1.50	=	4.50
Backload	Number of backload insertions	7	×	?	=	2.80
Test	Number of testing hours	0.39	×	60.00	=	?
Defect analysis	Number of defect analysis hours	0.10	×	?	=	4.00
Total activity-based costs						$?

Requirements

1. Complete the missing items for the two tables.
2. Why might managers favor this ABC system instead of Alexander's older system, which allocated all manufacturing overhead costs on the basis of direct labor hours?

P19-40B, cont.

SOLUTION

Requirement 1

Activity	Allocation Base			Cost Allocated to each Unit		
Start station	Number of raw component chassis	3	×	$ 1.50	=	$ 4.50
Dip insertion	Number of dip insertions	**29**[a]	×	0.50	=	14.50
Manual insertion	Number of manual insertions	13	×	0.40	=	**5.20**[b]
Wave solder	Number of components soldered	3	×	1.50	=	4.50
Backload	Number of backload insertions	7	×	**0.40**[c]	=	2.80
Test	Number of testing hours	0.39	×	60.00	=	**23.40**[d]
Defect analysis	Number of defect analysis hours	0.10	×	**40.00**[e]	=	4.00
Total activity-based costs						**$ 58.90**[f]

Direct materials cost	$ 81.00
Direct labor cost	21.00
Activity-based costs allocated	58.90[f]
Total manufacturing product cost	$ 160.90

Calculations:
(a) $14.50 / $0.50 = 29
(b) 13 × $0.40 = $5.20
(c) $2.80 / 7 = $0.40
(d) 0.39 × $60.00 = $23.40
(e) $4.00 / 0.10 = $40.00
(f) Sum of column

Requirement 2

Because the traditional (older) costing system doesn't reflect the way products actually use the company's resources (activities), while the ABC system does, the ABC system costs are closer to the true cost of making products. Thus, one should favor, and feel more comfortable, making decisions using cost data from the ABC system.

P19-41B Computing product costs in an ABC system

Learning Objectives 2, 3

1. Standard $72 per unit

Martin, Inc. manufactures bookcases and uses an activity-based costing system. Martin's activity areas and related data follow:

Activity	Budgeted Cost of Activity	Allocation Base	Predetermined Overhead Allocation Rate
Materials handling	$ 230,000	Number of parts	$ 1.50
Assembly	3,200,000	Number of assembling direct labor hours	16.00
Finishing	150,000	Number of finished units*	3.00

*Refers to number of units receiving the finishing activity, not the number of units transferred to Finished Goods Inventory

Martin produced two styles of bookcases in April: the standard bookcase and an unfinished bookcase, which has fewer parts and requires no finishing. The totals for quantities, direct materials costs, and other data follow:

Product	Total Units Produced	Total Direct Materials Costs	Total Direct Labor Costs	Total Number of Parts	Total Assembling Direct Labor Hours
Standard bookcase	3,000	$ 54,000	$ 67,500	9,000	4,500
Unfinished bookcase	3,500	56,000	52,500	7,000	3,500

Requirements

1. Compute the manufacturing product cost per unit of each type of bookcase.
2. Suppose that pre-manufacturing activities, such as product design, were assigned to the standard bookcases at $5 each and to the unfinished bookcases at $3 each. Similar analyses were conducted of post-manufacturing activities such as distribution, marketing, and customer service. The post-manufacturing costs were $24 per standard bookcase and $18 per unfinished bookcase. Compute the full product costs per unit.
3. Which product costs are reported in the external financial statements? Which costs are used for management decision making? Explain the difference.
4. What price should Martin's managers set for unfinished bookcases to earn a net profit of $19 per bookcase?

P19-41B, cont.

