Solutions Manual
for

COST ACCOUNTING

Creating Value for Management

Fifth Edition

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How to Use this File

This file contains an entire manual for your use. Within this file, there have been *hypertext links* created to allow you to quickly access various subjects. The following chart is to be used as a guide as to how to move about this document easily. Please print out a copy for future reference.

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These four icons are used to access pages one at a time. The first icon, ⏮, allows you to move quickly to the first page of the book. The last icon, ⏭, allows you to move quickly to the last page. The two icons, ◀▶, allow you to view pages one at a time, forwards and backwards.

The *Go Back* and *Go Forward* buttons allow you to retrace your steps in a document, moving to each view in the order visited.

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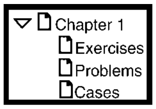
Click the *Bookmarks and Page* button (second from the left on toolbox) to open the overview area and display bookmarks created for the document. (See next entry for bookmark explanation.)



Chapter 1
Exercises
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Cases

This is a sample of the bookmarks that will display when the *Bookmarks and Page* button is used.

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Chapter 1

Cost Accounting: How Managers Use Cost Accounting Information

Solutions to Review Questions

1–1.

C Analysis of divisional performance

A Costing for income tax purposes

B Determining how many units to produce in the coming week

1–2.

Descriptions of the six business functions in the value chain are as follows:

1. **Research and development:** the creation and development of ideas related to new products, services, or processes.
2. **Design:** the detailed development and engineering of products, services, or processes.
3. **Production:** the collection and assembly of resources to produce a product or deliver a service.
4. **Marketing:** the process that informs potential customers about the attributes of products or services, and leads to the sale of those products or services.
5. **Distribution:** the process established to deliver products or services to customers.
6. **Customer Service:** product or service support activities provided to customers.

1–3.

Value-added activities are activities that customers perceive as adding utility to the goods or services they purchase. Nonvalue-added activities do not add value to the goods or services.

1–4.

Differential costs are important for managerial decision making, but other cost data can provide management with additional important information. For example, inventory values and costs of goods sold are important for income tax and financial reporting purposes as well as for most bonus and cost-plus contracting purposes. Costs for performance evaluation are not necessarily differential costs. Companies try to recover all costs, hence some estimate of total costs is needed. (This could be an opportunity to discuss short-run and long-run costs with students, noting that in the long run, all costs must be covered.)

1–5.

Costs that could be shared among housemates might include a share of the rent, food, utilities, and other related costs. Costs that would differ with the addition of another person are the differential costs. These differential costs might include food. It would be necessary to negotiate an agreement between you and the other person considering all factors. For example, should you split the total costs or charge only the differential costs of the additional person.

Businesses are often faced with similar decisions on finding the appropriate cost base for splitting costs. There are no generally accepted accounting rules for determining appropriate shared costs in either situation. Hence, it is important to specify arrangements about costs precisely when agreements are made.

1–6.

Performance evaluation systems are designed for a specific company’s needs. The systems should be flexible to adapt to the circumstances which exist in that company. A common set of accounting principles would tend to reduce flexibility and usefulness of these systems. As long as all parties know the accounting basis used by the system, the exact rules can be designed in whatever manner the parties deem appropriate.

1–7.

Most utilities are characterized by the need to install a substantial amount of equipment to meet peak loads. The peak load for the telephone company is during business hours, particularly in the mid-morning. At other times this equipment is operating at less than capacity. That is, there are lines available for use. By encouraging users to shift their usage from the peak times to such off-peak hours as evenings, nights and weekends, less equipment is required and the existing equipment is utilized more heavily.

The considerations in the decision would include: (a) the savings from not having to purchase more equipment; (b) the revenues that could be generated on off-peak hours when existing equipment would be sufficient; (c) the revenues that could be generated from telephone calls that would not be made at all at the higher prices; and (d) the costs of operating the telephone system in off-peak hours. Offsetting these benefits would be the reduction in revenues from calls that would be made during off-peak hours even if full rates were in effect. Apparently the telephone company has found that the benefits outweigh the loss in revenues from using off-peak rates.

1–8.

While a manager, and not the controller, has the business expertise to make management decisions, the decisions will not be good ones if the manager does not understand the data used to make them. For example, the manager may be working with the costs of a product, and not realize which costs are fixed and which are variable. The controller understands the types of data that are available, the rules used to accumulate the data, and the limitations that exist on the data. Therefore, the manager and the controller need to interact in the decision-making process. The controller can provide the manager with the relevant data, and an explanation of its suitable uses. The manager then can make better decisions.

1–9.
In decision making, managers or supervisors may wish to take actions that are not economically justifiable. In most cases, upon receipt of a well-developed cost analysis, a production manager is satisfied whether an action is feasible. If the action is not economically justifiable, the matter is dropped without conflict. In a few cases, however, managers may wish to pursue a project because of personal reasons, and hope to have an economic analysis to support it. In these situations, care must be taken to ascertain the economic merits of the plan, and, if the plan cannot be justified on economic grounds, the manager must make the case for the project on another basis. The final responsibility for the decision rests with the manager. Therefore, plans that cannot be justified on a cost analysis basis may still be adopted at the discretion of management.

In the control area, the accountant is charged with the responsibility of making certain that plans are executed in an optimal and efficient manner. In some cases this may be viewed as placing restrictions on management actions. Under these circumstances the manager may view the accounting function as placing too great a constraint on the manager while the accountant may view the manager as attempting to circumvent the rules.

1–10.
The marketing people at Lever Bros. rely on accounting information for decisions. For example, accounting provides information about distribution costs, and helps marketing people determine the cost of materials and packaging if management decides to change a product.

1–11.
The nonvalue-added activity—the amount of time employees are idle during normal trash pickups as a result of their trucks breaking down—occurred because workers did not inspect their trucks at the end of shifts for maintenance and repairs needs. So trucks broke down during normal trash pickups. The threat of privatization created incentives probably because workers thought they would not be hired by private trash collectors (or their working conditions would be worse or their wages would be lower).

1–12.
The answer is simple—you get what you motivate.

Solutions to Exercises

1–13. (20 min.) *Cost data for managerial purposes.*

a. Differential costs are costs that would change; that is, the materials costs in this situation. Other costs would presumably not be affected by the change in materials. Other issues include the quality and availability of the new materials.

Differential costs next year are $.90 (= $6.00 – $5.10) calculated as follows:

	Cost	
	Old Materials	New Materials
Next year	$6.00	$5.10 (85% x $6.00)

b. Management would use the information to help decide whether to use the new materials. Management would also want to know the quality of materials and the reliability of the vendor.

1–14. (20 min.) *Cost data for managerial purposes: Technology, Inc.*

This exercise demonstrates the importance of determining what is differential, and not being misled by the "bottom line."

All costs except corporate administration would be differential. Here is the calculation of the lost contribution:

Revenue lost	$430,000
Costs saved (excluding corporate admin.)	393,000
Contribution lost, before taxes	37,000
Taxes saved (40% of the lost contribution)	14,800
Net contribution lost	$ 22,200

Management must decide whether the contribution toward corporate administrative costs and profits is sufficient to justify continuing operations, or whether it should seek a more profitable line of business. Unless there is a better alternative use of corporate resources, the division should not be closed in the short run, despite the reported loss on the financial statement.

1–15.

Cost	*Value Chain Classification*
Transportation	distribution
Utilities	production
Salaries	research and development
Visits to customer	customer service
Packaging design	design
Advertising	marketing

1–16.

Cost	*Value Chain Classification*
Redesign	design
Promotion materials	marketing
Equipment	research and development
Sales people bonuses	marketing
Postage	distribution
Labor	production

1–17. (20 min.) *Ethics and altering the books: Amos & Associates*

a. The unofficial CMA answer comments specifically on competence, confidentiality, integrity, and objectivity with respect to the Standards of Ethical Conduct for Management Accountants. Basically, Elizabeth has a responsibility to perform professional duties in accordance with relevant laws, standards, and GAAP. Elizabeth must communicate both favorable as well as unfavorable information fairly and objectively. She must disclose all relevant information that could influence the users' understanding of the reports.

b. Elizabeth should first follow Amos & Associates' established policy on the resolution of ethical conflict. (Assuming there is one!) If there isn't an established policy Elizabeth should confront the next higher level of management that she believes is not involved in the altering of figures. This could be the Chairman of the Board of Directors. If the matter remains unresolved she should take the issue to the Audit Committee and the Board of Directors. Perhaps Elizabeth should seek confidential discussion with an objective advisor. When all levels of internal review have been exhausted without satisfactory results, Elizabeth should resign and submit an informative memorandum to the chairman of the Board of Directors.

Solutions to Problems

1–18. (30 min.) *Responsibility for ethical action: Toxic, Inc.*

a. As a management accountant Paul has a responsibility to perform his professional duties with competence in accordance with relevant laws and regulations. Clearly, dumping toxic waste is a violation of the law. As such, Paul might have a legal responsibility to take some action. As a professional, he must communicate both favorable and unfavorable information in an objective and fair manner. Thus, he cannot simply ignore the fact that Toxic, Inc. is involved in illegal toxic dumping.

b. The first possible course of action was to discuss the situation with the controller. This is an appropriate approach to the problem. Always take a problem to your immediate supervisor first. If the controller indicates that he is aware of the situation and that you should not worry about it, then take the matter up with your controller's superior. Move up the layers of management until someone is concerned and will deal with the problem.

As for the second course of action, the proper authorities should be notified by someone in the company. The local newspaper, however, is not the proper authority. Paul should discuss the matter with the Board of Directors only after exhausting possibilities of discussing the matter with internal management.

1–19. (30 min.) *Ethics and inventory obsolescence: Angioplasty Corporation.*

a. The controller has a responsibility to perform his duties in a competent manner, one that is in accordance with relevant laws, regulations, technical standards, and generally accepted accounting principles. The controller's lack of action regarding the overstatement of inventory is a violation of professional responsibilities.

b. Linda should first follow Angioplasty's established policy on the resolution of ethical conflict. (Assuming there is one!) If there isn't an established policy, Linda might want to mention to the controller the fact that she believes both the CFO and the external auditors are unaware of the inventory overvaluation. If she is uncomfortable mentioning this to the controller, she should talk directly to the CFO instead. If the situation is still unresolved then Linda should bring it to the attention of the Audit Committee and the Board of Directors. Perhaps Linda should seek confidential discussion with an objective advisor to clarify the issues and possible courses of action.

When all levels of internal review have been exhausted without satisfactory results, Linda should resign and submit an informative memorandum to the chairman of the Board of Directors. Except where legally prescribed, the disclosure of such information to outsiders (the media, regulatory bodies, external auditors, etc.) is considered inappropriate.

1–20. (30 min.) *Cost data for managerial purposes: Wegrow Fruits, Inc.*

This problem demonstrates the ambiguity of cost-based contracting and, indeed, the measurement of “cost.”

Recommended prices may range from the $42.90 suggested by NASA to the $53.35 charged by Wegrow Fruits, Inc. The key is to negotiate the cost-based price prior to the signing of the contract. Considerations which affect the base costs are reflected in the following options:

Options:

A. Only the differential costs could be considered as the cost basis.

B. The total cost per case for normal production of 80,000 cases could be used as the cost basis.

C. The total cost per case for production of 120,000 cases, excluding marketing costs, could be used as the cost basis.

D. The total cost per case for production of 120,000 cases, including marketing costs, could be used as the cost basis.

Costs		*Unit Cost Options (One Unit = One Case of Fang)*			
		A	*B*	*C*	*D*
Materials (var.)	$12	$12	$12	$12	$12
Labor (var.)	19	19	19	19	19
Supplies (var.)	8	8	8	8	8
Indirect costs (fixed)	440,000	N/A	5.50	3.67	3.67
Marketing (var)	2	N/A	2	N/A	2
Administrative (fixed)	160,000	N/A	2	1.33	1.33
Per case cost basis		$39	$48.50	$44	$46
Per case price (Cost + 10%)		$42.90	$53.35	$48.40	$50.60

We believe the most justifiable options exclude marketing costs and reflect the actual production level of 120,000 cases. These are Options A and C. (As stockholders in Wegrow Fruits, Inc., we would prefer Option C.)

1–21. (30 min.) *Cost data for managerial purposes: Ante Division.*

This problem demonstrates the ambiguity in measuring “costs.”

Ante Division’s controller included the “per unit” fixed costs, calculated for allocation purposes under normal production volume, when it calculated the per unit cost of the additional production. The controller charged Beta Division on that basis, ignoring the differential costs as a basis for inter-division sales.

Possible options available are as follows:

A. Use the full per unit cost for normal production of 25,000 units.

B. Use only differential costs as the cost basis.

C. Use differential costs plus a share of fixed costs, based on actual production volume (with Beta’s order) of 37,500 units.

Costs		*Unit Cost Options:*		
		A	*B*	*C*
Direct materials (var.)	$.80	$.80	$.80	$.80
Direct Labor (var.)	4.00	4.00	4.00	4.00
Other variable costs	.40	.40	.40	.40
Fixed costs	90,000.00	3.60	N/A	3.00
Per unit cost		$8.80	$5.20	$ 8.20
Cost plus 20%		10.56	6.24	9.84
Total price (5,000 units)		$52,800	$31,200	$49,200

If fixed costs are not differential and Ante has no alternative uses of the excess capacity (between 37,500 units available capacity and 25,000 units used), then Option B is the most defensible. Options A and C overstate the differential cost of production which could inappropriately affect Beta’s decisions about buying internally or externally, or about pricing its product, among other decisions.

1–22. (20 min.) *Cost data for managerial purposes: Amanda's Coffee, Inc.*

a.

	(1) *Baseline*	*(2)* *Alternative with Ice Cream*	*(3)* *Differential Revenues and Costs*
Sales revenue	$38,000	$78,000	$40,000
Costs:			
Food	$15,000	$35,000	$20,000
Labor	12,000	18,000[a]	6,000
Utilities	2,000	3,000[a]	1,000
Rent	4,000	4,800[b]	800
Other costs	2,000	2,400[b]	400
Manager’s salary	6,000	6,000	–0–
Total costs	41,000	69,200	28,200
Operating profit	$ (3,000)	$ 8,800	$11,800

[a] Fifty percent higher than baseline.

[b] Twenty percent higher than baseline

b. The decision to expand and offer ice cream results in differential profits of $11,800, so it is profitable to expand. Note that only differential costs and revenues figured in the decision. The supervisor's salary did not change, so it was not included.

1–23. (25 min.) *Cost data for managerial purposes: Change Management Corporation.*

a. The following differential costs would be incurred:

Consultant Labor	$134,000	Given
Equipment Lease.......	4,200	5% of $84,000
Supplies.....................	5,400	10% of $54,000
Other Costs	5,700	15% of $38,000
Total Costs	$149,300	

b. Technically, since acceptance of the contract would add $700 to operating profits, it would seem that acceptance of the contract is called for. Of course, as a practical matter the amount is so small that it would probably not be worth the effort.

c. Other factors would include (1) whether this will enable the company to get into a new, profitable line of business; (2) what other opportunities the company has for expanding; and (3) whether the contract will provide for more revenues in the future. In short, the company must consider the long run as well as the first year's results.

Chapter 2
Cost Concepts and Behavior

Solutions to Review Questions

2–1.
Cost is a more general term that refers to a sacrifice of resources and may be either an opportunity cost or an outlay cost. An expense is the write-off of an outlay cost against revenues in a particular accounting period and usually pertains only to external financial reports.

2–2.
Product costs are those costs that can be more easily attributed to products, while period costs are those costs that are more easily attributed to time periods. The determination of product costs varies depending on the approach used: full absorption, variable, or managerial costing. See page 44 for definitions of product cost using each approach.

2–3.
Yes. The costs associated with goods sold in a period are not expected to result in future benefits. They provided revenues for the period in which the goods were sold; therefore, they are expensed for financial accounting purposes.

2–4.
Both accounts represent the cost of the goods acquired from an outside supplier, which include all costs necessary to ready the goods for sale (in merchandising) or production (in manufacturing).

The merchandiser expenses these costs as the product is sold, as no additional costs are incurred. The manufacturer transforms the purchased materials into finished goods and charges these costs, along with conversion costs to production (work in process inventory). These costs are expensed when the finished goods are sold.

2–5.

Direct materials:	Materials in their raw or unconverted form which become an integral part of the finished product are considered direct materials. In some cases, materials are so immaterial in amount that they are considered part of overhead.
Direct labor:	Costs associated with labor engaged in manufacturing activities. Sometimes this is considered as the labor which is actually responsible for converting the materials into finished product. Assembly workers, cutters, finishers and similar “hands on” personnel are classified as direct labor.
Manufacturing overhead:	All other costs directly related to product manufacture. These costs include the indirect labor and materials, costs related to the facilities and equipment required to carry out manufacturing operations, supervisory costs, and all other direct support activities.

2–6.
Step costs change with volume in steps, such as when supervisors are added. Mixed costs have elements of both fixed and variable costs. Utilities and maintenance are often mixed costs.

2–7.
Total variable costs change in direct proportion to a change in volume (within the relevant range of activity). Total fixed costs do not change as volume changes (within the relevant range of activity).

2–8.
Prime costs are direct. Direct materials and direct labor are by their very nature directly related to the product. Some overhead costs are treated as indirect for practical reasons—while they might be directly associated with the product (e.g., incidental materials), they are too small in value to be separately measured. Other overhead costs, such as the occupancy costs of the manufacturing plant, are clearly indirect.

2–9.
Unit costs are averages only at a *given level of production*, the relevant range. Since some costs do not change, i.e. fixed costs, within certain production ranges, the average (fixed costs divided by number of units) will change as production changes within those ranges. Thus, to determine the incremental (or differential) cost per unit one must look at the change in *total* costs because of a change in production activity and divide by the total number of units.

2–10.
Marketing and administrative costs are treated as period costs and expensed for financial accounting purposes in both manufacturing and merchandising organizations.

2–11.
Knowing which costs would be assigned to the film was important for people who were paid based on a percentage of the film's net profits. Had they understood how costs of Forrest Gump were to be defined, they may have insisted on a share of revenues or a flat fee instead of profit sharing.

2–12.
Answer will depend on the restaurant studied. Examples are: materials—food; labor—meal preparers; overhead—maintenance, utilities, lease on building. Provocative questions include the following: Are napkins and condiments direct or indirect materials? Is the restaurant manager direct or indirect labor? Then ask if the way one categorizes these costs affects managerial decisions. (Probably not.)

2–13.
Examples: labor—instructors' salaries; overhead—departmental office staff's salaries.

Solutions to Exercises

2–14. (15 min.) *Basic concepts.*

Cost Item	*Fixed (F)* *Variable (V)*	*Period (P)* *Product (R)*
a. Transportation-in costs on materials purchased	V	R
b. Assembly line workers wages	V	R
c. Property taxes on office buildings for administrative staff	F	P
d. Salaries of top executives in the company	F	P
e. Overtime pay for assembly workers	V	R
f. Sales commissions	V	P
g. Sales personnel office rent	F	P
h. Sales supervisory salaries	F	P
i. Controller's office rental	F	P
j. Administrative office heat and air conditioning	F	P

2–15. (10 min.) *Basic concepts.*

a. Factory heating and air conditioning.	C
b. Production supervisor's salary.	C
c. Transportation-in costs on materials purchased.	P
d. Assembly line worker's salary.	B
e. Raw materials used in production process.	P
f. Indirect materials.	C

2–16. (15 min.) *Basic concepts.*

Concept	*Definition*	
Period costs	5.	Costs that can be more easily attributed to time intervals.
Indirect costs	9.	Costs that cannot be directly related to a cost object.
Fixed costs	11.	Costs that do not vary with the volume of activity.
Opportunity costs	7.	The lost benefit from the best forgone alternative.
Outlay costs	6.	Past, present or near-future cash flow.
Direct costs	10.	Costs that can be directly related to a cost object.
Expense	3.	The cost charged against revenue in a particular accounting period.
Cost	2.	A sacrifice of resources.
Variable costs	1.	Costs that vary with the volume of activity.
Full-absorption cost	8.	Costs used to compute inventory value according to GAAP.
Product costs	4.	Costs that are part of inventory.

2–17. (15 min.) *Basic concepts.*

Cost Item	*Fixed (F)* *Variable (V)*	*Period (P)* *Product (R)*
a. Factory security personnel	F	R
b. Utilities in controller's office	F	P
c. Factory heat and air conditioning	F	R
d. Power to operate factory equipment	V	R
e. Depreciation on furniture for company executives	F	P

2–18. (15 min.) *Prepare statements for a merchandising company: PC, Inc.*

PC, Inc.
Income Statement
For the Year Ended December 31, This Year

Revenue	$5,000,000
Cost of goods sold (see statement below)	3,060,000
Gross margin	1,940,000
Marketing and administrative costs	1,600,000
Operating profit	$ 340,000

PC, Inc.
Cost of Goods Sold Statement
For the Year Ended December 31, This Year

Beginning inventory		$ 500,000
Purchases	$2,600,000	
Transportation-in	260,000	
Total cost of goods purchased		2,860,000
Cost of goods available for sale		3,360,000
Ending inventory		300,000
Cost of goods sold		$3,060,000

2–19. (30 min.) *Prepare statements for a manufacturing company.*

We recommend setting up either T-accounts or equations to solve for the missing data.

a.

Materials Inv.	
12,250	
x	23,850
13,600	

Beginning direct materials inventory + Direct materials purchased = Direct materials used + Ending direct materials inventory

12,250 + X = $23,850 + $13,600

X = $23,850 + $13,600 – $12,250

X = $25,200

b.

Finished Goods Inventory	
2,250	
x	28,000
3,250	

Beginning finished goods inventory + Cost of goods manufactured = Cost of goods sold + Ending finished goods inventory

2,250 + X = $28,000 + $3,250

X = $28,000 + $3,250 – $2,250

X = $29,000

c.

Work in Process Inventory	
16,150	
x	29,000 *
14,500	

Beginning work in process inventory + Total manufacturing cost = Cost of goods manufactured + Ending work in process inventory

16,150 + X = $29,000* + $14,500

X = $29,000 + $14,500 – $16,150

X = $27,350

*From solution to part b.

2–19. (continued)

Sebastian Company
Cost of Goods Sold Statement
For the Year Ended December 31

Beginning work in process inventory			$16,150
Manufacturing costs:			
Direct materials:			
Beginning inventory	$12,250		
Purchases	25,200[(a)]		
Materials available	37,450		
Less ending inventory	13,600		
Direct materials used		$23,850	
Other manufacturing costs		3,500*	
Total manufacturing costs			27,350[(c)]
Less ending work in process inv.			14,500
Cost of goods manufactured			29,000[(b)]
Beginning finished goods inventory			2,250
Finished goods available for sale			31,250
Less ending finished goods inventory			3,250
Cost of goods sold			$28,000

Letters (a), (b), and (c) refer to amounts found for requirements *a, b,* and *c.*

*Difference between total manufacturing costs and direct materials used:
$3,500 = $27,350 – $23,850.

2–20. (30 min.) *Prepare statements for a manufacturing company: Nishimoto Machine Tools Company*

We recommend setting up T-accounts or equations to solve for the missing data.

a.

Direct Materials Inventory	
32,800	
x	173,200
36,600	

Beginning direct materials inventory	+	Direct materials purchases	=	Direct materials used	+	Ending direct materials inventory

$$\$32{,}800 + X = \$173{,}200 + \$36{,}600$$

$$X = \$173{,}200 + \$36{,}600 – \$32{,}800$$

$$X = \$177{,}000$$

b.

