Chapter 8
Activity-Based Costing: A Tool to Aid Decision Making

Solutions to Questions

8-1 Activity-based costing differs from traditional costing systems in a number of ways. In activity-based costing, nonmanufacturing as well as manufacturing costs may be assigned to products. And, some manufacturing costs may be excluded from product costs. An activity-based costing system typically includes a number of activity cost pools, each of which has its unique measure of activity. These measures of activity often differ from the allocation bases used in traditional costing systems. Finally, the activity rates differ from typical predetermined overhead rates in that they should be based on activity at capacity rather than on the budgeted level of activity.

8-2 When direct labor is used as an allocation base for overhead, it is implicitly assumed that overhead cost is directly proportional to direct labor. When cost systems were originally developed in the 1800s, this assumption may have been reasonably accurate. However, direct labor has declined in importance over the last hundred years while overhead has been increasing. This suggests that there is no longer a direct link between the level of direct labor and overhead. Indeed, when a company automates, direct labor is replaced by machines; a decrease in direct labor is accompanied by an increase in overhead. This violates the assumption that overhead cost is directly proportional to direct labor. Overhead cost appears to be driven by factors such as product diversity and complexity as well as by volume, for which direct labor has served as a convenient measure.

8-3 When an overhead rate is based on the budgeted level of activity, products are implicitly charged for the costs of the capacity they don't use as well as for the costs of capacity that they do use. This is because all of the costs of capacity—whether utilized or not—are spread across the budgeted production. Since the costs of capacity are largely fixed, this results in higher unit product costs when the level of activity declines.

If an overhead rate is based on the level of activity at capacity, a product is charged only for the costs of capacity that it actually uses. The costs of unused capacity are not charged to products and are instead charged to the current period as expenses of the period (see Appendix 3A). As a result, unit product costs are more stable and costs do not appear to increase as the level of budgeted activity decreases.

8-4 Activity-based costing may be resisted because it changes the "rules of the game." It changes some of the key measures such as product costs used in making decisions and may affect how individuals are evaluated. Without top management support, there may be little interest in making these changes. In addition, if top managers continue to make decisions based on the numbers generated by the traditional costing system, subordinates will quickly conclude that the activity-based costing system can be ignored.

8-5 Unit-level activities are performed for each unit that is produced. Batch-level activities are performed for each batch regardless of how many units are in the batch. Product-level activities must be carried out to support a product regardless of how many batches are run or units produced. Customer-level activities must be carried out to support customers regardless of what products or services they buy. Organization-sustaining activities are carried out regardless of the company's precise product mix or mix of customers.

8-6 Organization-sustaining costs and the costs of idle capacity should not be assigned to products. These costs represent resources that are not consumed by the products.

8-7 In activity-based costing, costs must first be allocated to activity cost pools and then are allocated from the activity cost pools to products, customers, and other cost objects.

8-8 Since people are often involved in more than one activity, some way must be found to estimate how much time they spend on each. The most practical approach is often to ask employees what percentage of time they spend on each activity. It is also possible to ask people to keep records of how they spend their time or observe them as they perform their tasks, but both of these alternatives are costly and it is not obvious that the data would be any better. People who know they are being observed may change how they behave.

8-9 In traditional cost systems, product-level costs are indiscriminately spread across all products using direct labor-hours or some other allocation base that is tied to volume. As a consequence, high-volume products are assigned the bulk of such costs. If a product is responsible for 40% of the direct labor in a factory, it will be assigned 40% of the manufacturing overhead cost in the factory—including 40% of the product-level costs of low-volume products. In an activity-based costing system, batch-level and product-level costs are assigned more appropriately. This results in shifting product-level costs back to the products that cause them and away from the high-volume products. (A similar effect will be observed with batch-level costs if high-volume products are produced in larger batches than low-volume products.)

8-10 Activity rates tell managers the average cost of resources consumed in carrying out a particular activity such as processing purchase orders. An activity whose average cost is high may be a good candidate for process improvements. Benchmarking can be used to identify which activities have unusually large costs. If some other organization is able to carry out the activity at a significantly lower cost, it is reasonable to suppose that improvement may be possible.

8-11 The activity-based costing approach described in the chapter is probably unacceptable for external financial reports for two reasons. First, activity-based product costs, as described in this chapter, exclude some manufacturing costs and include some nonmanufacturing costs. Second, the first-stage allocations are based on interviews rather than verifiable, objective data.

8-12 While an activity analysis such as in Exhibit 8-9 can yield insights, it should not be used for decision making. The conventional activity analysis contains no indication of what costs can actually be adjusted nor is there any indication of who would be responsible for adjusting the costs after a decision has been made. It would be dangerous, for example, to drop a product based solely on the activity analysis. Most of the costs do not automatically disappear if a product is dropped; managers must take explicit actions to eliminate resources or to transfer resources to other uses. Managers may be reluctant to take these actions—particularly if it involves firing or transferring people. The action analysis has the advantage of making it clearer where savings have to come from and hence which managers will have to take action.

Exercise 8-1 (10 minutes)

a. Receive raw materials from suppliers: Batch-level

b. Manage parts inventories: Product-level

c. Do rough milling work on products: Unit-level

d. Interview and process new employees in the personnel department: Organization-sustaining

e. Design new products: Product-level

f. Perform periodic preventative maintenance on general-use equipment: Organization-sustaining

g. Use the general factory building: Organization-sustaining

h. Issue purchase orders for a job: Batch-level

Some of these classifications are debatable and depend on the specific circumstances found in particular companies.

Exercise 8-2 (15 minutes)

	Travel	*Pickup and Delivery*	*Customer Service*	*Other*	*Totals*
Driver and guard wages	$360,000	$252,000	$ 72,000	$ 36,000	$ 720,000
Vehicle operating expense	196,000	14,000	0	70,000	280,000
Vehicle depreciation	72,000	18,000	0	30,000	120,000
Customer representative salaries and expenses	0	0	144,000	16,000	160,000
Office expenses	0	6,000	9,000	15,000	30,000
Administrative expenses	0	16,000	192,000	112,000	320,000
Total cost	$628,000	$306,000	$417,000	$279,000	$1,630,000

Each entry in the table is derived by multiplying the total cost for the cost category by the percentage taken from the table below that shows the distribution of resource consumption:

	Travel	*Pickup and Delivery*	*Customer Service*	*Other*	*Totals*
Driver and guard wages	50%	35%	10%	5%	100%
Vehicle operating expense	70%	5%	0%	25%	100%
Vehicle depreciation	60%	15%	0%	25%	100%
Customer representative salaries and expenses	0%	0%	90%	10%	100%
Office expenses	0%	20%	30%	50%	100%
Administrative expenses	0%	5%	60%	35%	100%

Exercise 8-3 (10 minutes)

Activity Cost Pool	*Estimated Overhead Cost*	*Expected Activity*		*Activity Rate*	
Caring for lawn	$72,000	150,000	square feet of lawn	$0.48	per square foot of lawn
Caring for garden beds–low maintenance	$26,400	20,000	square feet of low maintenance beds	$1.32	per square foot of low maintenance beds
Caring for garden beds–high maintenance	$41,400	15,000	square feet of high maintenance beds	$2.76	per square foot of high maintenance beds
Travel to jobs	$3,250	12,500	miles	$0.26	per mile
Customer billing and service	$8,750	25	customers	$350	per customer

The activity rate for each activity cost pool is computed by dividing its estimated overhead cost by its expected activity.

Exercise 8-4 (10 minutes)

K425

Activity Cost Pool		*Activity Rate*		*Activity*	*ABC Cost*
Labor related	$6	per direct labor-hour	80	direct labor-hours	$ 480
Machine related	$4	per machine-hour	100	machine-hours	400
Machine setups	$50	per setup	1	setups	50
Production orders	$90	per order	1	order	90
Shipments	$14	per shipment	1	shipment	14
Product sustaining	$840	per product	1	product	840
Total					$1,874

M67

Activity Cost Pool		*Activity Rate*		*Activity*	*ABC Cost*
Labor related	$6	per direct labor-hour	500	direct labor-hours	$ 3,000
Machine related	$4	per machine-hour	1,500	machine-hours	6,000
Machine setups	$50	per setup	4	setups	200
Production orders	$90	per order	4	orders	360
Shipments	$14	per shipment	10	shipments	140
Product sustaining	$840	per product	1	product	840
Total					$10,540

	K425	*M67*
Total cost (a)	$1,874	$10,540
Number of units produced (b)	200	2,000
Average cost per unit (a) ÷ (b)	$9.37	$5.27

Exercise 8-5 (30 minutes)

The first step is to compute the overhead cost for each of the products ordered by the customer:

Standard Model

Activity Cost Pool		*Activity Rate*		*Activity*	*ABC Cost*
Manufacturing volume	$26	per direct labor-hour	527	direct labor-hours	$13,702
Order processing.....	$284	per order	1	order	$284
Custom design processing.....	$186	per custom design	0	custom designs	$0
Customer service	$379	per customer		Not applicable	

Custom Design

Activity Cost Pool		*Activity Rate*		*Activity*	*ABC Cost*
Manufacturing volume	$26	per direct labor-hour	84	direct labor-hours	$2,184
Order processing.....	$284	per order	3	order	$852
Custom design processing.....	$186	per custom design	3	custom designs	$558
Customer service	$379	per customer		Not applicable	

Exercise 8-5 (continued)

The second step is to compute the product margins for the two products:

Product Profitability Analysis

	Standard Model		*Custom Design*	
Sales		$37,000		$7,200
Costs:				
Direct materials	$11,280		$1,902	
Direct labor	10,277		1,638	
Manufacturing volume	13,702		2,184	
Order processing	284		852	
Custom design processing	0	35,543	558	7,134
Product margin		$ 1,457		$ 66

The final step is to compute the profitability of the customer:

Customer Profitability Analysis

Product margin of orders placed by customer:	
Standard model	$1,457
Custom design	66
Total product margins	1,523
Customer service overhead	379
Customer margin	$1,144

Exercise 8-6 (30 minutes)

1. Under the traditional direct labor-hour based costing system, manufacturing overhead is applied to products using the predetermined overhead rate computed as follows:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total direct labor-hours}}$$

$$= \frac{\$1,920,000}{12,000 \text{ DLHs}^*} = \$160 \text{ per DLH}$$

*50,000 units of Model X100 @ 0.2 DLH per unit + 5,000 units of Model X200 @ 0.4 DLH per unit = 10,000 DLHs + 2,000 DLHs = 12,000 DLHs

Consequently, manufacturing overhead would be applied to the products as follows:

	Model X100	*Model X200*	*Total*
Unit sales	50,000	5,000	
Direct labor-hours per unit	0.2	0.4	
Total direct labor-hours	10,000	2,000	12,000
Total manufacturing overhead applied @ $160 per direct labor-hour	$1,600,000	$320,000	$1,920,000
Manufacturing overhead per unit	$32	$64	

Note that all of the manufacturing overhead cost is applied to the products under the company's traditional costing system.