SOLUTION

Requirement 1

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Standard bookcases					
Materials handling	$1.50 per part	×	9,000 parts	=	$ 13,500
Assembly	$16.00 per DLHr	×	4,500 DLHr	=	72,000
Finishing	$3.00 per finished unit	×	3,000 finished units	=	9,000
Total manufacturing overhead cost					$ 94,500
Unfinished bookcases					
Materials handling	$1.50 per part	×	7,000 parts	=	$ 10,500
Assembly	$16.00 per DLHr	×	3,500 DLHr	=	56,000
Finishing	$3.00 per finished unit	×	0 finished units	=	0
Total manufacturing overhead cost					$ 66,500

	Standard bookcases	Unfinished bookcases
Total direct materials cost	$ 54,000	$ 56,000
Total direct labor cost	67,500	52,500
Total manufacturing overhead cost	94,500	66,500
Total manufacturing product cost	$ 216,000	$ 175,000
÷ Number of units	÷ 3,000 units	÷ 3,500 units
Manufacturing product cost per unit	$ 72	$ 50

Requirement 2

	Standard bookcases	Unfinished bookcases
Pre-manufacturing costs per unit	$ 5	$ 3
Manufacturing product costs per unit [(a)]	72	50
Post-manufacturing costs per unit	24	18
Full product costs per unit	$ 101	$ 71

[(a)] Calculated in Requirement 1.

P19-41B, cont.
Requirement 3

Manufacturing product costs are reported in the external financial statements in the inventory accounts on the balance sheet and Cost of Goods Sold on the income statement. Full product costs are used for management decision making. Full product costs include the costs of pre-manufacturing and post-manufacturing activities that are expensed when incurred for external financial reporting.

Requirement 4

Sales price per unit	=	Full product cost	+	Net profit
	=	$71[(b)]	+	$19
	=	$90		

[(b)] Calculated in Requirement 2.

P19-42B Using ABC in a service company

Learning Objective 4

1. Total OH cost $890

Rennie Plant Service completed a special landscaping job for Brenton Company. Rennie uses ABC and has the following predetermined overhead allocation rates:

Activity	Allocation Base	Predetermined Overhead Allocation Rate
Designing	Number of designs	$ 290 per design
Planting	Number of plants	$ 20 per plant

The Brenton job included $1,500 in plants; $800 in direct labor; one design; and 30 plants.

Requirements

1. What is the total cost of the Brenton job?

2. If Brenton paid $3,690 for the job, what is the operating income or loss?

3. If Rennie desires an operating income of 30% of cost, how much should the company charge for the Brenton job?

SOLUTION

Requirement 1

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Overhead Cost
Designing	$290 per design	×	1 design	=	$ 290
Planting	$20 per plant	×	30 plants	=	600
Total					$ 890

Total plant cost	$ 1,500
Total direct labor cost	800
Total overhead cost	890
Total cost	$ 3,190

Requirement 2

Profit = $3,690 service revenue – $3,190 total cost = $500

P19-42B, cont.
Requirement 3

Required service revenue	=	$3,190 total cost	×	130%
	=	$4,147		

P19-43B Recording manufacturing costs for a JIT system

Learning Objective 5

3. $2,500

High Mountain produces fleece jackets. The company uses JIT costing for its JIT production system.

High Mountain has two inventory accounts: Raw and In-Process Inventory and Finished Goods Inventory. On April 1, 2018, the account balances were Raw and In-Process Inventory, $10,000; Finished Goods Inventory, $2,100.

The standard cost of a jacket is $33, composed of $12 direct materials plus $21 conversion costs. Data for April's activities follow:

Number of jackets completed	19,000
Number of jackets sold (on account for $50 each)	18,600
Direct materials purchased (on account)	$ 220,500
Conversion costs incurred	$ 500,000

Requirements

1. What are the major features of a JIT production system such as that of High Mountain?

2. Prepare summary journal entries for April. Underallocated or overallocated conversion costs are adjusted to Cost of Goods Sold monthly.

3. Use a T-account to determine the April 30, 2018, balance of Raw and In-Process Inventory.

P19-43B, cont.

SOLUTION

Requirement 1

A just-in-time management system is an inventory management system in which a company produces just in time to satisfy customer needs. Suppliers deliver raw materials just in time to begin production and finished units are completed just in time for delivery to customers.

