CHAPTER 5
ACTIVITY-BASED COSTING AND ACTIVITY-BASED MANAGEMENT

5-1 Broad averaging (or "peanut-butter costing") describes a costing approach that uses broad averages for assigning (or spreading, as in spreading peanut butter) the cost of resources uniformly to cost objects when the individual products or services, in fact, use those resources in non-uniform ways.

Broad averaging, by ignoring the variation in the consumption of resources by different cost objects, can lead to inaccurate and misleading cost data, which in turn can negatively impact the marketing and operating decisions made based on that information.

5-2 Overcosting may result in overpricing and competitors entering a market and taking market share for products that a company erroneously believes are low-margin or even unprofitable.

Undercosting may result in companies selling products on which they are in fact losing money, when they erroneously believe them to be profitable.

5-3 Costing system refinement means making changes to a simple costing system that reduces the use of broad averages for assigning the cost of resources to cost objects and provides better measurement of the costs of overhead resources used by different cost objects.

Three guidelines for refinement are

1. Classify as many of the total costs as direct costs as is economically feasible.
2. Expand the number of indirect cost pools until each of these pools is more homogenous.
3. Use the cause-and-effect criterion, when possible, to identify the cost-allocation base for each indirect-cost pool.

5-4 An activity-based approach refines a costing system by focusing on individual activities (events, tasks, or units of work with a specified purpose) as the fundamental cost objects. It uses the cost of these activities as the basis for assigning costs to other cost objects such as products or services.

5-5 Four levels of a cost hierarchy are

(i) Output unit-level costs: costs of activities performed on each individual unit of a product or service.

(ii) Batch-level costs: costs of activities related to a group of units of products or services rather than to each individual unit of product or service.

(iii) Product-sustaining costs or service-sustaining costs: costs of activities undertaken to support individual products or services regardless of the number of units or batches in which the units are produced.

(iv) Facility-sustaining costs: costs of activities that cannot be traced to individual products or services but support the organization as a whole.

5-6 It is important to classify costs into a cost hierarchy because costs in different cost pools relate to different cost-allocation bases and not all cost-allocation bases are unit-level. For example, an allocation base like setup hours is a batch-level allocation base, and design hours is a product-sustaining base, both insensitive to the number of units in a batch or the number of units of product produced. If costs were not classified into a cost hierarchy, the alternative would

be to consider all costs as unit-level costs, leading to misallocation of those costs that are not unit-level costs.

5-7 An ABC approach focuses on activities as the fundamental cost objects. The costs of these activities are built up to compute the costs of products, and services, and so on. Simple costing systems have one or a few indirect cost pools, irrespective of the heterogeneity in the facility while ABC systems have multiple indirect cost pools. An ABC approach attempts to use cost drivers as the allocation base for indirect costs, whereas a simple costing system generally does not. The ABC approach classifies as many indirect costs as direct costs as possible. A simple costing system has more indirect costs.

5-8 Four decisions for which ABC information is useful are

1. pricing and product mix decisions,
2. cost reduction and process improvement decisions,
3. product design decisions, and
4. decisions for planning and managing activities.

5-9 No. Department indirect-cost rates are similar to activity-cost rates if (1) a single activity accounts for a sizable fraction of the department's costs, or (2) significant costs are incurred on different activities within a department but each activity has the same cost-allocation base, or (3) significant costs are incurred on different activities with different cost-allocation bases within a department but different products use resources from the different activity areas in the same proportions.

5-10 "Tell-tale" signs that indicate when ABC systems are likely to provide the most benefits are as follows:

1. Significant amounts of indirect costs are allocated using only one or two cost pools.
2. All or most indirect costs are identified as output-unit-level costs (i.e., few indirect costs are described as batch-level, product-sustaining, or facility-sustaining costs).
3. Products make diverse demands on resources because of differences in volume, process steps, batch size, or complexity.
4. Products that a company is well suited to make and sell show small profits, whereas products that a company is less suited to produce and sell show large profits.
5. Operations staff has significant disagreements with the accounting staff about the costs of manufacturing and marketing products and services.

5-11 The main costs and limitations of ABC are the measurements necessary to implement the systems. Even basic ABC systems require many calculations to determine costs of products and services. Activity-cost rates often need to be updated regularly. Very detailed ABC systems are costly to operate and difficult to understand. Sometimes the allocations necessary to calculate activity costs often result in activity-cost pools and quantities of cost-allocation bases being measured with error. When measurement errors are large, activity-cost information can be misleading.

5-12 No, ABC systems apply equally well to service companies such as banks, railroads, hospitals, and accounting firms, as well merchandising companies such as retailers and distributors.

5-13 No. An activity-based approach should be adopted only if its expected benefits exceed its expected costs. It is not always a wise investment. If the jobs, products or services are alike in the way they consume indirect costs of a company, then a simple costing system will suffice.

5-14 Increasing the number of indirect-cost pools does NOT guarantee increased accuracy of product or service costs. If the existing cost pool is already homogeneous, increasing the number of cost pools will not increase accuracy. If the existing cost pool is not homogeneous, accuracy will increase only if the increased cost pools themselves increase in homogeneity vis-à-vis the single cost pool.

5-15 The controller faces a difficult challenge. The benefits of a better accounting system show up in improved decisions by managers. It is important that the controller have the support of these managers when seeking increased investments in accounting systems. Statements by these managers showing how their decisions will be improved by a better accounting system are the controller's best arguments when seeking increased funding. For example, the new system will result in more accurate product costs which will influence pricing and product mix decisions. The new system can also be used to reduce product costs which will lower selling prices. As a result, the customer will benefit from the new system.

5-16 (20 min.) **Cost hierarchy.**

1. a. Indirect manufacturing labor costs of $1,450,000 support direct manufacturing labor and are output unit-level costs. Direct manufacturing labor generally increases with output units, and so will the indirect costs to support it.
   b. Batch-level costs are costs of activities that are related to a group of units of a product rather than each individual unit of a product. Purchase order-related costs (including costs of receiving materials and paying suppliers) of $850,000 relate to a group of units of product and are batch-level costs.
   c. Cost of indirect materials of $275,000 generally changes with labor hours or machine hours which are unit-level costs. Therefore, indirect material costs are output unit-level costs.
   d. Setup costs of $630,000 are batch-level costs because they relate to a group of units of product produced after the machines are set up.
   e. Costs of designing processes, drawing process charts, and making engineering changes for individual products, $775,000, are product-sustaining because they relate to the costs of activities undertaken to support individual products regardless of the number of units or batches in which the product is produced.
   f. Machine-related overhead costs (depreciation and maintenance) of $1,500,000 are output unit-level costs because they change with the number of units produced.
   g. Plant management, plant rent, and insurance costs of $925,000 are facility-sustaining costs because the costs of these activities cannot be traced to individual products or services but support the organization as a whole.

2. The complex boom box made in many batches will use significantly more batch-level overhead resources compared to the simple boom box that is made in a few batches. In addition, the complex boom box will use more product-sustaining overhead resources because it is complex. Because each boom box requires the same amount of machine-hours, both the simple and the complex boom box will be allocated the same amount of overhead costs per boom box if Hamilton uses only machine-hours to allocate overhead costs to boom boxes. As a result, the complex boom box will be undercosted (it consumes a relatively high level of resources but is reported to have a relatively low cost) and the simple boom box will be overcosted (it consumes a relatively low level of resources but is reported to have a relatively high cost).

3. Using the cost hierarchy to calculate activity-based costs can help Hamilton to identify both the costs of individual activities and the cost of activities demanded by individual products. Hamilton can use this information to manage its business in several ways:
   a. Pricing and product mix decisions. Knowing the resources needed to manufacture and sell different types of boom boxes can help Hamilton to price the different boom boxes and also identify which boom boxes are more profitable. It can then emphasize its more profitable products.
   b. Hamilton can use information about the costs of different activities to improve processes and reduce costs of the different activities. Hamilton could have a target of reducing costs of activities (setups, order processing, etc.) by, say, 3% and constantly seek to eliminate activities and costs (such as engineering changes) that its customers perceive as not adding value.
   c. Hamilton management can identify and evaluate new designs to improve performance by analyzing how product and process designs affect activities and costs.
   d. Hamilton can use its ABC systems and cost hierarchy information to plan and manage activities. What activities should be performed in the period and at what cost?

5-17 (25 min.) **ABC, cost hierarchy, service.**

1. Output unit-level costs
   a. Direct-labor costs, $146,000
   b. Equipment-related costs (rent, maintenance, energy, and so on), $350,000
   These costs are output unit-level costs because they are incurred on each unit of materials tested, that is, for every hour of testing.

   Batch-level costs
   c. Setup costs, $430,000
   These costs are batch-level costs because they are incurred each time a batch of materials is set up for either HT or ST, regardless of the number of hours for which the tests are subsequently run.

   Service-sustaining costs
   d. Costs of designing tests, $264,000.
   These costs are service-sustaining costs because they are incurred to design the HT and ST tests, regardless of the number of batches tested or the number of hours of test time.

2.

	Heat Testing (HT)		Stress Testing (ST)	
	Total (1)	**Per Hour (2) = (1) ÷ 40,000**	**Total (3)**	**Per Hour (4) = (3) ÷ 30,000**
Direct labor costs (given)	$100,000	$ 2.50	$ 46,000	$ 1.53
Equipment-related costs				
$5 per hour* × 40,000 hours	200,000	5.00		
$5 per hour* × 30,000 hours			150,000	5.00
Setup costs				
$25 per setup-hour† × 13,600 setup-hours	340,000	8.50		
$25 per setup-hour† × 3,600 setup-hours			90,000	3.00
Costs of designing tests				
$60 per hour** × 3,000 hours	180,000	4.50		
$60 per hour** × 1,400 hours			84,000	2.80
Total costs	$820,000	$20.50	$370,000	$12.33

*$350,000 ÷ (40,000 + 30,000) hours = $5 per test-hour
†$430,000 ÷ (13,600 + 3,600) setup hours = $25 per setup-hour
**$264,000 ÷ (3,000 + 1,400) hours = $60 per hour

At a cost per test-hour of $17, the simple costing system undercosts heat testing ($20.50) and overcosts stress testing ($12.33). The reason is that heat testing uses direct labor, setup, and design resources per hour more intensively than stress testing. Heat tests are more complex, take longer to set up, and are more difficult to design. The simple costing system assumes that testing costs per hour are the same for heat testing and stress testing.

3. The ABC system better captures the resources needed for heat testing and stress testing because it identifies all the various activities undertaken when performing the tests and recognizes the levels of the cost hierarchy at which costs vary. Hence, the ABC system generates more accurate product costs.

Vineyard's management can use the information from the ABC system to make better pricing and product mix decisions. For example, it might decide to increase the prices charged for the more costly heat testing and consider reducing prices on the less costly stress testing. Vineyard should watch if competitors are underbidding Vineyard in stress testing, and causing it to lose business. Vineyard can also use ABC information to reduce costs by eliminating processes and activities that do not add value, identifying and evaluating new methods to do testing that reduce the activities needed to do the tests, reducing the costs of doing various activities, and planning and managing activities.

5-18 (15 min.) **Alternative allocation bases for a professional services firm.**

1.

Client (1)	Direct Professional Time: Rate per Hour (2)	Direct Professional Time: Number of Hours (3)	Direct Professional Time: Total (4) = (2) × (3)	Support Services: Rate (5)	Support Services: Total (6) = (4) × (5)	Amount Billed to Client (7) = (4) + (6)
SAN ANTONIO DOMINION						
Walliston	$640	26	$16,640	30%	$4,992	$21,632
Boutin	220	5	1,100	30	330	1,430
Abbington	100	39	3,900	30	1,170	5,070
						$28,132
AMSTERDAM ENTERPRISES						
Walliston	$640	4	$2,560	30%	$768	$ 3,328
Boutin	220	14	3,080	30	924	4,004
Abbington	100	52	5,200	30	1,560	6,760
						$14,092

2.