Exercise 8-6 (continued)

2. Under the activity-based costing system, overhead costs (both nonmanufacturing and manufacturing) would be applied to products as follows:

	Model X100	*Model X200*	*Total*
Unit sales	50,000	5,000	
Manufacturing overhead applied	$1,340,000	$390,000	$1,730,000
Nonmanufacturing overhead applied	160,000	110,000	270,000
Total overhead applied	$1,500,000	$500,000	$2,000,000
Manufacturing overhead per unit	$30	$100	

3. Under activity-based costing, a total of $1,500,000 is assigned to Model X100 and a total of $500,000 is assigned to Model X200. This is in contrast to $1,600,000 for Model X100 and $320,000 for Model X200 under the traditional costing method. Also note that the total amount of overhead applied to both products is $2,000,000 under activity-based costing and $1,920,000 under the traditional costing method. A number of reasons exist for these differences. First, not all manufacturing overhead costs are assigned to products under activity-based costing. Apparently $190,000 (= $1,920,000 – $1,730,000) of manufacturing overhead consists of the costs of idle capacity and organization-sustaining costs that are not assigned to products under activity-based costing. Counterbalancing this, a total of $270,000 in nonmanufacturing costs are assigned to products under activity-based costing, but not under the traditional method. Additionally, manufacturing overhead costs have been shifted from Model X100, the high-volume product, to Model X200, the low-volume product under activity-based costing. This is probably due to the existence of batch-level or product-level costs that are more appropriately assigned under activity-based costing.

   Per unit costs have changed under activity-based costing. This is partly due to the exclusion of some manufacturing overhead from product costs and the inclusion of nonmanufacturing overhead costs. But it is also due to shifting costs from the high-volume to the low-volume product. This has the predictable effect of increasing the per unit cost of the low-volume product more than the per unit cost of the high-volume product is decreased.

Exercise 8-7 (20 minutes)

Sales (120 clubs × $49 per club)		$5,880.00
Green costs:		
Direct materials (120 clubs × $27.65 per club)	$3,318.00	3,318.00
Green margin		2,562.00
Yellow costs:		
Direct labor (120 clubs × 0.4 hour per club × $22 per hour)	1,056.00	
Indirect labor	113.40	
Marketing expenses	709.80	1,879.20
Yellow margin		682.80
Red costs:		
Factory equipment depreciation	216.60	
Factory administration	291.70	
Selling and administrative wages and salaries	387.60	
Selling and administrative depreciation	28.00	923.90
Red margin		($ 241.10)

While not required in the problem, the conventional ABC analysis would be presented as follows:

Sales (120 clubs × $49 per club)		$5,880.00
Product costs:		
Direct materials	$3,318.00	
Direct labor	1,056.00	
Volume related overhead	595.20	
Batch processing overhead	53.50	
Order processing overhead	132.40	5,155.10
Product margin		724.90
Customer service overhead		966.00
Customer margin		($ 241.10)

Exercise 8-8 (10 minutes)

	Activity	*Activity Level*
a.	Sales representatives' periodic visits to customers to keep them informed about the services provided by CD Express	Customer-level
b.	Ordering labels from the printer for a particular CD*	Product-level
c.	Setting up the CD duplicating machine to make copies from a particular master CD	Batch-level
d.	Loading the automatic labeling machine with labels for a particular CD*	Batch-level
e.	Visually inspecting CDs and placing them by hand into protective plastic cases prior to shipping	Unit-level
f.	Preparation of the shipping documents for the order	Product-level
g.	Periodic maintenance of equipment	Organization-sustaining
h.	Lighting and heating the company's production facility	Organization-sustaining
i.	Preparation of quarterly financial reports	Organization-sustaining

*The cost of the labels themselves would be part of direct materials.

Exercise 8-9 (10 minutes)

Teller wages	$160,000
Assistant branch manager salary	$75,000
Branch manager salary	$80,000

	Distribution of Resource Consumption Across Activities				
	Opening Accounts	*Processing Deposits and Withdrawals*	*Processing Other Customer Transactions*	*Other Activities*	*Totals*
Teller wages	5%	65%	20%	10%	100%
Assistant branch manager salary	15%	5%	30%	50%	100%
Branch manager salary	5%	0%	10%	85%	100%

	Opening Accounts	*Processing Deposits and Withdrawals*	*Processing Other Customer Transactions*	*Other Activities*	*Totals*
Teller wages	$ 8,000	$104,000	$32,000	$ 16,000	$160,000
Assistant branch manager salary	11,250	3,750	22,500	37,500	75,000
Branch manager salary	4,000	0	8,000	68,000	80,000
Total cost	$23,250	$107,750	$62,500	$121,500	$315,000

Teller wages are $160,000 and 65% of the tellers' time is spent processing deposits and withdrawals:
$160,000 × 65% = $104,000
Other entries in the table are determined similarly.

Exercise 8-10 (20 minutes)

1. Computation of activity rates:

Activity Cost Pools	*(a) Total Cost*	*(b) Total Activity*	*(a) ÷ (b) Activity Rate*
Opening accounts.....	$23,250	500 new accounts opened	$46.50 per new account opened
Processing deposits and withdrawals	$107,750	100,000 deposits and withdrawals processed	$1.08 per deposit or withdrawal processed
Processing other customer transactions .	$62,500	5,000 other customer transactions processed	$12.50 per other customer transaction processed

Exercise 8-10 (continued)

2. The cost of opening an account at the Westfield branch is apparently much higher than at the lowest cost branch ($46.50 versus $26.75). On the other hand, the cost of processing deposits and withdrawals is lower than at the lowest cost branch ($1.08 versus $1.24). And the cost of processing other customer transactions is somewhat higher at the Westfield branch ($12.50 versus $11.86). This suggests that the other branches may have something to learn from Westfield concerning processing deposits and withdrawals and Westfield may benefit from learning about how some of the other branches open accounts and process other transactions. It may be particularly instructive to compare the details of the activity rates. For example, is the cost of opening accounts at Westfield apparently high because of the involvement of the assistant branch manager in this activity?

   It should be mentioned that the apparent differences in the costs of the activities at the various branches could be due to inaccuracies in employees' reports of the amount of time they devote to the activities. The differences in costs may also reflect different strategies. For example, the Westfield branch may purposely spend more time with new customers in order to win their loyalty. The higher cost of opening new accounts at the Westfield branch may be justified by future benefits of having more satisfied customers. Nevertheless, comparative studies of the costs of activities may provide a useful starting point for identifying best practices within a company and where improvements can be made.

Exercise 8-11 (10 minutes)

Activity Cost Pool	*(a)* *Activity Rate*	*(b)* *Activity*	*(a) × (b)* *ABC Cost*
Order size	R 16.85 per direct labor-hour	200 direct labor-hours	R 3,370
Customer orders	R 320.00 per customer order	1 customer order	R 320
Product testing	R 89.00 per product testing hour	4 product testing hours	R 356
Selling	R 1,090.00 per sales call	2 sales calls	R 2,180
Total			R 6,226

According to these calculations, the total overhead cost of the order was R 6,226.

Exercise 8-12 (30 minutes)

1.

	Order Size	*Customer Orders*	*Product Testing*	*Selling*	*Total*
Activity level.....	200 direct labor-hours	1 customer order	4 product testing hours	2 sales calls	
Manufacturing:					
Indirect labor.....	R1,650	R180	R120	R 0	R1,950
Factory depreciation.....	1,600	0	160	0	1,760
Factory utilities	20	0	4	0	24
Factory administration.....	0	48	72	60	180
General selling & administrative:					
Wages and salaries	100	80	0	1,600	1,780
Depreciation	0	12	0	80	92
Taxes and insurance	0	0	0	40	40
Selling expenses	0	0	0	400	400
Total overhead cost	R3,370	R320	R356	R2,180	R6,226

Example: R8.25 per direct labor-hour from the problem statement × 200 direct labor-hours = R1,650

According to these calculations, the overhead cost of the order was R6,226.

Exercise 8-12 (continued)

2. The table prepared in part (1) above allows two different perspectives on the overhead cost of the order. The column totals that appear in the last row of the table tell us the cost of the order in terms of the activities it required. The row totals that appear in the last column of the table tell us how much the order cost in terms of the overhead accounts in the underlying accounting system. Another way of saying this is that the column totals tell us what the costs were incurred *for*. The row totals tell us what the costs were incurred *on*. For example, you may spend money *on* a chocolate bar in order to satisfy your craving *for* chocolate. Both perspectives are important. To control costs, it is necessary to know both what the costs were incurred for and what actual costs would have to be adjusted (i.e., what the costs were incurred on).

   The two different perspectives can be explicitly shown as follows:

   What the overhead costs were incurred *on*:

Manufacturing:	
Indirect labor	R1,950
Factory depreciation	1,760
Factory utilities	24
Factory administration	180
General selling & administrative:	
Wages and salaries	1,780
Depreciation	92
Taxes and insurance	40
Selling expenses	400
Total overhead cost	R6,226

   What the overhead costs were incurred *for*:

Order size	R3,370
Customer orders	320
Product testing	356
Selling	2,180
Total overhead cost	R6,226

Exercise 8-13 (10 minutes)

Activity	*Level of Activity*	*Examples of Activity Measures*
a. Direct labor workers assemble a product.	Unit	Direct labor-hours
b. Products are designed by engineers.	Product	Hours of design time; Number of new products designed
c. Equipment is set up.	Batch	Hours of setup time; Number of setups
d. Machines are used to shape and cut materials.	Unit	Machine-hours; Number of units processed
e. Monthly bills are sent out to regular customers.	Customer	Number of bills sent
f. Materials are moved from the receiving dock to production lines.	Batch	Number of loads transferred
g. All completed units are inspected for defects.	Unit	Hours of inspection time; Number of units inspected

Note: Some of these activity measures are debatable.

Exercise 8-14 (20 minutes)

1. Activity rates are computed as follows:

Activity Cost Pool	*(a) Estimated Overhead Cost*	*(b) Expected Activity*	*(a) ÷ (b) Activity Rate*
Machine setups.....	$72,000	400 setups	$180 per setup
Special processing.....	$200,000	5,000 MHs	$40 per MH
General factory	$816,000	24,000 DLHs	$34 per DLH

2. The unit costs can be computed as follows, starting with the computation of the manufacturing overhead:

	Hubs	*Sprockets*
Machine setups:		
100 setups × $180 per setup.....	$ 18,000	
300 setups × $180 per setup		$ 54,000
Special processing:		
5,000 MHs × $40 per MH.....	200,000	
0 MH × $40 per MH.....		-
General factory:		
8,000 DLHs × $34 per DLH	272,000	
16,000 DLHs × $34 per DLH		544,000
Total overhead cost (a)	$490,000	$598,000
Number of units produced (b)	10,000	40,000
Overhead cost per unit (a) ÷ (b)	$49.00	$14.95

	Hubs	*Sprockets*
Direct materials	$32.00	$18.00
Direct labor:		
0.80 DLHs × $15 per DLH.....	12.00	
0.40 DLHs × $15 per DLH.....		6.00
Manufacturing overhead (see above).....	49.00	14.95
Unit cost	$93.00	$38.95

Exercise 8-15 (15 minutes)

1. and 2.

Activity	*Activity Level*	*Possible Activity Measures*
a. Machine settings are changed between batches of different products.	Batch-level	Number of batches; time to change settings
b. Parts inventories are maintained in the storeroom.	Product-level	Number of part types maintained in stock
c. Products are milled on a milling machine	Unit-level	Machine-hours; labor-hours
d. New employees are hired by the personnel office.	Organization-sustaining	Not applicable*
e. New products are designed.	Product-level	Hours of design time
f. Periodic maintenance is performed on general-purpose production equipment.	Organization-sustaining	Not applicable*
g. A bill is sent to a customer who is late in making payments.	Customer-level	Number of bills
h. Yearly taxes are paid on the company's facilities.	Organization-sustaining	Not applicable*
i. Purchase orders are issued for materials to be used in production.	Batch-level	Number of purchase orders

* Organization-sustaining costs should not be allocated to products or customers.

Note: Some of these classifications and activity measures are debatable.