Production in JIT systems is completed in self-contained work cells. A work cell is an area where everything needed to complete a manufacturing process is readily available. Each work cell includes the machinery and labor resources to manufacture a product. Employees work in a team in the work cell and are empowered to complete the work without supervision. Workers complete a small batch of units and are responsible for inspecting quality throughout the process. As the completed product moves out of the work cell, the suppliers deliver more materials to the work cell just in time to keep production moving along.

A JIT costing system uses a Finished Goods Inventory account, but combines Raw Materials Inventory and Work-in-Process Inventory into a single account called Raw and In-Process Inventory. And, direct labor and manufacturing overhead costs are combined into a single Conversion Costs account. The Conversion Costs account is a temporary account that works just like the Manufacturing Overhead account. Actual conversion costs accumulate as debits in the Conversion Costs account and allocated conversion costs are credited to the account as units are completed. Accountants adjust any underallocated or overallocated conversion costs to the Cost of Goods Sold account at the end of the period, just like they do for underallocated or overallocated manufacturing overhead.

JIT costing is sometimes called backflush costing because it seems to work backwards. JIT costing starts with output that has been completed and then assigns manufacturing costs to units sold and to inventories.

P19-43B, cont.
Requirement 2

Date	Accounts and Explanation	Debit	Credit
	Raw and In-Process Inventory	220,500	
	Accounts Payable		220,500
	Conversion Costs	500,000	
	Wages Payable, Accumulated Depreciation, etc.		500,000
	Finished Goods Inventory	627,000	
	Raw and In-Process Inventory (19,000 units × $12/unit)		228,000
	Conversion Costs (19,000 units × $21/unit)		399,000
	Accounts Receivable (18,600 units × $50/unit)	930,000	
	Sales Revenue		930,000
	Cost of Goods Sold (18,600 units × $33/unit)	613,800	
	Finished Goods Inventory		613,800
	Cost of Goods Sold ($500,000 – $399,000)	101,000	
	Conversion Costs		101,000

Requirement 3

Raw and In-Process Inventory

Apr. 1	10,000	
	220,500	228,000
Apr. 30	2,500	

P19-44B Analyzing costs of quality

Learning Objective 6

2. Net benefit $33,025

Roxi, Inc. is using a costs-of-quality approach to evaluate design engineering efforts for a new skateboard. Roxi's senior managers expect the engineering work to reduce appraisal, internal failure, and external failure activities. The predicted reductions in activities over the two-year life of the skateboards follow. Also shown are the predetermined overhead allocation rates for each activity.

Activity	Predicted Reduction in Activity Units	Predetermined Overhead Allocation Rate per Unit
Inspection of incoming raw materials	395	$ 44
Inspection of finished goods	395	26
Number of defective units discovered in-house	1,500	54
Number of defective units discovered by customers	275	73
Lost profits due to dissatisfied customers	100	103

Requirements

1. Calculate the predicted quality cost savings from the design engineering work.
2. Roxi spent $106,000 on design engineering for the new skateboard. What is the net benefit of this "preventive" quality activity?
3. What major difficulty would Roxi's managers have in implementing this costs-of-quality approach? What alternative approach could they use to measure quality improvement?

P19-44B, cont.

SOLUTION

Requirement 1

Activity	Predicted Reduction in Activity Units	×	Predetermined Overhead Allocation Rate per Unit	=	Predicted Quality Cost Savings
Inspection of incoming raw materials	395	×	$ 44	=	$ 17,380
Inspection of finished goods	395	×	26	=	10,270
Number of defective units discovered in-house	1,500	×	54	=	81,000
Number of defective units discovered by customers	275	×	73	=	20,075
Lost profits due to dissatisfied customers	100	×	103	=	10,300
Total					$ 139,025

Requirement 2

Total predicted quality cost savings	$ 139,025
Design engineering cost	(106,000)
Net benefit	$ 33,025

Requirement 3

Some quality costs are hard to measure because they don't appear in a company's accounting records; for example, lost profits due to unhappy customers. Therefore, quality management systems use many nonfinancial metrics to measure success or failure (e.g. the number of customer complaints and the volume of incoming customer service phone calls).