Client (1)	Direct Professional Time: Rate per Hour (2)	Direct Professional Time: Number of Hours (3)	Direct Professional Time: Total (4) = (2) × (3)	Support Services: Rate per Hour (5)	Support Services: Total (6) = (3) × (5)	Amount Billed to Client (7) = (4) + (6)
SAN ANTONIO DOMINION						
Walliston	$640	26	$16,640	$75	$1,950	$18,590
Boutin	220	5	1,100	75	375	1,475
Abbington	100	39	3,900	75	2,925	6,825
						$26,890
AMSTERDAM ENTERPRISES						
Walliston	$640	4	$2,560	$75	$ 300	$ 2,860
Boutin	220	14	3,080	75	1,050	4,130
Abbington	100	52	5,200	75	3,900	9,100
						$16,090

	Requirement 1	Requirement 2
San Antonio Dominion	$28,132	$26,890
Amsterdam Enterprises	14,092	16,090
	$42,224	$42,980

Both clients use 70 hours of professional labor time. However, San Antonio Dominion uses a higher proportion of Walliston's time (26 hours), which is more costly. This attracts the highest support-services charge when allocated on the basis of direct professional labor costs.

3. Assume that the Walliston Group uses a cause-and-effect criterion when choosing the allocation base for support services. You could use several pieces of evidence to determine whether professional labor costs or hours is the driver of support-service costs:

a. *Interviews with personnel*. For example, staff in the major cost categories in support services could be interviewed to determine whether Walliston requires more support per hour than, say, Abbington. The professional labor costs allocation base implies that an hour of Walliston's time requires 6.40 ($640 ÷ $100) times more support-service dollars than does an hour of Abbington's time.
b. *Analysis of tasks undertaken for selected clients*. For example, if computer-related costs are a sizable part of support costs, you could determine if there was a systematic relationship between the percentage involvement of professionals with high billing rates on cases and the computer resources consumed for those cases.

5-19 (20 min.) **Plantwide, department and ABC indirect cost rates.**

1.

Actual plant-wide variable MOH rate based on machine hours, $308,600 ÷ 4,000 = $77.15 per machine hour

	United Motors	Holden Motors	Leland Vehicle	Total
Variable manufacturing overhead, allocated based on machine hours ($77.15 × 120; $77.15 × 2,800; $77.15 × 1,080)	$9,258	$216,020	$83,322	$308,600

2.

Department	Variable MOH in 2011	Total Driver Units	Rate	
Design	$39,000	390	$100	per CAD-design hour
Production	29,600	370	$ 80	per engineering hour
Engineering	240,000	4,000	$ 60	per machine hour

	United Motors	Holden Motors	Leland Vehicle	Total
Design-related overhead, allocated on CAD-design hours (110 × $100; 200 × $100; 80 × $100)	$11,000	$ 20,000	$ 8,000	$ 39,000
Production-related overhead, allocated on engineering hours (70 × $80; 60 × $80; 240 × $80)	5,600	4,800	19,200	29,600
Engineering-related overhead, allocated on machine hours (120 × $60; 2,800 × $60; 1,080 × $60)	7,200	168,000	64,800	240,000
Total	$23,800	$192,800	$92,000	$308,600

3.

	United Motors	Holden Motors	Leland Vehicle
a. Department rates (Requirement 2)	$23,800	$192,800	$92,000
b. Plantwide rate (Requirement 1)	$ 9,258	$216,020	$83,322
Ratio of (a) ÷ (b)	2.57	0.89	1.10

The variable manufacturing overhead allocated to United Motors increases by 157% under the department rates, the overhead allocated to Holden decreases by about 11% and the overhead allocated to Leland increases by about 10%.

The three contracts differ sizably in the way they use the resources of the three departments.

The percentage of total driver units in each department used by the companies is:

Department	Cost Driver	United Motors	Holden Motors	Leland Vehicle
Design	CAD-design hours	28%	51%	21%
Engineering	Engineering hours	19	16	65
Production	Machine hours	3	70	27

The United Motors contract uses only 3% of total machines hours in 2011, yet uses 28% of CAD design-hours and 19% of engineering hours. The result is that the plantwide rate, based on machine hours, will greatly underestimate the cost of resources used on the United Motors contract. This explains the 157% increase in indirect costs assigned to the United Motors contract when department rates are used. The Leland Vehicle contract also uses far fewer machine-hours than engineering-hours and is also undercosted.

In contrast, the Holden Motors contract uses less of design (51%) and engineering (16%) than of machine-hours (70%). Hence, the use of department rates will report lower indirect costs for Holden Motors than does a plantwide rate.

Holden Motors was probably complaining under the use of the simple system because its contract was being overcosted relative to its consumption of MOH resources. United and Leland, on the other hand, were having their contracts undercosted and underpriced by the simple system. Assuming that AP is an efficient and competitive supplier, if the new department-based rates are used to price contracts, United and Leland will be unhappy. AP should explain to United and Leland how the calculation was done, and point out United's high use of design and engineering resources and Leland's high use of engineering resources relative to production machine hours. Discuss ways of reducing the consumption of those resources, if possible, and show willingness to partner with them to do so. If the price rise is going to be steep, perhaps offer to phase in the new prices.

4. Other than for pricing, AP can also use the information from the department-based system to examine and streamline its own operations so that there is maximum value-added from all indirect resources. It might set targets over time to reduce both the consumption of each indirect resource and the unit costs of the resources. The department-based system gives AP more opportunities for targeted cost management.

5. It would not be worthwhile to further refine the cost system into an ABC system if (1) a single activity accounts for a sizable proportion of the department's costs or (2) significant costs are incurred on different activities within a department, but each activity has the same cost driver or (3) there wasn't much variation among contracts in the consumption of activities within a department. If, for example, most activities within the design department were, in fact, driven by CAD-design hours, then the more refined system would be more costly and no more accurate than the department-based cost system. Even if there was sufficient variation, considering the relative sizes of the 3 department cost pools, it may only be cost-effective to further analyze the engineering cost pool, which consumes 78% ($240,000 ÷ $308,600) of the manufacturing overhead.

5-20 (50 min.) **Plantwide, department, and activity-cost rates.**

1.

	Trophies	Plaques	Total
Direct materials			
Forming	$13,000	$11,250	
Assembly	2,600	9,375	
Total	15,600	20,625	
Direct Labor			
Forming	15,600	9,000	
Assembly	7,800	10,500	
Total	23,400	19,500	
Total direct costs	$39,000	$40,125	$79,125

$$\text{Budgeted overhead rate} = \frac{(\$12,000 + \$10,386 + \$23,000 + \$10,960)}{\$79,125} = \frac{\$56,346}{\$79,125} = \$0.712114 \text{ per dollar of direct cost}$$

	Trophies	Plaques	Total
Direct materials	$15,600	$20,625	$ 36,225
Direct labor	23,400	19,500	42,900
Total direct cost	39,000	40,125	79,125
Allocated overhead*	27,772	28,574	56,346
Total costs	$66,772	$68,699	$135,471

*Allocated overhead = Total direct cost × Budgeted overhead rate (0.712114).

2. $$\text{Budgeted overhead rate — Forming Dept.} = \frac{\text{Budgeted Forming Department overhead costs}}{\text{Budgeted Forming Department direct-labor costs}}$$

$$= \frac{\$12,000 + \$10,386}{\$15,600 + \$9,000}$$

$$= \frac{\$22,386}{\$24,600} = \$0.91 \text{ per Forming Department direct-labor dollar}$$

$$\text{Budgeted overhead rate — Assembly Dept.} = \frac{\text{Budgeted Assembly Department overhead costs}}{\text{Budgeted Assembly Department direct costs}}$$

$$= \frac{\$23,000 + \$10,960}{(\$2,600 + \$9,375 + \$7,800 + \$10,500)}$$

$$= \frac{\$33,960}{\$30,275} = \$1.121718 \text{ per Assembly Department direct cost dollar}$$

	Trophies	Plaques	Total
Direct materials	$15,600	$20,625	$ 36,225
Direct labor	23,400	19,500	42,900
Total direct cost	39,000	40,125	79,125
Allocated overhead			
Forming Dept.[a]	14,196	8,190	22,386
Assembly Dept.[b]	11,666	22,294	33,960
Total costs	$64,862	$70,609	$135,471

3.

	Trophies	Plaques	Total
[a] **Forming Dept.**			
Direct labor costs	$15,600	$ 9,000	$24,600
Allocated overhead (0.91 × $15,600; $9,000)	$14,196	$ 8,190	$22,386
[b] **Assembly Dept.**			
Total direct costs ($2,600 + $7,800; $9,375 + $10,500)	$10,400	$19,875	$30,275
Allocated overhead (1.121718 × $10,400; $19,875)	$11,666	$22,294	$33,960

Forming Department

$$\text{Budgeted setup rate} = \frac{\$12,000}{156 \text{ batches}} = \$76.92308 \text{ per batch}$$

$$\text{Budgeted supervision rate} = \frac{\$10,386}{\$24,600} = \$0.422195 \text{ per direct-labor dollar}$$

Assembly Department

$$\text{Budgeted set up rate} = \frac{\$23,000}{146 \text{ batches}} = \$157.5342 \text{ per batch}$$

$$\text{Budgeted supervision rate} = \frac{\$10,960}{\$18,300} = \$0.598907 \text{ per direct-labor dollar}$$

	Trophies	Plaques	Total
Direct material costs	$15,600	$20,625	$36,225
Direct labor costs	23,400	19,500	42,900
Total direct costs	39,000	40,125	79,125
Forming Dept. overhead			
Set up			
$76.92308 × 40; 116	3,077	8,923	12,000
Supervision			
0.422195 × $15,600; $9,000	6,586	3,800	10,386
Assembly Department overhead			
Set up			
$157.5342 × 43; 103	6,774	16,226	23,000
Supervision			
0.598907 × $7,800; $10,500	4,671	6,289	10,960
Total costs	$60,108	$75,363	$135,471

4. Tarquin uses more refined cost pools the costs of trophies decreases and costs of plaques increases. This is because plaques use a higher proportion of cost drivers (batches of set ups and direct manufacturing labor costs) than trophies whereas the direct costs (the allocation base used in the simple costing system) are slightly smaller for plaques compared to trophies. This results in plaques being undercosted and trophies overcosted in the simple costing system.

Department costing systems increases the costs of plaques relative to trophies because the forming department costs are allocated based on direct manufacturing labor costs in the forming department and plaques use more direct manufacturing labor in this department compared to trophies.

Disaggregated information can improve decisions by allowing managers to see the details which helps them understand how different aspects of cost influence total cost per unit. Managers can also understand the drivers of different cost categories and use this information for pricing and product-mix decisions, cost reduction and process-improvement decisions, design decisions, and to plan and manage activities. However, too much detail can overload managers who don't understand the data or what it means. Also, managers looking at per-unit data may be misled when considering costs that aren't unit-level costs.

5-21 (10–15 min.) **ABC, process costing.**

1. Rates per unit cost driver.

Activity	Cost Driver	Rate
Machining	Machine-hours	$375,000 ÷ (25,000 + 50,000) = $5 per machine-hour
Set up	Production runs	$120,000 ÷ (50 + 50) = $1,200 per production run
Inspection	Inspection-hours	$105,000 ÷ (1,000 + 500) = $70 per inspection-hour

Overhead cost per unit:

	Mathematical	Financial
Machining: $5 × 25,000; 50,000	$125,000	$250,000
Set up: $1,200 × 50; $1,200 × 50	60,000	60,000
Inspection: $70 × 1,000; $70 × 500	70,000	35,000
Total manufacturing overhead costs	$255,000	$345,000
Divide by number of units	÷ 50,000	÷100,000
Manufacturing overhead cost per unit	$ 5.10	$ 3.45

2.