Exercise 8-16 (30 minutes)

1. The first step is to determine the activity rates:

Activity Cost Pools	*(a) Total Cost*	*(b) Total Activity*	*(a) ÷ (b) Activity Rate*
Serving parties.....	$33,000	6,000 parties	$5.50 per party
Serving diners.....	$138,000	15,000 diners	$9.20 per diner
Serving drinks.....	$24,000	10,000 drinks	$2.40 per drink

According to the activity-based costing system, the cost of serving each of the parties can be computed as follows:

a. Party of 4 persons who order a total of 3 drinks:

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Serving parties	$5.50 per party	1 party	$ 5.50
Serving diners	$9.20 per diner	4 diners	36.80
Serving drinks	$2.40 per drink	3 drinks	7.20
Total.....			$49.50

b. Party of 2 persons who order no drinks:

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Serving parties	$5.50 per party	1 party	$ 5.50
Serving diners	$9.20 per diner	2 diners	18.40
Serving drinks	$2.40 per drink	0 drinks	0
Total.....			$23.90

c. Party of 1 person who orders 2 drinks:

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Serving parties	$5.50 per party	1 party	$ 5.50
Serving diners	$9.20 per diner	1 diner	9.20
Serving drinks	$2.40 per drink	2 drinks	4.80
Total.....			$19.50

Exercise 8-16 (continued)

2. The average cost per diner for each party can be computed by dividing the total cost of the party by the number of diners in the party as follows:
   a. $49.50 ÷ 4 diners = $12.375 per diner
   b. $23.90 ÷ 2 diners = $11.95 per diner
   c. $19.50 ÷ 1 diner = $19.50 per diner

3. The average cost per diner differs from party to party under the activity-based costing system for two reasons. First, the cost of serving a party ($5.50) does not depend on the number of diners in the party. Therefore, the average cost per diner of this activity decreases as the number of diners in the party increases. With only one diner, the cost is $5.50. With two diners, the average cost per diner is cut in half to $2.75. With five diners, the average cost per diner would be only $1.10. And so on. Second, the average cost per diner differs also because of the differences in the number of drinks ordered by the diners. If a party does not order any drinks, as was the case with the party of two, no costs of serving drinks are assigned to the party.

   The average cost per diner differs from the overall average cost of $16 per diner for several reasons. First, the average cost of $16 per diner includes organization-sustaining costs that are excluded from the computations in the activity-based costing system. Second, the $16 per diner figure does not recognize differences in the diners' demands on resources. It does not recognize that some diners order more drinks than others nor does it recognize the economies of scale in serving larger parties. (The batch-level costs of serving a party can be spread over more diners if the party is larger.)

   We should note that the activity-based costing system itself does not recognize all of the differences in diners' demands on resources. For example, there are undoubtedly differences in the costs of preparing the various meals on the menu. It may or may not be worth the effort to build a more detailed activity-based costing system that would take such nuances into account.

Exercise 8-17 (45 minutes)

1. The unit product costs under the company's conventional costing system would be computed as follows:

	Rascon	*Parcel*	*Total*
Number of units produced (a)	20,000	80,000	
Direct labor-hours per unit (b)	0.40	0.20	
Total direct labor-hours (a) × (b)	8,000	16,000	24,000
Total manufacturing overhead (a)	$576,000		
Total direct labor-hours (b)	24,000 DLHs		
Predetermined overhead rate (a) ÷ (b)	$ 24.00 per DLH		

	Rascon	*Parcel*
Direct materials	$13.00	$22.00
Direct labor	6.00	3.00
Manufacturing overhead applied:		
0.40 DLH per unit × $24.00 per DLH	9.60	
0.20 DLH per unit × $24.00 per DLH		4.80
Unit product cost	$28.60	$29.80

Exercise 8-17 (continued)

2. The unit product costs with the proposed ABC system can be computed as follows:

Activity Cost Pool	*Estimated Overhead Cost**	*(b) Expected Activity*	*(a) ÷ (b) Activity Rate*
Labor related.....	$288,000	24,000 direct labor-hours	$12.00 per direct labor-hour
Engineering design...	$288,000	6,000 engineering-hours	$48.00 per engineering-hour

*The total overhead cost is split evenly between the two activity cost pools.

	Rascon		*Parcel*	
	Expected Activity	*Amount*	*Expected Activity*	*Amount*
Labor related at $12.00 per direct labor-hour	8,000	$ 96,000	16,000	$192,000
Engineering design at $48.00 per engineering-hour	3,000	144,000	3,000	144,000
Total overhead cost assigned (a).....		$240,000		$336,000
Number of units produced (b)		20,000		80,000
Overhead cost per unit (a) ÷ (b		$12.00		$4.20

The unit product costs combine direct materials, direct labor, and overhead costs:

	Rascon	*Parcel*
Direct materials.....	$13.00	$22.00
Direct labor.....	6.00	3.00
Manufacturing overhead (see above) ..	12.00	4.20
Unit product cost.....	$31.00	$29.20

Exercise 8-17 (continued)

3. The unit product cost of the high-volume product, Parcel, declines under the activity-based costing system, whereas the unit product cost of the low-volume product, Rascon, increases. This occurs because half of the overhead is applied on the basis of engineering design hours instead of direct labor-hours. When the overhead was applied on the basis of direct labor-hours, most of the overhead was applied to the high-volume product. However, when the overhead is applied on the basis of engineering-hours, more of the overhead cost is shifted over to the low-volume product. Engineering-hours is a product-level activity, so the higher the volume, the lower the unit cost and the lower the volume, the higher the unit cost.

Exercise 8-18 (15 minutes)

1. The order requires 250 direct labor-hours (1,000 units @ 0.25 DLH per unit) and is run in two batches. Therefore, the overhead cost of the order according to the activity-based costing system would be computed as follows:

Activity Cost Pool	*(a)* *Activity Rate*	*(b)* *Activity*	*(a) × (b)* *ABC Cost*
Volume	$5.55 per direct labor-hour	250 direct labor-hours	$1,387.50
Batch processing..	$107.00 per batch	2 batches	$214.00
Order processing .	$275.00 per order	1 order	$275.00
Total.....			$1,876.50

The product margin on the order can be computed as follows:

Sales (1,000 units × $20 per unit).....		$20,000.00
Costs:		
Direct materials (1,000 units × $8.50 per unit) ..	$8,500.00	
Direct labor (1,000 units × $6.00 per unit)	6,000.00	
Volume.....	1,387.50	
Batch processing	214.00	
Order processing	275.00	16,376.50
Product margin		$ 3,623.50

2. The customer margin for sales to Interstate Trucking is computed as follows:

Product margin (above).....	$3,623.50
Less: Customer service overhead	
(1 customer × $2,463 per customer)	2,463.00
Customer margin	$1,160.50

Exercise 8-19 (45 minutes)

1. The order from Interstate Trucking requires 250 direct labor-hours (1,000 units @ 0.25 DLH per unit) and is run in two batches. Therefore, the overhead cost of the order according to the activity-based costing system would be computed as follows:

	Volume	*Batch Processing*	*Order Processing*	*Total*
Activity	250 DLHs	2 batches	1 order	
Production overhead:				
Indirect labor	$ 150.00	$120.00	$ 20.00	$ 290.00
Factory equipment depreciation	1,000.00	34.00	0.00	1,034.00
Factory administration	25.00	14.00	25.00	64.00
General selling and administrative overhead:				
Wages and salaries	100.00	40.00	160.00	300.00
Depreciation	0.00	6.00	10.00	16.00
Marketing expenses	112.50	0.00	60.00	172.50
Total cost	$1,387.50	$214.00	$275.00	$1,876.50

Example: 250 DLHs × $0.60 per DLH from the problem statement = $150.00

Exercise 8-19 (continued)

The action analysis report for the order can be constructed using the row totals from the activity rate table, organized according to the ease of adjustment codes:

Sales (1,000 units × $20 per unit)		$20,000.00
Green costs:		
Direct materials (1,000 units × $8.50 per unit)	$8,500.00	8,500.00
Green margin		11,500.00
Yellow costs:		
Direct labor (1,000 units × $6.00 per unit)	6,000.00	
Indirect labor	290.00	
Marketing expenses	172.50	6,462.50
Yellow margin		5,037.50
Red costs:		
Factory equipment depreciation	1,034.00	
Factory administration	64.00	
Selling and administrative wages and salaries	300.00	
Selling and administrative depreciation	16.00	1,414.00
Red margin		$ 3,623.50

Exercise 8-19 (continued)

2. An action analysis report for the customer can be prepared by including the customer service costs in the overhead analysis.

	Volume	*Batch Processing*	*Order Processing*	*Customer Service*	*Total*
Activity	250 DLHs	2 batches	1 order	1 customer	
Production overhead:					
Indirect labor	$ 150.00	$120.00	$ 20.00	$ 0.00	$ 290.00
Factory equipment depreciation	1,000.00	34.00	0.00	0.00	1,034.00
Factory administration	25.00	14.00	25.00	150.00	214.00
General selling and administrative overhead:					
Wages and salaries	100.00	40.00	160.00	1,600.00	1,900.00
Depreciation	0.00	6.00	10.00	38.00	54.00
Marketing expenses	112.50	0.00	60.00	675.00	847.50
Total cost	$1,387.50	$214.00	$275.00	$2,463.00	$4,339.50

Example: 250 DLHs × $0.60 per DLH from the problem statement = $150.00

Exercise 8-19 (continued)

The action analysis report for the customer can be constructed using the row totals from the activity rate table, organized according to the ease of adjustment codes:

Sales (1,000 units × $20 per unit)		$20,000.00
Green costs:		
Direct materials (1,000 units × $8.50 per unit)	$8,500.00	8,500.00
Green margin		11,500.00
Yellow costs:		
Direct labor (1,000 units × $6.00 per unit)	6,000.00	
Indirect labor	290.00	
Marketing expenses	847.50	7,137.50
Yellow margin		4,362.50
Red costs:		
Factory equipment depreciation	1,034.00	
Factory administration	214.00	
Selling and administrative wages and salaries	1,900.00	
Selling and administrative depreciation	54.00	3,202.00
Red margin		$ 1,160.50

Exercise 8-20 (30 minutes)

1. The first-stage allocation is shown below:

	Volume Related	*Order Related*	*Customer Support*	*Other*	*Totals*
Wages and salaries	$120,000	$ 90,000	$60,000	$30,000	$300,000
Other overhead costs ..	30,000	10,000	20,000	40,000	100,000
Total overhead cost.....	$150,000	$100,000	$80,000	$70,000	$400,000

Example: According to the distribution of resources across activities, 40% of the $300,000 wages and salaries cost is attributable to volume related activities.

$300,000 × 40% = $120,000

Other entries in the table are determined in a similar manner.

2. Computation of activity rates:

Activity Cost Pools	*(a) Total Cost*	*(b) Total Activity*	*(a) ÷ (b) Activity Rate*
Volume	$150,000	20,000 DLHs	$7.50 per DLH
Order related.....	$100,000	400 orders	$250 per order
Customer support	$80,000	200 customers	$400 per customer

Exercise 8-20 (continued)

3. Computation of the overhead costs for the Shenzhen Enterprises order:

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Volume	$7.50 per DLH	20 DLHs*	$150
Order related.....	$250 per order	1 order	250
Total.....			$400

*2 DLHs per unit × 10 units = 20 DLHs

4. The margins for the order and for the customer follow:

Product Profitability Analysis

Sales (10 units × $300 per unit).....		$3,000
Costs:		
Direct materials (10 units × $180 per unit)...	$1,800	
Direct labor (10 units × $50 per unit).....	500	
Volume overhead	150	
Order related overhead.....	250	2,700
Product margin		$ 300

Customer Profitability Analysis

Product margin (above).....	$ 300
Less: Customer support overhead	
(1 customer @ $400 per customer).....	400
Customer margin	$ (100)

Exercise 8-21 (60 minutes)

1. The first-stage allocation is shown below:

	Distribution of Resource Consumption Across Activity Cost Pools				
	Volume	*Order Related*	*Customer Support*	*Other*	*Totals*
Wages and salaries	40%	30%	20%	10%	100%
Other overhead costs	30%	10%	20%	40%	100%

	Volume related	*Order Related*	*Customer Support*	*Other*	*Totals*
Wages and salaries	$120,000	$ 90,000	$60,000	$30,000	$300,000
Other overhead costs ..	30,000	10,000	20,000	40,000	100,000
Total overhead cost.....	$150,000	$100,000	$80,000	$70,000	$400,000

Example: 40% × $300,000 = $120,000

Other entries in the table are determined in a similar manner.