Using Excel

P19-45 Using Excel for allocating manufacturing overhead with activity-based costing (ABC)

Download an Excel template for this problem online in MyAccountingLab or at http://www.pearsonhighered.com/Horngren.

Mt. Hood Manufacturing uses ABC to allocate manufacturing overhead costs, and has computed the following:

Activity	Allocation Base	Allocation Rate
Equipment Setup	Number of Setups	$400 per setup
Ordering	Number of Orders	$ 10 per order
Machine Maintenance	Machine Hours	$ 10 per hour
Receiving	Receiving Hours	$ 20 per hour

The company produces two models of industrial heaters, Crest and Cascade.

The quantity of each activity required by Crest and Cascade is listed below.

Allocation Base	Crest	Cascade
Number of Setups	350	250
Number of Orders	6,000	12,000
Machine Hours	24,000	18,000
Receiving Hours	3,000	7,000

Requirement

Allocate the $1,040,000 estimated manufacturing overhead between the products using activity-based costing to obtain the total manufacturing overhead cost per product. Reconcile the manufacturing overhead allocated to the two products with total manufacturing overhead.

SOLUTION

The student templates for *Using Excel* are available online in MyAccountingLab in the Multimedia Library or at http://www.pearsonhighered.com/Horngren. The solution to *Using Excel* is available online in MyAccountingLab in the Instructor Resource Center or at http://www.pearsonhighered.com/Horngren.

Continuing Problem

P19-46 Comparing costs from ABC and single-rate systems

This problem continues the Piedmont Computer Company situation from Chapter 17. Recall that Piedmont Computer Company allocated manufacturing overhead costs to jobs based on a predetermined overhead allocation rate, computed as 25% of direct labor costs. Piedmont Computer Company is now considering using an ABC system. Information about ABC costs for 2020 follows:

Activity	Allocation Base	Predetermined Overhead Allocation Rate
Assembly	Number of parts	$ 0.25
Programming	Number of direct labor hours	3.50
Testing	Number of tests	125.00

Records for two jobs appear here:

Job	Total Direct Materials Costs	Total Number of Parts	Total Direct Labor Hours	Total Number of Tests
Job 721	$ 23,400	2,500	780	8
Job 722	2,500	300	60	2

Requirements

1. Compute the total cost for each job using activity-based costing. The cost of direct labor is $25 per hour.
2. Is the job cost greater or less than that computed in Chapter 17 for each job? Why?
3. If Piedmont Computer Company wants to earn an operating income equal to 45% of the total cost, what sales price should it charge each of these two customers?

SOLUTION

Requirement 1

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Overhead Cost
Job 721					
Assembly	$0.25 per part	×	2,500 parts	=	$ 625
Programming	$3.50 per DLHr	×	780 DLHr	=	2,730
Testing	$125 per test	×	8 tests	=	1,000
Total overhead cost					$ 4,355
Job 722					
Assembly	$0.25 per part	×	300 parts	=	$ 75
Programming	$3.50 per DLHr	×	60 DLHr	=	210
Testing	$125 per test	×	2 tests	=	250
Total overhead cost					$ 535

	Direct Labor Rate per DLHr	×	Number of DLHr worked	=	Total Direct Labor Cost
Job 721	$25 per DLHr	×	780 DLHr	=	$ 19,500
Job 722	$25 per DLHr	×	60 DLHr	=	$ 1,500

	Job 721	Job 722
Total direct materials costs	$ 23,400	$ 2,500
Total direct labor cost	19,500	1,500
Total overhead cost	4,355	535
Total cost	$ 47,255	$ 4,535

Requirement 2

	Single plantwide rate*		Activity-based costing**	
	Job 721	Job 722	Job 721	Job 722
Total direct materials costs	$ 23,400	$ 2,500	$ 23,400	$ 2,500
Total direct labor costs	19,500	1,500	19,500	1,500
Total overhead costs	4,875	375	4,355	535
Total cost	$ 47,775	$ 4,375	$ 47,255	$ 4,535

*From Continuing Problem, Chapter 17
**From Requirement 1

Compared with the calculations from Chapter 17, the total cost of Job 721 is $520 less when using ABC ($47,255 – $47,775) and the total cost of Job 722 is $160 greater using ABC ($4,535 – $4,375).