Finished Goods Inventory	
14,600	
x	600,000
15,000	

Beginning finished goods inventory	+	Cost of goods manufactured	=	Cost of goods sold	+	Ending finished goods inventory

$$\$14{,}600 + X = \$600{,}000 + \$15{,}000$$

$$X = \$600{,}000 + \$15{,}000 – \$14{,}600$$

$$X = \$600{,}400$$

c.

Work in Process Inventory	
36,200	
x	600,400*
35,400	

Beginning work in process inventory	+	Total manufacturing costs	=	Cost of goods manufactured	+	Ending work in process inventory

$$\$36{,}200 + X = \$600{,}400 + \$35{,}400$$

$$X = \$600{,}400 + \$35{,}400 – \$36{,}200$$

$$X = \$599{,}600$$

*From part b.

2–20. (continued)

Nishimoto Machine Tools Company
Cost of Goods Sold Statement
For the Year Ended December 31

Beginning work in process inventory			$ 36,200
Manufacturing costs:			
Direct materials:			
Beginning inventory	$ 32,800		
Purchases	177,000(a)		
Materials available	209,800		
Less ending inventory	36,600		
Direct materials used		$173,200	
Other manufacturing costs		426,400*	
Total manufacturing costs			599,600(c)
Total costs of work in process			635,800
Less ending work in process			35,400
Cost of goods manufactured			600,400(b)
Beginning finished goods inventory			14,600
Finished goods available for sale			615,000
Ending finished goods inventory			15,000
Cost of goods sold			$600,000

Letters (a), (b), and (c) refer to amounts found in solutions to requirements *a, b,* and *c.*
*Difference between total manufacturing costs and direct materials used.

2–21. (30 min.) *Prepare statements for a manufacturing company: Alexis Company.*

Alexis Company
Statement of Cost of Goods Sold
For the Year Ended December 31

Work in process, Jan. 1			$ 30,800
Manufacturing costs:			
Direct materials:			
Beginning inventory, Jan. 1	$ 36,800		
Add material purchases	44,600		
Direct materials available	81,400		
Less ending inventory, Dec. 31	38,000		
Direct materials used		$ 43,400	
Direct labor		71,200	
Manufacturing overhead:			
Supervisory and indirect labor	28,800		
Indirect materials and supplies	12,600		
Plant utilities and power	47,000		
Manufacturing building depreciation	54,000		
Property taxes, manufacturing plant	16,800		
Total manufacturing overhead		159,200	
Total manufacturing costs			273,800
Total cost of work in process during the year			304,600
Less work in process, Dec. 31			26,200
Costs of goods manufactured during the year			278,400
Beginning finished goods, Jan. 1			21,800
Finished goods inventory available for sale			300,200
Less ending finished goods inventory, Dec. 31			18,000
Cost of goods sold			$282,200

Alexis Company
Income Statement
For the Year Ended December 31

Sales revenue		$420,800
Less: Cost of goods sold		282,200
Gross margin		138,600
Administrative costs	$88,600	
Marketing costs (sales commissions)	30,400	
Total marketing and administrative costs		119,000
Operating profit		$ 19,600

2–22. (30 min.) *Prepare statements for a manufacturing company: Tots' Toy Factory.*

Tots' Toy Factory
Statement of Cost of Goods Sold
For the Year Ended December 31

Beginning work in process, Jan. 1			$ 6,600
Manufacturing costs:			
Direct materials:			
Beginning inventory, January 1	$ 8,200		
Add purchases	10,150		
Direct materials available	18,350		
Less ending inventory, December 31	9,000		
Direct materials put into process		$ 9,350	
Direct labor		16,300	
Manufacturing overhead:			
Supervisory and indirect labor	6,200		
Indirect materials and supplies	2,150		
Plant utilities and power	10,750		
Manufacturing building depreciation	12,500		
Property taxes, manufacturing plant	3,700		
Total manufacturing overhead		35,300	
Total manufacturing costs			60,950
Total cost of work in process during the year			67,550
Less work in process, December 31			5,550
Costs of goods manufactured during the year			62,000
Beginning finished goods, January 1			4,450
Finished goods inventory available for sale			66,450
Less ending finished goods inventory, December 31			4,050
Cost of goods sold			62,400

Tots' Toy Factory
Income Statement
For the Year Ended December 31

Sales revenue		$97,200
Less: Cost of goods sold (per statement)		62,400
Gross margin		34,800
Administrative costs	$21,550	
Sales commissions	7,100	
Total marketing and administrative costs		28,650
Operating profit		$ 6,150

2–23. (30 min.) *Prepare statements for a manufacturing company: Carey's Cakes.*

Carey's Cakes
Statement of Cost of Goods Sold
For the Year Ended December 31

Beginning work in process, Jan. 1			$ 7,700
Manufacturing costs:			
Direct materials:			
Beginning inventory, Jan. 1	$ 8,600		
Add: Purchases	11,560		
Transportation-in	1,150		
Direct materials available	21,310		
Less ending inventory, Dec. 31	8,050		
Direct materials used		$13,260	
Direct labor		19,350	
Manufacturing overhead:			
Supervisory and indirect labor	10,950		
Supplies and indirect materials	1,450		
Heat, light and power—plant (77.6% of total)	9,700		
Depreciation—manufacturing (80% of total)	12,000		
Property taxes—plant (80% of total)	3,150		
Total manufacturing overhead		37,250	
Total manufacturing costs			69,860
Total cost of work in process during the year			77,560
Less work in process, Dec. 31			6,210
Costs of goods manufactured during the year			71,350
Beginning finished goods, Jan. 1			3,550
Finished goods available for sale			74,900
Less ending finished goods, Dec. 31			4,950
Cost of goods sold			$ 69,950

2–23. (continued)

Carey's Cakes
Income Statement
For the Year Ended December 31

Sales revenue		$131,150
Less: Cost of goods sold (per statement)		69,950
Gross profit		61,200
Marketing and administrative costs:		
Depreciation (20% of total)	$3,000	
Heat, light and power (22.4% of total)	2,800	
Property taxes (25% of total)	1,050	
Administrative salaries	18,000	
Other administrative costs	4,350	
Marketing costs	16,350	
Total marketing and administrative costs		45,550
Operating profit		$ 15,650

2–24. (20 min.) *Cost behavior for decision making: Excalabur Company.*

Variable costs:	
Direct materials used ($35,200 x 1.4)	$ 49,280
Direct labor ($66,500 x 1.4)	93,100
Indirect materials and supplies ($8,000 x 1.4)	11,200
Power to run plant equipment ($7,100 x 1.4)	9,940
Total variable costs	$163,520
Fixed costs:	
Supervisory salaries	31,100
Plant utilities (other than power to run plant equipment)	9,600
Depreciation on plant and equipment	4,800
Property taxes on building	6,500
Total fixed costs	52,000
Total costs for 1,400 units	$215,520

$$\text{Unit cost} = \frac{\$215{,}520}{1{,}400 \text{ units}} = \$153.94$$

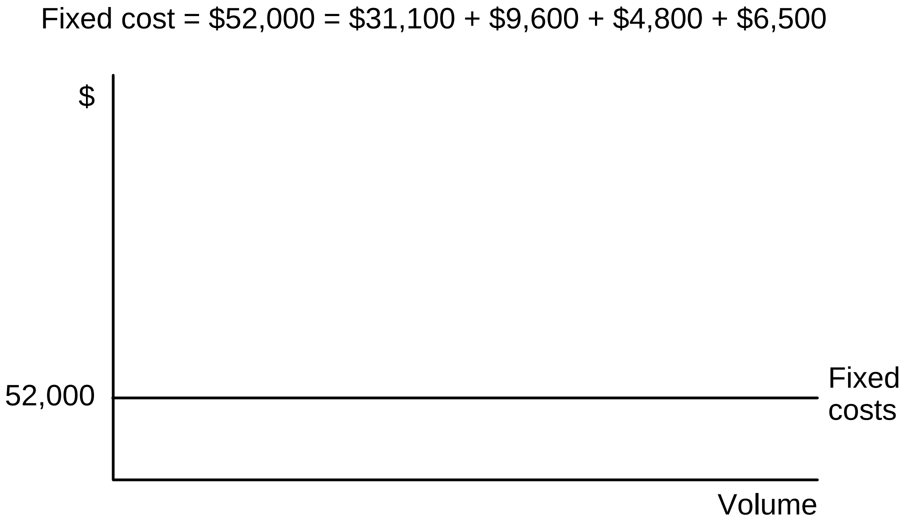
$$\text{Unit variable cost} = \frac{\$163{,}520}{1{,}400 \text{ units}} = \$116.80$$

Check to see if variable cost per unit is the same at 1,400 units as at 1,000 units:

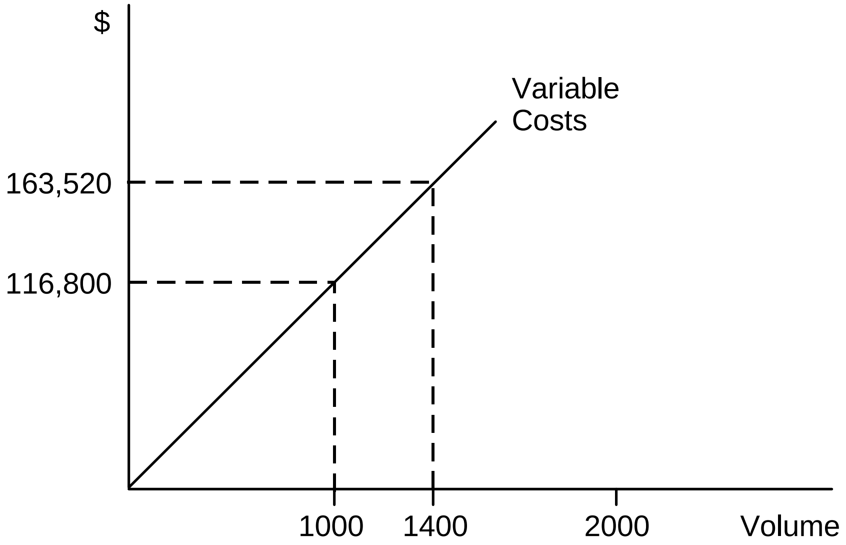
$$\begin{array}{c}\text{Unit variable cost} \\ \text{at 1,000 units}\end{array} = \frac{\$35{,}200 + \$66{,}500 + \$8{,}000 + \$7{,}100}{1{,}000} = \frac{\$116{,}800}{1{,}000} = \$116.80$$

2–25. (20 min.) *Cost behavior: Excalabur Company.*

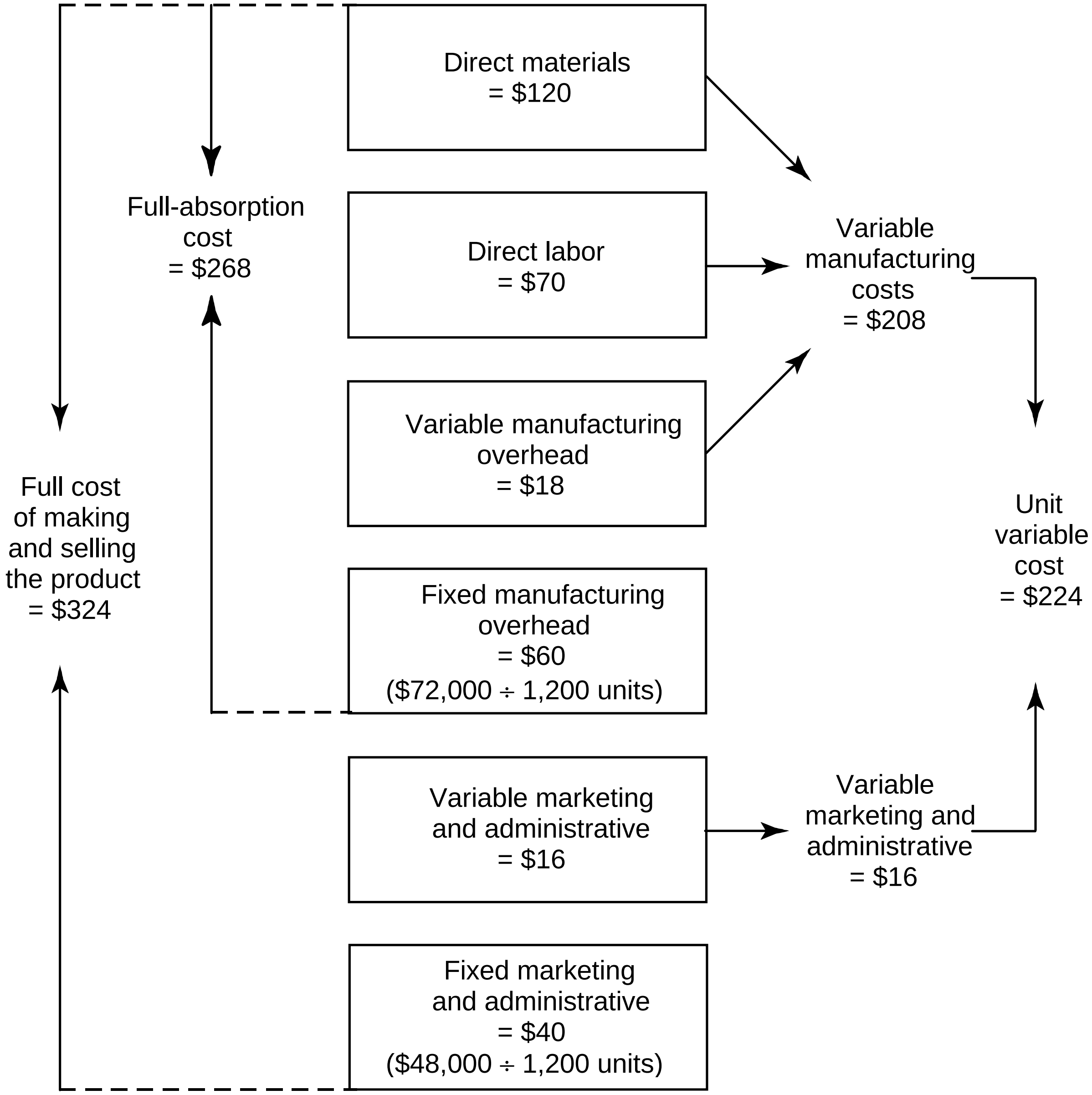
Fixed costs = \$52,000 = \$31,100 + \$9,600 + \$4,800 + \$6,500



Variable costs = \$116.80 per unit = (\$163,520 ÷ 1,400 units) or (\$116,800 ÷ 1,000 units)



2–26. (30 min.) *Components of full costs.*


Direct materials = $120
Full-absorption cost = $268
Direct labor = $70
Variable manufacturing costs = $208
Variable manufacturing overhead = $18
Full cost of making and selling the product = $324
Unit variable cost = $224
Fixed manufacturing overhead = $60 ($72,000 ÷ 1,200 units)
Variable marketing and administrative = $16
Variable marketing and administrative = $16
Fixed marketing and administrative = $40 ($48,000 ÷ 1,200 units)

a. Variable manufacturing cost:
$120 + $70 + $18 = $208

b. Variable cost:
$120 + $70 + $18 + $16 = $224

c. Full absorption cost:
$120 + $70 + $18 + ($72,000/1,200 units) = $268

d. Full cost:
$120 + $70 + $18 + $16 + ($72,000/1,200 units) + ($48,000/1,200 units) = $324

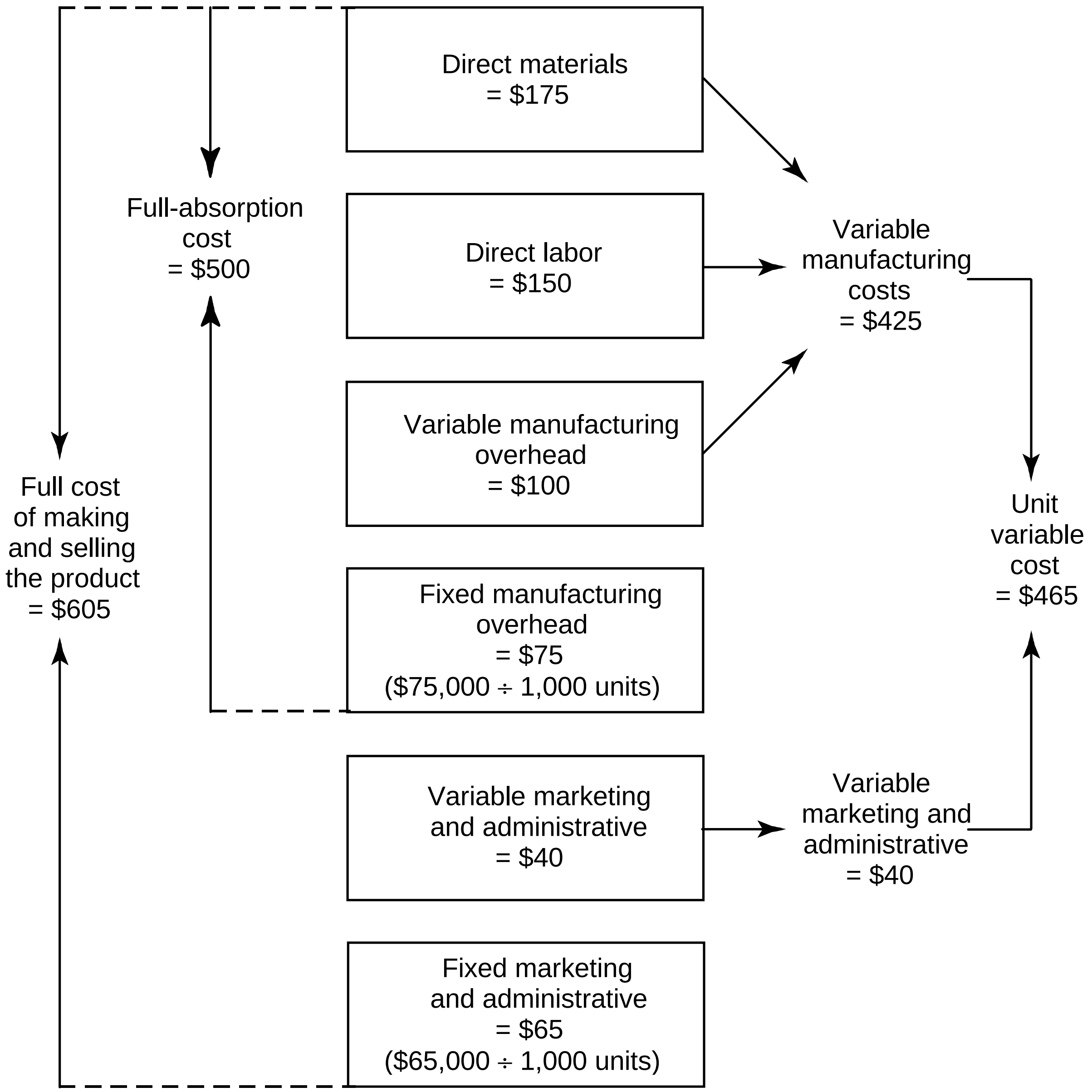
2–27. (15 min.) *Components of full costs.*

a. Product cost per unit:
$120 + $70 + $18 + ($72,000/1,200 units) = $268

b. Period costs for the period:
$48,000 + ($16 x 1,200 units) = $67,200

2–28. (30 min.) *Components of full cost: Young Company.*

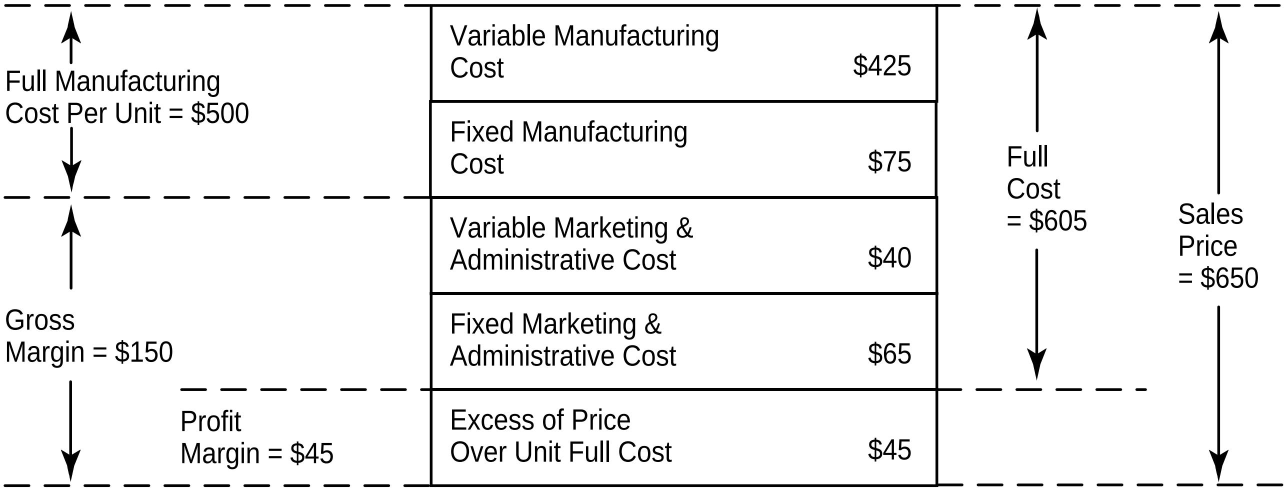
a.


Direct materials = $175
Direct labor = $150
Variable manufacturing overhead = $100
Fixed manufacturing overhead = $75 ($75,000 ÷ 1,000 units)
Variable marketing and administrative = $40
Fixed marketing and administrative = $65 ($65,000 ÷ 1,000 units)
Full-absorption cost = $500
Full cost of making and selling the product = $605
Variable manufacturing costs = $425
Variable marketing and administrative = $40
Unit variable cost = $465

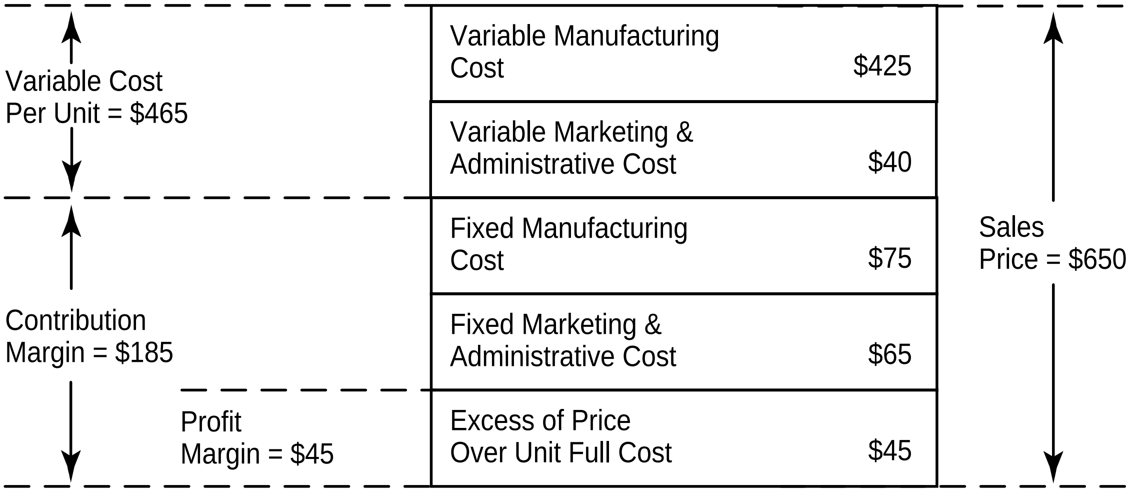
1. Variable manufacturing cost:
   $175 + $150 + $100 = $425
2. Variable cost:
   $175 + $150 + $100 + $40 = $465
3. Full-absorption cost:
   $175 + $150 + $100 + ($75,000/1,000 units) = $500
4. Full cost:
   $175 + $150 + $100 + ($75,000/1,000 units) + ($65,000/1,000 units) + $40 = $605

2–28. (continued)

b. Profit margin and gross margin (per unit at 1,000 units):


Full Manufacturing Cost Per Unit = $500
Gross Margin = $150
Profit Margin = $45
Variable Manufacturing Cost $425
Fixed Manufacturing Cost $75
Variable Marketing & Administrative Cost $40
Fixed Marketing & Administrative Cost $65
Excess of Price Over Unit Full Cost $45
Full Cost = $605
Sales Price = $650

Profit margin and contribution margin (per unit at 1,000 units):


Variable Cost Per Unit = $465
Contribution Margin = $185
Profit Margin = $45
Variable Manufacturing Cost $425
Variable Marketing & Administrative Cost $40
Fixed Manufacturing Cost $75
Fixed Marketing & Administrative Cost $65
Excess of Price Over Unit Full Cost $45
Sales Price = $650

2–29. (20 min.) *Components of full costs: Service organizations: Joe's Tax Service*

a. Variable costs for month + (Fixed costs for the month/hours) = Cost per unit
   (a unit is an hour billed.)
   $20 + ($55,000/20,000 hours) = $22.75

b. 1. Price per hour – Cost per unit = Profit margin
   $35 – $22.75 = $12.25

   2. Price per hour – Variable costs per hour = Contribution margin
   $35 – $20 = $15

2–30. (30 min.) *Value income statement: Top Videos*

a.