Exercise 8-21 (continued)

2. The activity rates are computed by dividing the costs in the cells of the first-stage allocation above by the total activity from the top of the column.

	Volume Related	*Order Related*	*Customer Support*
Total activity	20,000 DLHs	400 orders	200 customers
Wages and salaries	$6.00	$225.00	$300.00
Other overhead costs	1.50	25.00	100.00
Total cost	$7.50	$250.00	$400.00

Example: $120,000 ÷ 20,000 DLHs = $6.00 per DLH

Volume related wages and salaries from the first-stage allocation above.

3. The overhead cost for the order is computed as follows:

	Volume Related	*Order Related*	*Total*
Activity	20 DLHs	1 order	
Wages and salaries	$120.00	$225.00	$345.00
Other overhead costs	30.00	25.00	55.00
Total cost	$150.00	$250.00	$400.00

Example: 20 DLHs × $6.00 per DLH = $120.00

Activity rate for volume related wages and salaries from part (2) above.

Exercise 8-21 (continued)

4. The activity view report can be constructed using the column totals at the bottom of the overhead cost analysis in part (3) above.

Product Profitability Analysis		
Sales (10 units × $300 per unit)		$3,000
Costs:		
Direct materials (10 units × $180 per unit)	$1,800	
Direct labor (10 units × $50 per unit)	500	
Volume related overhead	150	
Order related overhead	250	2,700
Product Margin		$ 300

Customer Profitability Analysis	
Product margin of order (above)	$ 300
Less: Customer support overhead (1 customer × $400 per customer)	400
Customer margin	$ (100)

5. The action analysis report can be constructed using the row totals from the activity rate table, organized according to the ease of adjustment codes:

Sales (10 units × $300 per unit)		$3,000
Green costs:		
Direct materials (10 units × $180 per unit)	$1,800	1,800
Green margin		1,200
Yellow costs:		
Direct labor (10 units × $50 per unit)	500	
Wages and salaries (see part (3) above)	345	845
Yellow margin		355
Red costs:		
Other overhead costs (see part (3) above)	55	55
Red margin		$ 300

Exercise 8-21 (continued)

6. The first step is to include the customer support costs in the overhead cost analysis as follows:

	Volume Related	*Order Related*	*Customer Support*	*Total*
Activity	20 DLHs	1 order	1 customer	
Wages and salaries	$120.00	$225.00	$300.00	$645.00
Other overhead costs	30.00	25.00	100.00	155.00
Total cost	$150.00	$250.00	$400.00	$800.00

The action analysis report can then be easily constructed as follows:

Sales (10 units × $300 per unit)		$3,000
Green costs:		
Direct materials (10 units × $180 per unit)	$1,800	1,800
Green margin		1,200
Yellow costs:		
Direct labor (10 units × $50 per unit)	500	
Wages and salaries (see above)	645	1,145
Yellow margin		55
Red costs:		
Other overhead costs (see above)	155	155
Red margin		$ (100)

Exercise 8-21 (continued)

7. While the company apparently incurred a loss on its business with Shenzen Enterprises, caution must be exercised. The green margin on the business was $1,200. Advanced Products Corporation really incurred a loss on this business only if at least $1,200 of the yellow and red costs would have been avoided if the Shenzen Enterprises order had been rejected. For example, we don't know what specific costs are included in the "Other overhead" category. If these costs are committed fixed costs that cannot be avoided in the short run, then the company would been worse off if the Shenzen Enterprises order had not been accepted.

   Suppose that Shenzen Enterprises will be submitting a similar order every year. As a general policy, the company might consider turning down this business in the future. Costs that cannot be avoided in the short run, may be avoided in the long run through the budgeting process or in some other manner. However, if the Shenzen Enterprises business is turned down, management must make sure that at least $1,200 of the yellow and red costs are really eliminated or the resources represented by those costs are really redeployed to the constraint. If these costs remain unchanged, then the company would be better off accepting the Shenzen Enterprises business in the future.

Problem 8-22 (60 minutes)

1. The company's estimated direct labor-hours can be computed as follows:

Deluxe model: 5,000 units × 2 DLHs per unit	10,000 DLHs
Regular model: 40,000 units × 1 DLH per unit ..	40,000 DLHs
Total	50,000 DLHs

Using just direct labor-hours as the base, the predetermined overhead rate would be:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated manufacturing overhead cost}}{\text{Estimated direct labor-hours}}$$

$$= \frac{\$900{,}000}{50{,}000 \text{DLHs}} = \$18 \text{ per DLH}$$

Using this predetermined manufacturing overhead rate, the unit product cost of each model can be computed as follows:

	Deluxe	*Regular*
Direct materials.....	$40	$25
Direct labor	14	7
Manufacturing overhead:		
$18 per DLH × 2 DLHs.....	36	
$18 per DLH × 1 DLH	___	18
Total unit product cost	$90	$50

Problem 8-22 (continued)

2. Overhead rates by activity are computed below:

Activity Cost Pool	*(a) Estimated Overhead Cost*	*(b) Expected Activity*		*(a) ÷ (b) Predetermined Overhead Rate*	
Purchasing	$204,000	600	purchase orders	$340	per purchase order
Processing.....	$182,000	35,000	machine-hours	$5.20	per machine-hour
Scrap/rework.....	$379,000	2,000	orders	$189.50	per order
Shipping.....	$135,000	900	shipments	$150	per shipment

Problem 8-22 (continued)

3. a. The overhead applied to each product can be determined as follows:

The Deluxe Model

Activity Cost Pool	*(a) Predetermined Overhead Rate*		*(b) Activity*		*(a) × (b) Overhead Applied*
Purchasing	$340	per purchase order	200	purchase orders	$ 68,000
Processing	$5.20	per machine-hour	20,000	machine-hours	104,000
Scrap/rework	$189.50	per order	1,000	orders	189,500
Shipping	$150	per shipment	250	shipments	37,500
Total overhead cost					$399,000

Manufacturing overhead cost per unit = $399,000 ÷ 5,000 units = $79.80 per unit

The Regular Model

Activity Cost Pool	*(a) Predetermined Overhead Rate*		*(b) Activity*		*(a) × (b) Overhead Applied*
Purchasing	$340	per purchase order	400	purchase orders	$136,000
Processing	$5.20	per machine-hour	15,000	machine-hours	78,000
Scrap/rework	$189.50	per order	1,000	orders	189,500
Shipping	$150	per shipment	650	shipments	97,500
Total overhead cost					$501,000

Manufacturing overhead cost per unit = $501,000 ÷ 40,000 units = $12.53 per unit

Problem 8-22 (continued)

b. The unit product cost of each model under an activity costing approach would be:

	Deluxe	*Regular*
Direct materials	$ 40.00	$25.00
Direct labor	14.00	7.00
Manufacturing overhead (above)	79.80	12.53
Total unit product cost	$133.80	$44.53

4. It is risky to draw any definite conclusions based on the above analysis. The activity-based costing system used in this company is not completely suitable for making decisions. Product costs probably include costs of idle capacity and organization-sustaining costs. They also exclude nonmanufacturing costs that may be caused by the products. Nevertheless, the above analysis is suggestive.

   Unit costs appear to be distorted as a result of using direct labor-hours as the base for assigning overhead cost to products. Although the deluxe model requires twice as much labor time as the regular model, it still is not being assigned enough overhead cost, as shown in the analysis in part 3(a).

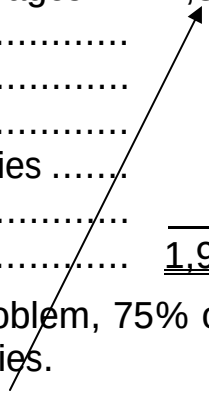
   When the company's overhead costs are analyzed on an activities basis, it appears that the deluxe model is more expensive to manufacture than the company realizes. Note that the deluxe model accounts for a majority of the machine-hours worked, even though it accounts for only 20% of the company's direct labor-hours. Also, it requires just as many scrap/rework orders as the regular model, and scrap/rework orders are very costly to the company.

   When activity-based costing is used and the company's transactions are analyzed by product, the overhead cost jumps for the deluxe model from $36.00 per unit to $79.80 per unit. This suggests that less than half the overhead cost is being assigned to the deluxe model that ought to be assigned, and unit costs for the deluxe model are badly understated. If these costs are being used as a basis for pricing, then the selling price for the deluxe model may be too low. This may be the reason why profits have been steadily declining over the last several years. It may also be the reason why sales of the deluxe model have been increasing rapidly.

Problem 8-23 (45 minutes)

1. The first-stage allocation of costs to activity cost pools for the CDG operation appears below. All figures below are in euros.

	Meal Preparation	*Flight-Related*	*Customer Service*	*Other*	*Totals*
Cooks and delivery personnel wages	1,800,000	480,000	0	120,000	2,400,000
Kitchen supplies	30,000	0	0	0	30,000
Chef salaries	54,000	36,000	72,000	18,000	180,000
Equipment depreciation	36,000	0	0	24,000	60,000
Administrative wages and salaries	0	30,000	90,000	30,000	150,000
Building costs	0	0	0	120,000	120,000
Total cost	1,920,000	546,000	162,000	312,000	2,940,000



According to the data in the problem, 75% of the cooks and delivery personnel wages are attributable to meal preparation activities.

75% of €2,400,000 = €1,800,000

Other entries in the table are determined in a similar manner.

Problem 8-23 (continued)

2. The activity rates at the CDG operation are:

	Meal Preparation	*Flight-Related*	*Customer Service*
Activity at CDG	1,000,000 meals	5,000 flights	10 airlines
Cooks and delivery personnel wages.....	€1.800	€ 96.00	
Kitchen supplies.....	0.030		
Chef salaries.....	0.054	7.20	€7,200
Equipment depreciation.....	0.036		
Administrative wages and salaries		6.00	9,000
Building costs			
Total cost	€1.920	€109.20	€16,200

Example: €1,800,000 ÷ 1,000,000 meals = €1.80 per meal

Cooks and delivery personnel wages attributable to meal preparation from the first-stage allocation.

Problem 8-23 (continued)

3. Managers should be cautious when comparing operations using activity-based costing data—particularly when the activity-based costing data rely on interviews. Nevertheless, comparisons of the data can provide insights and may suggest where it would be fruitful to investigate further. In this case, side-by-side comparison of the Orly and CDG activity rates reveals that the cost per meal and cost per flight is less at CDG than at Orly, but the cost per airline for customer service activities is higher at CDG than at Orly. This suggests that Orly might have something to learn from CDG concerning meal preparation and flight-related activities, but CDG may be able to learn from Orly concerning customer service activities.

   Overall, CDG seems to be more efficient than Orly by about €26,000 as shown in the table below.