There is no difference in direct costs (direct materials and direct labor). The difference in total cost is due to the difference in allocated manufacturing overhead costs. In Chapter 17, overhead is allocated to the two jobs based solely on a percentage of direct labor costs, using a single predetermined overhead allocation rate of 25% of direct labor costs. This costing system doesn't reflect the way the two jobs actually use the company's resources (activities) and under-costs one job while it over-costs the other. ABC takes into account assembling, programming, and testing activities when allocating overhead costs to the two jobs. Because ABC reflects the way the jobs actually use the company's resources, ABC costs are closer to the true costs of completing each job.

Requirement 3

Desired Operating Income	=	Total Cost	×	45%
Job 721	=	$ 47,255	×	45%
	=	$ 21,265		
Job 722	=	$ 4,535	×	45%
	=	$ 2,041		

	Job 721	Job 722
Total Cost	$ 47,255	$ 4,535
+ Desired operating income	21,265	2,041
Total fee	$ 68,520	$ 6,576

CRITICAL THINKING

Tying It All Together Case 19-1

Before you begin this assignment, review the Tying It All Together feature in the chapter.

PetSmart, Inc. is a large specialty pet retailer of services and solutions for the needs of pets. In addition to selling pet food and pet products, PetSmart also offers dog grooming services including bath, nail trim, teeth brushing, aromatherapy to reduce everyday stress, and nail polish and stickers. PetSmart even offers a Top Dog service that includes a premium shampoo, milk bath conditioner, scented cologne spritz, teeth brushing, and bandana or bow.

Assume PetSmart, Inc. expects to incur $380,000 of indirect costs this year. The company allocates indirect costs based on the following activities:

Activity	Estimated Cost	Allocation Base	Estimated Quantity of Allocation Base
Admission	$ 60,000	Number of admissions	20,000
Cleaning	240,000	Cleaning direct labor hours	100,000
Grooming	80,000	Grooming direct labor hours	4,000
Total indirect costs	$ 380,000		

Requirements

1. Calculate the predetermined overhead allocation rate for each activity.

2. Assume a customer brought in Sophie, a beagle, for Top Dog service. PetSmart used the following resources:

Allocation Base	Sophie, Beagle
Number of admissions	1
Cleaning direct labor hours	1
Grooming direct labor hours	0.5

Determine the total cost of the Top Dog service for Sophie assuming the total direct materials cost was $3.50 and the total direct labor cost was $12 per DLHr.

3. If PetSmart desires a 30% target operating income after covering all its costs, what would PetSmart have to charge the customer to achieve that operating income?

SOLUTION

Requirement 1

Predetermined Overhead Allocation Rate	=	Total estimated overhead costs / Total estimated quantity of the overhead allocation base

Admissions	$60,000 total estimated overhead costs / 20,000 total estimated admissions	=	$3.00 per admission
Cleaning	$240,000 total estimated overhead costs / 100,000 total estimated direct labor hours	=	$2.40 per DLHr
Grooming	$80,000 total estimated overhead costs / 4,000 total estimated direct labor hours	=	$20.00 per DLHr

Requirement 2

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Admission	$3.00 per admission	×	1 admission	=	$ 3.00
Cleaning	$2.40 per DLHr	×	1 DLHr	=	2.40
Grooming	$20.00 per DLHr	×	0.5 DLHr	=	10.00
Total					$ 15.40

Tying It All Together Case 19-1, cont.
Requirement 3

		Sophie, Beagle
Total direct materials costs		$ 3.50
Total direct labor cost	1.5 DLHrs × $12 per DLHr	18.00
Total overhead cost		15.40
Total cost		$ 36.90

Desired operating income = Required service revenue – Total cost

Required service revenue × 30% = Required service revenue – Total cost

Thus:

Required service revenue = Total cost / 70%

= $36.90 / 70% = $52.71 (rounded)

Decision Cases

Decision Case 19-1

Harris Systems specializes in servers for workgroup, e-commerce, and ERP applications. The company's original job costing system has two direct cost categories: direct materials and direct labor. Overhead is allocated to jobs at the single rate of $22 per direct labor hour.