Top Videos
Value Income Statement
For the month ending August 31

	Nonvalue-added activities	*Value-added activities*	*Total*
Sales Revenue		$200,000	$200,000
Cost of merchandise:			
Cost of goods sold		110,000	110,000
Defective goods destroyed	$ 10,000		10,000
Gross margin	(10,000)	90,000	80,000
Operating expenses:			
Employee salaries and wages	8,000	32,000	40,000
Supervisory salaries	2,000	8,000	10,000
Rent, utilities, and other store costs*		20,000	20,000
Operating income/(loss)	$(20,000)	$ 30,000	$ 10,000

*A portion of these costs might be nonvalue-added if they can be reduced by reducing nonvalue-added activities.

b. The store manager can implement quality control procedures to identify defective goods as they reach the store rather than waiting for customers to complain or return the defective goods. In addition, the store manager can contact the studios that produce the videos and ask for improved quality (the studios may have the upper hand if they are the only ones distributing the videos—especially the popular videos!)

2–31. (30 min.) *Value income statement: Atul's Restaurant*

a.

Atul's Restaurant
Value Income Statement
For the month ending November 30

	Nonvalue-added activities	*Value-added activities*	*Total*
Sales Revenue		$130,000	$130,000
Cost of food and beverages			
Food and beverages		34,000	34,000
Food returned by patrons	$ 3,000		3,000
Food rejected in the kitchen	2,000		2,000
Gross margin	(5,000)	96,000	91,000
Operating expenses:			
Employee salaries and wages	9,000	51,000	60,000
Supervisory salaries	1,800	10,200	12,000
Rent, utilities, and other store costs*		16,000	16,000
Operating income/(loss)	$(15,800)	$ 18,800	$ 3,000

*A portion of these costs might be nonvalue-added if they can be reduced by reducing nonvalue-added activities.

b. The restaurant manager can buy better quality goods from suppliers to prevent food waste in the kitchen. The chef can also inspect the prepared food before taking it to the customer to reduce the number of returned meals.

2–32. (30 min.) *Value income statement: Tastee Ice Cream Shop*

a.

Tastee Ice Cream Shop
Value Income Statement
For the month ending July 31

	Nonvalue-added activities	*Value-added activities*	*Total*
Sales Revenue		$60,000	$60,000
Cost of ice cream	4,400	17,600	22,000
Gross margin	(4,400)	42,400	38,000
Operating expenses:			
Employee salaries and wages	2,000	6,000	8,000
Supervisory salaries	3,000	9,000	12,000
Rent, utilities, and other store costs*		9,000	9,000
Operating income/(loss)	$(9,400)	$18,400	$ 9,000

*A portion of these costs might be nonvalue-added if they can be reduced by reducing nonvalue-added activities.

b. The ice cream shop manager should consider purchasing a backup generator for future power outages—especially if these outages are common.

Solutions to Problems

2–33. (30 min.) *Cost concepts: Multiple choice.*

a. The answer is (1).

Prime costs = direct materials + direct labor

Direct materials = beginning inventory + purchases – ending inventory
= $9,000 + $21,000 – $7,500
= $22,500

Direct labor is given as $15,000

Prime costs = $22,500 + $15,000
= $37,500

b. The answer is (3).
Conversion costs = direct labor + manufacturing overhead
Conversion costs = $15,000 +$20,000 = $35,000

c. The answer is (2).

Total manufacturing costs = direct materials + direct labor + manufacturing overhead
= $22,500 (from a above) + $15,000 + $20,000
= $57,500

d. The answer is (1).

Cost of goods manufactured = beginning WIP + total manufacturing costs – ending WIP
= beginning WIP + direct materials + direct labor + manufacturing overhead – ending WIP
= $4,500 + $22,500 + $15,000 + $20,000 – $3,000
= $4,500 + $57,500 (from c above) – $3,000
= $59,000

e. The answer is (4).

Cost of goods sold = Cost of goods manufactured + Beginning finished goods inventory – Ending finished goods inventory

= $59,000 (from d above) + $13,500 – $18,000
= $54,500

2–34. (30 minutes) *Cost Concepts: multiple choice.*

a. The answer is (3)

variable manufacturing cost = manufacturing overhead + direct labor + direct materials
= $30 + $10 + $40
= $80

b. The answer is (4)

full unit cost = all unit fixed costs + all unit variable costs
= $20 + $15 + $5 + $30 + $10 + $40
= $120

c. The answer is (2)

variable cost = all variable unit costs
= $5 + $30 + $10 + $40
= $85

d. The answer is (1)

full absorption cost = fixed and variable manufacturing overhead + direct labor + direct materials
= $15 + $30 + $10 + $40
= $95

e. The answer is (2).

Prime cost = direct labor + direct materials
= $10 + $40
= $50

2–34. (continued)

f. The answer is (4).

conversion cost = direct labor + manufacturing overhead
= $10 + ($30 + $15)
= $55

g. The answer is (2).

profit margin = sales price – full cost
= $160 – $120
= $40

h. The answer is (2).

contribution margin = sales price – variable costs
= $160 – $85
= $75

i. The answer is (4).

gross margin = sales price – full absorption cost
= $160 – $95
= $65

j. The answer is (1).

As the number of units increases (reflected in the denominator), fixed manufacturing cost per unit decreases.

2–35. (40 min.) Find the unknown account balances.

a.	Finished goods beginning inventory	+	Cost of goods manufactured	–	Cost of goods sold	=	Finished goods ending inventory
	$254,200	+	$679,200	–	$760,000	=	Finished goods ending inventory
					$173,400	=	Finished goods ending inventory

b.	Direct materials used	+	Direct labor	+	Manufacturing overhead	=	Total manufacturing costs
	Direct materials used	+	$173,000	+	$240,000	=	$679,600
	Direct materials used	=	$266,600[a] (= $679,600 – $173,000 – $240,000)				

c.	Materials beginning inventory	+	Purchases	–	Materials used	=	Materials ending inventory
	$8,000	+	Purchases	–	$15,000	=	$12,400
			Purchases	=	$19,400 (= $12,400 – $8,000 + $15,000)		

d.	Materials beginning inventory	+	Purchases	–	Materials used	=	Materials ending inventory
	$45,000	+	$248,400	–	$234,200	=	Materials ending inventory
					$ 59,200	=	Materials ending inventory

---

[a] Also can be found from the Direct Materials Inventory account: $24,600 + $262,000 = $20,000 + Direct materials used. Direct materials used = $266,600

2–35. (continued)

e.

Work in process beginning inventory	+	Total manufacturing costs	–	Cost of goods manufactured	=	Work in process ending inventory
Work in process beginning inventory	+	$1,526,800	–	$1,518,220	=	$85,200
Work in process beginning inventory	=	$76,620	(= $85,200 – $1,526,800 + $1,518,220)			

f. Revenue – Cost of goods sold = Gross margin

$3,359,900 – Cost of goods sold = $1,874,600

Cost of goods sold = $1,485,300 (= $3,359,900 – $1,874,600)

g.

Direct materials used	+	Direct labor	+	Manufacturing overhead	=	Total manufacturing costs
$234,200	+	Direct labor	+	$430,600	=	$1,526,800
		Direct labor	=	$862,000	(= $1,526,800 – $234,200 – $430,600)	

2–35. (continued) (*Extra items.*)

Some instructors require Statements of Cost of Goods Sold which we include here:

	Company 1			*Company 2*		
Work in process, January 1			$ 11,600			$12,560
Manufacturing costs:						
Direct materials:						
Direct materials inventory, January 1	$ 24,600			$ 8,000		
Direct materials purchased	262,000			19,400[c]		
Direct materials available for use	286,600			27,400		
Less materials inventory, December 31	20,000			12,400		
Materials used		$266,600[b]			$15,000	
Direct labor		173,000			23,200	
Manufacturing overhead		240,000			19,800	
Total manufacturing costs			679,600			58,000
Total costs of work in process during the year			691,200			70,560
Less work in process, December 31			12,000			12,560
Cost of goods manufactured this year			679,200			58,000
Add finished goods, January 1			254,200			2,800
Cost of goods available for sale			933,400			60,800
Less finished goods, December 31			173,400[a]			4,600
Cost of goods sold			$760,000			$56,200

Note: Superscript letters cross-reference to missing amounts in the problem.

2–35. (concluded) (*Extra items.*)

	Company 3		
Work in process, January 1			$ 76,620[e]
Manufacturing costs:			
Direct materials:			
Direct materials inventory, January 1	$ 45,000		
Direct materials purchased	248,400		
Direct materials available for use	293,400		
Less materials inventory, December 31	59,200[d]		
Materials used		$234,200	
Direct labor		862,000[g]	
Manufacturing overhead		430,600	
Total manufacturing costs			1,526,800
Total costs of work in process during the year			1,603,420
Less work in process, December 31			85,200
Cost of goods manufactured this year			1,518,220
Add finished goods, January 1			334,480
Cost of goods available for sale			1,852,700
Less finished goods, December 31			367,400
Cost of goods sold			$1,485,300[f]

2–36. (40 min.) *Find the unknown account balances.*

a. Materials beginning inventory + Purchases – Materials used = Materials ending inventory

Materials beginning inventory + $16,100 – $15,300 = $3,600

Materials beginning inventory = $ 2,800 (= $3,600 – $16,100 + $15,300)

b. Work in progress beginning inventory + Total manufacturing costs – Cost of goods manufactured = Work in process ending inventory

$2,700 + $55,550 – Cost of goods manufactured = $ 3,800

Cost of goods manufactured = $54,450

(= $2,700 + $55,550 – $3,800)

c. Sales revenues – Cost of goods sold = Gross margin

$103,300 – $56,050 = Gross margin

$47,250 = Gross margin

d. Finished goods beginning inventory + Cost of goods manufactured – Cost of goods sold = Finished goods ending inventory

Finished goods beginning inventory + $27,220 – $27,200 = $4,400

Finished goods beginning inventory = $ 4,380 (= $4,400 – $27,220 + $27,200)

2–36. (continued)

e. Direct materials used + Direct labor + Manufacturing overhead = Total manufacturing costs

Direct materials used + $ 3,800 + $7,200 = $23,600

Direct materials used = $12,600[a] (= $23,600 – $3,800 – $7,200)

f. Sales revenue – Cost of goods sold = Gross margin

Sales revenue – $27,200 = $16,400

Sales revenue = $43,600 (= $16,400 + $27,200)

g. Direct materials used + Direct labor + Manufacturing overhead = Total manufacturing costs

$66,100 + $124,700 + Manufacturing overhead = $308,100

Manufacturing overhead = $117,300

[a] Also found from Direct Materials Inventory account: Beg. Bal. + Purchases = Mat. Used + End. Bal.

$3,500 + $12,000 = Mat. used + $2,900

Mat. used = $12,600

2–36. *(continued) (Extra items.)*
Some instructors assign the Cost of Goods Sold Statements. Here they are:

	Company 1			*Company 2*		
Work in process, January 1			$ 2,700			$ 6,720
Manufacturing costs:						
Direct materials:						
Direct materials inventory, January 1	$ 2,800[a]			$ 3,500		
Direct materials purchased	16,100			12,000		
Direct materials available for use	18,900			15,500		
Less materials inventory, December 31	3,600			2,900		
Materials used		15,300			$12,600(e)	
Direct labor		26,450			3,800	
Manufacturing overhead		13,800			7,200	
Total manufacturing costs			55,550			23,600
Total costs of work in process during the year			58,250			30,320
Less work in process, December 31			3,800			3,100
Cost of goods manufactured this year			54,450[b]			27,220
Add finished goods, January 1			1,900			4,380[d]
Cost of goods available for sale			56,350			31,600
Less finished goods, December 31			300			4,400
Cost of goods sold			$56,050			$27,200

2–36. (concluded) (*Extra item.*)

	Company 3		
Work in process, January 1			$ 82,400
Manufacturing costs:			
Direct materials:			
Direct materials inventory, January 1	$16,000		
Direct materials purchased	64,200		
Direct materials available for use	80,200		
Less materials inventory, December 31	14,100		
Materials used		$ 66,100	
Direct labor		124,700	
Manufacturing overhead		117,300(g)	
Total manufacturing costs			308,100
Total costs of work in process during the year			390,500
Less work in process, December 31			76,730
Cost of goods manufactured this year			313,770
Add finished goods, January 1			17,200
Cost of goods available for sale			330,970
Less finished goods, December 31			28,400
Cost of goods sold			$302,570

2–37. (30 min.) *Reconstruct financial statements: Garcia Mesa Company.*

Garcia Mesa Company
Statement of Cost of Goods Sold
For the Year Ended December 31

Work in process, January 1			$ 12,950
Manufacturing costs:			
Direct materials:			
Direct materials inventory, January 1	$ 53,550[a]		
Direct materials purchased	180,000		
Direct materials available for use	233,550		
Less materials inventory, December 31	42,500		
Materials used		$191,050	
Direct labor		200,000	
Manufacturing overhead:			
Indirect labor	16,000		
Plant heat, light and power	18,600		
Building depreciation	31,500[b]		
Miscellaneous factory expenses	15,950		
Maintenance on factory machines	6,050		
Insurance on factory equipment	9,500		
Taxes on manufacturing property	6,550		
Total overhead		104,150	
Total manufacturing costs			495,200
Total cost of work in process during the year			508,150
Less work in process, December 31			12,300
Cost of goods manufactured this year			495,850
Add finished goods, January 1			40,000
Cost of goods available for sale			535,850
Less finished goods, December 31			45,000
Cost of goods sold (to income statement)			$490,850

[a] Materials used is given, but this number is not. To obtain it,

Beg. Bal. + Purchases = Mat. Used + End. Bal.
Beg. Bal. = Mat. Used + End. Bal. – Purchases
$53,550 = $191,050 + 42,500 – $180,000

[b] $31,500 = 7/9 times $40,500

2–37. (continued)

Garcia Mesa Company
Income Statement
For the Year Ended December 31

Sales revenue		$812,500
Less: Cost of goods sold (per statement)		490,850
Gross margin		321,650
Building depreciation	$ 9,000[a]	
Administrative salaries	25,700	
Marketing costs	18,500	
Distribution costs	800	
Legal fees	4,100	
Total operating costs		58,100
Operating profit		$263,550

[a] 2/9 times $40,500

2–38. (30 min.) *Analyze the impact of a decision on income statements: Micro, Inc.*

a. This year's income statement:

	Baseline (Status Quo)	*Rent Equipment*	*Difference*
Revenue	$1,600,000	$1,600,000	0
Operating costs:			
Variable	(200,000)	(200,000)	0
Fixed (cash expenditures)	(750,000)	(750,000)	0
Equipment depreciation	(150,000)	(150,000)	0
Other depreciation	(125,000)	(125,000)	0
Loss from equipment write-off	0	(850,000)[a]	$850,000 lower
Operating profit (before taxes)	$ 375,000	$ (475,000)	$850,000 lower

---

[a] Equipment write-off = $1 million cost – $150,000 accumulated depreciation for one year (equipment was purchased on January 1 of the year).

b. Next year's income statement:

	Baseline (Status Quo)	*Rent Equipment*	*Difference*
Revenue	$1,600,000	$1,760,000	$160,000 higher
Operating costs:			
Equipment rental	0	(230,000)	230,000 higher
Variable	(200,000)	(200,000)	0
Fixed cash expenditures	(750,000)	(712,500)	37,500 lower
Equipment depreciation	(150,000)	0	150,000 lower
Other depreciation	(125,000)	(125,000)	0
Operating profit	$375,000	$492,500	117,500 higher

c. Despite the effect on next year's income statement, the company should not rent the new machine because net cash inflow as a result of installing the new machine ($160,000 + $37,500) does not cover cash outflow for equipment rental.

Chapter 3

Cost System Design: An Overview

Solutions to Review Questions

3–1.
A job costing accounting system traces costs to individual units or to specific jobs (typically custom products). A process costing accounting system is used when identical units are produced through a series of uniform production steps. Operation costing is used when goods have some common characteristics (process costing) and some individual characteristics (job costing).

3–2.
Continuous flow processing is used when a single product is mass produced in a continuing process. Examples would include products such as paint, gasoline, paper, or any others that are mass produced in a continuing process.

3–3.
The basic cost flow model appears as follows:

Beginning balance + Transfers in – Transfers out = Ending balance

Beginning balance is the balance of inventory at the beginning of the period. Transfers in represent inventory purchased or transferred in from another department (for example, raw materials would be goods *transferred in* to work in process) for the period. Transfers out are goods transferred from one department to another (for example, work in process would be *transferred out* to finished goods). Ending balance represents the amount of inventory in a department at the end of the accounting period.

3–4.
The perpetual method of inventory accounting requires an ongoing record of transfers-in and transfers-out for all inventory accounts. Management is able to determine inventory amounts at any point in time. The physical method of inventory accounting requires that a physical count of inventory be performed to determine inventory amounts.

3–5.
Backflush costing is typically used in companies that use just-in-time production processes. Inventory levels are kept to a minimum. Production costs are recorded directly in costs of goods sold when incurred. At the end of the accounting period, costs are assigned (backflushed) to any remaining inventory on hand.

3–6.
Traditional costing systems attach costs to the product at each step of the production process. See Panel A of illustration 3–3 for a detailed description of the flow of costs through T-accounts using a traditional costing system.

3–7.
The three important characteristics of a JIT system are as follows:

1. Inventory levels are reduced (thus reducing carrying costs).
2. The production process is improved as quality becomes increasingly important.
3. The time to produce a product is reduced—allowing for more flexibility in meeting customers' demands.

Solutions to Critical Analysis and Discussion Questions

3–8.

Customer costing compares the costs of serving a customer to the revenues generated from that customer. Marketing managers are able to use this information to assess the profitability of each customer.

3–9.
There are three important points to consider:

1. The cost system should meet the needs of the users (the decision makers).
2. The cost system must provide the appropriate data for its intended purpose. Different cost information is used for different purposes.
3. Cost information for managerial purposes must meet the cost-benefit test. The costs of implementing the system should be less than the benefits derived from the system (i.e. better decisions).

3–10.
The basic cost flow model is as follows:

Beginning balance + Transfers in – Transfers out = Ending balance

This model is used for finding one unknown or for comparing perpetual inventory system output to a physical inventory count. An example of finding one unknown is if the beginning balance is known (from the previous period ending balance), transfers in are known, and ending inventory is counted physically—and we are asked to find the cost of goods sold for the period (transfers out).

3–11.
The memo should include a description of the two methods. The perpetual method of inventory accounting requires an ongoing record of transfers-in and transfers-out for all inventory accounts. Management is able to determine inventory amounts at any point in time. The physical method of inventory accounting requires that a physical count of inventory be performed to determine inventory amounts.

The memo should also include a recommendation with reasoning to back up the recommendation. Perpetual inventory systems are more appropriate for high volume retailers and are more costly to maintain than physical inventory systems. Conversely, physical inventory systems are more appropriate for low volume retailers. It is not clear which category a new sporting goods store falls under. However, if high growth is anticipated, a perpetual inventory system may be appropriate.

3–12.
Reasons to agree with approach: If the customers are not contributing to company profits, then the cutomers should be eliminated. This will increase overall company profits.

Reasons not to agree with approach: The marketing manager may be building a relationship with new customers hoping for a long-term payoff as these customers grow. To entice these customers to do business with the company, John may be offering discounts on his products or providing increased customer service. Thus, there might be strategic considerations that outweigh the financial considerations.

3–13.
JIT production can work well with companies that have very efficient purchasing and production processes. If this company has any consistent problems in these areas, JIT could be a disaster. Also, JIT is effective only if the company has a backlog of orders. If production is shut down for long periods while awaiting orders, JIT will not work.

In addition, if customers are accustomed to receiving products immediately upon being ordered, JIT will likely increase the waiting period since no finished goods inventory is maintained.

3–14.
GM was trying to minimize inventories while inplementing JIT. As a result, brake parts were in short supply at most of GM’s plants before the strike began. Once the inflow of brake parts stopped at most of GM’s plants, these plants were forced to shut down.

3–15.
Just-in-time eliminates inventory where spoiled goods and defects can be stored. If a department is making defective products, with JIT it must correct the problem before the products are transferred to the next department.

3–16.
Flexible manufacturing enables companies to change from production of product A to product B quickly, with minimal setup time. This reduces the need for inventories.

3–17.
Ending inventory can be determined two ways. First, you can physically count the inventory and determine total cost based on the count. Second, you can use the basic cost flow model (BB + TI – TO = EB) to verify the results of costing out the physical count of inventory. If fraud occurs in the physical count process, it should be detected using the basic cost flow approach.