	Mathematical	Financial
Manufacturing cost per unit:		
Direct materials		
$150,000 ÷ 50,000	$3.00	
$300,000 ÷ 100,000		$3.00
Direct manufacturing labor		
$50,000 ÷ 50,000	1.00	
$100,000 ÷ 100,000		1.00
Manufacturing overhead (from requirement 1)	5.10	3.45
Manufacturing cost per unit	$9.10	$7.45

5-22 (30 min.) **Activity-based costing, service company.**

1. Total indirect costs = $150,000 + $90,000 + $36,000 + $40,000 + $39,000 + $48,000
= $403,000
Total machine-hours = (400 × 10) + (200 × 10) = 6,000
Indirect cost rate per machine-hour = $403,000 ÷ 6,000
= $67.17 per machine-hour

Simple Costing System	Standard Job	Special Job
Cost of supplies per job	$ 200.00	$ 250.00
Direct manufacturing labor cost per job	180.00	200.00
Indirect cost allocated to each job (10 machine hours × $67.17 per machine hour)	671.70	671.70
Total costs	$1,051.70	$1,121.70

2. **Activity-based Costing System**

Activity (1)	Cost Driver (2)	Quantity of Cost Driver Consumed during 2011 (see column (1)) Standard Job (3)	Special Job (4)	Total Cost of Activity (given) (5)	Allocation Rate (6) = (5) ÷ ((3) + (4)), or given	
Machine operations (400 jobs × 10 mach. hrs. per job; 200 jobs × 10 mach. hrs. per job)	machine hours	4,000	2,000	$150,000	$ 25.00	per machine hour
Setups (4 × 400; 7 × 200)	setup hours	1,600	1,400	$ 90,000	$ 30.00	per setup hour
Purchase orders (given)	no. of purchase orders	400	500	$ 36,000	$ 40.00	per purchase order
Design				$ 40,000		
Marketing	selling price			$ 39,000	$ 0.05	per dollar of sales
Administration ($180 × 400; $200 × 200)	dir. labor costs	$72,000	$40,000	$ 48,000	$0.42857	per dollar of direct manuf. labor cost

	Total Costs Standard Job	Special Job
Cost of supplies ($200 × 400; $250 × 200)	$ 80,000	$ 50,000
Direct manuf. labor costs ($180 × 400; $200 × 200)	72,000	40,000
Indirect costs allocated:		
Machine operations ($25 per mach. hr. × 4,000; 2,000)	100,000	50,000
Setups ($30 per setup hr. × 1,600; 1,400)	48,000	42,000
Purchase orders ($40 per order × 400; 500)	16,000	20,000
Design	8,000	32,000
Marketing (0.05×$1,200 × 400; 0.05 × $1,500 × 200)	24,000	15,000
Administration (0.42857 × $72,000; $40,000)	30,857	17,143
Total costs	$378,857	$ 266,143
Cost of each job ($378,857 ÷ 400; $266,143 ÷ 200)	$ 947.14	$1,330.72

3.

Cost per job	Standard Job	Special Job
Simple Costing System	$1,051.70	$1,121.70
Activity-based Costing System	$ 947.14	$1,330.72
Difference (Simple – ABC)	$ 104.56	$ (209.02)

Relative to the ABC system, the simple costing system overcosts standard jobs and undercosts special jobs. Both types of jobs need 10 machine hours per job, so in the simple system, they are each allocated $671.70 in indirect costs. But, the ABC study reveals that each standard job consumes less of the indirect resources such as setups, purchase orders, and design costs than a special job, and this is reflected in the higher indirect costs allocated to special jobs in the ABC system.

4. Quikprint can use the information revealed by the ABC system to change its pricing based on the ABC costs. Under the simple system, Quikprint was making a gross margin of 12% on each standard job (($1,200 – $1,051.70) ÷ $1,200) and 25% on each special job (($1,500 – $1,121.70) ÷ $1,500). But, the ABC system reveals that it is actually making a gross margin of about 21% (($1,200 – $947) ÷ $1,200) on each standard job and about 11% (($1,500 – $1,331) ÷ $1,500) on each special job. Depending on the market competitiveness, Quikprint may either want to reprice the different types of jobs, or, it may choose to market standard jobs more aggressively than before.

Quikprint can also use the ABC information to improve its own operations. It could examine each of the indirect cost categories and analyze whether it would be possible to deliver the same level of service, but consume fewer indirect resources, or find a way to reduce the per-unit-cost-driver cost of some of those indirect resources.

5-23 (30 min.) **Activity-based costing, manufacturing.**

1. Simple costing system:

Total indirect costs = \$95,000 + \$45,000 + \$25,000 + \$60,000 + \$8,000 + 3%[(\$125 × 3,200) + (\$200 × 1,800)]
= \$255,800

Total machine-hours = 5,500 + 4,500 = 10,000

Indirect cost rate per machine-hour = \$255,800 ÷ 10,000
= \$25.58 per machine-hour

Simple Costing System	Interior	Exterior
Direct materials[a]	\$ 96,000	\$ 81,000
Direct manufacturing labor[b]	76,800	64,800
Indirect cost allocated to each job ($25.58 × 5,500; 4,500 machine hours)	140,690	115,110
Total costs	\$313,490	\$260,910
Total cost per unit ($313,490 ÷ 3,200; \$260,910 ÷ 1,800)	\$ 97.97	\$ 144.95

[a] \$30 × 3,200 units; \$45 × 1,800 units
[b] \$16 × 1.5 × 3,200 units; \$16 × 2.25 × 1,800 units

2. **Activity-based Costing System**

Activity (1)	Total Cost of Activity (2)	Cost Driver (3)	Cost Driver Quantity (4)	Allocation Rate (5) = (2) ÷ (4)	
Product scheduling	\$ 95,000	production runs	125[c]	\$ 760.00	per production run
Material handling	\$ 45,000	material moves	240[d]	\$ 187.50	per material move
Machine setup	\$ 25,000	machine setups	200[e]	\$ 125.00	per setup
Assembly	\$ 60,000	machine hours	10,000	\$ 6.00	per machine hour
Inspection	\$ 8,000	inspections	400[f]	\$ 20.00	per inspection
Marketing		selling price		\$ 0.03	per dollar of sales

[c] 40 + 85 = 125; [d] 72 + 168 = 240; [e] 45 + 155 = 200; [f] 250 + 150 = 400

ABC System	Interior	Exterior
Direct materials	$ 96,000	$ 81,000
Direct manufacturing labor	76,800	64,800
Indirect costs allocated:		
Product scheduling ($760 per run × 40; 85)	30,400	64,600
Material handling ($187.50 per move × 72; 168)	13,500	31,500
Machine setup ($125 per setup × 45; 155)	5,625	19,375
Assembly ($6 per MH × 5,500; 4,500)	33,000	27,000
Inspection ($20 per inspection × 250; 150)	5,000	3,000
Marketing (0.03 × $125 × 3,200; 0.03 × $200 × 1,800)	12,000	10,800
Total costs	$272,325	$302,075
Total cost per unit ($272,325 ÷ 3,200 units; $302,075 ÷ 1,800 units)	$ 85.10	$ 167.82

3.

Cost per unit	Interior	Exterior
Simple Costing System	$97.97	$144.95
Activity-based Costing System	$85.10	$167.82
Difference (Simple – ABC)	$12.87	$(22.87)

Relative to the ABC system, the simple costing system overcosts interior doors and undercosts exterior doors. Under the simple costing system, the doors require a similar number of total machine hours (5,500 for interior and 4,500 for exterior), even though interior doors take fewer machine hours per unit. Under the simple costing system, the volume of the production of interior doors is driving the amount of overhead allocated to that product. The ABC study reveals that each exterior door requires more production runs, material moves, and setups. This is reflected in the higher indirect costs allocated to exterior doors in the ABC system.

4. Open Doors, Inc. can use the information revealed by the ABC system to change its pricing based on the ABC costs. Under the simple system, Open Doors was making an operating margin of 21.6% on each interior door (($125 – $97.97) ÷ $125) and 27.5% on each exterior door (($200 – $144.95) ÷ $200). But, the ABC system reveals that it is actually making an operating margin of about 32% (($125 – $85.10)÷$125) on each interior door and about 16% (($200 – $167.82) ÷ $200) on each exterior door. Open Doors, Inc. should consider decreasing the price of its interior doors to be more competitive. Open Doors should also consider increasing the price of its exterior doors, depending on the competition it faces in this market.

Open Doors can also use the ABC information to improve its own operations. It could examine each of the indirect cost categories and analyze whether it would be possible to deliver the same level of service, but consume fewer indirect resources, or find a way to reduce the per-unit-cost-driver cost of some of those indirect resources. Making these operational improvements can help Open Doors to reduce costs, become more competitive, and reduce prices to gain further market share while increasing its profits.

5-24 (30 min.) **ABC, retail product-line profitability.**

1. The simple costing system (Panel A of Solution Exhibit 5-24) reports the following:

	Baked Goods	Milk & Fruit Juice	Frozen Products	Total
Revenues	$57,000	$63,000	$52,000	$172,000
Costs				
Cost of goods sold	38,000	47,000	35,000	120,000
Store support (30% of COGS)	11,400	14,100	10,500	36,000
Total costs	49,400	61,100	45,500	156,000
Operating income	$ 7,600	$ 1,900	$ 6,500	$ 16,000
Operating income ÷ Revenues	13.33%	3.02%	12.50%	9.30%

2. The ABC system (Panel B of Solution Exhibit 5-24) reports the following:

	Baked Goods	Milk & Fruit Juice	Frozen Products	Total
Revenues	$57,000	$63,000	$52,000	$172,000
Costs				
Cost of goods sold	38,000	47,000	35,000	120,000
Ordering ($100 × 30; 25; 13)	3,000	2,500	1,300	6,800
Delivery ($80 × 98; 36; 28)	7,840	2,880	2,240	12,960
Shelf-stocking ($20 × 183; 166; 24)	3,660	3,320	480	7,460
Customer support ($0.20 × 15,500; 20,500; 7,900)	3,100	4,100	1,580	8,780
Total costs	55,600	59,800	40,600	156,000
Operating income	$ 1,400	$ 3,200	$11,400	$ 16,000
Operating income ÷ Revenues	2.46%	5.08%	21.92%	9.30%

These activity costs are based on the following:

Activity	Cost Allocation Rate	Baked Goods	Milk & Fruit Juice	Frozen Products
Ordering	$100 per purchase order	30	25	13
Delivery	$80 per delivery	98	36	28
Shelf-stocking	$20 per hour	183	166	24
Customer support	$0.20 per item sold	15,500	20,500	7,900

3. The rankings of products in terms of relative profitability are:

	Simple Costing System		ABC System	
1.	Baked goods	13.33%	Frozen products	21.92%
2.	Frozen products	12.50	Milk & fruit juice	5.08
3.	Milk & fruit juice	3.02	Baked goods	2.46

The percentage revenue, COGS, and activity costs for each product line are:

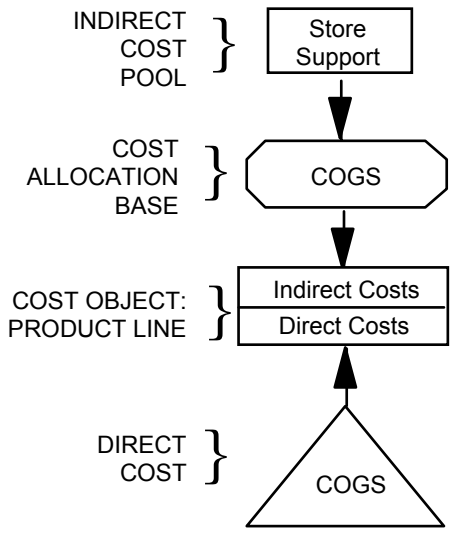
	Baked Goods	Milk & Fruit Juice	Frozen Products	Total
Revenues	33.14	36.63	30.23	100.00
COGS	31.67	39.17	29.16	100.00
Activity areas:				
Ordering	44.12	36.76	19.12	100.00
Delivery	60.49	22.22	17.29	100.00
Shelf-stocking	49.06	44.50	6.44	100.00
Customer support	35.31	46.70	17.99	100.00

The baked goods line drops sizably in profitability when ABC is used. Although it constitutes 31.67% of COGS, it uses a higher percentage of total resources in each activity area, especially the high cost delivery activity area. In contrast, frozen products draws a much lower percentage of total resources used in each activity area than its percentage of total COGS. Hence, under ABC, frozen products is much more profitable.