A task force headed by Harris's CFO recently designed an ABC system with four activities. The ABC system retains the current system's two direct cost categories. Overhead costs are reflected in the four activities. Pertinent data follow:

Activity	Allocation Base	Predetermined Overhead Allocation Rate
Materials handling	Number of parts	$ 0.85
Machine setup	Number of setups	500.00
Assembling	Number of assembling hours	80.00
Shipping	Number of shipments	1,500.00

Harris Systems has been awarded two new contracts, which will be produced as Job A and Job B. Budget data relating to the contracts follow:

	Job A	Job B
Number of parts	15,000	2,000
Number of setups	6	4
Number of assembling hours	1,500	200
Number of shipments	1	1
Total direct labor hours	8,000	600
Number of units produced	100	10
Direct materials cost	$ 220,000	$ 30,000
Direct labor cost	$ 160,000	$ 12,000

Requirements

1. Compute the budgeted product cost per unit for each job, using the original costing system (with two direct cost categories and a single overhead allocation rate).
2. Suppose Harris Systems adopts the ABC system. Compute the budgeted product cost per unit for each job using ABC.
3. Which costing system more accurately assigns to jobs the costs of the resources consumed to produce them? Explain.

SOLUTION

Requirement 1

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Job A:	$22 per DLHr	×	8,000 DLHr	=	$ 176,000
Job B:	$22 per DLHr	×	600 DLHr	=	$ 13,200

	Job A	Job B
Total direct materials cost	$ 220,000	$ 30,000
Total direct labor cost	160,000	12,000
Total manufacturing overhead cost	176,000	13,200
Total product cost	$ 556,000	$ 55,200
÷ Number of units	÷ 100 units	÷ 10 units
Product cost per unit	$ 5,560	$ 5,520

Decision Case 19-1, cont.
Requirement 2

	Predetermined Overhead Allocation Rate	×	Actual Quantity of the Allocation Base Used	=	Allocated Manufacturing Overhead Cost
Job A					
Materials handling	$0.85 per part	×	15,000 parts	=	$ 12,750
Machine setup	$500 per setup	×	6 setups	=	3,000
Assembling	$80 per assembling hour	×	1,500 assembling hours	=	120,000
Shipping	$1,500 per shipment	×	1 shipment	=	1,500
Total manufacturing overhead cost					$ 137,250
Job B					
Materials handling	$0.85 per part	×	2,000 parts	=	$ 1,700
Machine setup	$500 per setup	×	4 setups	=	2,000
Assembling	$80 per assembling hour	×	200 assembling hours	=	16,000
Shipping	$1,500 per shipment	×	1 shipment	=	1,500
Total manufacturing overhead cost					$ 21,200

	Job A	Job B
Total direct materials cost	$ 220,000	$ 30,000
Total direct labor cost	160,000	12,000
Total manufacturing overhead cost	137,250	21,200
Total product cost	$ 517,250	$ 63,200
÷ Number of units	÷ 100 units	÷ 10 units
Product cost per unit	$ 5,172.50	$ 6,320

Decision Case 19-1, cont.
Requirement 3

	Total Direct Labor Hours	/	Number of units	=	Direct Labor Hours per Unit
Job A	8,000 DLHr	/	100 units	=	80 DLHr per unit
Job B	600 DLHr	/	10 units	=	60 DLHr per unit