	CDG	*Orly*	*Difference*	*Activity at CDG*	*Difference × Activity at CDG*
Meal preparation (per meal).....	€1.92	€1.98	€0.06	1,000,000 meals	€60,000
Flight-related (per flight)	€109.20	€115.60	€6.40	5,000 flights	€32,000
Customer service (per airline)	€16,200	€9,600	(€6,600)	10 airlines	(€66,000)
Total.....					€26,000

Problem 8-24 (45 minutes)

1. The first-stage allocation of costs to activity cost pools appears below:

	Distribution of Resource Consumption Across Activity Cost Pools				
	Cleaning Carpets	*Travel to Jobs*	*Job Support*	*Other*	*Total*
Wages	70%	20%	0%	10%	100%
Cleaning supplies	100%	0%	0%	0%	100%
Cleaning equipment depreciation	80%	0%	0%	20%	100%
Vehicle expenses	0%	60%	0%	40%	100%
Office expenses	0%	0%	45%	55%	100%
President's compensation	0%	0%	40%	60%	100%

	Cleaning Carpets	*Travel to Jobs*	*Job Support*	*Other*	*Total*
Wages	$105,000	$30,000	$ 0	$ 15,000	$150,000
Cleaning supplies	40,000	0	0	0	40,000
Cleaning equipment depreciation	16,000	0	0	4,000	20,000
Vehicle expenses	0	48,000	0	32,000	80,000
Office expenses	0	0	27,000	33,000	60,000
President's compensation	0	0	32,000	48,000	80,000
Total cost	$161,000	$78,000	$59,000	$132,000	$430,000

Example: 70% of $150,000 = $105,000
Other entries in the table are determined in a similar manner.

Problem 8-24 (continued)

2. The activity rates are computed as follows:

Activity Cost Pool	*(a) Total Cost*	*(b) Total Activity*	*(a) ÷ (b) Activity Rate*
Cleaning carpets ..	$161,000	20,000 hundred square feet	$8.05 per hundred square feet
Travel to jobs	$78,000	60,000 miles	$1.30 per mile
Job support	$59,000	2,000 jobs	$29.50 per job

3. The cost for the Flying N Ranch job is computed as follows:

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Cleaning carpets ...	$8.05 per hundred square feet	5 hundred square feet	$ 40.25
Travel to jobs	$1.30 per mile	75 miles	97.50
Job support	$29.50 per job	1 job	29.50
Total			$167.25

4. The product margin can be easily computed by using the costs calculated in part (3) above.

Sales		$140.00
Costs:		
Cleaning carpets	$40.25	
Travel to jobs	97.50	
Job support	29.50	167.25
Product margin		($ 27.25)

Problem 8-24 (continued)

5. Gallatin Carpet Cleaning appears to be losing money on the Flying N Ranch job. However, caution is advised. Some of the costs may not be avoidable and hence would have been incurred even if the Flying N Ranch job had not been accepted. An action analysis (discussed in Appendix 8A) is a more appropriate starting point for analysis than the simple report in part (4) above.

   Nevertheless, there is a point at which travel costs eat up all of the profit from a job. With the company's current policy of charging a flat fee for carpet cleaning irrespective of how far away the client is from the office, there clearly is some point at which jobs should be turned down. (What if a potential customer is located in Florida?)

6. The company should consider charging a fee for travel to outlying customers based on the distance traveled and a flat fee per job. At present, close-in customers are in essence subsidizing service to outlying customers and large-volume customers are subsidizing service to low-volume customers. With fees for travel and for job support, the fee per hundred square feet can be dropped substantially. This may result in losing some low-volume jobs in outlying areas, but the lower fee per hundred square feet may result in substantially more business close to Bozeman. (If the fee is low enough, the added business may not even have to come at the expense of competitors. Some customers may choose to clean their carpets more frequently if the price were more attractive.)

Problem 8-25 (75 minutes)

1. The first-stage allocation of costs to activity cost pools appears below:

	Distribution of Resource Consumption Across Activity Cost Pools				
	Cleaning Carpets	*Travel to Jobs*	*Job Support*	*Other*	*Total*
Wages	70%	20%	0%	10%	100%
Cleaning supplies	100%	0%	0%	0%	100%
Cleaning equipment depreciation	80%	0%	0%	20%	100%
Vehicle expenses	0%	60%	0%	40%	100%
Office expenses	0%	0%	45%	55%	100%
President's compensation	0%	0%	40%	60%	100%

	Cleaning Carpets	*Travel to Jobs*	*Job Support*	*Other*	*Total*
Wages	$105,000	$30,000	$ 0	$ 15,000	$150,000
Cleaning supplies	40,000	0	0	0	40,000
Cleaning equipment depreciation	16,000	0	0	4,000	20,000
Vehicle expenses	0	48,000	0	32,000	80,000
Office expenses	0	0	27,000	33,000	60,000
President's compensation	0	0	32,000	48,000	80,000
Total cost	$161,000	$78,000	$59,000	$132,000	$430,000

Example: 70% of $150,000 = $105,000
Other entries in the table are determined in a similar manner.

Problem 8-25 (continued)

2. The activity rates are computed as follows:

	Cleaning Carpets	*Travel to Jobs*	*Job Support*
Total activity	20,000 hundred square feet	60,000 miles driven	2,000 jobs
Wages	$5.25	$0.50	
Cleaning supplies	2.00		
Cleaning equipment depreciation	0.80		
Vehicle expenses		0.80	
Office expenses			$13.50
President's compensation	0.00	0.00	16.00
Total cost	$8.05	$1.30	$29.50

Example: $105,000 ÷ 20,000 hundred square feet = $5.25 per hundred square feet

Wages attributable to cleaning carpets from the first-stage allocation above.

Problem 8-25 (continued)

3. The cost for the Flying N Ranch job is computed as follows:

	Cleaning Carpets	*Travel to Jobs*	*Job Support*	*Total*
Activity for the Flying N job	5 hundred square feet	75 miles driven	1 job	
Wages	$26.25	$37.50		$63.75
Cleaning supplies	10.00			10.00
Cleaning equipment depreciation	4.00			4.00
Vehicle expenses		60.00		60.00
Office expenses			$13.50	13.50
President's compensation	0.00	0.00	16.00	16.00
Total cost	$40.25	$97.50	$29.50	$167.25

Example: $5.25 per hundred square feet × 5 hundred square feet = $26.25

Activity rate for wages and cleaning carpets.

Problem 8-25 (continued)

4. The product margin can be easily computed using the costs along the right-most column of the cost table prepared in part (3).

Sales		$140.00
Green costs:		
Wages	$63.75	
Cleaning supplies	10.00	
Cleaning equipment depreciation	4.00	
Vehicle expenses	60.00	137.75
Green margin		2.25
Yellow costs:		
Office expenses	13.50	13.50
Yellow margin		(11.25)
Red costs:		
President's compensation	16.00	16.00
Red margin		($ 27.25)

5. At most, Gallatin Carpet Cleaning is making only $2.25 on the Flying N Ranch job. If more than $2.25 of the $13.50 in Office Expenses are actually avoidable if the job were not accepted, then the job is actually losing money.

   There is a point at which travel costs eat up all of the profit from a job. With the company's current policy of charging a flat fee for carpet cleaning irrespective of how far away the client is from the office, there clearly is some point at which jobs should be turned down. (What if a potential customer is located in Florida?)

Problem 8-25 (continued)

6. The company should consider charging a fee for travel to outlying customers based on the distance traveled and a flat fee per job. At present, close-in customers are in essence subsidizing service to outlying customers and large-volume customers are subsidizing service to low-volume customers. With fees for travel and for job support, the fee per hundred square feet can be dropped substantially. This may result in losing some low-volume jobs in outlying areas, but the lower fees per hundred square feet may result in substantially more business close to Bozeman. (If the fees are low enough, the added business may not even have to come at the expense of competitors. Some customers may choose to clean their carpets more frequently if the price were more attractive.)

   Before making such a radical change, the data should be carefully reviewed. For example, the wage cost of $37.50 for a 75-mile trip seems rather high. Are two people sent out on jobs? Can the remote jobs be done with one person?

Problem 8-26 (60 minutes)

1. a. When direct labor-hours are used to apply overhead cost to products, the company's predetermined overhead rate would be:

$$\text{Predetermined overhead rate} = \frac{\text{Manufacturing overhead cost}}{\text{Direct labor-hours}}$$

$$= \frac{\$1{,}800{,}000}{36{,}000\text{DLHs}} = \$50 \text{ per DLH}$$

b.

	Model	
	X200	*X99*
Direct materials	$ 72	$ 50
Direct labor:		
$10 per hour × 1.8 hours and 0.9 hours	18	9
Manufacturing overhead:		
$50 per hour × 1.8 hours and 0.9 hours	90	45
Total unit product cost	$180	$104

2. a. Predetermined overhead rates for the activity cost pools:

Activity Cost Pool	*(1) Total Cost*	*(2) Total Activity*	*(1) ÷ (2) Activity Rate*
Machine setups	$ 360,000	150 setups	$2,400 per setup
Special processing	180,000	12,000 MHs	$15 per MH
General factory	1,260,000	36,000 DLHs	$35 per DLH

The manufacturing overhead cost that would be applied to each model:

	Model	
	X200	*X99*
Machine setups:		
$2,400 per setup × 50 setups, 100 setups	$120,000	$ 240,000
Special processing:		
$15 per MH × 12,000 MHs	180,000	—
General factory:		
$35 per DLH × 9,000 DLH, 27,000 DLH	315,000	945,000
Total manufacturing overhead cost applied	$615,000	$1,185,000

Problem 8-26 (continued)

b. Before we can determine the unit product cost under activity-based costing, we must first take the overhead costs applied to each model in part 2(a) above and express them on a per-unit basis:

	Model	
	X200	*X99*
Total overhead cost applied (a)	$615,000	$1,185,000
Number of units produced (b)	5,000	30,000
Manufacturing overhead cost per unit (a) ÷ (b)	$123	$39.50

With this information, the unit product cost of each model under activity-based costing would be computed as follows:

	Model	
	X200	*X99*
Direct materials	$72.00	$50.00
Direct labor:		
$10 per DLH × 1.8 DLHs, 0.9 DLHs	18.00	9.00
Manufacturing overhead (above)	123.00	39.50
Total unit product cost	$213.00	$98.50

Comparing these unit cost figures with the unit costs in Part 1(b), we find that the unit product cost for Model X200 has increased from $180 to $213, and the unit product cost for Model X99 has decreased from $104 to $98.50.

3. It is especially important to note that, even under activity-based costing, 70% of the company's overhead costs continue to be applied to products on the basis of direct labor-hours:

Machine setups (number of setups)	$ 360,000	20%
Special processing (machine-hours)	180,000	10
General factory (direct labor-hours)	1,260,000	70
Total overhead cost	$1,800,000	100%

Thus, the shift in overhead cost from the high-volume product (Model X99) to the low-volume product (Model X200) occurred as a result of reassigning only 30% of the company's overhead costs.

Problem 8-26 (continued)

The increase in unit product cost for Model X200 can be explained as follows: First, where possible, overhead costs have been traced to the products rather than being lumped together and spread uniformly over production. Therefore, the special processing costs, which are traceable to Model X200, have all been assigned to Model X200 and none assigned to Model X99 under the activity-based costing approach. It is common in industry to have some products that require special handling or special processing of some type. This is especially true in modern factories that produce a variety of products. Activity-based costing provides a vehicle for assigning these costs to the appropriate products.