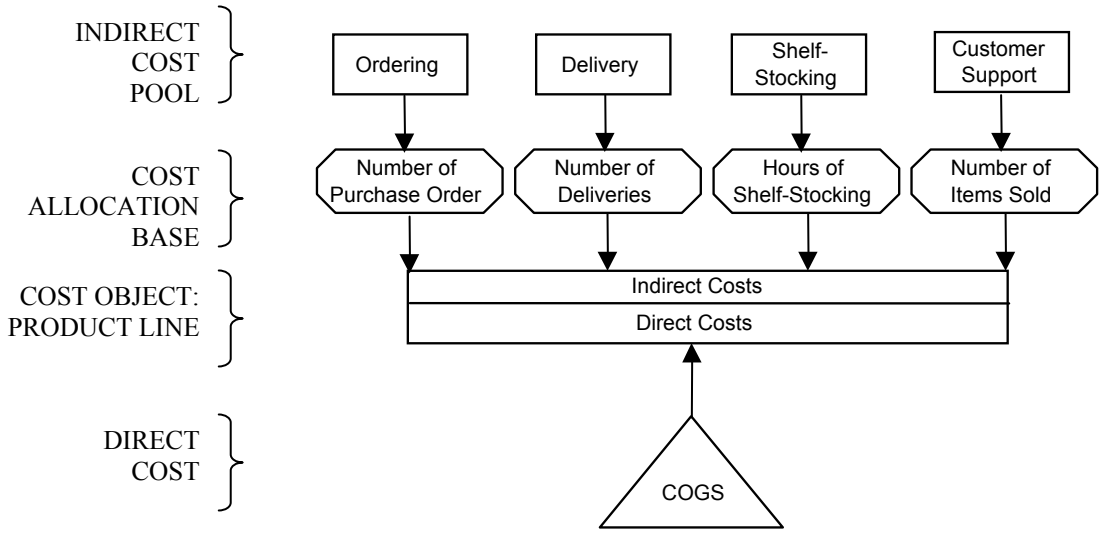
Family Supermarkets may want to explore ways to increase sales of frozen products. It may also want to explore price increases on baked goods.

SOLUTION EXHIBIT 5-24
Product-Costing Overviews of Family Supermarkets

PANEL A: SIMPLE COSTING SYSTEM



PANEL B: ABC SYSTEM



5-25 (15–20 min.) **ABC, wholesale, customer profitability.**

	Chain			
	1	**2**	**3**	**4**
Gross sales	$55,000	$25,000	$100,000	$75,000
Sales returns	11,000	3,500	7,000	6,500
Net sales	44,000	21,500	93,000	68,500
Cost of goods sold (70%)	30,800	15,050	65,100	47,950
Gross margin	13,200	6,450	27,900	20,550
Customer-related costs:				
Regular orders				
$25 × 45; 175; 52; 75	1,125	4,375	1,300	1,875
Rush orders				
$125 × 11; 48; 11; 32	1,375	6,000	1,375	4,000
Returned items				
$15 × 101; 25; 65; 35	1,515	375	975	525
Catalogs and customer support	1,100	1,100	1,100	1,100
Customer related costs	5,115	11,850	4,750	7,500
Contribution (loss) margin	$ 8,085	$(5,400)	$ 23,150	$13,050
Contribution (loss) margin as percentage of gross sales	14.7%	(21.6%)	23.15%	17.4%

The analysis indicates that customers' profitability (loss) contribution varies widely from (21.6%) to 23.15%. Immediate attention to Chain 2 is required which is currently showing a loss contribution. The chain has a disproportionate number of both regular orders and rush orders. Ramirez should work with the management of Chain 2 to find ways to reduce the number of orders, while maintaining or increasing the sales volume. If this is not possible, Ramirez should consider dropping Chain 2, if it can save the customer-related costs.

Chain 1 has a disproportionate number of the items returned as well as sale returns. The causes of these should be investigated so that the profitability contribution of Chain 1 could be improved.

5-26 (50 min.) **ABC, activity area cost-driver rates, product cross-subsidization.**

1. Direct costs

Direct materials	$ 150,000
Indirect costs	
Product support	983,000
Total costs	$1,133,000

$$\text{Cost per pound of potato cuts} = \frac{\$1{,}133{,}000}{1{,}000{,}000} = \$1.133$$

2.

Cost Pool	Costs in Pool	Number of Driver Units	Costs per Driver Unit
Cleaning	$120,000	1,200,000 raw pounds	$ 0.10
Cutting	$231,000	3,850 hours*	$60.00
Packaging	$444,000	37,000 hours**	$12.00

*(900,000 ÷ 250) + (100,000 ÷ 400) = 3,600 + 250 = 3,850
**(900,000 ÷ 25) + (100,000 ÷ 100) = 36,000 + 1,000 = 37,000

3.

	Retail Potato Cuts		Institutional Potato Cuts	
Direct costs				
Direct materials	$135,000		$15,000	
Packaging	180,000	$ 315,000	8,000	$23,000
Indirect costs				
Cleaning				
$0.10 × 90% × 1,200,000	108,000			
$0.10 × 10% × 1,200,000			12,000	
Cutting				
$60 × 3,600 hours	216,000			
$60 × 250 hours			15,000	
Packaging				
$12 × 36,000; $12 × 1,000	432,000	756,000	12,000	39,000
Total costs		$1,071,000		$62,000
Pounds produced		900,000		100,000
Costs per pound		$ 1.19		$ 0.62

Note: The total costs of $1,133,000 ($1,071,000 + $62,000) are the same as those in Requirement 1.

4. There is much evidence of product-cost cross-subsidization.

Cost per Pound	Retail	Institutional
Simple costing system	$1.133	$1.133
ABC system	$1.190	$0.620

Assuming the ABC numbers are more accurate, potato cuts sold to the retail market are undercosted while potato cuts sold to the institutional market are overcosted.

The simple costing system assumes each product uses all the activity areas in a homogeneous way. This is not the case. Institutional sales use sizably less resources in the cutting area and the packaging area. The percentages of total costs for each cost category are as follows:

	Retail	Institutional	Total
Direct costs			
Direct materials	90.0%	10.0%	100.0%
Packaging	95.7	4.3	100.0
Indirect costs			
Cleaning	90.0	10.0	100.0
Cutting	93.5	6.5	100.0
Packaging	97.3	2.7	100.0
Units produced	90.0%	10.0%	100.0%

Idaho can use the revised cost information for a variety of purposes:

a. *Pricing/product emphasis decisions.* The sizable drop in the reported cost of potatoes sold in the institutional market makes it possible that Idaho was overpricing potato products in this market. It lost the bid for a large institutional contract with a bid 30% above the winning bid. With its revised product cost dropping from $1.133 to $0.620, Idaho could have bid much lower and still made a profit. An increased emphasis on the institutional market appears warranted.

b. *Product design decisions.* ABC provides a road map as to how to reduce the costs of individual products. The relative components of costs are:

	Retail	Institutional
Direct costs		
Direct materials	12.6%	24.20%
Packaging	16.8	12.90
Indirect costs		
Cleaning	10.1	19.35
Cutting	20.2	24.20
Packaging	40.3	19.35
Total costs	100.0%	100.00%

Packaging-related costs constitute 57.1% (16.8% + 40.3%) of total costs of the retail product line. Design efforts that reduce packaging costs can have a big impact on reducing total unit costs for retail.

c. *Process improvements.* Each activity area is now highlighted as a separate cost. The three indirect cost areas comprise over 60% of total costs for each product, indicating the upside from improvements in the efficiency of processes in these activity areas.

5-27 (20–25 min.) **Activity-based costing, job-costing system.**

1. Overhead allocation using a simple job-costing system, where overhead is allocated based on machine hours:

Overhead allocation rate = $453,600 ÷ 10,500 machine-hours = $43.20 per machine-hour

	Job 215	Job 325
Overhead allocated[a]	$1,728	$2,592

[a] $43.20 per machine-hour × 40 hours; 60 hours

2. Overhead allocation using an activity-based job-costing system:

	Budgeted Overhead (1)	Activity Driver (2)	Budgeted Activity Driver (3)	Activity Rate (4) = (1) ÷ (3)
Purchasing	$ 70,000	Purchase orders processed	2,000	$35.00
Material handling	$ 87,500	Material moves	5,000	$17.50
Machine maintenance	$ 237,300	Machine hours	10,500	$22.60
Product inspection	$ 18,900	Inspections	1,200	$15.75
Packaging	$ 39,900	Units produced	3,800	$10.50
	$ 453,600			

	Job 215	Job 325
Overhead allocated		
Purchasing ($35 × 25; 8 orders)	$ 875.00	$ 280.00
Material handling ($17.50 × 10; 4 moves)	175.00	70.00
Machine maintenance ($22.60 × 40; 60 hours)	904.00	1,356.00
Product inspection ($15.75 × 9; 3 inspections)	141.75	47.25
Packaging ($10.50 × 15; 6 units)	157.50	63.00
Total	$2,253.25	$1,816.25

3. The manufacturing manager likely would find the ABC job-costing system more useful in cost management. Unlike direct manufacturing labor costs, the five indirect cost pools are systematically linked to the activity areas at the plant. The result is more accurate product costing. The manufacturing manager can seek to reduce both the level of activity (fewer purchase orders, less material handling) and the cost of each activity (such as the cost per inspection).

Marketing managers can use ABC information to bid for jobs more competitively because ABC provides managers with a more accurate reflection of the resources used for and the costs of each job.

5-28 (30 min.) **ABC, product-costing at banks, cross-subsidization.**

1.

	Holt	Turner	Graham	Total
Revenues				
Spread revenue on annual basis				
(3% ×; $1,100, $700, $24,600)	$ 33.00	$ 21.00	$738.00	$ 792.00
Monthly fee charges				
($22 ×; 0, 12, 0)	0.00	264.00	0.00	264.00
Total revenues	33.00	285.00	738.00	1,056.00
Costs				
Deposit/withdrawal with teller				
$2.30 × 42; 48; 5	96.60	110.40	11.50	218.50
Deposit/withdrawal with ATM				
$0.70 × 7; 19; 17	4.90	13.30	11.90	30.10
Deposit/withdrawal on prearranged basis				
$0.40 × 0; 13; 62	0.00	5.20	24.80	30.00
Bank checks written				
$8.40 × 11; 1; 3	92.40	8.40	25.20	126.00
Foreign currency drafts				
$12.40 × 4; 2; 6	49.60	24.80	74.40	148.80
Inquiries				
$1.40 × 12; 20; 9	16.80	28.00	12.60	57.40
Total costs	260.30	190.10	160.40	610.80
Operating income (loss)	$(227.30)	$ 94.90	$577.60	$ 445.20

The assumption that the Holt and Graham accounts exceed $1,000 every month and the Turner account is less than $1,000 each month means the monthly charges apply only to Turner.

One student with a banking background noted that in this solution 100% of the spread is attributed to the "depositor side of the bank." He noted that often the spread is divided between the "depositor side" and the "lending side" of the bank.

2. Cross-subsidization across individual Premier Accounts occurs when profits made on some accounts are offset by losses on other accounts. The aggregate profitability on the three customers is $445.20. The Graham account is highly profitable, $577.60, while the Holt account is sizably unprofitable. The Turner account shows a small profit but only because of the $264 monthly fees. It is unlikely that Turner will keep paying these high fees and that NSB would want Turner to pay such high fees from a customer relationship standpoint.

The facts also suggest that the customers do not use the bank services uniformly. For example, Holt and Turner have a lot of transactions with the teller, and also inquire about their account balances more often than Graham. This suggests cross-subsidization. NSB should be very concerned about the cross-subsidization. Competition likely would "understand" that high-balance low-activity type accounts (such as Graham) are highly profitable. Offering free services to these customers is not likely to retain these accounts if other banks offer higher interest rates. Competition likely will reduce the interest rate spread NSB can earn on the high-balance low-activity accounts they are able to retain.