	Total Quantity of the Allocation Base Used	/	Number of units	=	Quantity of the Allocation Base Used per Unit
Job A					
Materials handling	15,000 parts	/	100 units	=	150 parts
Machine setup	6 setups	/	100 units	=	0.06 setups
Assembling	1,500 assembling hours	/	100 units	=	15 assembling hours
Shipping	1 shipment	/	100 units	=	0.01 shipment
Job B					
Materials handling	2,000 parts	/	10 units	=	200 parts
Machine setup	4 setups	/	10 units	=	0.40 setups
Assembling	200 assembling hours	/	10 units	=	20 assembling hours
Shipping	1 shipment	/	10 units	=	0.10 shipment

	Total manufacturing overhead cost	/	Number of units	=	Manufacturing overhead cost per unit
Job A					
Traditional System	$176,000[(a)]	/	100 units	=	$ 1,760.00 per unit
ABC System	$137,250[(b)]	/	100 units	=	$ 1,372.50 per unit
Job B					
Traditional System	$13,200[(a)]	/	10 units	=	$ 1,320.00 per unit
ABC System	$21,200[(b)]	/	10 units	=	$ 2,120.00 per unit

[(a)] Calculated in Requirement 1.
[(b)] Calculated in Requirement 2.

Decision Case 19-1, cont.
Requirement 3, cont.

Comparison of manufacturing overhead cost per unit:

	Traditional System		ABC System		Difference
Job A	$ 1,760.00 per unit	–	$ 1,372.50 per unit	=	$ 387.50
Job B	$ 1,320.00 per unit	–	$ 2,120.00 per unit	=	$ (800.00)

The difference in total product cost per unit between the traditional (original) system and the ABC system is due to allocation of manufacturing overhead. The traditional costing system doesn't reflect the way the two jobs actually use the company's resources (activities), while the ABC system does.

Relative to the ABC system, the traditional costing system over-costs Job A by $387.50 per unit and under-costs Job B by $800.00 per unit. The traditional costing system allocates manufacturing overhead costs based solely on direct labor hours, using a single predetermined overhead allocation rate of $22 per direct labor hour.

One unit of Job A requires 1.33 times as many direct labor hours than does one unit of Job B (80 direct labor hours per unit / 60 direct labor hours per unit). However, one unit of Job B actually requires more activity allocation base quantities using ABC for all four activities, as shown in the following table:

	Quantity of the Allocation Base Used per Unit for Job B	/	Quantity of the Allocation Base Used per Unit for Job A	=	Ratio of the Quantity of the Allocation Base Used per Unit
Materials handling	200 parts	/	150 parts	=	1.33 times
Machine setup	0.40 setups	/	0.06 setups	=	6.67 times
Assembling	20 assembling hours	/	15 assembling hours	=	1.33 times
Shipping	0.10 shipment	/	0.01 shipment	=	10.0 times[(c)]

[(c)] Note also that the activity with the highest ratio for Job B relative to Job A is also the one with the highest ABC predetermined overhead allocation rate.

Because the traditional costing system doesn't reflect the way the two jobs actually use the company's resources (activities), while the ABC system does, the ABC system costs are closer to the true cost of making each job. Thus, one should feel more comfortable making decisions using cost data from the ABC system.

Decision Case 19-2

Harris Systems has decided to adopt ABC. To remain competitive, Harris Systems's management believes the company must produce the type of servers produced in Job B (from Decision Case 19-1) at a target cost of $5,400. Harris Systems has just joined a B2B e-market site that management believes will enable the firm to cut direct materials costs by 10%. Harris's management also believes that a value engineering team can reduce assembly time.

Compute the assembling cost savings required per Job B-type server to meet the $5,400 target cost. (*Hint*: Begin by calculating the direct materials, direct labor, and allocated overhead costs per server.)