Solutions to Exercises

3–18. (20 min.) *Basic cost flow model: Singh Company*

a. $150,000 (see item 5)

b. $410,000 = $400,000 + $10,000 (see items 2 & 3)

c. $125,000 (see item 5)

d. $435,000 BB + TI – TO = EB

$150,000 + $410,000 – X = $125,000

X = $150,000 + $410,000 – $125,000

X = $435,000

3–19. (20 min.) *Basic cost flow model: Boeing Company*

a. $394 million = $104 million + $164 million + (.7 x $180 million)

b. $236.4 million = .6 x $394 million

c. BB + TI – TO = EB

0 + $394 million – $236.4 million = EB

EB = $157.6 million

3–20. (20 min.) *Basic cost flow model.*

Based on the basic formula:

BB + TI – TO = EB
a. $34,000 + $32,000 – $38,000 = X
X = $28,000

b. $14,200 + X – $44,000 = $12,400
X = $12,400 – $14,200 + $44,000
X = $42,200

c. $78,000 + $140,000 – X = $64,000
X = $78,000 + $140,000 – $64,000
X = $154,000

3–21. (20 min.) *Basic cost flow model.*

Based on the basic formula:

BB + TI – TO = EB
a. $136,000 + $128,000 – $152,000 = X
X = $112,000

b. $56,800 + X – $176,000 = $49,600
X = $49,600 – $56,800 + $176,000
X = $168,800

c. $312,000 + $560,000 – X = $256,000
X = $312,000 + $560,000 – $256,000
X = $616,000

3–22. (20 min.) *Basic cost flow model.*

Based on the basic formula:

BB + TI – TO = EB
a. $170,000 + $160,000 – $190,000 = X
X = $140,000

b. $71,000 + X – $220,000 = $62,000
X = $62,000 – $71,000 + $220,000
X = $211,000

c. $390,000 + $700,000 – X = $320,000
X = $390,000 + $700,000 – $320,000
X = $770,000

3–23. (20 min.) *Basic cost flow model: Tower Designs.*

a. BB + TI – TO = EB

$$\text{BB} + \$9{,}000 - \$10{,}500 = \$3{,}750$$
$$\text{BB} = \$10{,}500 + \$3{,}750 - \$9{,}000$$
$$\text{BB} = \underline{\underline{\$\ \ 5{,}250}}$$

b. Materials are transferred from Direct Materials Inventory to Work in Process Inventory: $10,500.

c. Goods are transferred from Work in Process to Finished Goods: $29,300

d. Cost of goods charged to Cost of Goods Sold comes from Finished Goods: $41,000

e. $\text{BB} + \text{TI}_{\text{Mat'ls}} + \text{TI}_{\text{Labor}} + \text{TI}_{\text{Overhead}} - \text{TO} = \text{EB}$

$$\$3{,}000 + \$10{,}500 + \$8{,}500 + \text{TI}_{\text{Overhead}} - \$29{,}300 = \$4{,}850$$
$$\text{TI}_{\text{Overhead}} + \$4{,}850 - \$3{,}000 - \$10{,}500 - \$8{,}500 + \$29{,}300$$
$$\text{TI}_{\text{Overhead}} = \underline{\underline{\$12{,}150}}$$

f. BB + TI – TO = EB

$$\$23{,}200 + \$29{,}300 - \$41{,}000 = \text{EB}$$
$$\text{EB} = \underline{\underline{\$11{,}500}}$$

3–24. (20 min.) *Basic cost flow model: Bridal Wear Corp.*

a. BB + TI – TO = EB

$$\begin{aligned} \text{BB} + \$27{,}000 - \$31{,}500 &= \$11{,}250 \\ \text{BB} &= \$31{,}500 + \$11{,}250 - \$27{,}000 \\ \text{BB} &= \underline{\underline{\$15{,}750}} \end{aligned}$$

b. Materials are transferred from Direct Materials Inventory to Work in Process Inventory: $31,500.

c. Goods are transferred from Work in Process to Finished Goods: $87,900

d. Cost of goods charged to Cost of Goods Sold comes from Finished Goods: $123,000

e. $\text{BB} + \text{TI}_{\text{Mat'ls}} + \text{TI}_{\text{Labor}} + \text{TI}_{\text{Overhead}} - \text{TO} = \text{EB}$

$\$9{,}000 + \$31{,}500 + \$25{,}500 + \text{TI}_{\text{Overhead}} - \$87{,}900 = \$14{,}550$

$\text{TI}_{\text{Overhead}} = \$14{,}550 - \$9{,}000 - \$31{,}500 - \$25{,}500 + \$87{,}900$

$\text{TI}_{\text{Overhead}} = \underline{\underline{\$36{,}450}}$

f. BB + TI – TO = EB

$69,600 + $87,900 – $123,000 = EB

$\text{EB} = \underline{\underline{\$34{,}500}}$

3–25. (20 minutes) *Customer Costing: Powertools, Inc.*

	Larry	*Curly*	*Moe*
Sales revenue	$ 40,000[1]	$20,000[2]	$140,000[3]
Cost of goods sold	48,000[4]	6,000[5]	66,000[6]
Gross margin	(8,000)	14,000	74,000
M&A costs	8,750[7]	10,500[8]	15,750[9]
Operating profit	$(16,750)	$ 3,500	$ 58,250

[1] $40,000 = $200,000 x 20%
[2] $20,000 = $200,000 x 10%
[3] $140,000 = $200,000 x 70%
[4] $48,000 = $120,000 x 40%
[5] $6,000 = $120,000 x 5%
[6] $66,000 = $120,000 x 55%
[7] $8,750 = $35,000 x 25%
[8] $10,500 = $35,000 x 30%
[9] $15,750 = $35,000 x 45%

3–26. (20 minutes) *Customer Costing: Custom Trailers Inc.*

	Trail Rite	*Trail Ways*	*UTrail*
Sales revenue	$360,000[1]	$30,000[2]	$210,000[3]
Cost of goods sold	234,000[4]	36,000[5]	90,000[6]
Gross margin	126,000	(6,000)	120,000
M&A costs	78,750[7]	10,500[8]	15,750[9]
Operating profit	$ 47,250	$(16,500)	$104,250

[1] $360,000 = $600,000 x 60%
[2] $30,000 = $600,000 x 5%
[3] $210,000 = $600,000 x 35%
[4] $234,000 = $360,000 x 65%
[5] $36,000 = $360,000 x 10%
[6] $90,000 = $360,000 x 25%
[7] $78,750 = $105,000 x 75%
[8] $10,500 = $105,000 x 10%
[9] $15,750 = $105,000 x 15%

3–27. (20 min.) *Backflush costing: Carson Biotech, Inc.*

Journal entries:

Cost of Goods Sold	14,000	
Accounts Payable		14,000
Cost of Goods Sold	48,000	
Cash		16,000
Wages Payable		12,000
Manufacturing Overhead Applied		20,000
Work in Process Inventory	3,160	
Cost of Goods Sold		3,160

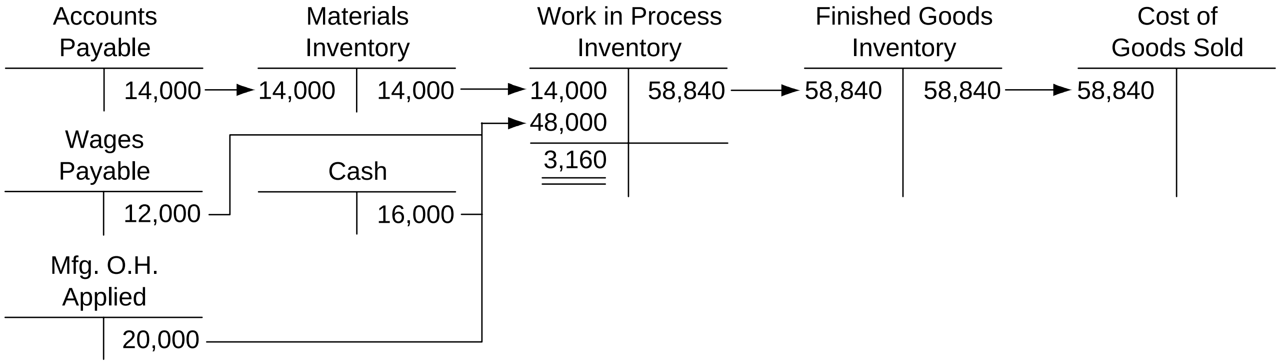
3–28. (20 min.) *Backflush costing: Interplay Systems, Inc.*

Journal entries:

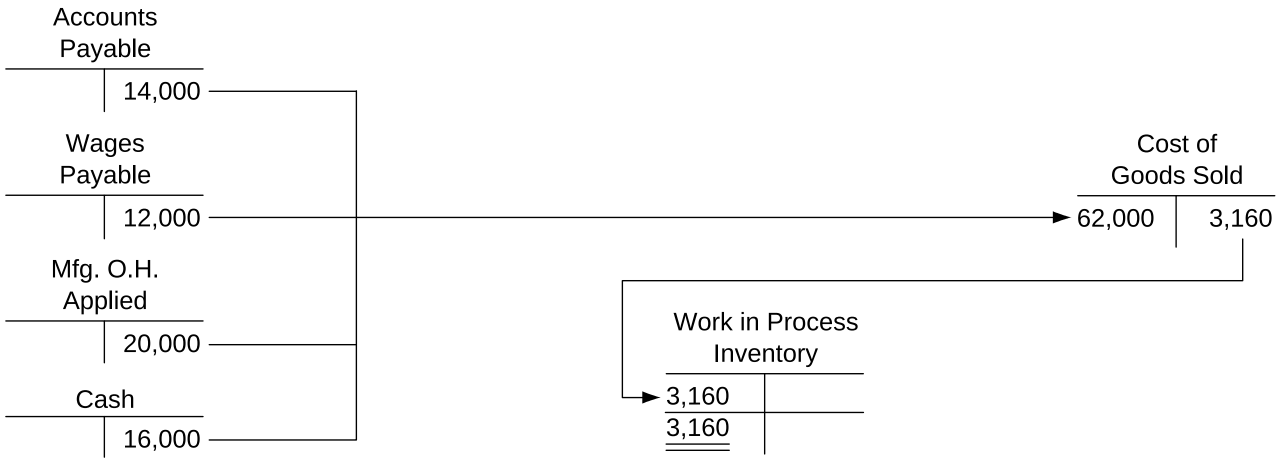
Cost of Goods Sold	25,000	
Accounts Payable		25,000
Cost of Goods Sold	94,000	
Accounts Payable		50,000
Wages Payable		44,000
Work in Process Inventory	8,200	
Cost of Goods Sold		8,200

3–29. (30 min.) *Comparing backflush and traditional costing: Carson Biotech, Inc.*

Traditional Sequential Costing

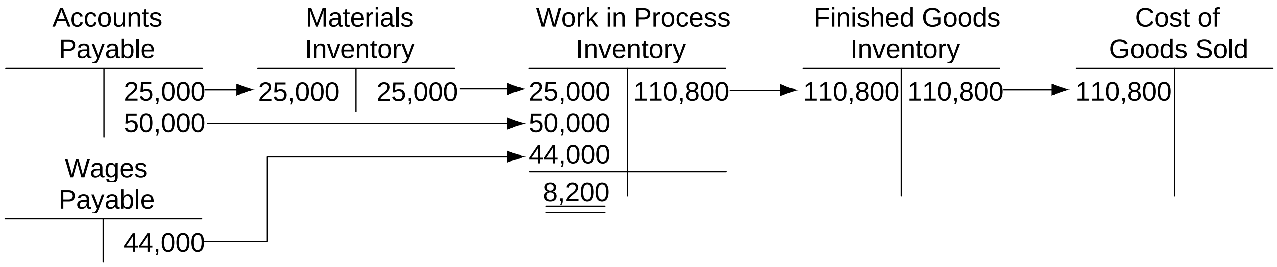


Backflush Costing

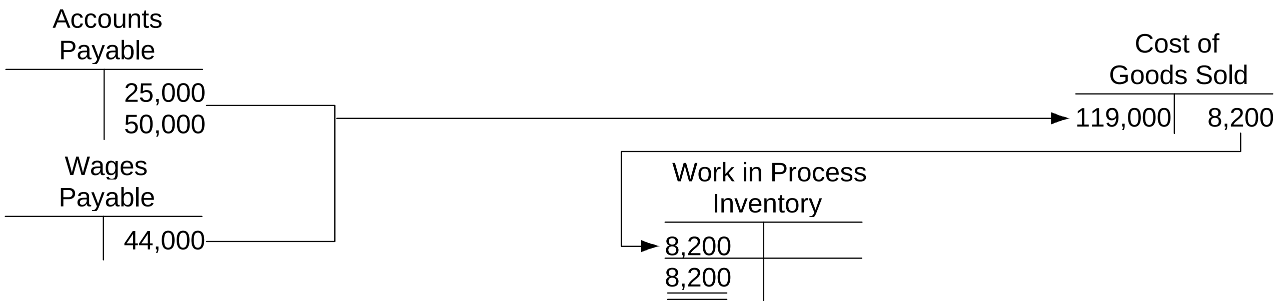


3–30. (30 min.) Comparing backflush and traditional costing: Interplay Systems, Inc.

Traditional Sequential Costing



Backflush Costing



Solutions to Problems

3–31.

The marketing manager for Powertools Inc. should look at Larry carefully given that Larry is not a profitable customer. The first question should be “are there any strategic implications if we drop Larry as a customer?” (i.e. will he be profitable in the future? Is his company growing?). Then, the marketing manager should consider whether revenues can be increased and/or cost decreased to make this customer profitable. Although Curly and Moe are both profitable, Curly’s profit margin percentage (17.5%) is well below Moe’s profit margin percentage (41.6%). Powertools may decide to focus on increasing sales to Moe given his relatively high profit margin percentage.

3–32.

The marketing manager for Custom Trailers Inc. should look at Trail Ways carefully given that Trail Ways is not a profitable customer. The first question should be “are there any strategic implications if we drop Trail Ways as a customer?” (i.e. will they be profitable in the future? Is the company growing?). Then, the marketing manager should consider whether revenues can be increased and/or costs decreased to make this customer profitable. Although Trail Rite and UTrail are both profitable, Trail Ways’ profit margin percentage (13.1%) is well below UTrail’s profit margin percentage (49.6%). Custom Trailers Inc. may decide to focus on increasing sales to UTrail given their relatively high profit margin.

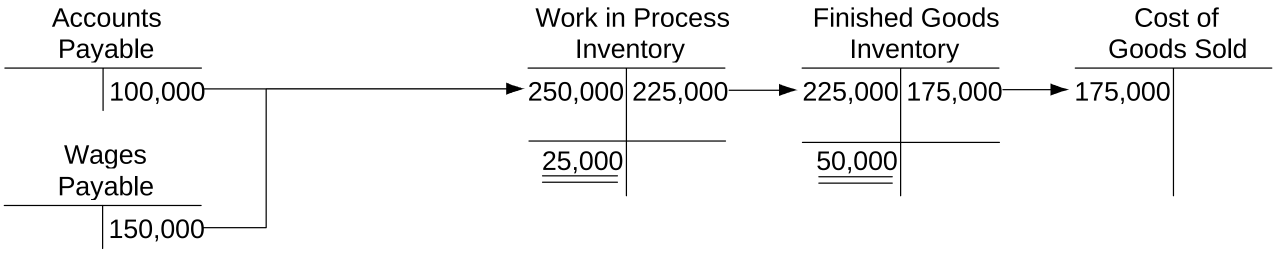
3–33. (20 min.) *Backflush costing: Creative Designers, Inc.*

Journal entries:

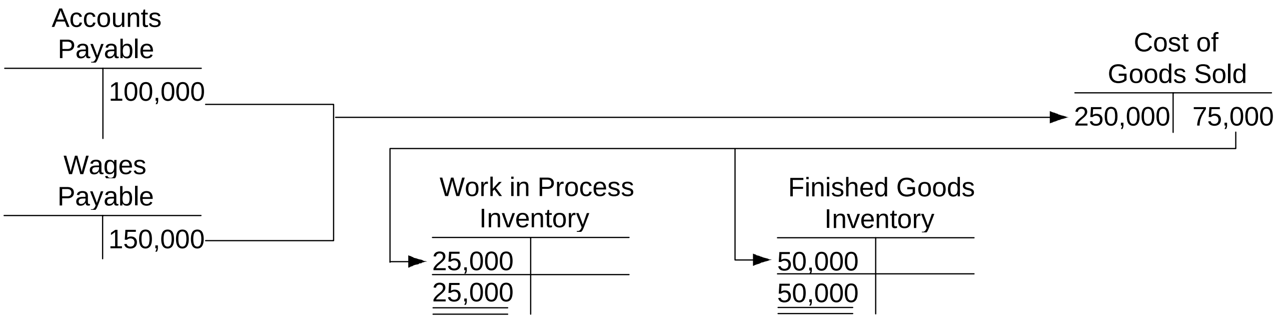
Cost of Goods Sold	250,000	
Accounts Payable		100,000
Wages Payable		150,000
Work in Process Inventory	25,000	
Finished Goods Inventory	50,000	
Cost of Goods Sold		75,000

3–34. (30 min.) *Comparing backflush and traditional costing: Creative Designers, Inc.*

Traditional Costing



Backflush Costing



3–35.

Answers will vary. Companies with computerized inventory systems are more likely to log in an order at the point of sale. Students should not assume a retail store uses just-in-time in a literal sense, but should recognize the difference between keeping a stock of items that are replenished as customers order them (perpetual approach) compared to looking at inventory from time to time to see what needs to be ordered (the supply cabinet approach).

3–36. (45 min.) *Compare backflush and traditional cost flows: River City Quality Instruments.*

T-accounts

a. **Traditional cost system:**

Accounts Payable—Materials

			260,000

WIP Meter Assembly

materials	210,000		
labor	200,000		
overhead	840,000[a]	to Case Assembly	1,125,000[d]
	$125,000		

Finished Goods

from Testing	1,731,250	to Cost of Goods Sold	1,731,250
	$0		

Materials Inventory

purchase	260,000	To:	
		Meter Ass'y	210,000
		Case Ass'y	40,000
		Testing	10,000
	$0		

WIP Case Assembly

materials	40,000		
labor	350,000		
overhead	160,000[b]		
from Meter	1,125,000	to Testing	1,591,250[e]
	83,750		

Cost of Goods Sold

from Finished Goods	1,731,250		

Wages Payable

		Meter Ass'y	200,000
		Case Ass'y	350,000
		Testing	90,000

WIP Testing

materials	10,000		
labor	90,000		
overhead	40,000[c]	to Finished Goods	1,731,250
from Meter	1,591,250		
	$0		

Overhead

		Applied	
		Meter Ass'y	840,000[a]
		Case Ass'y	160,000[b]
		Testing	40,000[c]

[a] $\$840,000 = \frac{\$210,000}{\$260,000} \times \$1,040,000$

[b] $\$160,000 = \frac{\$40,000}{\$260,000} \times \$1,040,000$

[c] $\$40,000 = \frac{\$10,000}{\$260,000} \times \$1,040,000$

[d] $90% of WIP Meter Assembly costs were transferred out.

[e] $95% of WIP Case Assembly costs were transferred out.

3–36. (continued)

T-accounts

b. **Backflush system:**

Accounts Payable—Materials

		to COGS	260,000

Cost of Goods Sold

Materials	260,000		
Labor	640,000		
Overhead	1,040,000	to Meter	125,000[a]
		to Case	$83,750[b]

Wages Payable

		to COGS	640,000

Overhead

		Applied to COGS	1,040,000

WIP Meter Assembly

from COGS	125,000		
	125,000		

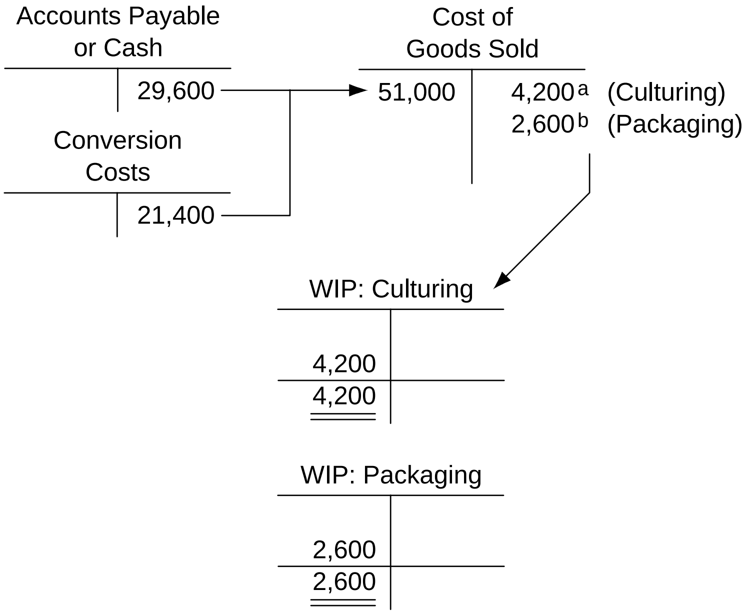
WIP Case Assembly

from COGS	83,750		
	83,750		

[a] 10% of Meter's costs are still in inventory.
[b] 5% of Case's costs are still in inventory.

3–37. (30 min.) *Compare backflush and traditional cost flows: Davis Agriproducts Inc.*

a. Backflush costing



Accounts Payable or Cash

	29,600

Conversion Costs

	21,400

Cost of Goods Sold

51,000	4,200[a]	(Culturing)
	2,600[b]	(Packaging)

WIP: Culturing

4,200	
4,200	

WIP: Packaging

2,600	
2,600	

[a] \$4,200 = 2,000 x (\$1.30 + \$.80)

[b] \$2,600 = 1,000 x (\$1.30 + \$.80 + \$.20 + \$.30)

3–37. (continued)

b. Traditional costing

Accounts Payable or Cash

	29,600

WIP: Culturing

Materials	26,000[c]	37,800[a]
Conv. Costs	16,000[d]	
	4,200	

WIP: Packaging

	37,800	
Materials	3,600[e]	
Conv. Costs	5,400[f]	44,200[b]
	2,600	

Materials Inventory

29,600	29,600

Conversion Costs

	21,400

Finished Goods Inventory

44,200	44,200
0	

Cost of Goods Sold

44,200	

[a] \$37,800 = 18,000 units x (\$1.30 for materials + \$.80 for conversion costs).

[b] \$44,200 = 17,000 units x (\$1.30 + \$.80 + \$.20 + \$.30).

[c] \$26,000 = \$1.30 for materials x 20,000 units.

[d] \$16,000 = \$.80 for conversion costs x 20,000 units.

[e] \$3,600 = \$.20 for materials x 18,000 units.

[f] \$5,400 = \$.30 for conversion costs x 18,000 units.

3–38. *Customer Costing: Quality Lawn Care Inc.*

1.

	Revenues	*Costs*	*Operating Income*
Sierra University	$130,000	$91,000	$39,000
Davis Agriproducts Inc.	90,000	92,000	(2,000)
American River Restaurant	40,000	37,000	3,000
Brown and Associates	38,000	54,000	(16,000)
Ott Investment Advisers	186,500	115,500	71,000
Totals	$484,500	$389,500	$95,000

2. The company should look closely at three customers—Davis Agriproducts (loss of $2,000), American River Restaurant (negligible income of $3,000), and Brown and Associates (loss of $18,000). Given Brown and Associates' significant loss, Quality Lawn Care should seriously consider raising rates for Brown and/or reducing expenses by cutting back on the work force working on this project or finding lower paid labor. If no other strategic factors are involved (for example, Brown is not expected to grow or provide references for other significant profitable business), Quality Lawn Care should also consider dropping Brown and Associates as a client.

3. The labor costs allocated to each client is straightforward assuming these labor costs are strictly variable costs within the relevant range. However, if salaried supervisors' costs are allocated to each client, there is the potential for arbitrary allocations, and thus, inaccurate labor costs for each customer. It is also difficult to allocate equipment costs to each project given the difficulty of tracking equipment use by each customer.

Chapter 4
Job Costing

Solutions to Review Questions

4–1.
Companies using a job order cost system are likely to be performing services or manufacturing products according to specific customer orders and product specifications. Construction contractors, manufacturers of special equipment, aircraft manufacturers, CPA firms, attorneys, and hospitals all employ job order cost systems.

4–2.
The most common allocation bases in the US are direct labor hours and direct labor dollars. This is probably the result of a close linkage between labor worked and indirect costs. However, with the current shift away from labor to increased automation, this may no longer hold true.

4–3.
The Manufacturing Overhead account is used to accumulate the actual manufacturing overhead costs as they are incurred. Manufacturing Overhead Applied represents the estimate of overhead that is used as a basis for computing work in process and other inventory costs. The applied account is used to facilitate recordkeeping during the period.

4–4.
A materials requisition is used to document the authorization for issuances of materials from the storeroom while the source document (or receiving slip) is used to indicate quantities and descriptions of materials received.

4–5.
The job costing procedure is basically the same in both types of organizations, except that service firms use less direct materials. Also, service firms typically do not show inventories on their balance sheets, and use a cost of services billed account rather than Cost of Goods Sold.