3. Possible changes NSB could make are:
   a. Offer higher interest rates on high-balance accounts to increase NSB's competitiveness in attracting and retaining these accounts.
   b. Introduce charges for individual services. The ABC study reports the cost of each service. NSB has to decide if it wants to price each service at cost, below cost, or above cost. If it prices above cost, it may use advertising and other means to encourage additional use of those services by customers. Of course, in determining its pricing strategy, NSB would need to consider how other competing banks are pricing their products and services.

5-29 (15 min.) **Job costing with single direct-cost category, single indirect-cost pool, law firm.**

1. Pricing decisions at Wigan Associates are heavily influenced by reported cost numbers. Suppose Wigan is bidding against another firm for a client with a job similar to that of Widnes Coal. If the costing system overstates the costs of these jobs, Wigan may bid too high and fail to land the client. If the costing system understates the costs of these jobs, Wigan may bid low, land the client, and then lose money in handling the case.

2.

	Widnes Coal	**St. Helen's Glass**	**Total**
Direct professional labor, $70 × 104; $70 × 96	$ 7,280	$ 6,720	$14,000
Indirect costs allocated, $105 × 104; $105 × 96	10,920	10,080	21,000
Total costs to be billed	$18,200	$16,800	$35,000

5-30 (20–25 min.) **Job costing with multiple direct-cost categories, single indirect-cost pool, law firm (continuation of 5-29).**

1.

Indirect costs	=	$7,000
Total professional labor-hours	=	200 hours (104 hours on Widnes Coal + 96 hours on St. Helen's Glass)
Indirect cost allocated per professional labor-hour (revised)	=	$7,000 ÷ 200 = $35 per hour

2.

	Widnes Coal	St. Helen's Glass	Total
Direct costs:			
Direct professional labor, $70 × 104; $70 × 96	$ 7,280	$ 6,720	$14,000
Research support labor	1,600	3,400	5,000
Computer time	500	1,300	1,800
Travel and allowances	600	4,400	5,000
Telephones/faxes	200	1,000	1,200
Photocopying	250	750	1,000
Total direct costs	10,430	17,570	28,000
Indirect costs allocated, $35 × 104; $35 × 96	3,640	3,360	7,000
Total costs to be billed	$14,070	$20,930	$35,000

3.

	Widnes Coal	St. Helen's Glass	Total
Problem 5-29	$18,200	$16,800	$35,000
Problem 5-30	14,070	20,930	35,000

The Problem 5-30 approach directly traces $14,000 of general support costs to the individual jobs. In Problem 5-29, these costs are allocated on the basis of direct professional labor-hours. The averaging assumption implicit in the Problem 5-29 approach appears incorrect—for example, the St. Helen's Glass job has travel costs over seven times higher than the Widnes Coal case despite having lower direct professional labor-hours.

5-31 (30 min.) **Job costing with multiple direct-cost categories, multiple indirect-cost pools, law firm (continuation of 5-29 and 5-30).**

1.

	Widnes Coal	St. Helen's Glass	Total
Direct costs:			
Partner professional labor, $100 × 24; $100 × 56	$ 2,400	$ 5,600	$ 8,000
Associate professional labor, $50 × 80; $50 × 40	4,000	2,000	6,000
Research support labor	1,600	3,400	5,000
Computer time	500	1,300	1,800
Travel and allowances	600	4,400	5,000
Telephones/faxes	200	1,000	1,200
Photocopying	250	750	1,000
Total direct costs	9,550	18,450	28,000
Indirect costs allocated:			
Indirect costs for partners, $57.50 × 24; $57.50 × 56	1,380	3,220	4,600
Indirect costs for associates, $20 × 80; $20 × 40	1,600	800	2,400
Total indirect costs	2,980	4,020	7,000
Total costs to be billed	$12,530	$22,470	$35,000

Comparison	Widnes Coal	St. Helen's Glass	Total
Single direct cost/ Single indirect cost pool	$18,200	$16,800	$35,000
Multiple direct costs/ Single indirect cost pool	$14,070	$20,930	$35,000
Multiple direct costs/ Multiple indirect cost pools	$12,530	$22,470	$35,000

The higher the percentage of costs directly traced to each case, and the greater the number of homogeneous indirect cost pools linked to the cost drivers of indirect costs, the more accurate the product cost of each individual case.

The Widnes and St. Helen's cases differ in how they use "resource areas" of Wigan Associates:

	Widnes Coal	St. Helen's Glass
Partner professional labor	30.0%	70.0%
Associate professional labor	66.7	33.3
Research support labor	32.0	68.0
Computer time	27.8	72.2
Travel and allowances	12.0	88.0
Telephones/faxes	16.7	83.3
Photocopying	25.0	75.0

The Widnes Coal case makes relatively low use of the higher-cost partners but relatively higher use of the lower-cost associates than does St. Helen's Glass. As a result, it also uses less of the higher indirect costs required to support partners compared to associates. The Widnes Coal case also makes relatively lower use of the support labor, computer time, travel, phones/faxes, and photocopying resource areas than does the St. Helen's Glass case.

2. The specific areas where the multiple direct/multiple indirect (MD/MI) approach can provide better information for decisions at Wigan Associates include:

Pricing and product (case) emphasis decisions. In a bidding situation using single direct/single indirect (SD/SI) or multiple direct/single indirect (MD/SI) data, Wigan may win bids for legal cases on which it will subsequently lose money. It may also not win bids on which it would make money with a lower-priced bid.

From a strategic viewpoint, SD/SI or MD/SI exposes Wigan Associates to cherry-picking by competitors. Other law firms may focus exclusively on Widnes Coal-type cases and take sizable amounts of "profitable" business from Wigan Associates. MD/MI reduces the likelihood of Wigan Associates losing cases on which it would have made money.

Client relationships. MD/MI provides a better "road map" for clients to understand how costs are accumulated at Wigan Associates. Wigan can use this road map when meeting with clients to plan the work to be done on a case *before* it commences. Clients can negotiate ways to get a lower-cost case from Wigan, given the information in MD/MI—for example, (a) use a higher proportion of associate labor time and a lower proportion of a partner time, and (b) use fax machines more and air travel less. If clients are informed in advance how costs will be accumulated, there is less likelihood of disputes about bills submitted to them *after* the work is done.

Cost control. The MD/MI approach better highlights the individual cost areas at Wigan Associates than does the SD/SI or MD/SI approaches:

	MD/MI	SD/SI	MD/SI
Number of direct cost categories	7	1	7
Number of indirect cost categories	2	1	1
Total	9	2	8

MD/MI is likely to promote better cost-control practices than SD/SI or MD/SI, as the nine cost categories in MD/MI give Wigan a better handle on how to effectively manage different categories of both direct and indirect costs.

5-32 (50 min.) **Plantwide, department, and activity-cost rates.**

1. Plant-wide costing rate

	Fighters	Cargo	Total
Direct materials			
Assembly	$2.50	$3.75	$6.25
Painting	0.50	1.00	1.50
Total	$3.00	$4.75	$7.75
Direct Labor			
Assembly	$3.50	$2.00	$5.50
Painting	2.25	1.50	3.75
Total	$5.75	$3.50	$9.25

	Fighters	Cargo	Total
Direct materials			
($3.00 × 800 units; $4.75 × 740 units)	$2,400	$3,515	$ 5,915
Direct manufacturing labor			
($5.75 × 800 units; $3.50 × 740 units)	4,600	2,590	7,190
Total direct costs	$7,000	$6,105	$13,105

Plant- wide overhead rate = $11,180 ÷ $13,105 = $0.85311 per direct cost dollar

	Fighters	Cargo
Total direct costs	$ 7,000.00	$ 6,105.00
Overhead allocated (0.85311 × $7,000; $6,105)	5,971.77	5,208.24
Total costs	$12,971.77	$11,313.24
Divided by number of units	÷ 800	÷ 740
Total cost per unit	$ 16.21	$ 15.29

2. Departmental costing

$$\text{Budgeted overhead rate Assembly Dept.} = \frac{\text{Budgeted Assembly Department overhead costs}}{\text{Budgeted Assembly Department direct manufacturing labor costs}}$$

$$= \frac{\$7{,}030}{\$3.50 \times 800 \text{ units} + \$2 \times 740 \text{ units}}$$

$$= \frac{\$7{,}030}{\$2{,}800 + \$1{,}480} = \frac{\$7{,}030}{\$4{,}280} = \$1.64252 \text{ per direct manuf. labor dollar}$$

$$\text{Budgeted overhead rate Painting Dept.} = \frac{\text{Budgeted Painting Department overhead costs}}{\text{Budgeted Painting Department direct costs}}$$

$$= \frac{\$4{,}150}{\$2.75 \times 800 \text{ units} + \$2.50 \times 740 \text{ units}}$$

$$= \frac{\$4{,}150}{\$2{,}200 + \$1{,}850} = \frac{\$4{,}150}{\$4{,}050} = \$1.02469 \text{ per direct cost dollar}$$

	Fighters	**Cargo**	**Total**
Direct materials	$ 2,400	$ 3,515	$ 5,915
Direct manufacturing labor	4,600	2,590	7,190
Total direct costs	7,000	6,105	13,105
Allocated overhead:			
Assembly Department			
(1.64252 × $2,800[a]; $1,480[a])	4,599	2,431	7,030
Painting Department			
(1.02469 × $2,200[b]; $1,850[b])	2,254	1,896	4,150
Total costs	$13,853	$10,432	$24,285
Divided by number of units	÷ 800	÷ 740	
	$ 17.32	$ 14.10	

[a]Direct manufacturing labor costs in Assembly Department calculated previously:
Fighters, $3.50 × 800 units = $2,800; Cargo, $2 × 740 units = $1,480

[b]Direct costs of Painting Department calculated previously:
Fighters, $2.75 × 800 units = $2,200; Cargo, $2.50 × 740 units = $1,850

3. Activity-based Costing

Assembly Department

$$\text{Budgeted materials handling rate} = \frac{\$1{,}700}{198 \text{ batches}} = \$8.58586 \text{ per batch}$$

$$\text{Budgeted quality inspection rate} = \frac{\$2{,}750}{198 \text{ batches}} = \$13.88889 \text{ per batch}$$

$$\text{Budgeted utilities rate} = \frac{\$2{,}580}{\$4{,}280} = \$0.602804 \text{ per direct manuf. labor dollar}$$

Painting Department

$$\text{Budgeted materials handling rate} = \frac{\$900}{132 \text{ batches}} = \$6.81818 \text{ per batch}$$

$$\text{Budgeted quality inspection rate} = \frac{\$1{,}150}{132 \text{ batches}} = \$8.71212 \text{ per batch}$$

$$\text{Budgeted utilities rate} = \frac{\$2{,}100}{\$2.25 \times 800 \text{ units} + \$1.50 \times 740 \text{ units}}$$

$$= \frac{\$2{,}100}{\$1{,}800 + \$1{,}110} = \frac{\$2{,}100}{\$2{,}910} = \$0.72165 \text{ per direct manuf. labor dollar}$$

	Fighters	**Cargo**	**Total**
Direct materials	$ 2,400	$3,515	$ 5,915
Direct manufacturing labor	4,600	2,590	7,190
Total direct costs	7,000	6,105	13,105
Allocated Assembly Department Overhead:			
Materials handling ($8.58586 × 150; 48)	1,288	412	1,700
Inspection ($13.88889 × 150; 48)	2,083	667	2,750
Utilities (0.602804 × $2,800; $1,480)	1,688	892	2,580
Allocated Painting Department Overhead:			
Materials handling ($6.81818 × 100; 32)	682	218	900
Inspection ($8.71212 × 100; 32)	871	279	1,150
Utilities (0.72165 × $1,800[c]; $1,110[c])	1,299	801	2,100
Total costs	$14,911	$9,374	$24,285
Divided by number of units	÷ 800	÷ 740	
	$ 18.64	$12.67	

[c]Direct manufacturing labor costs in Painting Department calculated previously:
Fighters, $2.25 × 800 units = $1,800; Cargo, $1.50 × 740 units = $1,110

4. Activity-based cost information can improve decisions by allowing managers to understand how different aspects of cost influence total cost per unit. Using ABC and determining the drivers of overhead costs help Allen's Aero Toys understand that cargo planes were overcosted and fighter jets were undercosted.