SOLUTION

Revised total direct materials cost	=	Original total cost	×	(1 – 10%)	
	=	$30,000	×	90%	
	=	$27,000			

Revised direct materials cost per server	=	$27,000 revised total cost	/	10 servers	
	=	$2,700 per server			

	Total Costs	/	Number of servers	=	Cost per server
Direct materials costs	$ 27,000	/	10	=	$ 2,700
Direct labor costs	12,000	/	10	=	1,200
Manufacturing overhead costs:					
Materials handling	1,700[(a)]	/	10	=	170
Machine setup	2,000[(a)]	/	10	=	200
Assembling				=	980[(b)]
Shipping	1,500[(a)]	/	10	=	150
Target product cost per server					$ 5,400

(a) Calculated in Decision Case 19-1

(b) $5,400 – $2,700 – $1,200 – $170 – $200 – $150 = $980

Original assembling cost per server	=	Original total assembling cost	/	Number of servers		
	=	$16,000 [(c)]	/	10	=	$1,600

(c) Calculated in Decision Case 19-1

Required assembling cost savings per server	=	Original assembling cost per server	–	Revised assembling cost per server		
	=	$1,600	–	$980	=	$620

Ethical Issue 19-1

Cassidy Manning is assistant controller at LeMar Packaging, Inc., a manufacturer of cardboard boxes and other packaging materials. Manning has just returned from a packaging industry conference on activity-based costing. She realizes that ABC may help LeMar meet its goal of reducing costs by 5% over each of the next three years.

LeMar Packaging's Order Department is a likely candidate for ABC. While orders are entered into a computer that updates the accounting records, clerks manually check customers' credit history and hand-deliver orders to shipping. This process occurs whether the sales order is for a dozen specialty boxes worth $80 or 10,000 basic boxes worth $8,000.

Manning believes that identifying the cost of processing a sales order would justify (1) further computerization of the order process and (2) changing the way the company processes small orders. However, the significant cost savings would arise from elimination of two positions in the Order Department. The company's sales order clerks have been with the company many years. Manning is uncomfortable with the prospect of proposing a change that will likely result in terminating these employees.

Use the IMA's ethical standards (see Chapter 16**)** to consider Manning's responsibility when cost savings come at the expense of employees' jobs.

SOLUTION

The IMA standard of competence states that management accountants should "provide decision support information and recommendations that are accurate, clear, concise, and timely".

The IMA standard of credibility states that management accountants should "communicate information fairly and objectively" and "disclose all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, analyses, or recommendations".

Manning must use her knowledge and expertise to provide all information and recommendations that will benefit the company and facilitate decision making, even if she is uncomfortable with the prospect of terminating employees.

Fraud Case 19-1

Anu Ghai was a new production analyst at RHI, Inc., a large furniture factory in North Carolina. One of her first jobs was to update the predetermined overhead allocation rates for factory production costs. This was normally done once a year, by analyzing the previous year's actual data, factoring in projected changes, and calculating a new rate for the coming year. What Anu found was strange. The activity rate for "maintenance" had more than doubled in one year, and she was puzzled how that could have happened. When she spoke with Larry McAfee, the factory manager, she was told to spread the increases out over the other activity costs to "smooth out" the trends. She was a bit intimidated by Larry, an imposing and aggressive man, but she knew something wasn't quite right. Then one night she was at a restaurant and overheard a few employees who worked at RHI talking. They were joking about the work they had done fixing up Larry's home at the lake last year. Suddenly everything made sense. Larry had been using factory labor, tools, and supplies to have his lake house renovated on the weekends. Anu had a distinct feeling that if she went up against Larry on this issue, she would come out the loser. She decided to look for work elsewhere.

Requirements

1. Besides spotting irregularities, like the case above, what are some other ways that ABC cost data are useful for manufacturing companies?
2. What are some of the other options that Anu might have considered?

SOLUTION

Requirement 1

An ABC system reflects the way products actually use a company's resources (activities). Thus ABC system costs are closer to the true cost of making products, and one should feel more comfortable making decisions using ABC cost data (including pricing and product mix decisions and cost management decisions such as computing target prices and target costs). ABC cost data can also help identify activities where costs are excessive and there are opportunities for savings and gains in efficiency.

Requirement 2

Anu might have considered communicating with the company's audit committee (if the company has one) and upper management. If this didn't yield resolution, Anu might also have considered approaching the company's external auditors or law enforcement.