4–6.
The costs of a product using normal costing are:

- Actual direct materials cost
- Actual direct labor cost
- Predetermined overhead rate x actual allocation base

4–7.
Indirect costs are reimbursed based on a negotiated percentage of direct costs using historical data as a guide. As a result of allocating improper indirect expenses to research projects funded by the Office of Naval Research, Stanford University's indirect cost reimbursement rate decreased from 70% of direct costs to 58% (as requested by the Office of Naval Research).

Solutions to Critical Analysis and Discussion Questions

4–8.
The problem with this recommendation is the actual overhead costs often consist of many different line items, some of which cannot be easily assigned to jobs. In addition, many actual costs are not known until after the period is over. Further, overhead costs are affected by seasons. It may not be logical, for example, to charge costs of heating the factory only to those jobs produced in the winter months. Rather, such seasonal costs should be allocated across all production during the year.

4–9.
If materials costs are not properly assigned to jobs, management may later be mislead in estimating the actual costs to complete future, similar jobs. Thus, profit planning may be in error. Profitable jobs may be rejected because errors in cost assignments have made the jobs look unprofitable or less profitable. If the company prepares bids on jobs, the bids may be in error if they are based on the wrong costs.

4–10.
Orion assigned the cost of “flops” to good jobs, thus overstating assets and understating cost write-offs. A more accurate approach would be to assign costs only to jobs (movies) they relate to, regardless of the movie’s profitability.

4–11.
Answers will vary. Expect the managers in small construction firms to base their estimates on their own experience, not a formal model.

4–12.
Answers will vary.

4–13.
They would most likely use job costing since their jobs are typically easily identifiable and relatively unique.

4–14.
Yes, O.J.’s trial was a job for costing purposes.

Solutions to Exercises

4–15. (20 min.) *Assigning costs to jobs: Apex, Inc.*

1.	Materials Inventory	10,000	
	Accounts Payable		10,000
2.	Manufacturing Overhead	500	
	Materials Inventory		500
3.	Materials Inventory	7,000	
	Accounts Payable		7,000
4.	Accounts Payable	10,000	
	Cash		10,000
5.	Work-in-Process—Direct Materials	8,500	
	Materials Inventory		8,500
6.	Work-in-Process—Direct Labor	12,500	
	Payroll Payable		12,500
7.	Manufacturing Overhead	13,250	
	Cash		13,250
8.	Work-In-Process—Overhead Applied (12,500 x 125%)	15,625	
	Manufacturing Overhead Applied		15,625
9.	Manufacturing Overhead	6,250	
	Accumulated Depreciation—Property, Plant and Equipment		6,250

4–16. (15 min.) *Assigning costs to jobs: Apex, Inc..*

Materials Inventory

Balance 1/1	18,525	2. Ind. materials	500
1.	10,000	5. Direct materials	8,500
3.	7,000		
Balance 1/31	26,525*		

*$26,525 = $18,525 + $10,000 + $7,000 – $500 – $8,500

Work in Process

Balance 1/1	4,125		
5. Direct materials	8,500	Per Finished Goods	
6. Direct labor	12,500	T-account	30,075
8. Overhead applied	15,625		
Balance 1/31	10,675		

Actual Manufacturing Overhead

2.	500		
7.	13,250		
9.	6,250		

Manufacturing Overhead Applied

		8.	15,625

Accounts Payable

4.	10,000	1.	10,000
		3.	7,000

Cash

		4.	10,000
		7.	13,250

Payroll Payable

		6.	12,500

4–16. (continued)

Accumulated Depreciation—
Property, Plant, and Equipment

		9.	6,250

Finished Goods

Balance 1/1	20,750	Transfer to Cost of Goods Sold	32,925
Goods completed	30,075*		
Balance 1/31	17,900		

*$30,075 = $32,925 + $17,900 – $20,750

Cost of Goods Sold

Balance 1/31	32,925		

4–17. (25 min.) *Assigning costs to jobs: Avian Company.*

a. $6,400, the credit side of the Materials Inventory account.

b.

Direct labor	$6,000
Labor rate	$24 per hour
Direct labor hours	$6,000 ÷ $24 = 250 hours
Manufacturing overhead applied	250 x $20 = $5,000

c. $12,000, the debit addition to the Finished Goods Inventory account.

d. BB + TI – TO = EB
EB = $4,000 + ($6,400 + $6,000 + $5,000) – $12,000
EB = $9,400

e. $5,200 – $5,000 = $200 (variance)

f.

Sales		$18,000
COGS	$8,000	
Underapplied OH	200	
S&A costs	3,200	11,400
Operating profit		$ 6,600

4–18. (10 min.) *Predetermined overhead rates: Kustom-Kraft, Inc.*

Direct material used	$115,000[c]
Direct labor	220,000[b]
Manufacturing overhead applied	165,000[a]
Total manufacturing cost during the year	500,000

Supporting Computations

[a] Manufacturing overhead applied:
$165,000 = 33% x total manufacturing cost (33% x $500,000)

[b] Direct labor:
75% of direct labor equals $165,000, so direct labor was $220,000 (= $165,000 ÷ 75%)

[c] Direct material used equals total manufacturing cost less direct labor and manufacturing overhead applied [$500,000 – ($220,000 + $165,000) = $115,000].

4–19. (15 min.) *Predetermined overhead rates: Xavier Corp.*

a. Application rate: $\frac{\$44{,}000}{\$80{,}000}$ = $.55 per dollar of direct labor

Job 1:	$20,000 x $.55 =	$11,000
Job 2:	30,000 x .55 =	16,500
Job 3:	40,000 x .55 =	22,000
		$49,500

b. $52,000 – $49,500 = $2,500 manufacturing overhead variance

4–20. (20 min.) *Applying overhead using a predetermined rate: Paige Printing*

The answer is (3).

Since Job No. 75 is the only job in the account, the ending balance of the account must equal the total cost of the job. We can find the account's ending balance using the basic cost equation:

BB + TI – TO = EB
EB = $ 5,000 + ($30,000 + $20,000 + $16,000) –60,000
EB = $11,000

We are told that direct labor for Job No. 75 is $2,500 and that overhead is applied at a rate of 80% of direct labor cost. So,

Factory overhead = 80% x $2,500
= $2,000

To solve for direct materials we set up the cost equation,

Total cost = direct materials + direct labor + factory overhead
$11,000 = direct materials + $2,500 + $2,000
Direct materials = $11,000 – $2,500 – $2,000
Direct materials = $6,500

4–21. (15 min.) *Calculating overhead variance: Owings Co.*

The answer is (1).

Predetermined overhead rate = estimated overhead/estimated allocation base
= $600,000/100,000 hours
= $6 per hour

Applied overhead = predetermined overhead rate x actual allocation base
= $6 per hour x 110,000 hours
= $660,000

Overhead variance = applied overhead – actual overhead
= $660,000 – $650,000
= $10,000 overapplied

4–22. (15 min.) *Prorate under- or overapplied overhead: Xavier Corp.*

Calculation of manufacturing overhead variance:

Manufacturing overhead applied	$49,500	
Manufacturing overhead actual	52,000	
Manufacturing overhead variance	2,500	underapplied

Proration of manufacturing overhead variance:

Work in Process Inventory......................	250[a]	
Finished Goods Inventory.......................	625[b]	
Cost of Goods Sold................................	1,625[c]	
Manufacturing Overhead Variance		2,500

---

[a] $ 250 = $2,500 x 10%
[b] $ 625 = $2,500 x 25%
[c] $1,625 = $2,500 x 65%

4–23. (25 min.) *Compute job costs for a service organization: Terne Corporation*

a. Beginning of month

	Direct Labor	*Applied Overhead*	*Total*
X-10......	$1,280	$640	$1,920
Y-12......	$840	$420	$1,260

Each month

	Beginning Total	*Additional Direct Labor*	*Additional Applied Overhead*	*Total*
X-10......	$1,920	$1,400	$700	$4,020
Y-12......	$1,260	$4,000	$2,000	$7,260

b.

	Direct Labor	*Applied Overhead*	*Total*
Z-14......	$2,840*	$1,420	$4,260

*$2,840 = $8,240 – $1,400 – $4,000

c. Overhead applied during month:

X-10......	$ 700
Y-12......	2,000
Z-14......	1,420
Total	$4,120

Variance = $4,120 applied – $4,000 actual = $120 overapplied.

4–24. (30 min.) *Job costing in a service organization: Ernest Peat & Co.*

a.

Wages Payable	
	140,000[a]

Work in Process	
140,000[a] 24,000[b]	164,000[c]

Cost of Services Billed	
164,000[c]	

Service Overhead	
20,000	20,000[d]

Service O.H. Applied	
24,000[d]	24,000[b]

Service O.H. Variance	
	4,000[d]

[a] $70 per hour x 600 hours for Client A, and $70 per hour x 1,400 hours for Client B.

[b] $12 per hour x 600 hours for Client A, and $12 per hour x 1,400 hours for Client B.

[c] Sum of work done during September, all billed to clients.

[d] Closing entry to record overapplied overhead of $4,000 (= $24,000 applied – $20,000 actual)

b.

Ernest Peat & Co.
Income Statement
For the Month Ended September 30

Sales revenue	$280,000[a]
Cost of services billed	164,000
Add: Overapplied service overhead	4,000
Gross margin	120,000
Marketing and administration	84,000
Operating profit	$ 36,000

[a] $280,000 = 2,000 hours x $140

Solutions to Problems

4–25. (25 min.) Estimate hours worked from overhead data: Grault Co.

31,000 direct labor hours were worked. With $120,000 in fixed costs expected and 30,000 direct labor hours expected, the application rate for the fixed costs was $4.00 per direct labor hour. If the overapplied overhead, all due to production volume, is $4,000, then an extra 1,000 direct labor hours were worked ($4,000/$4 per hour). Consequently, 31,000 (= 30,000 + 1,000) direct labor hours were worked.

Also, see T accounts below:

Manufacturing Overhead	
120,000 (given as actual = expected)	

Manufacturing Overhead Applied	
	124,000 (= $4 x Actual hours worked)

From these accounts, we solve for actual hours worked: Actual hours worked = $124,000/$4 = 31,000 hours worked.

4–26. (40 min.) *Assigning costs—missing data.*

(a) $200,000, the other side of the credit to the Accounts Payable—Materials Suppliers account.

(b) $188,000, From the Materials Inventory account, $16,000 + $200,000 – $8,600 – $19,400 = $188,000

(c) $242,000 = $324,000 + $239,000 – $248,600 – $72,400.

(d) $361,000, the charge to Work in Process that is not due to direct materials or direct labor.

(e) $800,200 = $44,600 + $361,000 + $242,000 + $188,000 – $35,400.

(f) $805,600 from the Cost of Goods account.

(g) $23,000 = $28,400 + $800,200 (from e) – $805,600 (from f).

(h) $63,200 (charged to Manufacturing Overhead) = $471,400 – $408,200.

(i) $6,400 (charged to Manufacturing Overhead) = $48,600 – $42,200.

4–27. (50 min.) *Assigning costs—missing data.*

Materials Inventory

Balance 9/1	22,700	(a)	43,100	Direct materials
Purchases	56,800	(a)	8,200	Indirect materials
Balance 9/30	28,200			

Work-in-Process Inventory

	Balance 9/1	16,300	
(a)	Direct materials	43,100	
(b)	Direct labor	88,000	187,200
(b)	Overhead applied	132,000	
(d)	Balance 9/30	92,200	
(h)	Proration	3,135	
	Balance 9/30	95,335	

Finished Goods Inventory

	Balance 9/1	64,800		
(d)		187,200	(c)	201,500
	Balance 9/30	50,500		
(h)	Proration	1,881		
	Balance 9/30	52,381		

Cost of Goods Sold

(c)		201,500
(h)	Proration	7,524

(Actual) Manufacturing Overhead

(a)	8,200
(e)	13,000
(f)	24,100
(g)	99,240

Manufacturing Overhead Applied

	(b)	132,000
	(h)	12,540

4–27. (continued)

Wages Payable	
	(b) 88,000
	(e) 13,000

Sales Revenue	
	(c) 362,700

(a) From the work in process account we obtain the $43,100 in direct materials issued. The beginning balance equals the ending balance of $28,200 minus the increase of $5,500 equals $22,700. The unaccounted balance represents indirect materials and is determined as:

$22,700 + $56,800 – $28,200 – $43,100 (debit to work in process)
= $8,200

(b) Let X = direct labor costs
Overhead applied = 150% X
$132,000 = 150% X
X = $88,000

(c) Let X = Cost of goods sold
Sales = 180% X
$362,700 = 180% X
X = $201,500

(d) Finished goods BB = Finished Goods EB + $14,300
$64,800 = EB + $14,300
EB = $50,500

Cost of goods manufactured = Finished goods EB + Cost of goods sold – Finished Goods BB
= $50,500 + $201,500 – $64,800
= $187,200

Work in process EB = $16,300 + $43,100 + $88,000 + $132,000 – $187,200
= $92,200

4–27. (continued)

(e) Indirect labor = Payroll – Direct labor
= $101,000 – $88,000
= $13,000

(f) Charge factory depreciation to manufacturing overhead.

(g) Charge overhead to manufacturing overhead.

(h) Proration to:

Work-in-process	(25% x $12,540)	$ 3,135
Finished goods	(15% x $12,540)	1,881
Cost of goods sold	(60% x $12,540)	7,524
		$12,540

4–28. (40 min.) Analysis of overhead using a predetermined rate (multiple choice): Sparkle Corp.

a. (4) $10.60 per DLH $\frac{\$636{,}000}{60{,}000}$ = $10.60 per DLH

b. (3) $158,500

Beginning balance.....	$ 54,000
Direct materials	45,000
Direct labor	28,000*
Overhead applied	31,500**
	$158,500

*The wage rate for direct labor is $8.00 per hour. $8.00 x 3,500 hours = $28,000. ($8.00 = $68,000 in direct labor wages divided by 8,500 direct labor hours).

**$9.00 x 3,500 direct labor hours.

c. (1) $18,000 $9.00 x 2,000 direct labor hours = $18,000

d. (2) $76,500 $9.00 x 8,500 direct labor hours = $76,500

e. (2) $43,500

Supplies................................	$ 6,000
Indirect labor wages	17,000
Supervisory salaries	6,000
Factory facilities....................	6,500
Factory equipment costs	8,000
	$43,500

f. (5) Credit it to cost of goods sold. The amount is clearly not material (0.1% of cost of goods sold), so it is not worth the effort involved in prorating. If it were material, then the proper answer would be (2), prorate it between work in process inventory, finished goods inventory, and cost of goods sold.

4–29. (40 min.) *Basic cost flow model: I. M. Dunce.*

a. T-accounts follow these answers:

(1) *Marketing and Administrative Costs:*

Gross Margin – Operating Profit = Marketing and Administrative Costs
$4,000 – $1,000 = $3,000

(2) *Cost of Goods Sold:*

Total Revenue – Gross Margin = Cost of Goods Sold
$13,500 – $4,000 = $9,500

(3) *Beginning Finished Goods Inventory:*

BB + Cost of Goods Manufactured = Cost of Goods Sold + EB
BB + $8,000 = $9,500 + $3,000
BB = $4,500

(4) *Direct Materials Used:*

Beg. WIP. + Direct Materials Used + Direct Labor Incurred + Actual Overhead
= Cost of Goods Manufactured + Ending Work in Process

$1,500 + Direct Materials Used + (375 x $5) + $750 = $8,000 + $2,000
Direct Materials Used = $5,875

(5) *Ending Direct Materials Inventory:*

BB + Purchases = Direct Materials Used + EB
$1,400 + $5,250 = $5,875 + EB
$775 = Ending Direct Materials Inventory

4–29. (continued)

Direct Materials Inventory

BB	1,400		
Purch.	5,250	5,875	Used
EB	775		

Work in Process Inventory

BB	1,500		
Direct matl.	5,875		Cost of
Direct labor	1,875	8,000	Goods
Overhead	750		Manufactured
EB	2,000		

Finished Goods Inventory

BB	4,500		
	8,000	9,500	C.G.S.
EB	3,000		

Wages and Accounts Payable

		Purch.	5,250
		Overhead	750
		Direct Labor	1,875
		Marketing and Admin.	3,000

Cost of Goods Sold

9,500	

Marketing and Administrative Costs

3,000	

Manufacturing Overhead

750	750

4–29. *(*continued)

b. Income Statement

Revenue	$13,500
Cost of goods sold	9,500
Gross margin	4,000
Marketing and administrative costs	3,000
Operating profit	$ 1,000

4–30. (30 min.) *Basic cost flow model: Czech Co.*

a. April 30, Ending Work in Process Inventory:
—only one job is remaining in ending Work in Process Inventory.

Direct Materials	$5,200	
Direct Labor	3,600	($12 per hour x 300 hours)
Manufacturing Overhead	1,800	($6 per hour x 300 hours)
Total Cost of Ending Work in Process Inventory	$10,600	

b. Direct materials purchased during April:
Since the accounts payable account is used only for direct material purchases, the month's purchases can be determined from analyzing the accounts payable account:

Beginning Balance	+	Transfers In	–	Transfers Out	=	Ending Balance
$12,000	+	Transfers In	–	$84,000	=	$18,000
		Transfers In	=	$90,000		

c. Actual manufacturing overhead incurred during April:

$6 per hour x 5,200 total direct labor hours = $31,200

d. Cost of goods sold during April:

Beginning Finished Goods Inventory	+	Cost of Goods Manufactured	–	Cost of Goods Sold	=	Ending Finished Goods Inventory
$ 36,000	+	$188,000	–	Cost of Goods Sold	=	$22,000
$224,000	–	$ 22,000	=	Cost of Goods Sold		
		$192,000	=	Cost of Goods Sold		

4–31. (30 min.) *Cost accumulation; service: White and Brite Dry Cleaners.*

T-accounts (Not required—see next page for income statement)

Wages, Salaries and Accounts Payable	
	2,560
	3,590

Dry Cleaning Direct Labor Cost	
2,560 (= $8 x 320)	

Coin Washing and Drying Direct Labor Cost	
640 (= $8 x 80)	

Special Cleaning Direct Labor Cost	
1,000 (= $8 x 125)	

Repairs Direct Labor Cost	
720 (= $8 x 90)	

Unassigned Labor Cost	
200 (= $8 x 25)	

Dry Cleaning Direct Overhead Cost	
500	
125	
250	
200	

Coin Washing and Drying Direct Overhead Cost	
250	
200	
625	
500	

Special Cleaning Direct Overhead Cost	
400	
175	
100	
90	

Repairs Direct Overhead Cost	
140	
25	
10	

4–31. (continued)

Income Statement

White and Brite Dry Cleaners
Income Statement
for Month Ending November 30

	Dry Cleaning	*Coin Washing and Drying*	*Special Cleaning*	*Repairs*	*Total*
Revenue	$4,625	$5,250	$2,000	$625	$12,500
Cost of Services:					
Labor	$2,560[a]	$640[a]	$1,000[a]	$720[a]	
Direct Overhead	1,075[b]	1,575[b]	765[b]	175[b]	
Indirect Overhead	256[c]	64[c]	100[c]	72[c]	
Total costs of services	$3,891	$2,279	$1,865	$967	9,002
Department margin	$734	$2,971	135	$(342)	$ 3,498
Less other costs:					
Unassigned labor costs (idle time)					200[d]
Unassigned overhead indirect costs					20[e]
Marketing and administrative costs					4,050[f]
Operating profit					$ (772)

---

[a] Amounts equal $8 per hour times direct labor hours according to the problem (dry cleaning, $8 x 320 hours; etc.)

[b] Amounts equal the sum of direct overhead items given in the problem.

[c] $\text{Rate} = \dfrac{\text{Total cost}}{\text{Total hours}} = \dfrac{\$512}{640 \text{ hours worked (including idle time)}}$ = $.80 per hour. For dry cleaning, .80 x 320 hours = $256, etc.

[d] $200 = $8 x 25 hours

[e] $20 = $512 – $256 – $64 – $100 – $72

[f] Sum of marketing and administrative costs ($2,000 + $1,500 + $400 + $150)

4–31. (continued)

Only Coin Washing and Drying is clearly profitable. “Repairs” is losing money, and the margins of the other departments are low, considering the amount of salary for Hexter and the assistant (plus other costs) that must be covered. The company should reconsider its full-product-line strategy; perhaps dropping Repairs and raising prices on Dry Cleaning and Special Cleaning. The company could also find ways to be more efficient, perhaps eliminating the need for Hexter’s assistant or one of the other four employees.

4–32. (25 min.) *Job costs; service: Wehelp Consultants.*

a.

	Nocando	*Sails Inc.*	*Original John's*	*Unassigned Costs (not required)*	*Total*
Revenue	$80,000	$24,000	$40,000		$144,000
	(= 1,000 x $80)	(= 300 x $80)	(= 500 x $80)		
Labor	$30,000	$ 9,000	$15,000	$6,000	$ 60,000
	(= 1,000 x $30)	(= 300 x $30)	(= 500 x $30)	(= 200 x $30)	
Overhead	$15,000[a]	$ 4,500[a]	$ 7,500[a]	3,000[a]	30,000
Margin	$35,000	$10,500	$17,500		

[a] $15,000 = 1,000/2,000 x $30,000; $4,500 = 300/2,000 x $30,000; etc.

4–32. (continued)

b. Income Statement

Revenue from clients		$144,000
Less cost of services to clients:		
Labor	$54,000	
Overhead	27,000	
Total cost of services to clients		81,000
Gross margin		63,000
Less other costs:		
Labor	6,000	
Overhead	3,000	
Mktg. and adm. costs	20,000	
Total other costs		29,000
Operating profit		$ 34,000

4–33. (50 min.) *Job costs in a service company: McHale Painters Inc.*

Materials Inventory

Balance 1/1 (given)	920	16	Indirect Materials
Purchases (given)	116	314	Requisition
Balance 1/31	706		

Work-in-Process Inventory

(a) Balance 1/1	576	504	Job A-15	(c)
(b) Job A-15	170	850	Job A-38	(e)
(d) Job A-38	608			
(f) New Job A-40	556			
Balance 1/31	556			

Finished Goods Inventory

Balance 1/1 ($392 + $158)	550		
(c) Job A-15	504	550	Sold
(e) Job A-38	850		
Balance 1/31	1,354		

a. Direct Materials + Direct Labor + Applied Overhead

= $174 + $32 + $64 + $84 + [150% + ($64 + $84)]

= $576 .

b. To complete Job A-15:

$68 Direct Labor + ($68 x 150%) Applied Overhead

= $170 .

c. Transfer to Finished Goods: Job A-15
Beginning Inventory Cost + Current Cost

= $174 + $64 + 150%($64) + $170

= $504 .

4–33. (continued)

d. To complete Job A-38:
$108 Materials + $200 Direct Labor + (150% x $200) Applied Overhead

= $108 + $200 + $300

= $608 .

e. Transfer of Job A-38:
Beginning Inventory Cost + Current Cost

[$16 + $42 + 150%($42)] + [$54 + $100 + 150%($100)]

= [$32 + $84 + 150%($84)] + [$108 + $200 + 150%($200)]

= $850 .

f. New Job Cost = Current Charges to WIP less Current Charges for Jobs A-15 and A-38:

= Current Materials + Direct Labor + Overhead – Job A-15 Current Cost – Job A-38 Current Cost

= $314 + $408 + $150%($408) – $170(b)* – $608(d)*

= $556 .

---

*These letters refer to solution parts b and d above.