Managers can also understand the drivers of different cost categories and use this information for pricing and product-mix decisions, cost reduction and process-improvement decisions, design decisions, and to plan and manage activities. However, too much detail can overload managers who don't understand the data or what it means. Also, managers looking at per-unit data may be misled when considering costs that aren't unit-level costs.

5-33 (30-40 min.) **Department and activity-cost rates service sector.**

1. Overhead costs = $19,000 + $260,000 + $267,900 + $121,200 = $668,100

$$\text{Budgeted overhead rate} = \frac{\$668{,}100}{\$393{,}000} = \$1.70 \text{ per direct labor dollar}$$

	X-rays	Ultrasound	CT scan	MRI	Total
Technician labor	$ 64,000	$104,000	$119,000	$ 106,000	$ 393,000
Depreciation	136,800	231,000	400,200	792,000	1,560,000
Materials	22,400	16,500	23,900	30,800	93,600
Allocated overhead*	108,800	176,800	202,300	180,200	668,100
Total budgeted costs	$332,000	$528,300	$745,400	$1,109,000	$2,714,700
Budgeted number of procedures	÷ 2,555	÷ 4,760	÷ 3,290	÷2,695	
Budgeted cost per service	$ 129.94	$ 110.99	$ 226.57	$ 411.50	

* Allocated overhead = Budgeted overhead rate × Technician labor costs
= $1.70 × Technician labor costs

2. Budgeted Information

	X-rays	Ultrasound	CT scan	MRI	Total
Number of procedures	2,555	4,760	3,290	2,695	13,300
Cleaning minutes per procedure	×10	10	×20	×40	
Total cleaning minutes	25,550	47,600	65,800	107,800	246,750
Number of procedures	2,555	4,760	3,290	2,695	13,300
Minutes for each procedure	×5	×20	×15	×40	
Total procedure minutes	12,775	95,200	49,350	107,800	265,125

Activity	Budgeted Cost (1)	Cost Driver (2)	Units of Cost Driver (3)	Activity Rate (4) = (1) ÷ (3)
Administration	$ 19,000	Total number of procedures	13,300	$1.42857 per procedure
Maintenance	$260,000	Total dollars of depreciation	$1,560,000	$0.166667 per dollar of depreciation
Sanitation	$267,900	Total cleaning minutes	246,750	$1.08571 per cleaning minute
Utilities	$121,200	Total procedure minutes	265,125	$0.45714 per procedure minute

	X-rays	Ultrasound	CT Scan	MRI	Total
Technician labor	$ 64,000	$104,000	$119,000	$ 106,000	$ 393,000
Depreciation	136,800	231,000	400,200	792,000	1,560,000
Materials	22,400	16,500	23,900	30,800	93,600
Allocated activity costs:					
Administration ($1.42857 × 2,555; 4,760; 3,290; 2,695)	3,650	6,800	4,700	3,850	19,000
Maintenance $0.166667 × $136,800; $231,000; $400, 200; $792,000)	22,800	38,500	66,700	132,000	260,000
Sanitation ($1.08571 × 25,550; 47,600; 65,800; 107,800)	27,740	51,680	71,440	117,040	267,900
Utilities ($0.45714 × 12,775; 95,200; 49,350; 107,800)	5,840	43,520	22,560	49,280	121,200
Total budgeted cost	$283,230	$492,000	$708,500	$1,230,970	$2,714,700
Budgeted number of procedures	÷ 2,555	÷ 4,760	÷ 3,290	÷ 2,695	
Budgeted cost per service	$ 110.85	$ 103.36	$ 215.35	$ 456.76	

3. Using the disaggregated activity-based costing data, managers can see that the MRI actually costs substantially more and x-rays and ultrasounds substantially less than the traditional system indicated. In particular, the MRI activity generates a lot of maintenance activity and sanitation activity. Managers should examine the use of these two activities to search for ways to reduce the activity consumption and ultimately its cost.

5-34 (30 min.) **Choosing cost drivers, activity-based costing, activity-based management**.

1. Direct costs = Dance teacher salaries, Child care teacher salaries, Fitness instructor salaries
   Indirect costs = Supplies; Rent, maintenance, and utilities; Administration salaries; Marketing expenses

2.

Indirect Cost	Cost Driver	Budgeted Cost Driver Rate
Supplies	Number of participants	$21,984 ÷ 2,205 = $9.97 per participant
Rent, maintenance, and utilities	Square footage	$97,511÷ 11,650 = $8.37 per square foot
Administration salaries	Number of participants	$50,075 ÷ 2,205 = $22.71 per participant
Marketing expenses	Number of advertisements	$21,000 ÷ 70 = $300 per advertisement

Supplies – Larger programs with more participants will require more supplies. For example, as the number of dance participants increases, so will the cost of dance accessories.

Rent, maintenance and utilities are all building-related costs. Square-footage is the only space-oriented cost driver available.

Administration salaries – Larger programs require more time to enroll students and collect fees. Consequently, the number of participants appears to be a reasonable cost driver.

Marketing expenses – Marketing expenses include the cost of advertising the studio. As the number of ads increases so do total marketing costs.

3.

	Dance	Childcare	Fitness	Total
Salaries	$ 62,100	$ 24,300	$ 39,060	$ 125,460
Allocated costs:				
Supplies ($9.97×1,485; 450; 270)	14,805	4,487	2,692	21,984
Rent, maintenance, and utilities ($8.37×6,000; 3,150; 2,500)	50,220	26,366	20,925	97,511
Administration salaries ($22.71×1,485; 450; 270)	33,724	10,219	6,132	50,075
Marketing expenses ($300×26; 24; 20)	7,800	7,200	6,000	21,000
Budgeted total costs	$ 168,649	$ 72,572	$ 74,809	$ 316,030
÷ Number of participants	÷ 1,485	÷450	÷270	
Budgeted cost per participant	$ 113.57	$ 161.27	$ 277.07	

4. By dividing the full cost of each service line by the number of participants, Annie can see that fitness classes should be charged a higher price. Most of the higher unit cost is attributable to the cost of Aerobic instructors.

Besides cost data, Annie should also consider a variety of other factors before setting the price for each service. Examples of other issues she should consider include the actions of competitors in her market, and the quality of her facilities and instructors.

5-35 (30–40 min.) **Activity-based costing, merchandising.**

1.

	General Supermarket Chains	Drugstore Chains	Mom-and-Pop Single Stores	Total
Revenues	$3,708,000	$3,150,000	$1,980,000	$8,838,000
Cost of goods sold	3,600,000	3,000,000	1,800,000	8,400,000
Gross margin	$ 108,000	$ 150,000	$ 180,000	$ 438,000
Other operating costs				301,080
Operating income				$ 136,920
Gross margin %	2.91%	4.76%	9.09%	

The gross margin of Pharmacare, Inc., was 4.96% ($438,000 ÷ $8,838,000). The operating income margin of Pharmacare, Inc., was 1.55% ($136,920 ÷ $8,838,000).

2. The per-unit cost driver rates are:

1. Customer purchase order processing,
   $80,000 ÷ 2,000 (140 + 360 + 1,500) orders = $40 per order
2. Line item ordering,
   $63,840 ÷ 21,280 (1,960 + 4,320 + 15,000) line items = $ 3 per line item
3. Store delivery,
   $71,000 ÷ 1,480 (120 + 360 + 1,000) deliveries = $47.973 per delivery
4. Cartons shipped,
   $76,000 ÷ 76,000 (36,000 + 24,000 + 16,000) cartons = $ 1 per carton
5. Shelf-stocking,
   $10,240 ÷ 640 (360 + 180 + 100) hours = $16 per hour

3. The activity-based costing of each distribution market for 2011 is:

	General Supermarket Chains	Drugstore Chains	Mom-and-Pop Single Stores	Total
1. Customer purchase order processing ($40 × 140; 360; 1,500)	$ 5,600	$14,400	$ 60,000	$ 80,000
2. Line item ordering ($3 × 1,960; 4,320; 15,000)	5,880	12,960	45,000	63 ,840
3. Store delivery, ($47.973 × 120; 360; 1,000)	5,757	17,270	47,973	71,000
4. Cartons shipped ($1 × 36,000; 24,000; 16,000)	36,000	24,000	16,000	76,000
5. Shelf-stocking ($16 × 360; 180; 100)	5,760	2,880	1,600	10,240
	$58,997	$71,510	$170,573	$301,080

The revised operating income statement is:

	General Supermarket Chains	Drugstore Chains	Mom-and-Pop Single Stores	Total
Revenues	$3,708,000	$3,150,000	$1,980,000	$8,838,000
Cost of goods sold	3,600,000	3,000,000	1,800,000	8,400,000
Gross margin	108,000	150,000	180,000	438,000
Operating costs	58,997	71,510	170,573	301,080
Operating income	$ 49,003	$ 78,490	$ 9,427	$ 136,920
Operating income margin	1.32%	2.49%	0.48%	1.55%

4. The ranking of the three markets are:

Using Gross Margin		Using Operating Income	
1. Mom-and-Pop Single Stores	9.09%	1. Drugstore Chains	2.49%
2. Drugstore Chains	4.76%	2. General Supermarket Chains	1.32%
3. General Supermarket Chains	2.91%	3. Mom-and-Pop Single Stores	0.48%

The activity-based analysis of costs highlights how the Mom-and-Pop Single Stores use a larger amount of Pharmacare's resources per revenue dollar than do the other two markets. The ratio of the operating costs to revenues across the three markets is:

General Supermarket Chains	1.59%	($58,997 ÷ $3,708,000)
Drugstore Chains	2.27%	($71,510 ÷ $3,150,000)
Mom-and-Pop Single Stores	8.61%	($170,573 ÷ $1,980,000)

This is a classic illustration of the maxim that "all revenue dollars are not created equal." The analysis indicates that the Mom-and-Pop Single Stores are the least profitable market. Pharmacare should work to increase profits in this market through: (1) a possible surcharge, (2) decreasing the number of orders, (3) offering discounts for quantity purchases, etc.

Other issues for Pharmacare to consider include

a. *Choosing the appropriate cost drivers for each area.* The problem gives a cost driver for each chosen activity area. However, it is likely that over time further refinements in cost drivers would be necessary. For example, not all store deliveries are equally easy to make, depending on parking availability, accessibility of the storage/shelf space to the delivery point, etc. Similarly, not all cartons are equally easy to deliver—their weight, size, or likely breakage component are factors that can vary across carton types.

b. *Developing a reliable data base on the chosen cost drivers.* For some items, such as the number of orders and the number of line items, this information likely would be available in machine readable form at a high level of accuracy. Unless the delivery personnel have hand-held computers that they use in a systematic way, estimates of shelf-stocking time are likely to be unreliable. Advances in information technology likely will reduce problems in this area over time.

c. *Deciding how to handle costs that may be common across several activities.* For example, (3) store delivery and (4) cartons shipped to stores have the common cost of the same trip. Some organizations may treat (3) as the primary activity and attribute only incremental costs to (4). Similarly, (1) order processing and (2) line item ordering may have common costs.

d. *Behavioral factors are likely to be a challenge to Flair.* He must now tell those salespeople who specialize in Mom-and-Pop accounts that they have been less profitable than previously thought.

5-36 (30-40 min.) **Choosing cost drivers, activity-based costing, activity-based management**.

1.

Direct materials—purses	Output unit-level costs
Direct materials—backpacks	Output unit-level costs
Direct manufacturing labor—purses	Output unit-level costs
Direct manufacturing labor—backpacks	Output unit-level costs
Setup	Batch-level costs
Shipping	Batch-level costs
Design	Product-sustaining costs
Plant utilities and administration	Facility-sustaining costs

2.