Second, the costs associated with the batch-level activity (machine setups) have also been assigned to the specific products to which they relate. These costs have been assigned according to the number of setups completed for each product. However, since a batch-level activity is involved, another factor affecting unit costs comes into play. That factor is batch size. Some products are produced in large batches and some are produced in small batches. *The smaller the batch, the higher the per unit cost of the batch activity.* In the case at hand, the data can be analyzed as follows:

Model X200:		
Cost to complete one setup [see 2(a)]	$2,400	(a)
Number of units processed per setup (5,000 units per setup ÷ 50 setups = 100 units)	100 units	(b)
Setup cost per unit (a) ÷ (b)	$24	
Model X99:		
Cost to complete one setup (above).....	$2,400	(a)
Number of units processed per setup (30,000 units per setup ÷ 100 setups = 300 units).....	300 units	(b)
Setup cost per unit (a) ÷ (b)	$8	

Problem 8-26 (continued)

Thus, the cost per unit for setups is three times as great for Model X200, the low-volume product, as it is for Model X99, the high-volume product. Such differences in cost are obscured when direct labor-hours (or any other volume measure) is used as a basis for applying overhead cost to products.

In sum, overhead cost has shifted from the high-volume product to the low-volume product as a result of more appropriately assigning some costs to the products on the basis of the activities involved, rather than on the basis of direct labor-hours.

Problem 8-27 (45 minutes)

1. The results of the first-stage allocation appear below:

	Job Size	*Estimating and Job Setup*	*Working on Nonroutine Jobs*	*Other*	*Totals*
Wages and salaries	$150,000	$ 30,000	$ 90,000	$ 30,000	$ 300,000
Disposal fees	420,000	0	280,000	0	700,000
Equipment depreciation	36,000	4,500	18,000	31,500	90,000
On-site supplies	30,000	15,000	5,000	0	50,000
Office expenses	20,000	70,000	50,000	60,000	200,000
Licensing and insurance....	120,000	0	200,000	80,000	400,000
Total cost	$776,000	$119,500	$643,000	$201,500	$1,740,000

According to the data in the problem, 50% of the wages and salaries cost of $300,000 is attributable to activities related to job size.

$300,000 × 50% = $150,000

Other entries in the table are determined in a similar manner.

2.

Activity Cost Pool	*(a) Total Cost*	*(b) Total Activity*	*(a) ÷ (b) Activity Rate*
Job size.....	$776,000	800 thousand square feet	$970 per thousand square feet
Estimating and job setup.....	$119,500	500 jobs	$239 per job
Working on non-routine jobs	$643,000	100 nonroutine jobs	$6,430 per nonroutine job

Problem 8-27 (continued)

3. The costs of each of the jobs can be computed as follows using the activity rates computed above:

a. *Routine one thousand square feet job:*

Job size (1 thousand square feet @ $970 per thousand square feet).....	$ 970.00
Estimating and job setup (1 job @ $239 per job).....	239.00
Nonroutine job (not applicable).....	0
Total cost of the job.....	$1,209.00
Cost per thousand square feet ($1,209 ÷ 1 thousand square feet).....	$1,209.00

b. *Routine two thousand square feet job:*

Job size (2 thousand square feet @ $970 per thousand square feet).....	$1,940.00
Estimating and job setup (1 job @ $239 per job).....	239.00
Nonroutine job (not applicable).....	0
Total cost of the job.....	$2,179.00
Cost per thousand square feet ($2,179 ÷ 2 thousand square feet).....	$1,089.50

c. *Nonroutine two thousand square feet job:*

Job size (2 thousand square feet @ $970 per thousand square feet).....	$1,940.00
Estimating and job setup (1 job @ $239 per job).....	239.00
Nonroutine job	6,430.00
Total cost of the job.....	$8,609.00
Cost per thousand square feet ($8,609 ÷ 2 thousand square feet).....	$4,304.50

Problem 8-27 (continued)

4. The objectivity of the interview data can be questioned since the on-site work supervisors were undoubtedly trying to prove their case about the cost of nonroutine jobs. Nevertheless, the activity-based costing data certainly suggest that dramatic differences exist in the costs of jobs. While some of the costs may be difficult to adjust in response to changes in activity, it does appear that the standard bid of $2,500 per thousand square feet may be substantially under the company's cost for nonroutine jobs. Even though it may be difficult to detect nonroutine situations before work begins, the average additional cost of $6,430 for nonroutine work suggests that the estimator should try. And if a non-routine situation is spotted, this should be reflected in the bid price.

   Savvy competitors are likely to bid less than $2,500 per thousand square feet on routine work and substantially more than $2,500 per thousand square feet on nonroutine work. Consequently, Mercer Asbestos Removal may find that its product mix shifts toward nonroutine work and away from routine work as customers accept bids on nonroutine work from the company and go to competitors for routine work. This may have a disastrous effect on the company's profits.

Problem 8-28 (20 minutes)

1. The cost of serving the local commercial market according to the ABC model can be determined as follows:

Activity Cost Pool	*(a) Activity Rate*	*(b) Activity*	*(a) × (b) ABC Cost*
Animation concept	$6,040 per proposal	25 proposals	$151,000
Animation production	$7,725 per minute of animation	5 minutes	38,625
Contract administration ...	$6,800 per contract	10 contracts	68,000
			$257,625

2. The product margin of the local commercial market is negative, as shown below:

Product Profitability Analysis		
Sales.....		$180,000
Costs:		
Animation concept	$151,000	
Animation production	38,625	
Contract administration	68,000	257,625
Product margin		($77,625)

3. It appears that the local commercial market is losing money and the company would be better off dropping this market segment. However, as discussed in Problem 8-29, not all of the costs included above may be avoidable. If more than $77,625 of the total costs of $257,625 is not avoidable, then the company really isn't losing money on the local commercial market and the segment should not be dropped. These issues will be discussed in more depth in Chapters 12 and 13.

Problem 8-29 (30 minutes)

1. The detailed cost analysis of local commercials appears below:

	Activity Rates		
	Animation Concept	*Animation Production*	*Contract Administration*
Technical staff salaries	$4,000	$6,000	$1,600
Animation equipment depreciation	360	1,125	0
Administrative wages and salaries	1,440	150	4,800
Supplies costs	120	300	160
Facility costs	120	150	240
Total	$6,040	$7,725	$6,800

	Animation Concept	*Animation Production*	*Contract Administration*	*Total*
Activity level	25 proposals	5 minutes	10 contracts	
Technical staff salaries	$100,000	$30,000	$16,000	$146,000
Animation equipment depreciation	9,000	5,625	0	14,625
Administrative wages and salaries	36,000	750	48,000	84,750
Supplies costs	3,000	1,500	1,600	6,100
Facility costs	3,000	750	2,400	6,150
Total cost	$151,000	$38,625	$68,000	$257,625

Example: $4,000 per proposal × 25 proposals = $100,000

Problem 8-29 (continued)

2. The action analysis report is constructed by using the row totals from the cost report in part (1) above:

Sales		$180,000
Green costs:		
Supplies costs	$ 6,100	6,100
Green margin		173,900
Yellow costs:		
Administrative wages and salaries	84,750	84,750
Yellow margin		89,150
Red costs:		
Technical staff salaries	146,000	
Animation equipment depreciation	14,625	
Facility costs	6,150	166,775
Red margin		($77,625)

Problem 8-29 (continued)

3. At first glance, it appears that the company is losing money on local commercials. However, the action analysis report indicates that if this market segment were dropped, most of the costs are likely to continue being incurred. The nature of the technical staff salaries is clearly critical since it makes up the bulk of the costs. Management has suggested that the technical staff are the company's most valuable asset and that they would be the last to go in case of financial difficulties. Nevertheless, there are at least two situations in which these costs would be relevant. First, dropping the local commercial market segment may reduce future hiring of new technical staff. This would have the effect of reducing future spending and therefore would reduce the company's costs. Second, if technical staff time is a constraint, dropping the local commercial market segment would allow managers to shift technical staff time to other, presumably more profitable, work. However, if this is the case, there are better ways to determine which projects should get technical staff attention. This subject will be covered in Chapter 13 in the section on utilization of scarce resources.

   Finally, the cost of the animation concept at the proposal stage is a major drag on the profitability of the local commercial market. The activity-based costing system, as currently designed, assumes that all project proposals require the same effort. This may not be the case. Proposals for local commercials may be far less elaborate than proposals for major special effects animation sequences for motion pictures. If management *has* been putting about the same amount of effort into every proposal, the above activity-based costing analysis suggests that this may be a mistake. Management may want to consider cutting back on the effort going into animation concepts for local commercials at the project proposal stage. Of course, this may lead to an even lower success rate on bids for local commercials.

Problem 8-30 (45 minutes)

1. The company expects to work 40,000 direct labor-hours, computed as follows:

Mono-relay: 40,000 units × 0.75 DLH per unit.....	30,000 DLHs
Bi-relay: 10,000 units × 1.0 DLH per unit.....	10,000 DLHs
Total.....	40,000 DLHs

Using direct labor-hours as the base, the predetermined manufacturing overhead rate would be:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated manufacturing overhead cost}}{\text{Estimated direct labor-hours}}$$

$$= \frac{\$1{,}000{,}000}{40{,}000 \text{ DLHs}} = \$25 \text{ per DLH}$$

The unit product cost of each product would be:

	Mono-relay	*Bi-relay*
Direct materials (given)	$35.00	$48.00
Direct labor (given)	9.00	12.00
Manufacturing overhead:		
$25 per DLH × 0.75 DLH, 1.0 DLH....	18.75	25.00
Total unit product cost.....	$62.75	$85.00

2. The predetermined overhead rates would be computed as follows:

Activity	*(a) Estimated Overhead Costs*	*(b) Expected Activity*	*(a) ÷ (b) Predetermined Overhead Rate*
Maintaining parts inventory.....	$180,000	225 part types	$800 per part type
Processing purchase orders.....	$90,000	1,000 orders	$90 per order
Quality control.....	$230,000	5,750 tests	$40 per test
Machine related.....	$500,000	10,000 MHs	$50 per MH

Problem 8-30 (continued)

3. a.

	Mono-relay		*Bi-relay*	
	Activity	*Amount*	*Activity*	*Amount*
Maintaining parts inventory, at $800 per part type	75	$ 60,000	150	$120,000
Processing purchase orders, at $90 per order	800	72,000	200	18,000
Quality control, at $40 per test	2,500	100,000	3,250	130,000
Machine related, at $50 per machine-hour	4,000	200,000	6,000	300,000
Total manufacturing overhead cost		$432,000		$568,000

Manufacturing overhead cost per unit of each product:

Mono-relay: $432,000 ÷ 40,000 units = $10.80 per unit
Bi-relay: $568,000 ÷ 10,000 units = $56.80 per unit

b. Using activity-based costing, the unit product cost of each product would be:

	Mono-relay	*Bi-relay*
Direct materials	$35.00	$ 48.00
Direct labor	9.00	12.00
Manufacturing overhead (above)	10.80	56.80
Total unit product cost	$54.80	$116.80

Problem 8-30 (continued)

4. Although the bi-relay accounts for only 20% of the company's total production, it is responsible for two-thirds of the part types carried in inventory and 60% of the machine-hours worked. It is also responsible for well over half of the tests needed for quality control. These factors have been concealed as a result of using direct labor-hours as the base for assigning overhead cost to products. Since the bi-relay is responsible for a majority of the activity, under activity-based costing it is assigned a larger amount of overhead cost.

   Managers should be cautious about drawing firm conclusions about the profitability of products from the above activity-based cost analysis. The ABC system used in this company is not completely suitable for making decisions. Product costs probably include costs of idle capacity and organization-sustaining costs. They also exclude nonmanufacturing costs that may be caused by the products. Nevertheless, the above analysis is suggestive. The bi-relay may not be as profitable as management believes, and this may be the reason for the company's declining profits. Note that from part (1), the unit product cost of the bi-relay is $85. In part (3), however, the activity-based costing system sets the unit product cost of the bi-relay at $116.80. This is a difference of $31.80 per unit. If the $85 cost figure is being used as the base for determining a selling price for the bi-relay, the company may be losing money on this product.