4–34. (55 min.) *Tracing costs in a job company. Arrow Space, Inc.*

a.	(1)	Materials Inventory	71,600	
		Accounts Payable		71,600
	(2)	Manufacturing Overhead	2,000	
		Materials Inventory		2,000
	(3)	Accounts Payable	71,600	
		Cash		71,600
	(4)	Work in Process—Direct Materials	34,000	
		Materials Inventory		34,000
	(5)	Payroll	56,000	
		Payroll Taxes Payable		18,000
		Cash		38,000
	(6)	Payroll	28,000	
		Fringe Benefits Payable		28,000
	(7)	Work in Process (60 Percent x $84,000)	50,400	
		Manufacturing Overhead (30% x $84,000)	25,200	
		Administrative and Marketing Costs (10% x $84,000)	8,400	
		Payroll ($56,000 + $28,000)		84,000
	(8)	Manufacturing Overhead	43,200	
		Cash		43,200
	(9)	Work in Process—Overhead Applied ($50,400 x 175 percent)	88,200	
		Overhead Applied		88,200
	(10)	Manufacturing Overhead	21,000	
		Accumulated Depreciation—Property, Plant, and Equipment		21,000

4–34. (continued)

b. Materials Inventory

Balance 1/1	74,100	2,000	(2)
(1)	71,600	34,000	(4)
Balance 1/31	109,700[a]		

[a]$109,700 = $74,100 + $40,000 + $31,600 – $2,000 – $34,000.

Work-in-Process Inventory

Balance 1/1	16,500	115,100	Per Finished Goods T-account
(4) Direct Materials	34,000		
(7) Direct Labor	50,400		
(9) Overhead Applied	88,200		
Balance 1/31	74,000[b]		

[b]$74,000 = $16,500 + $34,000 + $50,400 + $88,200 – $115,100.

Actual Manufacturing Overhead

(2)	2,000		
(7)	25,200		
(8)	43,200		
(10)	21,000		

Manufacturing Overhead Applied

		88,200	(9)

Accounts Payable

(3)	71,600	71,600	(1)

4–34. (continued)

Cash

		71,600	(3)
		38,000	(5)
		43,200	(8)

Payroll

(5)	56,000		
(6)	28,000	84,000	(7)

Payroll Liabilities (Including Taxes)

		18,000	(5)
		28,000	(6)

Administrative and Marketing Costs

(7)	8,400		

Accumulated Depreciation—Property, Plant, and Equipment

		21,000	(10)

Finished Goods

Balance 1/1	83,000		
Goods Completed	115,100[a]	131,700	Cost of Goods Sold
Balance 1/31	66,400		

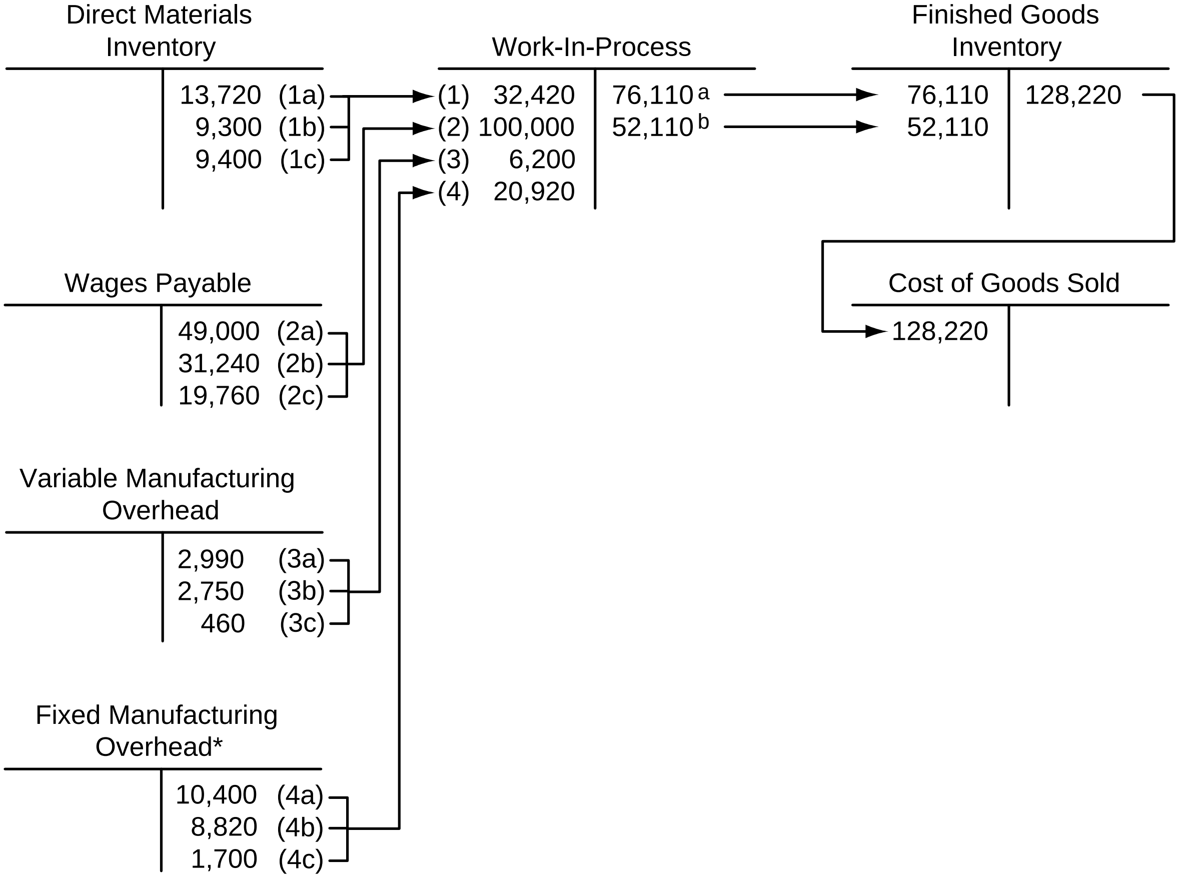
[a] \$115,100 = \$131,700 + \$66,400 – \$83,000.

Cost of Goods Sold

Balance 1/31	131,700		

4–35. (50 min.) *Cost flows through accounts: Leevies Pants Inc.*

a. T accounts.



[a] \$76,110 = 13,720 + \$49,000 + \$2,990 + \$10,400

[b] \$52,110 = \$9,300 + \$31,240 + \$2,750 + \$8,820

4–35. (continued)

b. Total Direct Labor Costs = \$400,000.

$$\text{Total Direct Labor Hours} = \frac{\$400{,}000}{\$5\text{ per Hour}} = 80{,}000.$$

Variable Manufacturing Overhead = 0.30 x \$104,000
= \$31,200

$$\text{Predetermined Variable Overhead Rate} = \frac{\$31{,}200}{80{,}000}$$

= \$0.39 per Direct Labor Hour.

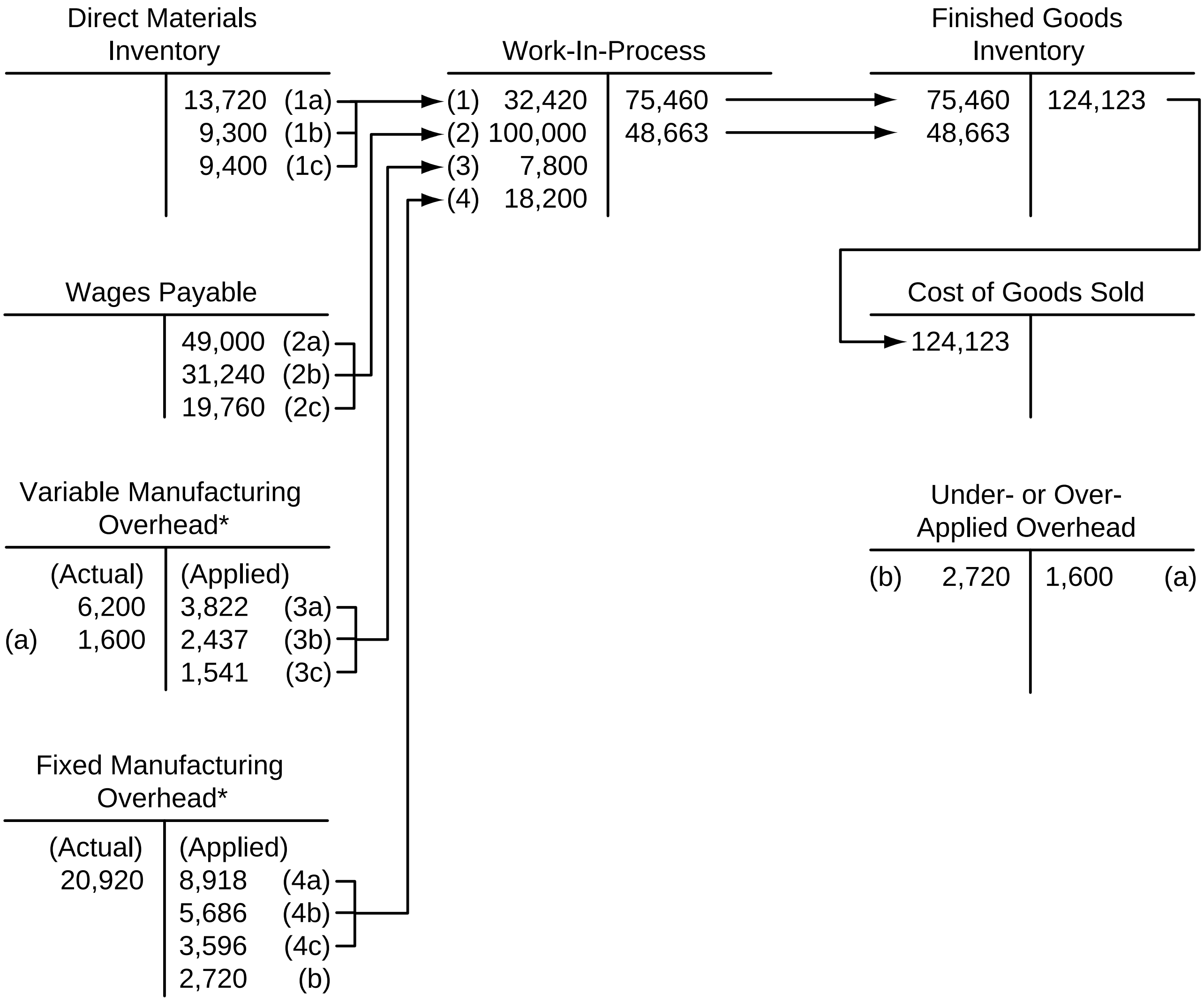
Fixed Manufacturing Overhead = 0.70 x \$104,000
= \$72,800

$$\text{Predetermined Fixed Overhead Rate} = \frac{\$72{,}800}{80{,}000}$$

= \$0.91 per Direct Labor Hour.

4–35. (continued)

c. T accounts



*These can be divided into two accounts, one for “actual” and one for “applied.” We put them in one account to save space.

4–35. (continued)

d.

	Actual	*Normal*
Full Absorption Costing		
Sales Revenue	$140,000	$140,000
Less Cost of Goods Sold	(128,220)	(124,123)
Gross Margin	$ 11,780	$ 15,877
Less:		
(Under-) Overapplied Overhead	—	(1,120)
Marketing and Administrative Costs	(11,200)	(11,200)
Operating Profit (Loss)	$ 580	$ 3,557

4–36. (60 min.) *Show flow of costs to jobs: Bright Equipment Co..*

a. 1. *Payment received on account*		
Cash	25,000	
Accounts receivable		25,000
2. *Inventory purchase*		
Materials and equipment inventory	18,700	
Accounts payable		18,700
3. *Billing*		
Accounts receivable	175,000	
Sales revenue		175,000
Cash	100,000	
Accounts receivable		100,000
4. *Indirect labor*		
Manufacturing overhead—Indirect labor	1,300	
Wages payable		1,300
5. *Indirect materials issued*		
Overhead	310	
Materials and equipment inventory		310
6. *Overhead and advertising*		
Overhead [$1,100 + $1,350 + $640 + $400 + $650 + $900]	5,040	
Selling costs—Advertising	1,200	
Cash		5,340
Accumulated Depreciation		900

4–36. (continued)

a. (continued)

7. *Charges to Work in Process*

Work in process—materials and equipment [$3,200 + $14,200 + $17,000 + $6,200]	40,600	
Work in process—direct labor [$1,800 + $1,200 + $3,100 + $900]	7,000	
Work in process—overhead applied [15% x $40,600]	6,090	
Materials inventory		40,600
Wages payable		7,000
Overhead applied		6,090

8. *Transfer of Job 51*

Cost of installations completed and sold	136,480	
Work in process—materials and equipment [$95,000 + $14,200]		109,200
Work in process—direct labor [$9,700 + $1,200]		10,900
Work in process—overhead applied [15% x $109,200]		16,380

Note: No finished goods inventory account is required.

b. *Overhead analysis:*

Applied (Entry 7)		$6,090
Incurred		
Entry 4	$1,300	
5	310	
6	5,040	
		6,650
Underapplied		$ 560

4–36. (continued)

c. *Inventory balances*

Materials and Equipment Inventory

Balance 9/1	48,000	(7)	40,600
(2)	18,700	(5)	310
Balance 9/30	25,790		

Work in Process Inventory

Balance 9/1	162,250*		
Current charges (7)	53,690	Job 51 (8)	136,480
Balance 9/30	79,460		

Cost of Goods Sold**

(8)	136,480		
Underapplied overhead	560		
Balance 9/30	137,040		

*Job 46 + Job 51 = $43,300 + $118,950

**Not required.

4–37. (70 min.) *Reconstruct missing data: Badomen Equipment Inc..*

This is a challenging problem. We put the work in process account on the board for the "big picture," then solve for each item in the account as follows:

Work-in-Process

(a) Balance, beginning	86,200	Transferred to	
(b) Direct materials	70,314	finished goods	53,500 (d)
(c) Direct labor	67,700	Disaster loss	204,014 (f)
(e) Overhead applied	33,300		
Balance, ending	–0–		

The calculations are shown below. We usually present these using both T-accounts and the following formulas.

(a) Given

(b) Direct materials = Beginning inventory + Purchases – Ending inventory – Indirect materials
= $49,000[a] + $66,400* – $43,000[a] – $2,086[b]
= $70,314

*Purchases = Accounts payable, ending + Cash payments – Accounts payable, beginning
= $50,100[a] + $37,900[a] – $21,600[a]
= $66,400

(c) Direct labor = Payroll – Indirect labor
= $82,400[a] – $14,700[a]
= $67,700

4–37. (continued)

(d) Cost transferred to finished goods = Finished goods, ending + Cost of goods sold – Finished goods, beginning

= \$37,500[a] + (\$396,600[a] – \$348,600[a]) – \$32,000[a]

= \$53,500

(e) Overhead applied = Ending manufacturing overhead – beginning manufacturing overhead + overapplied overhead

= \$217,000[a] – \$184,900[a] + \$1,200[a]

= \$33,300

(f) Loss = \$86,200[a] + \$70,314 + \$67,700 + \$33,300 – \$53,500

= \$204,014

Note: The insurance company may dispute paying the \$1,200 overapplied overhead.

---

[a] Given in problem

[b] Given in paper fragments

4–38. (60 min.) Deriving overhead rates: Premier Pasta Company.

This problem relates overhead allocation to decision making. It could be assigned in later chapters on decision making or budgeting, as well as here. We like to use it here to motivate overhead cost assignment for decision making and performance evaluation.

Calculate the cost and volume differentials to determine the variable overhead rate:

$$\frac{\$34{,}500{,}000 - \$29{,}880{,}000}{1{,}380{,}000 - 1{,}080{,}000} = \frac{\$4{,}620{,}000}{300{,}000}$$

$$= \$15.40 \text{ per direct labor hour}$$

Total overhead (Year 1)	$34,500,000
Total variable overhead (1,380,000 x $15.40)	(21,252,000)
Total fixed overhead	$13,248,000

Total overhead costs at 1,150,000 direct labor hours

Total variable overhead (1,150,000 x $15.40)	$17,710,000
Total fixed overhead	13,248,000
Total overhead	$30,958,000

$$\text{Total overhead rate} = \frac{\$30{,}958{,}000}{1{,}150{,}000 \text{ hrs.}} = \$26.92.$$

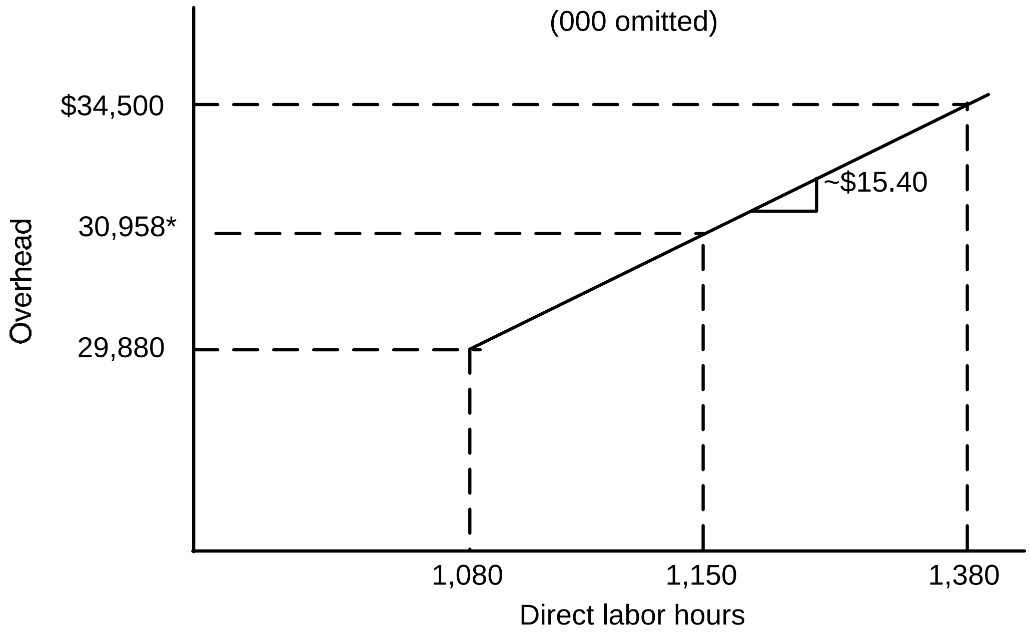
$$\text{Fixed overhead rate} = \$26.92 - \$15.40 = \$11.52.$$

$$\text{Also, fixed overhead rate} = \frac{\$13{,}248{,}000}{1{,}150{,}000 \text{ hours}} = \$11.52.$$

The information above should be incorporated into a report to management.

4–38. (continued)

For presentation to students, we find it helpful to present the following graph of these relationships:



*$29,880 + [(1,150 hrs. – 1,080 hrs) x $15.40] = $30,958.

4–39. (45 min.) *Incomplete data—job costing: Paige Printing Inc.*

The following information should be included (in summary) in a report to management.

Cash	
	4,600*

Wages Payable	
	32,000*

Overhead	
Actual	Applied
20,000*	16,000[9]

Work-in-Process

Job No. 101		
M*	2,000	2,000
L*	9,600	19,200
O[3]	4,800	9,600
4/1	16,400	
L[1]	9,600	
O[4]	4,800	
	0	

Job No. 102		
M[5]	3,000	3,000
L[6]	12,000	12,000
O[7]	6,000	6,000
	0	

Job No. 103		
M*	1,600	
L*	10,400	
O[8]	5,200	
4/30	17,200	

Cost of Goods Sold

Job No. 101		
M*	2,000	
L	19,200	
O[2]	9,600	
	30,800*	

Job No. 102		
M	3,000	
L	12,000	
O	6,000	
	21,000	

Overhead Variance	
4,000[10]	

Note: See footnotes on next page.

4–39. (continued)

M refers to direct materials
L refers to direct labor
O refers to manufacturing overhead
*Numbers given in the problem

[1] Labor to complete job is \$9,600 since the beginning inventory was 50% complete

[2] Applied overhead = \$30,800 – \$2,000 – \$19,200
= $\underline{\underline{\$9,600}}$

∴ Applied overhead = $\dfrac{\$9,600}{\$19,200}$
= $\underline{\underline{\$0.50}}$ per labor dollar

[3] Overhead in beginning inventory = 0.50 x \$9,600
= $\underline{\underline{\$4,800}}$

[4] Overhead applied in April = 0.50 x \$9,600
= $\underline{\underline{\$4,800}}$

[5] Materials for Job No. 102 = Purchases – materials for Job No. 103
= \$4,600 – \$1,600
= $\underline{\underline{\$3,000}}$

[6] Labor for Job No. 102 = Total direct labor costs – Labor for Job No. 101 – Labor for Job No. 103
= \$32,000 – \$9,600 – \$10,400
= $\underline{\underline{\$12,000}}$

[7] Overhead for Job No. 102 = 0.50 x \$12,000
= $\underline{\underline{\$6,000}}$

[8] Overhead for Job No. 103 = 0.50 x \$10,400
= $\underline{\underline{\$5,200}}$

[9] Applied Overhead = \$4,800 + \$6,000 + \$5,200
= $\underline{\underline{\$16,000}}$

[10] Underapplied overhead = Actual – Applied
= \$20,000 – \$16,000
= $\underline{\underline{\$4,000}}$

4–40. (25 min.) Job Costing and Ethics.

a. It would be unethical for Suzie to falsify job cost reports by improperly assigning costs to the U.S. government job which were actually part of the cost of the Arrow Space job. Since Suzie's boss suggested this course of action, she should approach higher levels of management with her problem. Given the potential illegality and other possible negative ramifications of this problem (such as lost reputation), it is likely that management will decide to write off the cost overruns instead of falsely reporting them.

b. The fact that Suzie's company is reimbursed on the U.S. government contract makes it particularly enticing to charge the excess costs to this project. However, since the U.S. government contract is based on costs, it may be an illegal action for the company to misrepresent costs charged to this project. If this action is discovered and proven in court, the company could be liable for the excess charges, interest and punitive damages. Suzie and her boss could be held responsible for civil and criminal penalties, not to mention the loss of their jobs and their reputations.

Chapter 5
Process Costing

Solutions to Review Questions

5–1.

The equivalent units concept equates units at various stages of completion to a common measurement unit. The calculation is necessary because products are partially incomplete.

5–2.

Using the basic cost flow equation, rearrange the terms to solve for the unknown beginning inventory. From BB + TI – TO = EB, we have:

> Beginning Inventory + Current Work – Transferred Out = Ending Inventory.
>
> Rearranging yields:
>
> Beginning Inventory = Transferred Out + Ending Inventory – Current Work

5–3.

With FIFO costing, the units in the beginning inventory are transferred out first. These beginning inventory units carry with them the costs incurred in a previous period plus the costs incurred this period to complete the beginning inventory. Units started and completed during the period are charged out using all current period costs. While such a distinction is made by the department transferring the units out, the department receiving the units usually ignores the distinction in costs incurred in the prior department.

5–4.

Under FIFO costing, the equivalent units represent only the work done in the current period. Under weighted–average, the equivalent units represent the work associated with all of the costs charged to work in process regardless of the period in which those costs were incurred (i.e., including costs from prior periods that are in beginning inventory).

5–5.

Prior department costs behave the same as direct materials which are typically added at the start of production. They are treated separately because they represent the accumulation of costs from previous departments rather than the receipt of materials from the stores area. It is helpful to separate prior department costs from other costs because the manager of the department receiving the transferred units has no control over the costs incurred in prior departments. Thus, the prior department costs are not useful for evaluating the performance of the manager of the department receiving the units.

5–6.