Direct materials—purses	Number of purses
Direct materials—backpacks	Number of backpacks
Direct manufacturing labor—purses	Number of purses
Direct manufacturing labor—backpacks	Number of backpacks
Setup	Number of batches
Shipping	Number of batches
Design	Number of designs
Plant utilities and administration	Hours of production

Direct material and direct manufacturing labor are costs that can be easily traced to output, which in this case is the number of purses or backpacks produced.

Setup and shipping are both a function of the number of batches produced.

Design is related to the number of designs created for each product.

Plant utilities and administration result from general activity level in the plant. Thus, hours of production seems to be an appropriate cost driver.

3.

Direct materials—purses	$379,290 ÷ 3,350 purses = $113.22 per purse
Direct materials—backpacks	$412,920 ÷ 6,050 backpacks = $68.25 per backpack
Direct manufacturing labor—purses	$98,000 ÷ 3,350 purses = $29.25 per purse
Direct manufacturing labor—backpacks	$120,000 ÷ 6,050 backpacks = $19.83 per backpack
Setup	$65,930 ÷ 190 batches = $347 per batch
Shipping	$73,910 ÷ 190 batches = $389 per batch
Design	$166,000 ÷ 4 designs = $41,500 per design
Plant utilities and administration	$243,000 ÷ 4,050 hours = $60 per hour

4.

	Backpacks	Purses	Total
Direct materials	$412,920	$379,290	$ 792,210
Direct manufacturing labor	120,000	98,000	218,000
Setup			
($347 × 130; 60 batches)	45,110	20,820	65,930
Shipping			
($389 × 130; 60 batches)	50,570	23,340	73,910
Design			
($41,500 × 2; 2 designs)	83,000	83,000	166,000
Plant utilities and administration			
($60 × 1,450; 2,600 hours)	87,000	156,000	243,000
Budgeted total costs	$798,600	$760,450	$1,559,050
Divided by number of backpacks/purses	÷ 6,050	÷ 3,350	
Budgeted cost per backpack/purse	$ 132.00	$ 227.00	

5. Based on this analysis, over 50% of product cost relates to direct material. Managers should determine whether the material costs can be reduced. Producing in small lots increases the setup and shipping costs. While both are relatively small components of product cost, management may want to evaluate ways to reduce the number of setups and the cost per setup. Of the indirect costs, the product- and facility-sustaining costs are the highest. Management should review the design process for cost savings and examine why it takes so long to produce purses relative to backpacks.

5-37 (40 min.) **ABC, health care.**

$$\text{1a. Medical supplies rate} = \frac{\text{Medical supplies costs}}{\text{Total number of patient - years}} = \frac{\$220{,}000}{110}$$
$$= \$2{,}000 \text{ per patient-year}$$

$$\text{Rent and clinic maintenance rate} = \frac{\text{Rent and clinic maint. costs}}{\text{Total amount of square feet of space}} = \frac{\$126{,}000}{21{,}000}$$
$$= \$6 \text{ per square foot}$$

$$\text{Admin. cost rate for patient-charts food and laundry} = \frac{\text{Admin. costs to manage patient charts, food, laundry}}{\text{Total number of patient - years}} = \frac{\$440{,}000}{110}$$
$$= \$4{,}000 \text{ per patient-year}$$

$$\text{Laboratory services rate} = \frac{\text{Laboratory services costs}}{\text{Total number of laboratory tests}} = \frac{\$84{,}000}{2{,}100}$$
$$= \$40 \text{ per test}$$

These cost drivers are chosen as the ones that best match the descriptions of why the costs arise. Other answers are acceptable, provided that clear explanations are given.

1b. Activity-based costs for each program and cost per patient-year of the alcohol and drug program follow:

	Drug	After-Care	Total
Direct labor			
Physicians at $150,000 × 4; 0	$ 600,000	—	$ 600,000
Psychologists at $75,000 × 4; 8	300,000	$ 600,000	900,000
Nurses at $30,000 × 6; 10	180,000	300,000	480,000
Direct labor costs	1,080,000	900,000	1,980,000
Medical supplies[1] $2,000 × 50; 60	100,000	120,000	220,000
Rent and clinic maintenance[2]			
$6 × 9,000; 12,000	54,000	72,000	126,000
Administrative costs to manage patient charts, food, and laundry[3]			
$4,000 × 50; 60	200,000	240,000	440,000
Laboratory services[4]			
$40 × 1,400; 700	56,000	28,000	84,000
Total costs	$1,490,000	$1,360,000	$2,850,000

$$\text{Cost per patient-year} \quad \frac{\$1{,}490{,}000}{50} = \$29{,}800$$

[1]Allocated using patient-years
[2]Allocated using square feet of space
[3]Allocated using patient-years
[4]Allocated using number of laboratory tests

1c. The ABC system more accurately allocates costs because it identifies better cost drivers. The ABC system chooses cost drivers for overhead costs that have a cause-and-effect relationship between the cost drivers and the costs. Of course, Clayton should continue to evaluate if better cost drivers can be found than the ones they have identified so far.

By implementing the ABC system, Clayton can gain a more detailed understanding of costs and cost drivers. This is valuable information from a cost management perspective. The system can yield insight into the efficiencies with which various activities are performed. Clayton can then examine if redundant activities can be eliminated. Clayton can study trends and work toward improving the efficiency of the activities.

In addition, the ABC system will help Clayton determine which programs are the most costly to operate. This will be useful in making long-run decisions as to which programs to offer or emphasize. The ABC system will also assist Clayton in setting prices for the programs that more accurately reflect the costs of each program.

2. The concern with using costs per patient-year as the rule to allocate resources among its programs is that it emphasizes "input" to the exclusion of "outputs" or effectiveness of the programs. After-all, Clayton's goal is to cure patients while controlling costs, not minimize costs per-patient year. The problem, of course, is measuring outputs.

Unlike many manufacturing companies, where the outputs are obvious because they are tangible and measurable, the outputs of service organizations are more difficult to measure. Examples are "cured" patients as distinguished from "processed" or "discharged" patients, "educated" as distinguished from "partially educated" students, and so on.

5-38 (25 min.) **Unused capacity, activity-based costing, activity-based management**.

1.

	Basketballs	Volleyballs	Total
Number of batches	300	400	700
Machine-hours	11,000	12,500	23,500

Setup cost per batch = $143,500 ÷ 700 batches = $205 per batch.

Equipment and maintenance = $109,900 ÷ 23,500 machine-hours = $4.6766 per machine-hour.

Lease rent, insurance, utilities = $216,000 ÷ 12,000 sq. ft. of capacity = $18 per sq. ft.

2. $$\text{Unused capacity} = \text{Total capacity} - \begin{matrix}\text{Capacity used for}\\ \text{basketball production}\end{matrix} - \begin{matrix}\text{Capacity used for}\\ \text{volleyball production}\end{matrix}$$

$$= 12{,}000 - 3{,}360 - 5{,}040 = 3{,}600 \text{ sq. ft.}$$

Cost of unused capacity = $18 per sq. ft × 3,600 sq. ft. = $64,800

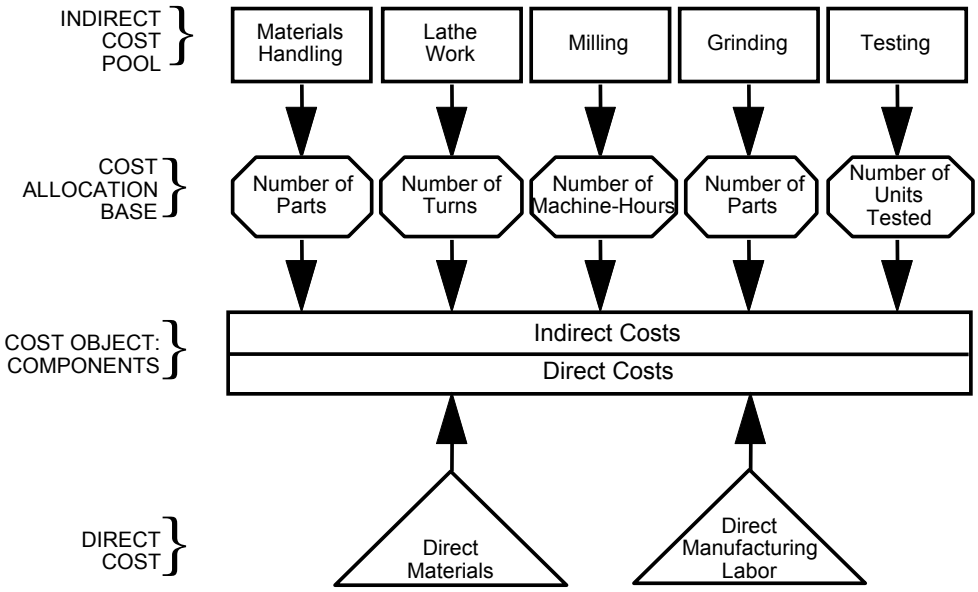
3.

	Basketballs	Volleyballs	Total
Direct materials	$209,750	$358,290	$ 568,040
Direct manufacturing labor	107,333	102,969	210,302
Setup			
($205 × 300; 400)	61,500	82,000	143,500
Equipment and maintenance			
($4.6766 × 11,000; 12,500)	51,443	58,457	109,900
Lease rent, etc.			
($18 × 3,360; 5,040)	60,480	90,720	151,200
Budgeted total costs	$490,506	$692,436	$1,182,942
Divided by number of units	÷ 66,000	÷100,000	
Budgeted cost per unit	$ 7.43	$ 6.92	

4. Currently, Nivag only utilizes 70% of its available capacity. Managers should consider whether the excess capacity is sufficient to produce footballs. Other issues to consider include demand for the proposed product, the competition, capital investment needed to start and support this product line, and the availability of skilled and unskilled labor needed to manufacture footballs.

5-39 (40–50 min.) **Activity-based job costing, unit-cost comparisons.**

An overview of the product-costing system is:



1.

	Job Order 410		Job Order 411	
Direct manufacturing cost				
Direct materials	$9,700		$59,900	
Direct manufacturing labor				
$30 × 25; $30 × 375	750	$ 10,450	11,250	$ 71,150
Indirect manufacturing cost				
$115 × 25; $115 × 375		2,875		43,125
Total manufacturing cost		$ 13,325		$114,275
Divided by number of units		÷ 10		÷ 200
Manufacturing cost per unit		$ 1,332.50		$571.375

2.

	Job Order 410		Job Order 411	
Direct manufacturing cost				
Direct materials	$9,700		$59,900	
Direct manufacturing labor				
$30 × 25; $30 × 375	750	$10,450	11,250	$ 71,150
Indirect manufacturing cost				
Materials handling				
$0.40 × 500; $0.40 × 2,000	200		800	
Lathe work				
$0.20 × 20,000; $0.20 × 59,250	4,000		11,850	
Milling				
$20.00 × 150; $20.00 × 1,050	3,000		21,000	
Grinding				
$0.80 × 500; $0.80 × 2,000	400		1,600	
Testing				
$15.00 × 10; $15.00 × 200	150	7,750	3,000	38,250
Total manufacturing cost		$18,200		$109,400
Divided by number of units		÷ 10		÷ 200
Manufacturing cost per unit		$ 1,820		$ 547

3.

	Job Order 410	Job Order 411
Number of units in job	10	200
Costs per unit with prior costing system	$1,332.50	$571.375
Costs per unit with activity-based costing	1,820.00	547

Job order 410 has an increase in reported unit cost of 36.6% [($1,820 – $1,332.50) ÷ $1,332.50], while job order 411 has a decrease in reported unit cost of 4.3% [($547 – $571.375) ÷ $571.375].

A common finding when activity-based costing is implemented is that low-volume products have increases in their reported costs while high-volume products have decreases in their reported cost. This result is also found in requirements 1 and 2 of this problem. Costs such as materials-handling costs vary with the number of parts handled (a function of batches and complexity of products) rather than with direct manufacturing labor-hours, an output-unit level cost driver, which was the only cost driver in the previous job-costing system.

The product cost figures computed in requirements 1 and 2 differ because

a. the job orders differ in the way they use each of five activity areas, and
b. the activity areas differ in their indirect cost allocation bases (specifically, each area does not use the direct manufacturing labor-hours indirect cost allocation base).