Case 8-31 (90 minutes)

1. a. The predetermined overhead rate would be computed as follows:

$$\frac{\text{Expected manufacturing overhead cost}}{\text{Estimated direct labor-hours}} = \frac{\$2{,}200{,}000}{50{,}000 \text{ DLHs}}$$

$$= \$44 \text{ per DLH}$$

   b. The unit product cost per pound, using the company's present costing system, would be:

	Kenya Dark	*Viet Select*
Direct materials (given)	$4.50	$2.90
Direct labor (given)	0.24	0.24
Manufacturing overhead:		
0.02 DLH × $44 per DLH.....	0.88	0.88
Total unit product cost.....	$5.62	$4.02

2. a. Overhead rates by activity center:

Activity Center	*(a) Estimated Overhead Costs*	*(b) Expected Activity*	*(a) ÷ (b) Predetermined Overhead Rate*
Purchasing	$560,000	2,000 orders	$280 per order
Material handling ..	$193,000	1,000 setups	$193 per setup
Quality control.....	$90,000	500 batches	$180 per batch
Roasting	$1,045,000	95,000 roasting hours	$11 per roasting hour
Blending.....	$192,000	32,000 blending hours	$6 per blending hour
Packaging	$120,000	24,000 packaging hours	$5 per packaging hour

Case 8-31 (continued)

Before we can determine the amount of overhead cost to assign to the products we must first determine the activity for each of the products in the six activity centers. The necessary computations follow:

Number of purchase orders:
Kenya Dark: 80,000 pounds ÷ 20,000 pounds per order = 4 orders
Viet Select: 4,000 pounds ÷ 500 pounds per order = 8 orders

Number of batches:
Kenya Dark: 80,000 pounds ÷ 5,000 pounds per batch = 16 batches
Viet Select: 4,000 pounds ÷ 500 pounds per batch = 8 batches

Number of setups:
Kenya Dark: 16 batches × 2 setups per batch = 32 setups
Viet Select: 8 batches × 2 setups per batch = 16 setups

Roasting hours:
Kenya Dark: 80,000 pounds × 1.5 roasting hours per 100 pounds = 1,200 roasting hours
Viet Select: 4,000 pounds × 1.5 roasting hours per 100 pounds = 60 roasting hours

Blending hours:
Kenya Dark: 80,000 pounds × 0.5 blending hours per 100 pounds = 400 blending hours
Viet Select: 4,000 pounds × 0.5 blending hours per 100 pounds = 20 blending hours

Packaging hours:
Kenya Dark: 80,000 pounds × 0.3 packaging hours per 100 pounds = 240 packaging hours
Viet Select: 4,000 pounds × 0.3 packaging hours per 100 pounds = 12 packaging hours

Case 8-31 (continued)

Using the activity figures, manufacturing overhead costs can be assigned to the two products as follows:

Kenya Dark

	Activity Rate	*Expected Activity*	*Amount*
Purchasing	$280 per order	4 orders	$ 1,120
Material handling	$193 per setup	32 setups	6,176
Quality control	$180 per batch	16 batches	2,880
Roasting.....	$11 per roasting hour	1,200 roasting hours	13,200
Blending.....	$6 per blending hour	400 blending hours	2,400
Packaging	$5 per packaging hour	240 packaging hours	1,200
Total overhead cost ...			$26,976

Viet Select

	Activity Rate	*Expected Activity*	*Amount*
Purchasing	$280 per order	8 orders	$2,240
Material handling	$193 per setup	16 setups	3,088
Quality control	$180 per batch	8 batches	1,440
Roasting.....	$11 per roasting hour	60 roasting hours	660
Blending.....	$6 per blending hour	20 blending hours	120
Packaging	$5 per packaging hour	12 packaging hours	60
Total overhead cost ...			$7,608

Case 8-31 (continued)

b. According to the activity-based costing system, the manufacturing overhead cost per pound is:

	Kenya Dark	*Viet Select*
Total overhead cost assigned (above) (a).....	$26,976	$7,608
Number of pounds manufactured (b)	80,000	4,000
Cost per pound (a) ÷ (b)	$0.34	$1.90

c. The unit product costs according to the activity-based costing system are:

	Kenya Dark	*Viet Select*
Direct materials (given)	$4.50	$2.90
Direct labor (given)	0.24	0.24
Manufacturing overhead	0.34	1.90
Total unit product cost.....	$5.08	$5.04

3. MEMO TO THE PRESIDENT: Analysis of JSI's data shows that several activities other than direct labor drive the company's manufacturing overhead costs. These activities include purchase orders issued, number of setups for material processing, and number of batches processed. The company's present costing system, which relies on direct labor time as the sole basis for assigning overhead cost to products, significantly undercosts low-volume products, such as the Viet Select coffee, and significantly overcosts high-volume products, such as our Kenya Dark coffee.

   An implication of the activity-based costing analysis is that our low-volume products may not be covering the costs of the manufacturing resources they use. For example, Viet Select coffee is currently priced at $5.03 per pound ($4.02 plus 25% markup), but this price is below its activity-based cost of $5.08 per pound. Under our present costing and pricing system, our high-volume products, such as our Kenya Dark coffee, may be subsidizing our low-volume products. Some adjustments in prices may be required. However, before taking such an action, an action analysis report (discussed in Appendix 8A) should be prepared.

Case 8-31 (continued)

ALTERNATIVE SOLUTION:

Most students will compute the manufacturing overhead cost per pound of the two coffees as shown above. However, the per pound cost can also be computed as shown below. *This alternative approach provides additional insight into the data and facilitates emphasis of some points made in the chapter.*

	Kenya Dark		*Viet Select*	
	Total	*Per Pound (÷ 80,000)*	*Total*	*Per Pound (÷ 4,000)*
Purchasing.....	$ 1,120	$0.014	$2,240	$0.560
Material handling....	6,176	0.077	3,088	0.772
Quality control	2,880	0.036	1,440	0.360
Roasting	13,200	0.165	660	0.165
Blending	2,400	0.030	120	0.030
Packaging.....	1,200	0.015	60	0.015
Total	$26,976	$0.337	$7,608	$1.902

Note particularly how batch size impacts unit cost data. For example, the cost to the company to process a purchase order is $280, regardless of how many pounds of coffee are contained in the order. Twenty thousand pounds of the Kenya Dark coffee are purchased per order (with four orders per year), and just 500 pounds of the Viet Select coffee are purchased per order (with eight orders per year). Thus, the purchase order cost *per pound* for the Kenya Dark coffee is just 1.4 cents, whereas the purchase order cost *per pound* for the Viet Select coffee is 40 times as much, or 56 cents. As stated in the text, this is one reason why unit costs of low-volume products, such as the Viet Select coffee, increase so dramatically when activity-based costing is used.

Case 8-32 (90 minutes)

1. The total direct labor-hours worked for the year would be:

X-20:	30,000 units × 2 DLHs per unit	60,000
Y-30:	5,000 units × 3 DLHs per unit	15,000
	Total DLHs.....	75,000

The predetermined overhead rate for the year would therefore be:

$$\frac{\text{Manufacturing overhead cost}}{\text{Direct labor-hours}} = \frac{\$1{,}800{,}000}{75{,}000 \text{ DLHs}}$$

$$= \$24 \text{ per DLH}$$

2. The unit product costs would be:

	X-20	*Y-30*
Direct materials (given)	$50	$80
Direct labor (given)	24	36
Manufacturing overhead:		
$24 per DLH × 2 DLHs per unit, 3 DLHs per unit.....	48	72
Total unit product cost.....	$122	$188

3. This part of the case is open-ended, but students should provide data such as given below.

Overhead rates for the activities are:

Activity	*(a) Estimated Overhead Costs*	*(b) Expected Activity*	*(a) ÷ (b) Predetermined Overhead Rate*
Machine setups ..	$208,000	1,600 setups	$130.00 per setup
Quality control ...	$360,000	9,000 inspections	$40.00 per inspection
Purchase orders .	$90,000	1,200 orders	$75.00 per order
Soldering.....	$450,000	200,000 joints	$2.25 per joint
Shipments	$132,000	600 shipments	$220.00 per shipment
Machine related .	$560,000	70,000 MHs	$8.00 per MH

Case 8-32 (continued)

Overhead cost assigned to each product:

X-20

	Activity Rate	*Expected Activity*	*Amount*
Machine setups	$130.00 per setup	1,000 setups	$130,000
Quality inspections	$40.00 per inspection	4,000 inspections	160,000
Purchase orders	$75.00 per order	840 orders	63,000
Soldering	$2.25 per joint	60,000 joints	135,000
Shipments	$220.00 per shipment	400 shipments	88,000
Machine related	$8.00 per MH	30,000 MHs	240,000
Total overhead cost (a)			$816,000
Number of units produced (b)			30,000
Overhead cost per unit (a) ÷ (b)			$27.20

Y-30

	Activity Rate	*Expected Activity*	*Amount*
Machine setups	$130.00 per setup	600 setups	$ 78,000
Quality inspections	$40.00 per inspection	5,000 inspections	200,000
Purchase orders	$75.00 per order	360 orders	27,000
Soldering	$2.25 per joint	140,000 joints	315,000
Shipments	$220.00 per shipment	200 shipments	44,000
Machine related	$8.00 per MH	40,000 MHs	320,000
Total overhead cost (a)			$984,000
Number of units produced (b)			5,000
Overhead cost per unit (a) ÷ (b)			$196.80

Case 8-32 (continued)

The unit product cost of each product under activity-based costing is given below. For comparison, the costs computed in part 2 above are also provided.

	Activity-Based Costing		*Direct Labor-Hour Base*	
	X-20	*Y-30*	*X-20*	*Y-30*
Direct materials.....	$ 50.00	$ 80.00	$ 50.00	$ 80.00
Direct labor.....	24.00	36.00	24.00	36.00
Manufacturing overhead	27.20	196.80	48.00	72.00
Total unit product cost.....	$101.20	$312.80	$122.00	$188.00

As shown by the above analysis, unit product costs may have been distorted as a result of using direct labor-hours as the base for assigning overhead costs to products. These distorted costs may have had a major impact on management's pricing policies and on management's perception of the margin being realized on each product. According to the activity-based costing approach, Model Y-30 is being sold at a loss:

	Activity-Based Costing		*Direct Labor-Hour Base*	
	X-20	*Y-30*	*X-20*	*Y-30*
Selling price per unit*	$200.00	$250.00	$200.00	$250.00
Less unit product cost (above).....	101.20	312.80	122.00	188.00
Gross margin (loss)	$ 98.80	($62.80)	$ 78.00	$ 62.00

*Total sales ÷ the number of units sold.

4. It is not surprising that the Y-30 "sells itself" since the company is selling it at an apparent loss of $62.80. This probably explains why Branson Company couldn't meet Cutler Products' price.

   In addition, Cutler Products' distorted unit costs explain why Branson Company is able to undercut Cutler's price on the X-20 units. Cutler's management *thinks* that the X-20 costs more to manufacture than it really does according to the activity-based costing system.

Case 8-32 (continued)

5. Students may suggest many possible strategies—there is no single "right" answer. Two possible strategies are: (a) raise the selling price of the Y-30 enough to provide a satisfactory margin; and (b) discontinue the Y-30 and focus all available resources on the X-20. The price of the X-20 might even be decreased to increase the volume of sales, if the company has adequate capacity to do so. Before taking any action, an action analysis report should be prepared as discussed in Appendix 8A.