From BB + TI – TO = EB; TO = BB + TI – EB

Solutions to Critical Analysis and Discussion Questions

5–7.

To assign costs to specific lots of cereal or similarly mass–produced items requires a lot of record-keeping. Assuming products are all the same, a process costing system provides sufficient information for control purposes. Recordkeeping is simplified since all costs in a given month are accumulated in one account and assigned at the end of the period.

5–8.

This is a fairly common problem. LIFO is usually beneficial for tax purposes when prices are rising and inventory levels are steady or rising. However, maintaining internal records on a LIFO basis is often quite burdensome. To avoid the problem, companies usually maintain their internal accounting records on a FIFO or weighted-average basis and then make an estimate of the LIFO cost of inventories. The LIFO estimate is usually done on a highly aggregated basis and employs some form of “dollar value” LIFO estimation.

A company may use LIFO for tax purposes and some other method for internal accounting purposes. This is an example of the idea of “different costs for different purposes” which was discussed in earlier chapters.

5–9.

Carbonated water and cola syrup are combined in the first stage. Empty cans are filled in the second stage. Tops are placed on the cans in the third stage. Finally, the cans are packaged and prepared for shipping.

5–10.

The correct answer is (2). When cost of goods manufactured is the same under FIFO and weighted-average, the difference between the weighted-average and FIFO methods of process costing is how they handle beginning WIP. When there is no beginning WIP there is no difference between the two costing methods.

5–11.

The correct answer is (1). If the percentage of completion assigned is lower than actually attained, equivalent units will be understated. For example, if the correct percentage should be 75%, but 50% is assigned to 100 units in ending inventory, EU will be 50 instead of 75. This error results in higher (overstated) costs per equivalent unit and higher (overstated) costs assigned to goods transferred out.

5–12.

The correct answer is (2). The weighted-average method of process costing combines the costs of work done in the previous period and the current period.

5–13.

(5). None of these answers are correct. Answers (1) and (2) are incorrect because (1) ignores stages of completion and (2) double counts units started that are still in ending inventory. Answer (3) is incorrect because the ending inventory should be multiplied by the amount of work done this period, not work necessary to complete the items. Answer (4) is incorrect because it defines weighted-average EU produced, and it has the same error as answer (3).

Solutions to Exercises

5–14. (20 min.) *Compute equivalent units—weighted average method.*

Computation of Equivalent Units Produced—Weighted Average

	a. *Materials*	*b.* *Conversion Costs*
Units transferred out	9,000	9,000
Equivalent units in ending inventory:		
Materials: 10% x 6,500[a] units	650 E.U.	
Conversion costs: 15% x 6,500 units		975 E.U.
Total equivalent units for all work done to date	9,650 E.U.	9,975 E.U.

[a] 6,500 units in ending inventory = 3,500 units in beginning inventory + 12,000 units started this period – 9,000 units transferred out.

5–15. (20 min.) *Compute equivalent units—FIFO method.*

Compute Equivalent Units—FIFO	*a.* *Materials*	*b.* *Conversion Costs*
To complete beginning inventory:		
Materials: 80%[a] x 3,500 units	2,800 E.U.	
Conversion costs: 85%[b] x 3,500 units		2,975 E.U.
Started and completed during the period	5,500 E.U.[c]	5,500 E.U.
Units still in ending inentory:		
Materials: 10% x 6,500[d] units	650 E.U.	
Conversion costs: 15% x 6,500 units		975 E.U.
	8,950 E.U.	9,450 E.U.

[a] 80% = 100% – 20% already done at the beginning of the period.

[b] 85% = 100% – 15% already done at the beginning of the period.

[c] 5,500 units started and completed = 9,000 units transferred out less 3,500 units from beginning inventory.

[d] 6,500 ending inventory = 3,500 units beginning inventory + 12,000 units started this period – 9,000 units transferred out.

Alternative Method

	Equivalent units of work done this period	=	Units transferred out	+	E.U. ending inventory	–	E.U. beginning inventory
a. Materials:	8,950 E.U.	=	9,000 units	+	650 E.U.	–	700 E.U.
b. Conversion Costs:	9,450 E.U.	=	9,000 units	+	975 E.U.	–	525 E.U.

5–16. (15 min.) *Compute equivalent units—weighted average method.*

	a. *Materials*	*b.* *Conversion Costs*
Units transferred out	30,000	30,000
Equivalent units in ending inventory:		
Materials: 25% x 10,000 units	2,500	
Conversion costs: 15% x 10,000 units		1,500
Total equivalent units for all work done to date	32,500	31,500

5–17. (20 min.) *Compute equivalent units—FIFO method.*

	a. *Materials*	*b.* *Conversion Costs*
To complete beginning inventory:		
Materials: 45%[b] x 5,000[a] units	2,250 E.U.	
Conversion costs: 30%[c] x 5,000 units...........		1,500 E.U.
Started and completed during the period..........	25,000 E.U.[d]	25,000 E.U.
Units still in ending inentory:		
Materials: 25% x 10,000[d] units......................	2,500 E.U.	
Conversion costs: 15% x 10,000[d] units..........		1,500 E.U.
	29,750 E.U.	28,000 E.U.

[a] 5,000 units in beginning inventory = 30,000 units transferred out + 10,000 units in ending inventory – 35,000 units started this period.

[b] 45% = 100% – 55% already done at the beginning of the period.

[c] 30% = 100% – 70% already done at the beginning of the period.

[d] 25,000 units started and completed = 30,000 units transferred out less 5,000 units from beginning inventory.

Alternative Method

	Equivalent units of work done this period	=	Units transferred out	+	E.U. ending inventory	–	E.U. beginning inventory
a. Materials:	29,750 E.U.	=	30,000 units	+	2,500 E.U.	–	2,750 E.U.
b. Conversion Costs:	28,000 E.U.	=	30,000 units	+	1,500 E.U.	–	3,500 E.U.

5–18. (20 min.) *Compute equivalent units—weighted average method: Keanu Co.*

The answer is (a).

Conversion Costs:

Units transferred out	40,000
Equivalent units in ending inventory (16,000 units x 75%)	12,000
Total equivalent units for conversion costs	52,000

5–19 (20 min.) *Compute equivalent units—FIFO method: Alyssa Co.*

The answer is (d)

	Materials Eq. units	*Conversion Costs Eq. units*
To complete beginning inventory:		
Materials: all complete	0	
Conv. costs: 250 units x (1–40%)		150
Started and completed during the period (1,050 units trans. out—250 beg. Invent.)	800	800
Units in ending inventory:		
Materials (200 x 100%)	200	
Conv. costs (200 x 25%)		50
Equivalent units of production	1,000	1,000

5–20. (20 min.) *Compute cost per equivalent unit—weighted average method: Alexis Co.*

The answer is (9).

	Physical Units	*Materials Eq. Units*
Flow of units:		
Units to be accounted for:		
Beginning WIP inventory	60,000	
Units started this period	160,000	
Total units to account for	220,000	
Units accounted for:		
Completed and transferred out		
Materials (170,000 x 100%)	170,000	170,000
Units in ending inventory:		
Materials (50,000 x 100%)	50,000	50,000
Total units accounted for	220,000	220,000

	Direct Materials
Flow of costs:	
Costs to be accounted for:	
Costs in beginning WIP inventory	$11,000
Current period costs	35,200
Total costs to be accounted for	$46,200
Cost per equivalent unit	
Materials ($46,200/220,000 units)	$ 0.21

5–21. (20 min.) *Compute equivalent units—FIFO method: Juan Co.*

The answer is (b).

	Physical Units	*Equiv. units Conversion Costs*
Flow of units:		
Units to be accounted for:		
Beginning WIP inventory	40,000	
Units started this period	680,000	
Total units to account for	720,000	
Units accounted for:		
Completed and transferred out		
From beginning WIP inventory:		
Conv. costs 40,000 x (1–60%)	40,000	16,000
Started and completed currently	600,000	600,000
Units in ending WIP inventory:		
Conv. costs 80,000 x 40%	80,000	32,000
Total units accounted for	720,000	648,000

5–22. (35 min.) *Compute cost per equivalent unit—weighted average method.*

	Physical Units	*Equivalent Units*	
		Materials Eq. units	*Conversion Costs Eq. units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	150		
Units started this period	1,000		
Total units to account for	1,150		
Units accounted for:			
Completed and transferred out	850	850	850
Units in ending inventory	300		
Materials (300 x 40%)		120	
Conv. costs (300 x 20%)			60
Total units accounted for	1,150	970	910

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ 624	$ 488	$ 136
Current period costs	9,042	5,720	3,322
Total costs to be accounted for	$9,666	$6,208	$3,458
Cost per equivalent unit			
Materials ($6,208/970 units)		$ 6.40	
Conv. costs ($3,458/910)			$ 3.80

5–23. (20 min.) *Assign costs to goods transferred out and ending inventory—weighted average method.*

	Physical Units	*Equivalent Units* *Materials Eq. units*	*Equivalent Units* *Conversion Costs Eq. units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	150		
Units started this period........................	1,000		
Total units to account for...................	1,150		
Units accounted for:			
Completed and transferred out.............	850	850	850
Units in ending inventory	300		
Materials (300 x 40%)		120	
Conv. costs (300 x 20%)...................			60
Total units accounted for...................	1,150	970	910

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory...........	$ 624	$ 488	$ 136
Current period costs	9,042	5,720	3,322
Total costs to be accounted for...........	$9,666	$6,208	$3,458
Cost per equivalent unit			
Materials ($6,208/970 units)...................		$ 6.40	
Conv. costs ($3,458/910)			$ 3.80
Costs accounted for:			
Costs assigned to units transferred out	$8,670	$5,440	$3,230
Cost of ending WIP inventory	996	768	228
Total costs accounted for....................	$9,666	$6,208	$3,458

Costs transferred out total $8,670, and costs in ending inventory total $996.

5–24. (35 min.) *Compute cost per equivalent unit—FIFO method.*

	Physical Units	*Equivalent Units*	
		Materials Eq. units	*Conversion Costs Eq. units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	150		
Units started this period	1,000		
Total units to account for	1,150		
Units accounted for:			
Completed and transferred out			
From beginning WIP inventory	150		
Materials 150 x (1–60%)		60	
Conv. costs 150 x (1–30%)			105
Started and completed currently	700	700	700
Units in ending WIP inventory	300		
Materials (300 x 40%)		120	
Conv. costs (300 x 20%)			60
Total units accounted for	1,150	880	865

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ 624	$ 488	$ 136
Current period costs	9,042	5,720	3,322
Total costs to be accounted for	$9,666	$6,208	$3,458
Cost per equivalent unit			
Materials ($5,720/880 units)		$ 6.50	
Conv. costs ($3,322/865 units)			$ 3.84

5–25. (20 min.) *Assign costs to goods transferred out and ending inventory—FIFO method.*

	Physical Units	*Equivalent Units*	
		Materials Eq. units	*Conversion Costs Eq. units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	150		
Units started this period	1,000		
Total units to account for	1,150		
Units accounted for:			
Completed and transferred out			
From beginning WIP inventory	150		
Materials 150 x (1–60%)		60	
Conv. costs 150 x (1–30%)			105
Started and completed currently	700	700	700
Units in ending WIP inventory	300		
Materials (300 x 40%)		120	
Conv. costs (300 x 20%)			60
Total units accounted for	1,150	880	865

5–25. (continued)

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ 624	$ 488	$ 136
Current period costs	9,042	5,720	3,322
Total costs to be accounted for	$9,666	$6,208	$3,458
Cost per equivalent unit			
Materials ($5,720/880 units)		$ 6.50	
Conv. costs ($3,322/865 units)			$ 3.84
Costs accounted for:			
Costs assigned to units transferred out			
Costs from beginning WIP inventory	$ 624	$ 488	$ 136
Current costs added to complete beginning WIP inventory	794		
Materials ($6.50 x 60 units)		390	
Conv. costs ($3.84 x 105 units)			404*
Current costs of units started and completed	7,238		
Materials ($6.50 x 700)		4,550	
Conv. costs ($3.84 x 700)			2,688
Total costs transferred out	$8,656	$5,428	$3,228
Cost of ending WIP inventory	1,010		
Materials ($6.50 x 120)		780	
Conv. costs ($3.84 x 60)			230
Total costs accounted for	$9,666	$6,208	$3,458

*Includes $1 rounding error.

Costs transferred out total $8,656, and costs in ending inventory total $1,010.

5–26. (35 min.) *Compute cost per equivalent unit—weighted average method.*

	Physical Units	*Equivalent Units*	
		Materials Eq. units	*Conversion Costs Eq. units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	8,000		
Units started this period	14,000		
Total units to account for	22,000		
Units accounted for:			
Completed and transferred out	17,000	17,000	17,000
Units in ending WIP inventory	5,000		
Materials (5,000 x 80%)		4,000	
Conv. costs (5,000 x 40%)			2,000
Total units accounted for	22,000	21,000	19,000

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ 124,160	$ 50,820	$ 73,340
Current period costs	895,240	390,600	504,640
Total costs to be accounted for	$1,019,400	$441,420	$577,980
Cost per equivalent unit			
Materials ($441,420/21,000 units)		$ 21.02	
Conv. costs ($577,980/19,000 units)			$ 30.42

5–27. (20 min.) *Assign costs to goods transferred out and ending inventory—weighted average method.*

	Physical Units	*Equivalent Units*	
		Materials Eq. units	*Conversion Costs Eq. units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	8,000		
Units started this period	14,000		
Total units to account for	22,000		
Units accounted for:			
Completed and transferred out	17,000	17,000	17,000
Units in ending inventory	5,000		
Materials (5,000 x 80%)		4,000	
Conv. costs (5,000 x 40%)			2,000
Total units accounted for	22,000	21,000	19,000

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ 124,160	$ 50,820	$ 73,340
Current period costs	895,240	390,600	504,640
Total costs to be accounted for	$1,019,400	$441,420	$577,980
Cost per equivalent unit			
Materials ($441,420/21,000 units)		$ 21.02	
Conv. costs ($577,980/19,000 units)			$ 30.42
Costs accounted for:			
Costs assigned to units transferred out	$ 874,480	$357,340	$517,140
Costs of ending WIP inventory	144,920	84,080	60,840
Total costs accounted for	$1,019,400	$441,420	$577,980

Costs transferred out total $874,480, and costs in ending inventory total $144,920.

5–28. (35 min.) *Compute cost per equivalent unit—FIFO method.*

	Physical Units	*Equivalent Units*	
		Materials Eq. units	*Conversion Costs Eq. units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	8,000		
Units started this period	14,000		
Total units to account for	22,000		
Units accounted for:			
Completed and transferred out			
From beginning WIP inventory	8,000		
Materials 8,000 x (1–30%)		5,600	
Conv. costs 8,000 x (1–30%)			5,600
Started and completed currently	9,000	9,000	9,000
Units in ending WIP inventory	5,000		
Materials (5,000 x 80%)		4,000	
Conv. costs (5,000 x 40%)			2,000
Total units accounted for	22,000	18,600	16,600

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ 124,160	$ 50,820	$ 73,340
Current period costs	895,240	390,600	504,640
Total costs to be accounted for	$1,019,400	$441,420	$577,980
Cost per equivalent unit			
Materials ($390,600/18,600 units)		$ 21.00	
Conv. costs ($504,640/16,600 units)			$ 30.40

The unit costs are slightly higher under weighted-average than under FIFO. The costs per unit in beginning inventory were slightly higher than the cost per unit incurred this period, which increases weighted-average unit cost.

5–29. (20 min.) *Assign costs to goods transferred out and ending inventory—FIFO method.*

	Physical Units	*Equivalent Units*	
		Materials Eq. units	*Conversion Costs Eq. units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	8,000		
Units started this period	14,000		
Total units to account for	22,000		
Units accounted for:			
Completed and transferred out			
From beginning WIP inventory	8,000		
Materials 8,000 x (1–30%)		5,600	
Conv. costs 8,000 x (1–30%)			5,600
Started and completed currently	9,000	9,000	9,000
Units in ending WIP inventory	5,000		
Materials (5,000 x 80%)		4,000	
Conv. costs (5,000 x 40%)			2,000
Total units accounted for	22,000	18,600	16,600

5–29. (continued)

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ 124,160	$ 50,820	$ 73,340
Current period costs	895,240	390,600	504,640
Total costs to be accounted for	$1,019,400	$441,420	$577,980
Cost per equivalent unit			
Materials ($390,600/18,600 units)		$ 21.00	
Conv. costs ($504,640/16,600 units)			$ 30.40
Costs accounted for:			
Costs assigned to units transferred out:			
Costs from beginning WIP inventory	$ 124,160	$ 50,820	$ 73,340
Current costs added to complete beginning WIP inventory	287,840		
Materials ($21 x 5,600)		117,600	
Conv. costs ($30.40 x 5,600)			170,240
Current costs of units started and completed:	462,600		
Materials ($21 x 9,000)		189,000	
Conv. costs ($30.40 x 9,000)			273,600
Total costs transferred out	$ 874,600	$357,420	$517,180
Cost of ending WIP inventory	144,800		
Materials ($21 x 4,000)		84,000	
Conv. costs ($30.40 x 2,000)			60,800
Total costs accounted for	$1,019,400	$441,420	$577,980

Ending inventory is slightly higher under the weighted-average method because the unit costs are higher under weighted-average. Under FIFO, the unit costs are $21 for materials and $30.40 for conversion costs. Under weighted-average, the unit costs are $21.02 for materials and $30.42 for conversion costs. The reason for the difference in unit cost is explained in Exercise 5–28.

5–30. (50 min.) *Production Cost Report: Overland Co.—FIFO method.*

	Physical Units	*Equivalent Units*	
		Prior Department	*Department No. 2*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	3,000		
Units started this period	7,000		
Total units to account for	10,000		
Units accounted for:			
Completed and transferred out			
From beginning WIP inventory	3,000		
Prior department		0	
Department No. 2 [3,000 units x (1–20%)]			2,400
Started and completed currently	6,000	6,000	6,000
Units in ending WIP inventory	1,000		
Prior department		1,000	
Department No. 2 (1,000 units x 45%)			450
Total units accounted for	10,000	7,000	8,850

5–30. (continued)

	Total	*Prior Department*	*Department No. 2*
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ 18,406	$14,500	$ 3,906
Current period costs	107,240	32,900	74,340
Total costs to be accounted for	$125,646	$47,400	$78,246
Cost per equivalent unit			
Prior department ($32,900/7,000 units)		$ 4.70	
Dept. No. 2 ($74,340/8,850 units)			$ 8.40
Costs accounted for:			
Costs assigned to units transferred out:			
Costs from beginning WIP inventory	$ 18,406	$14,500	$ 3,906
Current costs added to complete beginning WIP inventory	20,160		
Prior department		0	
Dept. No. 2 ($8.40 x 2,400 units)			20,160
Current costs of units started and completed:	78,600		
Prior department ($4.70 x 6,000)		28,200	
Dept. No. 2 ($8.40 x 6,000)			50,400
Total costs transferred out	$117,166	$42,700	$74,466
Cost of ending WIP inventory	8,480		
Prior department ($4.70 x 1,000)		4,700	
Dept. No. 2 ($8.40 x 450)			3,780
Total costs accounted for	$125,646	$47,400	$78,246

5–31. (50 min.) *Production cost report—weighted average method: Overland Co.*

	Physical Units	*Equivalent Units*	
		Prior Department	*Department No. 2*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	3,000		
Units started this period	7,000		
Total units to account for	10,000		
Units accounted for:			
Completed and transferred out	9,000	9,000	9,000
Units in ending inventory	1,000		
Prior department (1,000 units x 100%)		1,000	
Department No. 2 (1,000 units x 45%)			450
Total units accounted for	10,000	10,000	9,450

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ 18,406	$14,500	$ 3,906
Current period costs	107,240	32,900	74,340
Total costs to be accounted for	$125,646	$47,400	78,246
Cost per equivalent unit			
Prior departments ($47,400/10,000 units)		$ 4.74	
Department No. 2 ($78,246/9,450)			$ 8.28
Costs accounted for:			
Costs assigned to units transferred out	$117,180	$42,660	$74,520
Costs of ending WIP inventory	8,466	4,740	3,726
Total costs accounted for	$125,646	$47,400	$78,246

The ending inventory is lower under the weighted-average method than under the FIFO method. Under weighted-average, the ending inventory is $8,466. This is $14 less than FIFO, which is $8,480. The difference is due to the differences in costs per equivalent unit between FIFO and weighted-average.

Solutions to Problems

5–32. (45 min.) *Compute equivalent units—multiple choice.*

a. The answer is (2).

	Materials	*Conversion Costs*
Units transferred out	132,500[a]	132,500[a]
E.U. in ending inventory:		
Materials 100% x 12,500 units	12,500 E.U.	
Conversion costs 40% x 12,500 units		5,000 E.U.
E.U. produced this period	145,000 E.U.	137,500 E.U.

[a]Units transferred out = units started + beg. inventory – ending inventory
= 120,000 + 25,000 – 12,500
= 132,500

b. The answer is (4).

	Prior Department Costs	*Materials*	*Conversion Costs*
Units transferred out	330,000[a]	330,000[a]	330,000[a]
E.U. in ending inventory:			
Prior department costs	40,000 E.U.		
Materials[b]		–0– E.U.	
Conversion costs 90% x 40,000 units			36,000 E.U.
E.U. produced this period	370,000 E.U.	330,000 E.U.	366,000 E.U.

[a]320,000 started + 50,000 in beg. inv. – 40,000 in ending inv. = 330,000 transferred out.
[b]Materials are added at the end of the process.

5–32. (continued)

c. The answer is (2).

E.U. to complete beginning inventory 40%[a] x 16,000 units	6,400 E.U.
Started and completed[b]	240,000 E.U.
E.U. in ending inventory 40% x 32,000 units	12,800 E.U.
E.U. done this period	259,200 E.U.

[a] 40% = 100% – 60% already done at the beginning of the period.
[b] 240,000 units = 256,000 transferred out – 16,000 from beginning inventory.

d. The answer is (1).

	Materials	*Conversion Costs*
To complete beginning inventory:		
Materials: 0%[a] x 10,000 units	0	
Conversion costs: 30%[b] x 10,000 units		3,000 E.U.
Started and completed during the period	35,000[c] E.U.	35,000 E.U.
Units still in ending inventory:		
Materials: 100% x 8,000 units	8,000 E.U.	
Conversion costs: 50% x 8,000 units		4,000 E.U.
Work done in current period	43,000 E.U.	42,000 E.U.

[a] 0% = 100% – 100% already done at the beginning of the period.
[b] 30% = 100% – 70% already done at the beginning of the period.
[c] 35,000 = 45,000 transferred out – 10,000 from beginning inventory.

5–33. (30 min) *Production report to find conversion costs in ending WIP inventory—FIFO method*

a. The answer is (3)

	Physical Units	*Equivalent Units*
		Conversion Costs
Flow of units		
Units to be accounted for:		
Beginning WIP inventory	50,000	
Units started this period	270,000	
Total units to account for	320,000	
Units accounted for:		
Completed and transferred out		
From beginning WIP inventory	50,000	
(50,000 x 20%)		10,000
Started and completed currently	150,000	150,000
Units in ending WIP inventory	120,000	
(120,000 x 50%)		60,000
Total units accounted for	320,000	220,000

5–33. (continued)

	Conversion Costs
Flow of costs:	
Costs to be accounted for:	
Costs in beginning WIP inventory	$ 86,000
Current period costs	484,000
Total costs to be accounted for	$570,000
Cost per equivalent unit ($484,000/220,000)	$ 2.20
Costs accounted for:	
Costs assigned to units transferred out:	
Costs from beginning WIP inventory	$ 86,000
Current costs added to complete beginning WIP inventory:	
Conv. costs ($2.20 x 10,000)	22,000
Current costs of units started and completed:	
Conv. costs ($2.20 x 150,000)	330,000
Total costs transferred out	$438,000
Cost of ending WIP inventory:	
Conv. costs ($2.20 x 60,000)	132,000 (Answer)
Total costs accounted for	$570,000

b. The answer is (2).