The following table documents how the two job orders differ in the way they use each of the five activity areas included in indirect manufacturing costs:

	Usage Based on Analysis of Activity Area Cost Drivers		Usage Assumed with Direct Manuf. Labor-Hours as Application Base	
Activity Area	**Job Order 410**	**Job Order 411**	**Job Order 410**	**Job Order 411**
Materials handling	20.0%	80.0%	6.25%	93.75%
Lathe work	25.2	74.8	6.25	93.75
Milling	12.5	87.5	6.25	93.75
Grinding	20.0	80.0	6.25	93.75
Testing	4.8	95.2	6.25	93.75

The differences in product cost figures might be important to Tracy Corporation for product pricing and product emphasis decisions. The activity-based accounting approach indicates that job order 410 is being undercosted while job order 411 is being overcosted. Tracy Corporation may erroneously push job order 410 and deemphasize job order 411. Moreover, by its actions, Tracy Corporation may encourage a competitor to enter the market for job order 411 and take market share away from it.

4. Information from the ABC system can also help Tracy manage its business better in several ways.

a. *Product design*. Product designers at Tracy Corporation likely will find the numbers in the activity-based costing approach more believable and credible than those in the simple system. In a machine-paced manufacturing environment, it is unlikely that direct labor-hours would be the major cost driver. Activity-based costing provides more credible signals to product designers about the ways the costs of a product can be reduced—for example, use fewer parts, require fewer turns on the lathe, and reduce the number of machine-hours in the milling area.

b. *Cost management*. Tracy can reduce the cost of jobs both by making process improvements that reduce the activities that need to be done to complete jobs and by reducing the costs of doing the activities.

c. *Cost planning.* ABC provides a more refined model to forecast costs and to explain why actual costs differ from budgeted costs.

5-40 (50 min.) **ABC, implementation, ethics.**

1. Applewood Electronics should not emphasize the Regal model and should not phase out the Monarch model. Under activity-based costing, the Regal model has an operating income percentage of less than 3%, while the Monarch model has an operating income percentage of nearly 43%.

Cost driver rates for the various activities identified in the activity-based costing (ABC) system are as follows:

Soldering	$ 942,000	÷ 1,570,000	= $ 0.60	per solder point
Shipments	860,000	÷ 20,000	= 43.00	per shipment
Quality control	1,240,000	÷ 77,500	= 16.00	per inspection
Purchase orders	950,400	÷ 190,080	= 5.00	per order
Machine power	57,600	÷ 192,000	= 0.30	per machine-hour
Machine setups	750,000	÷ 30,000	= 25.00	per setup

Applewood Electronics
Calculation of Costs of Each Model
under Activity-Based Costing

	Monarch	Regal
Direct costs		
Direct materials ($208 × 22,000; $584 × 4,000)	$ 4,576,000	$2,336,000
Direct manufacturing labor ($18 × 22,000; $42 × 4,000)	396,000	168,000
Machine costs ($144 × 22,000; $72 × 4,000)	3,168,000	288,000
Total direct costs	8,140,000	2,792,000
Indirect costs		
Soldering ($0.60 × 1,185,000; $0.60 × 385,000)	711,000	231,000
Shipments ($43 × 16,200; $43 × 3,800)	696,600	163,400
Quality control ($16 × 56,200; $16 × 21,300)	899,200	340,800
Purchase orders ($5 × 80,100; $5 × 109,980)	400,500	549,900
Machine power ($0.30 × 176,000; $0.30 × 16,000)	52,800	4,800
Machine setups ($25 × 16,000; $25 × 14,000)	400,000	350,000
Total indirect costs	3,160,100	1,639,900
Total costs	$11,300,100	$4,431,900

Profitability analysis

	Monarch	Regal	Total
Revenues	$19,800,000	$4,560,000	$24,360,000
Cost of goods sold	11,300,100	4,431,900	15,732,000
Gross margin	$ 8,499,900	$ 128,100	$ 8,628,000
Per-unit calculations:			
Units sold	22,000	4,000	
Selling price ($19,800,000 ÷ 22,000; $4,560,000 ÷ 4,000)	$900.00	$1,140.00	
Cost of goods sold ($11,300,100 ÷ 22,000; $4,431,900 ÷ 4,000)	513.64	1,107.98	
Gross margin	$386.36	$ 32.02	
Gross margin percentage	42.9%	2.8%	

2. Applewood's simple costing system allocates all manufacturing overhead other than machine costs on the basis of machine-hours, an output unit-level cost driver. Consequently, the more machine-hours per unit that a product needs, the greater the manufacturing overhead allocated to it. Because Monarch uses twice the number of machine-hours per unit compared to Regal, a large amount of manufacturing overhead is allocated to Monarch.

The ABC analysis recognizes several batch-level cost drivers such as purchase orders, shipments, and setups. Regal uses these resources much more intensively than Monarch. The ABC system recognizes Regal's use of these overhead resources. Consider, for example, purchase order costs. The simple system allocates these costs on the basis of machine-hours. As a result, each unit of Monarch is allocated twice the purchase order costs of each unit of Regal. The ABC system allocates $400,500 of purchase order costs to Monarch (equal to $18.20 ($400,500 ÷ 22,000) per unit) and $549,900 of purchase order costs to Regal (equal to $137.48 ($549,900 ÷ 4,000) per unit). Each unit of Regal uses 7.55 ($137.48 ÷ $18.20) times the purchases order costs of each unit of Monarch.

Recognizing Regal's more intensive use of manufacturing overhead results in Regal showing a much lower profitability under the ABC system. By the same token, the ABC analysis shows that Monarch is quite profitable. The simple costing system overcosted Monarch, and so made it appear less profitable.

3. Duval's comments about ABC implementation are valid. When designing and implementing ABC systems, managers and management accountants need to trade off the costs of the system against its benefits. Adding more activities would make the system harder to understand and more costly to implement but it would probably improve the accuracy of cost information, which, in turn, would help Applewood make better decisions. Similarly, using inspection-hours and setup-hours as allocation bases would also probably lead to more accurate cost information, but it would increase measurement costs.

4. Activity-based management (ABM) is the use of information from activity-based costing to make improvements in a firm. For example, a firm could revise product prices on the basis of revised cost information. For the long term, activity-based costing can assist management in making decisions regarding the viability of product lines, distribution channels, marketing strategies, etc. ABM highlights possible improvements, including reduction or elimination of non-value-added activities, selecting lower cost activities, sharing activities with other products, and eliminating waste. ABM is an integrated approach that focuses management's attention on activities with the ultimate aim of continuous improvement. As a whole-company philosophy, ABM focuses on strategic, as well as tactical and operational activities of the company.

5. Incorrect reporting of ABC costs with the goal of retaining both the Monarch and Regal product lines is unethical. In assessing the situation, the specific "Standards of Ethical Conduct for Management Accountants" (described in Exhibit 1-7) that the management accountant should consider are listed below.

Competence
Clear reports using relevant and reliable information should be prepared. Preparing reports on the basis of incorrect costs in order to retain product lines violates competence standards. It is unethical for Benzo to change the ABC system with the specific goal of reporting different product cost numbers that Duval favors.

Integrity
The management accountant has a responsibility to avoid actual or apparent conflicts of interest and advise all appropriate parties of any potential conflict. Benzo may be tempted to change the product cost numbers to please Duval, the division president. This action, however, would violate the responsibility for integrity. The Standards of Ethical Conduct require the management accountant to communicate favorable as well as unfavorable information.

Credibility
The management accountant's standards of ethical conduct require that information should be fairly and objectively communicated and that all relevant information should be disclosed. From a management accountant's standpoint, adjusting the product cost numbers to make both the Monarch and Regal lines look profitable would violate the standard of objectivity.

Benzo should indicate to Duval that the product cost calculations are, indeed, appropriate. If Duval still insists on modifying the product cost numbers, Benzo should raise the matter with one of Duval's superiors. If, after taking all these steps, there is continued pressure to modify product cost numbers, Benzo should consider resigning from the company, rather than engage in unethical behavior.

5-41 (30-40 mins.) **Activity-based costing, cost hierarchy**.

1.

Super Bookstore
Income Statement
For the Year Ended 31 December, 2010

	Books	CDs	Café	Total
Revenues	$3,720,480	$2,315,360	$736,216	$6,772,056
Cost of Merchandise	2,656,727	1,722,311	556,685	4,935,723
Cost of Café Cleaning			18,250	18,250
Allocated Selling, General and Administration Costs[a] (0.300986 × $2,656,727; $1,722,311; $556,685)	799,638	518,392	167,554	1,485,584
Operating income	$ 264,115	$ 74,657	$ (6,273)	$ 332,499

[a]Overhead rate = $1,485,584 ÷ $4,935,723 = 0.300986 per cost of merchandise dollar

2. Selling, general and administration (S,G & A) is comprised of a variety of costs that are unlikely to be consumed uniformly across product lines based on the cost of merchandise. Super Bookstore should consider an activity-based costing system to clarify how each product line uses these S, G & A resources.

	Books	CDs	Café	Total
Number of purchase orders	2,800	2,500	2,000	7,300
Number of deliveries received	1,400	1,700	1,600	4,700
Hours of shelf-stocking time	15,000	14,000	10,000	39,000
Items sold	124,016	115,768	368,108	607,892

Purchasing	$474,500 ÷ 7,300 orders placed = $65 per purchase order
Receiving	$432,400 ÷ 4,700 deliveries = $92 per delivery
Stocking	$487,500 ÷ 39,000 hours = $12.50 per stocking hour
Customer support	$91, 184 ÷ 607,892 items sold = $0.15 per item sold

	Books	CDs	Café	Total
Revenues	$3,720,480	$2,315,360	$ 736,216	$6,772,056
Cost of Merchandise	2,656,727	1,722,311	556,685	4,935,723
Gross margin	1,063,753	593,049	179,531	1,836,333
Cost of Café Cleaning			18,250	18,250
Purchasing ($65 × 2,800; 2,500; 2,000)	182,000	162,500	130,000	474,500
Receiving ($92 × 1,400; 1,700; 1,600)	128,800	156,400	147,200	432,400
Shelf-stocking ($12.50 × 15,000; 14,000; 10,000)	187,500	175,000	125,000	487,500
Customer support ($0.15 × 124,016; 115,768; 368,108	18,603	17,365	55,216	91,184
Total S, G & A costs	516,903	511,265	475,666	1,503,834
Operating income	$ 546,850	$ 81,784	$(296,135)	$ 332,499

Comparing product line income statements in requirements 1 and 2, it appears that books are much more profitable and café loses a lot more money under the ABC system compared to the simple system. The reason is that books use far fewer S,G & A resources relative to its merchandise costs and café uses far greater S, G & A resources relative to its merchandise costs.

3.

To: Super Bookstore Management Team
From: Cost Analyst
Re: Costing System

The current accounting system allocates indirect costs (S,G & A) to product lines based on the Cost of Merchandise sold. Using this method, the S, G & A costs are assigned 54%, 35%, 11%, to the Books, CDs, and Café product lines, respectively.

I recommend that the organization switch to an activity-based costing (ABC) method. With ABC, the product lines are assigned indirect costs based on their consumption of the activities that give rise to the costs. An ABC analysis reveals that the Café consumes considerably more than 11% of indirect costs. Instead, the café generally requires 25-35% of the purchasing, receiving and stocking activity and 60% of the customer support.

The current accounting technique masks the losses being produced by the café because it assumes all indirect costs are driven by the dollar amount of merchandise sold. By adopting ABC, management can evaluate the costs of operating the three product lines and make more informed pricing and product mix decisions. For example, management may want to consider increasing prices of the food and drinks served in the café. Before deciding whether to increase prices or to close the café, management must consider the beneficial effect that having a cafe has on the other product lines.

An ABC analysis can also help Super Bookstore manage its costs by reducing the number of activities that each product line demands and by reducing the cost of each activity. These actions will improve the profitability of each product line. ABC analysis can also be used to plan and manage the various activities.