Case 8-33 (120 minutes)

1. a. The predetermined overhead rate is computed as follows:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated manufacturing overhead cost}}{\text{Estimated direct labor-hours}}$$

$$= \frac{\$780{,}000}{100{,}000 \text{ DLHs}} = \$7.80 \text{ per DLH}$$

b. The margins for the windows ordered by the two customers are computed as follows under the traditional costing system:

	Kuszik Builders		*Western Homes*	
Sales		$12,500		$68,000
Costs:				
Direct materials	$4,200		$18,500	
Direct labor	5,400		36,000	
Manufacturing overhead (@ $7.80 per DLH)	2,340	11,940	15,600	70,100
Margin		$ 560		($ 2,100)

Case 8-33 (continued)

2. a. The first-stage allocation of costs to activity cost pools appears below:

	Making Windows	*Process-ing Orders*	*Customer Relations*	*Other*	*Totals*
Indirect factory wages	$120,000	$160,000	$ 40,000	$ 80,000	$400,000
Production equipment depreciation	270,000	0	0	30,000	300,000
Other factory costs	24,000	0	0	56,000	80,000
Administrative wages and salaries	0	60,000	90,000	150,000	300,000
Office expenses	0	12,000	4,000	24,000	40,000
Marketing expenses	0	0	150,000	100,000	250,000
Total cost	$414,000	$232,000	$284,000	$440,000	$1,370,000

According to the data in the problem, 30% of the indirect factory wages are attributable to activities associated with making windows.

30% of $400,000 = $120,000

The other entries in the table are determined in a similar manner.

Case 8-33 (continued)

2. b. The activity rates are computed as follows:

	Making Windows	*Processing Orders*	*Customer Relations*
Total activity.....	100,000 DLHs	2,000 orders	100 customers
Indirect factory wages.....	$1.20	$80.00	$ 400.00
Production equipment depreciation ...	2.70		
Other factory costs.....	0.24		
Administrative wages and salaries.....		30.00	900.00
Office expenses		6.00	40.00
Marketing expenses	0.00	0.00	1,500.00
Total cost.....	$4.14	$116.00	$2,840.00

Example: $120,000 ÷ 100,000 DLHs = $1.20 per DLH

Indirect factory wages attributable to the activity making windows from the first-stage allocation above.

Case 8-33 (continued)

2. c. The overhead cost of serving Kuszik Builders is computed as follows:

	Making Windows	*Processing Orders*	*Customer Relations*	*Total*
Activity for Kuszik Builders	300 DLHs	2 orders	1 customer	
Indirect factory wages	$ 360	$160	$ 400	$ 920
Production equipment depreciation	810			810
Other factory costs	72			72
Administrative wages and salaries		60	900	960
Office expenses		12	40	52
Marketing expenses	0	0	1,500	1,500
Total cost	$1,242	$232	$2,840	$4,314

Example: $1.20 per DLH × 300 DLHs = $360

Activity rate for indirect wages for the activity making windows.

Case 8-33 (continued)

The overhead cost of serving Western Homes is computed as follows:

	Making Windows	*Processing Orders*	*Customer Relations*	*Total*
Activity for Western Homes.....	2,000 DLHs	3 orders	1 customer	
Indirect factory wages.....	$2,400	$240	$ 400	$ 3,040
Production equipment depreciation....	5,400			5,400
Other factory costs.....	480			480
Administrative wages and salaries		90	900	990
Office expenses		18	40	58
Marketing expenses.....	0	0	1,500	1,500
Total cost	$8,280	$348	$2,840	$11,468

Example: $1.20 per DLH × 2,000 DLHs = $2,400

Activity rate for indirect wages for the activity making windows.

Case 8-33 (continued)

2. d. The action analyses can be constructed using the row totals from the overhead cost analysis in part (2c) above.

Kuszik Builders		
Sales		$12,500
Green costs:		
Direct materials	$4,200	4,200
Green margin		8,300
Yellow costs:		
Direct labor	5,400	
Indirect factory wages	920	
Production equipment depreciation	810	
Other factory costs	72	
Office expenses	52	
Marketing expenses	1,500	8,754
Yellow margin		(454)
Red costs:		
Administrative wages and salaries	960	960
Red margin		($ 1,414)

Case 8-33 (continued)

Western Homes		
Sales		$68,000
Green costs:		
Direct materials	$18,500	18,500
Green margin		49,500
Yellow costs:		
Direct labor	36,000	
Indirect factory wages	3,040	
Production equipment depreciation	5,400	
Other factory costs	480	
Office expenses	58	
Marketing expenses	1,500	46,478
Yellow margin		3,022
Red costs:		
Administrative wages and salaries	990	990
Red margin		$ 2,032

Case 8-33 (continued)

3. According to the activity-based costing analysis, Classic Windows may be losing money dealing with Kuszik Builders. Both the red and yellow margins are negative. This means that if Classic Windows could actually avoid the yellow costs (or redeploy these resources to more profitable uses) by dropping Kuszik Builders as a customer, the company would be better off without this customer.

   The activity-based costing and traditional costing systems do not agree concerning the profitability of these two customers. The traditional costing system regards Kuszik Builders as a profitable customer and Western Homes as a money-losing customer. The activity-based costing system comes to exactly the opposite conclusion. The activity-based costing system provides more useful data for decision making for several reasons. First, the traditional costing system assigns all manufacturing costs to products—even costs that are not actually caused by the products such as costs of idle capacity and organization-sustaining costs. Second, the traditional costing system excludes all nonmanufacturing costs from product costs—even those that are caused by the product such as some office expenses. Third, the traditional costing system spreads manufacturing overhead uniformly among products based on direct labor-hours. This penalizes high-volume products with large amounts of direct labor-hours. Low-volume products with relatively small amounts of direct labor-hours benefit since the costs of batch-level activities like processing orders are pushed onto the high-volume products.

Case 8-34 (90 minutes)

1. Overhead rates:

	(a) Estimated Overhead Costs	*(b) Expected Activity*	*(a) ÷ (b) Predetermined Overhead Rate*
Purchasing.....	$12,000	200 orders[1]	$60 per order
Material handling.....	$15,000	300 receipts[2]	$50 per receipt
Production orders and equipment setup.....	$20,250	250 setup hours[3]	$81 per setup hour
Inspection	$16,000	800 inspection hours[4]	$20 per inspection hour
Frame assembly.....	$8,000	1,600 assembly hours	$5 per assembly hour
Machine related.....	$30,000	10,000 machine-hours[5]	$3 per machine-hour

[1] 40 + 60 + 100 = 200 orders.

[2] 60 + 80 + 160 = 300 receipts.

[3] Standard: 50 setups × 1 hour per setup	50 hours
Specialty: 100 setups × 2 hours per setup	200 hours
Total setup hours	250 hours

[4] 300 + 500 = 800 hours.

[5] Standard: 10,000 units × 0.5 hours per unit.....	5,000 hours
Specialty: 2,500 units × 2 hours per unit.....	5,000 hours
Total machine-hours.....	10,000 hours

Case 8-34 (continued)

Overhead cost charged to each product:

	Standard		*Specialty*	
	Activity	*Amount*	*Activity*	*Amount*
Purchasing @ $60 per order:				
Leather	34	$ 2,040	6	$ 360
Fabric	48	2,880	12	720
Synthetic	0	0	100	6,000
Material handling @ $50 per receipt:				
Leather	52	2,600	8	400
Fabric	64	3,200	16	800
Synthetic	0	0	160	8,000
Production orders and equipment setup @ $81 per hour	50	4,050	200	16,200
Inspection @ $20 per hour	300	6,000	500	10,000
Frame assembly @ $5 per hour	800	4,000	800	4,000
Machine related @ $3 per hour	5,000	15,000	5,000	15,000
Total overhead cost		$39,770		$61,480

Manufacturing overhead cost per unit of product:

Standard: $39,770 ÷ 10,000 units = $3.98 per unit (rounded)

Specialty: $61,480 ÷ 2,500 units = $24.59 per unit (rounded)

Case 8-34 (continued)

2. The unit product cost of each product line under activity-based costing is given below. For comparison, the costs computed by the company's accounting department using conventional costing are also provided.

	Activity-Based Costing		*Direct Labor-Hour Base*	
	Standard	*Specialty*	*Standard*	*Specialty*
Direct materials	$20.00	$17.50	$20.00	$17.50
Direct labor	6.00	3.00	6.00	3.00
Manufacturing overhead	3.98	24.59	9.00	4.50
Total unit product cost	$29.98	$45.09	$35.00	$25.00

3. The president was probably correct in being concerned about the profitability of the products, but the problem is apparently with the specialty product line rather than the standard product line. Traditional overhead cost assignment using a volume-based measure has resulted in the high-volume product subsidizing the low-volume product. Thus, unit costs for both products are badly distorted. These distorted costs have had a major impact on management's pricing policies and on management's perception of the margin being realized on each product. The specialty briefcases are apparently being sold at a loss even without considering nonmanufacturing costs:

	Standard Briefcases	*Specialty Briefcases*
Selling price per unit	$36.00	$40.00
Unit product cost	29.98	45.09
Gross margin (loss) per unit	$ 6.02	($ 5.09)

Based on these data, the company should not shift its resources entirely to the production of specialty briefcases. Whether or not the specialty briefcases can be made profitable depends on a number of factors including the sensitivity of the market to an increase in the selling price of the specialty line.

Case 8-34 (continued)

Note to the Instructor: You may want to mention to your class that before any decision can be made regarding dropping a product, a careful analysis will have to be made of the potential avoidable costs. Some of the costs included in the unit product costs are probably costs of idle capacity and organization-sustaining costs that are not relevant.

4. Perhaps the competition hasn't been able to touch CarryAll's price because CarryAll has been selling its specialty briefcases at a price that may be below its cost. Thus, rather than "gouging" its customers, CarryAll's competitor is probably just pricing its specialty items at a normal markup over their cost. Indeed, according to the activity-based costing system, if CarryAll is to realize a profit on its specialty items it may need to charge a price more in line with its competitor's price.

   When a company sells a product at a price substantially below that of its competitors, the company's management should take a careful look at the costing system to be sure that the product is being assigned all the costs for which it is responsible.

Group Exercise 8-35

The most equitable way to divide the dinner bill among a group of friends is probably to figure out the cost of what each individual consumed and divide up the bill accordingly. However, it would be easier to simply divide the total bill by the number of individuals. Everyone would then pay exactly the same amount. This issue relates to material in the chapter because the former method of charging individuals for the costs of what they consume is similar to activity-based costing and the method of just dividing the bill equally is similar to traditional costing methods. Figuring out the cost of what each individual consumes is the most accurate method, but it may take too much time and energy to be worth the bother.

Group Exercise 8-36

An activity-based costing system typically reduces the amount of overhead cost that is allocated based on direct labor-hours—shifting the overhead to other cost pools. Under an activity-based costing system, some of the overhead will be allocated based on the number of batches run, the number of products in the company's active list, and so on. This shifts costs from high-volume products produced in large batches to low-volume products produced in small batches. Once this is understood, the answers to the questions posed in the group exercise can be easily answered.

1. The unit product cost of a low-volume product made in small batches will typically increase in an activity-based costing system. The batch-level and product-level costs are spread across a small number of units, increasing the average unit cost.

2. The unit product cost of a high-volume product made in large batches with automated equipment and few direct labor-hours will typically go up under activity-based costing. Because of the low direct labor-hour requirement for the product, the unit product cost under a traditional direct labor-based costing system would be artificially low. Under an activity-based costing system, the product would be charged for its use of automated equipment and for batch-level and product-level costs.

3. The unit product cost of a high-volume product that requires little machine work but a lot of direct labor typically will decrease under activity-based costing. Because of the high direct labor-hour requirement for the product, the unit product cost under a traditional direct labor-based costing system would be artificially high. The activity-based costing system would shift some of the overhead costs that had been assigned to this product to other products that are made in smaller volumes.