Cost per unit for the previous period is $2.15 [= $86,000/(50,000 equiv. units x 80%)]
Cost per unit for the current period is $2.20 as calculated in (a) above.

5–34. (50 min.) *Prepare a production cost report—weighted average method: Baja Corporation.*

a.

Baja Corporation
Assembly Department
Production Cost Report—Weighted Average

FLOW OF PRODUCTION UNITS

	(Section 1) *Physical units*
Units to be accounted for:	
Beginning WIP inventory	1,000
Units started this period	5,000
Total units to be accounted for	6,000

		(Section 2) *COMPUTE EQUIVALENT UNITS*			
		Prior department costs	*Materials*	*Labor*	*Manufacturing overhead*
Units accounted for:					
Units completed and transferred out:					
From beginning inventory................	1,000				
Started and completed currently	3,000				
Total transferred out........................	4,000	4,000	4,000	4,000	4,000
Units in ending WIP inventory.............	2,000	2,000	1,800 (90%)	1,400 (70%)	700 (35%)
Total units accounted for........................	6,000	6,000	5,800	5,400	4,700

5–34. a. (continued)

		DETAILS			
	Total costs	*Prior department costs*	*Materials*	*Labor*	*Manufacturing overhead*
Costs to be accounted for: (Section 3)					
Costs in beginning WIP inventory	$ 64,700	$ 32,000	$ 20,000	$ 7,200	$ 5,500
Current period costs	310,000	160,000	96,000	36,000	18,000
Total costs to be accounted for	$374,700	$192,000	$116,000	$43,200	$23,500
Cost per equivalent unit: (Section 4)					
Prior department costs ($192,000 ÷ 6,000)		$32.00			
Materials ($116,000 ÷ 5,800)			$20.00		
Labor ($43,200 ÷ 5,400)				$8.00	
Manufacturing overhead ($23,500 ÷ 4,700)					$5.00
Costs accounted for: (Section 5)					
Costs assigned to units transferred out:					
Prior department costs ($32 x 4,000)	$128,000	$128,000			
Materials ($20 x 4,000)	80,000		$ 80,000		
Labor ($8 x 4,000)	32,000			$32,000	
Manufacturing overhead ($5 x 4,000)	20,000				$20,000
Total costs of units transferred out	260,000				
Costs assigned to ending WIP inventory:					
Prior department costs ($32 x 2,000)	64,000	64,000			
Materials ($20 x 1,800)	36,000		36,000		
Labor ($8 x 1,400)	11,200			11,200	
Manufacturing overhead ($5 x 700)	3,500				3,500
Total ending WIP inventory	$114,700				
Total costs accounted for	$374,700	$192,000	$116,000	$43,200	$23,500

5–34. a. (continued)

		Prior Department Costs	*Materials*	*Labor*	*Manufacturing Overhead*
Costs accounted for: (Section 5)					
Costs assigned to units transferred out:					
Prior department costs ($32 x 4,000)	$128,000	$128,000			
Materials ($20 x 4,000)	80,000		$ 80,000		
Labor ($8 x 4,000)	32,000			$32,000	
Manufacturing overhead ($5 x 4,000)	20,000				$20,000
Total costs of units transferred out	260,000				
Costs assigned to ending WIP inventory:					
Prior department costs ($32 x 2,000)	64,000	64,000			
Materials ($20 x 1,800)	36,000		36,000		
Labor ($8 x 1,400)	11,200			11,200	
Manufacturing overhead ($5.00 x 700)	3,500				3,500
Total ending WIP inventory	$114,700				
Total costs accounted for	$374,700	$192,000	$116,000	$43,200	$23,500

b. The report to management should include the following items:

- Materials: The $20 per unit goal set by management is currently being achieved by the Assembly Dept.
- Labor: Equivalent unit labor costs per unit ($8) is below management’s goal of $10.
- Manufacturing overhead: overhead costs per unit ($5) is slightly higher than management’s goal of $4.50.

5–35. (50 min.) *Prepare a production cost report—FIFO method: Baja Corporation.*

a.

Baja Corporation
Assembly Department
Production Cost Report—FIFO

FLOW OF PRODUCTION UNITS	*(Section 1)* *Physical units*	*(Section 2) COMPUTE EQUIVALENT UNITS* *Prior department costs*	*Materials*	*Labor*	*Manufacturing overhead*
Units to be accounted for:					
Beginning WIP inventory	1,000				
Units started this period	5,000				
Total units to be accounted for	6,000				
Units accounted for:					
Units completed and transferred out:					
From beginning inventory	1,000	–0–	–0–	400 (40)%[a]	500 (50%)[b]
Started and completed currently	3,000	3,000	3,000	3,000	3,000
Units in ending WIP inventory	2,000	2,000	1,800 (90%)	1,400 (70%)	700 (35%)
Total units accounted for	6,000	5,000	4,800	4,800	4,200

[a] 40% = 100% – 60% already done at the beginning of the period.

[b] 50% = 100% – 50% already done at the beginning of the period.

5–35. a. (continued)

COSTS

	Total Costs	DETAILS Prior department costs	 Materials	 Labor	 Manufacturing overhead
Costs to be accounted for: (Section 3)					
Costs in beginning WIP inventory	$ 64,700	$ 32,000	$ 20,000	$ 7,200	$ 5,500
Current period costs	310,000	160,000	96,000	36,000	18,000
Total costs to be accounted for	$374,700	$192,000	$116,000	$43,200	$23,500
Cost per equivalent unit: (Section 4)					
Prior department costs ($160,000 ÷ 5,000)		$32.00			
Materials ($96,000 ÷ 4,800)			$20.00		
Labor ($36,000 ÷ 4,800)				$7.50	
Manufacturing overhead ($18,000 ÷ 4,200)					$4.2857

5–35. a. (continued)

		Details			
	Total Costs	*Prior department costs*	*Materials*	*Labor*	*Manufacturing overhead*
Costs accounted for: (Section 5)					
Costs assigned to units transferred out:					
Costs from beginning WIP inventory	$ 64,700	$ 32,000	$ 20,000	$ 7,200	$ 5,500
Current costs added to complete beginning WIP inventory:					
Prior department costs	–0–	–0–			
Materials	–0–		–0–		
Labor ($7.50 x 400)	3,000			3,000	
Manufacturing overhead ($4.2857 x 500)	2,143				2,143
Total costs from beginning inventory	69,843				
Current costs of units started and completed:					
Prior department costs ($32.00 x 3,000)	96,000	96,000			
Materials ($20.00 x 3,000)	60,000		60,000		
Labor ($7.50 x 3,000)	22,500			22,500	
Manufacturing overhead ($4.2857 x 3,000)	12,857				12,857
Total costs of units started and completed	191,357				
Total costs of units transferred out	261,200				

5–35. a. (continued)

	Total Costs	*Details* *Prior department costs*	*Materials*	*Labor*	*Manufacturing overhead*
Costs assigned to ending WIP inventory:					
Prior department costs ($32.00 x 2,000)	$64,000	64,000			
Materials ($20.00 x 1,800)	36,000		36,000		
Labor ($7.50 x 1,400)	10,500			10,500	
Manufacturing overhead ($4.2857 x 700)	3,000				3,000
Total ending WIP inventory	$113,500				
Total costs accounted for	$374,700	$192,000	$116,000	$43,200	$23,500

b. The report to management should include the following items:

- Materials: The equivalent unit materials costs per unit ($20) is the same as management's goal of $20.
- Labor: Equivalent unit labor costs per unit ($7.50) is below management's goal of $10.
- Manufacturing overhead: Overhead costs per unit ($4.29) is below management's goal of $4.50.

5–36. (60 min.) *Prepare a production cost report and adjust inventory balances—weighted average method: Lakeview Corporation.*

a.

Lakeview Corporation
Production Cost Report—Weighted Average

FLOW OF PRODUCTION UNITS

	(Section 1) *Physical units*			
Units to be accounted for:				
Beginning WIP inventory	200,000			
Units started this period	1,000,000			
Total units to be accounted for	1,200,000			
		(Section 2) *COMPUTE EQUIVALENT UNITS*		
		Materials	*Labor*	*Overhead*
Units accounted for:				
Units completed and transferred out:				
From beginning inventory	200,000			
Started and completed currently	700,000			
Total transferred out	900,000	900,000	900,000	900,000
Units in ending WIP inventory	300,000	300,000	150,000 (50%)	150,000 (50%)
Total units accounted for	1,200,000	1,200,000	1,050,000	1,050,000

5–36. (continued)

COSTS

		DETAILS		
	Total costs	*Materials*	*Labor*	*Overhead*
Costs to be accounted for: (Section 3)				
Costs in beginning WIP inventory	$ 704,000	$ 200,000	$ 315,000	$ 189,000
Current period costs	4,492,000	1,300,000	1,995,000	1,197,000
Total costs to be accounted for	$5,196,000	$1,500,000	$2,310,000	$1,386,000
Cost per equivalent unit: (Section 4)				
Materials ($1,500,000 ÷ 1,200,000)		$1.25		
Labor ($2,310,000 ÷ 1,050,000)			$2.20	
Overhead ($1,386,000 ÷ 1,050,000)				$1.32
Costs accounted for: (Section 5)				
Costs assigned to units transferred out:				
Materials ($1.25 x 900,000)	$1,125,000	$1,125,000		
Labor ($2.20 x 900,000)	1,980,000		$1,980,000	
Overhead ($1.32 x 900,000)	1,188,000			$1,188,000
Total costs of units transferred out	4,293,000			
Costs assigned to ending WIP inventory:				
Materials ($1.25 x 300,000)	375,000	375,000		
Labor ($2.20 x 150,000)	330,000		330,000	
Overhead ($1.32 x 150,000)	198,000			198,000
Total ending WIP inventory	903,000			
Total costs accounted for	$5,196,000	$1,500,000	$2,310,000	$1,386,000

5–36. (continued)

b. Adjustment required:

	Work in Process	*Finished Goods*
Per problem statement	$660,960	$1,009,800
Correct	903,000	954,000[a]
Difference	($242,040)	$ 55,800

Journal entry:

Work in Process	242,040	
Finished Goods		55,800
Cost of Goods Sold		186,240

Additional computations:

[a] 200,000 ($1.25 + 2.20 + 1.32) = $954,000

c. Income would have been understated.
Work in process would have been understated.
Finished goods would have been overstated.

5–37. (70 min.) *Show cost flows—FIFO method: Bran-U-Flake Co.*

Work in Process

Beginning Balance	358,000[c]	Transferred out:	
Current work:		From beginning inventory	358,000
materials (given)	150,200	From current work	
conversion (given)	643,500	materials	120,160[a]
		conversion costs	416,988[b]
Ending Balance	256,552		

Additional computations:

[a] $120,160 = 20,000 E.U. transferred x ($150,200/25,000 E.U. for materials) (20,000 E.U. = 25,000 – 5,000 in ending inventory)

[b] $416,988 = 20,250 E.U. transferred out x ($643,500/31,250 E.U. for conversion costs) (20,250 E.U. = 31,250 – 11,000 in ending inventory)

Finished Goods

Transferred in	895,148[a]	To Cost of Goods Sold	626,604 (70%)
Balance	268,544		

[a] From total credits in Work in Process.

Cost of Goods Sold

From Finished Goods	$626,604	Overapplied overhead (See explanation below)	27,500

Overhead applied in beginning WIP inventory is 125% of direct labor costs (i.e., $162,500/$130,000). Since the application rate has not changed, the ratio of applied overhead to total conversion costs found in the beginning inventory should also hold for conversion costs this period.

For this period, 1.25 D.L. + D.L. = $643,500
2.25 D.L. = $643,500
D.L. = $286,000
$643,500 – $286,000 = $357,500

Based on the balance in the manufacturing overhead account, actual overhead is $330,000. Therefore, overhead is overapplied by $27,500 (i.e., $357,500 – $330,000).

The journal entry to assign the overapplied overhead to cost of goods sold is:

Overapplied overhead	27,500	
Cost of goods sold.....................................		27,500

5–38. (40 min.) *Prepare a production cost report and show cost flows through accounts—FIFO method: Malcolm Corporation.*

Malcolm Corporation
Production Cost Report—FIFO

a.

FLOW OF PRODUCTION UNITS	*(Section 1)* *Physical units*	*(Section 2)* *Compute Equivalent Units* *Conversion costs*
Units to be accounted for:		
Beginning WIP inventory	1,000	
Units started this period	9,000	
Total units to be accounted for	10,000	
Units accounted for:		
Units completed and transferred out:		
From beginning inventory	1,000	600 (60%)[a]
Started and completed currently	8,500	8,500
Units in ending WIP inventory	500	100 (20%)
Total units accounted for	10,000	9,200

[a] 60% = 100% – 40% already done at the beginning of the period.

5–38. (continued)

COSTS	*Total costs*	*Conversion costs*
Costs to be accounted for: (Section 3)		
Costs in beginning WIP inventory	$ 840	$ 840
Current period costs	36,000	36,000
Total costs to be accounted for	$36,840	$36,840
Cost per equivalent unit: (Section 4)		
Conversion costs ($36,000 ÷ 9,200)		$3.913
Costs accounted for: (Section 5)		
Costs assigned to units transferred out:		
Costs from beginning inventory	$ 840	$ 840
Current costs added to complete beginning WIP inventory:		
Conversion costs ($3.913 x 600)	2,348	2,348
Total costs from beginning inventory	$ 3,188	
Current costs of units started and completed:		
Conversion costs ($3.913 x 8,500)	33,260	33,260
Total costs of units started and completed	$33,260	
Total costs of units transferred out	$36,448	
Costs assigned to ending WIP inventory:		
Conversion costs ($3.913 x 100)	392	392
Total ending WIP inventory	$ 392	
Total costs accounted for	$36,840	$36,840

b.

Work in Process			
Beginning inventory:		To Finished Goods Inventory	
Conversion costs	840	From beginning inventory:	840
This period's costs:			
Conversion costs	36,000	From this period's costs	35,608[a]
Ending inventory	392		

All costs have been accounted for.

Various Payables	
	36,000

Finished Goods Inventory	
36,448	

[a] $35,608 = $2,348 + $33,260.

c. The company’s target has been achieved. Production costs total $3.913 per unit, less than management’s target of $4.

5–39. (40 min.) *Solving for unknowns—FIFO method.*

a. Equivalent units = Beginning inventory
x (1 – percentage of completion of beginning inventory)
+ 100% of units started and completed
+ ending inventory times its percentage of completion
= 2,800 equivalent units

Let X be the unknown percentage of completion. Then,

2,800 = 500 (1 – X) + 2,250 + (1,500 x 30%)
2,800 = 500 – 500X + 2,700

collecting terms:

2,800 – 2,700 – 500 = –500X
400 = 500X
X = 80%

Also, using BB = TO + EB – TI
= (2,250 + 500) + 450 – 2,800
= 400 units
400 = 500X
X = 80%

b. The cost per equivalent unit is obtained by dividing the ending inventory costs by the equivalent units in ending inventory;

$$\frac{\$8{,}700}{1{,}000 \text{ E.U.}} = \$8.70 \text{ per E.U.}$$

Equivalent units worked this period are the sum of the equivalent units to:

(a) complete the beginning inventory
(b) start and complete some units, and
(c) to start the ending inventory

Which, for the problem are:

4,200 + 6,000 + 1,000 = 11,200

The total costs incurred are the cost per equivalent unit times the equivalent units worked this period. That is

11,200 x $8.70 = $97,440

5–39. (continued)

c. Units started and completed equals the units transferred out (units completed this period) less the units started in a previous period (beginning inventory):

8,000	units transferred out
–1,000	units in beginning inventory
7,000	units started and completed.

d. Current units started equals units transferred out minus beginning inventory plus ending inventory or, in equation form:

$$\begin{aligned} \text{Current Starts} &= \text{TO} - \text{BB} + \text{EB} \\ &= 19{,}000 - 8{,}000 + 6{,}000 \\ &= \underline{\underline{17{,}000 \text{ units}}} \end{aligned}$$

5–40. (50 min.) Solving for unknowns—weighted-average method.

a. Units transferred out equals beginning inventory plus current work minus ending inventory. In equation form:

$$\begin{aligned} TO &= BB + TI \text{ (current work)} - EB \\ &= 4{,}100 + 3{,}500 - 3{,}250 \\ &= \underline{\underline{4{,}350}} \end{aligned}$$

Of the 4,350 units transferred out, 4,100 were from the beginning inventory. Therefore, 250 units were started and completed. That is, 4,350 completed this period less 4,100 started in a prior period equals the 250 started and completed this period.

b. The inventory equation yields:

$$BB + TI = TO + EB$$

Given the information in the problem, we can compute the right hand side. There are 1,200 (6,000 x 20%) equivalent units in ending inventory at a cost of $4,500. The cost per equivalent unit is $3.75 (or $4,500 ÷ 1,200 E.U.).

The right hand side of the equation is the total equivalent units represented by all costs in the account (18,000 E.U.) times the cost per equivalent unit ($3.75). The resulting $67,500 and the beginning inventory cost of $14,200 are entered in the equation:

$$\$14{,}200 + TI = \$67{,}500$$

and solving for TI:

$$\begin{aligned} TI &= \$67{,}500 - \$14{,}200 \\ &= \underline{\underline{\$53{,}300}} \end{aligned}$$

5–40. (continued)

c. First, we compute the cost of ending inventory:

$$\begin{aligned} \text{BB} + \text{TI (current work)} &= \text{TO} + \text{EB} \\ \$1{,}900 + \$18{,}100 &= \$19{,}200 + \text{EB} \\ \text{EB} &= \$20{,}000 - \$19{,}200 \\ &= \underline{\underline{\$800}} \end{aligned}$$

Equivalent units in ending inventory equals $800 divided by the cost per equivalent unit.

Costs per equivalent unit is the $19,200 transferred out costs divided by the units transferred out:

$$\$19{,}200/4{,}800 \text{ units} = \underline{\underline{\$4 \text{ per E.U.}}}$$

Cost assigned to ending inventory is based on the relationship:

$$\$800 = \text{E.U. in EB times } \$4.00$$

and solving for E.U. in EB

$$\begin{aligned} \text{E.U. in EB} &= \$800/\$4 \\ &= \underline{\underline{200 \text{ E.U.}}} \end{aligned}$$

d. The cost per equivalent unit is:

$$\$3{,}360/1{,}600 \text{ units transferred out} = \underline{\underline{\$2.10 \text{ per E.U.}}}$$

Since ending inventory contains direct materials cost of $630, it must contain $630/$2.10 equivalent units or 300 equivalent units.

If the inventory is 25% complete with respect to direct materials costs, then these 300 equivalent units represent 25% of the physical count of units in the ending inventory. Therefore, since

$$300 \text{ E.U.} = .25 \text{ (units in EB)}$$

Then

$$\begin{aligned} \text{units in EB} &= 300/.25 \\ &= \underline{\underline{1{,}200}} \end{aligned}$$

Chapter 6
Spoilage and Quality Management

Solutions to Review Questions

6–1.

Normal spoilage is defined as goods that do not pass quality inspections as a result of normal or typical problems in the production process. Abnormal spoilage is defined as goods that do not pass quality inspections as a result of unusual or infrequent problems with the production process.

6–2.

The entry is as follows:

Abnormal Spoilage	5,000	
WIP Inventory		5,000

Abnormal spoilage is a loss for the period and would appear in the income statement.

6–3.

The five steps are:

1. Summarize the flow of physical units: this is derived from the basic cost flow model (beginning inventory + transfers in – transfers out = ending inventory).

2. Compute the equivalent units produced taking into account the level of completion for direct materials and conversion costs.

3, Summarize the total costs to be accounted for including in beginning WIP inventory, and for units started during the period.

4. Compute costs per equivalent unit for direct materials and conversion costs by dividing total costs to be accounted for from step three by equivalent units from step two.

5. Assign costs to goods transferred out and ending WIP inventory using the cost per equivalent unit from step four and the flow of units from step one.

6–4.

The two approaches are 1) spreading spoilage costs over all jobs by establishing a provision for spoilage in the overhead rate; and 2) assigning spoilage costs to a specific job or set of jobs. The first approach is used when spoilage is a result of the production process and not one particular job. The second approach is used when spoilage is a result of a particular production process used for a specific job.

6–5.

When spoilage results from the production process, costs of spoilage are spread evenly across all products through an overhead rate. If spoilage is attributed to a specific job, costs of spoilage are assigned to that particular job and no provision in the overhead rate is necessary.

6–6.

Rework is performed on products that did not pass inspection and must be reworked to take care of quality problems discovered in the inspection process. The costs of rework can be assigned to specific products (called the product identification method), or spread evenly across all products through an increased overhead rate (called the overhead method).

Solutions to Critical Analysis and Discussion Questions

6–7.

Companies generally prefer to identify spoilage as early in the production process as possible. By moving the inspection point as far upstream on the value chain as possible, companies are able to minimize the costs of labor and materials used on defective goods after spoilage occurs. However, the disadvantage of moving the inspection point upstream on the value chain is that spoilage may occur further into the production process than anticipated and thus, products would pass the initial inspection but become spoilage after the inspection point.

6–8.

Normal spoilage assumes that defects are a result of the regular operation of the production process. However, using total quality management there should be no defects in production. So, advocates of total quality management would likely consider all spoilage to be abnormal spoilage.

6–9.

If spoilage is not detected during production and defective goods are sent to customers, the company may lose future sales to the customer and perhaps other customers due to lost customer goodwill.

6–10.

Answers will vary.

6–11.

Answers will vary.

6–12.

Answers will vary.

Solutions to Exercises

6–13. (40 minutes) *Normal spoilage, Sierra Company.*

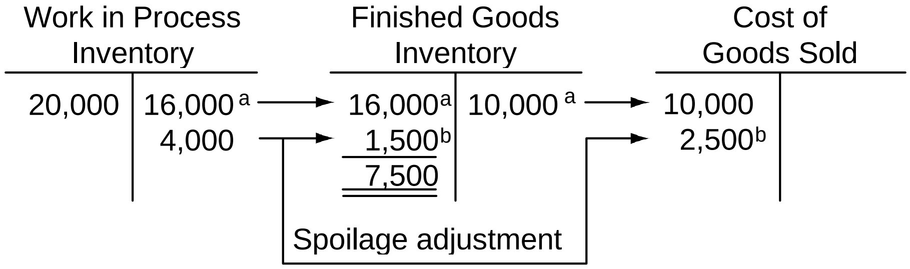
a.

	(Step 1) Physical Units	*(Step 2) Equivalent Units*
Flow of units:		
Units to be accounted for:		
Beginning WIP inventory	–0–	
Units started this period	2,000	
Total units to account for	2,000	
Units accounted for:		
Good units completed and transferred out	1,600	1,600
Spoiled units	400	400
Total units accounted for	2,000	2,000

	Total Costs
Flow of costs (step 3):	
Costs to be accounted for:	
Costs in beginning WIP inventory	$ –0–
Current period costs	20,000
Total costs to be accounted for	$20,000
Cost per equivalent unit (step 4):	
($20,000/2,000)	$ 10.00
Costs accounted for (step 5):	
Costs assigned to good units transferred out	$16,000
Costs assigned to spoiled units	4,000
Cost of ending WIP inventory	–0–
Total costs accounted for	$20,000

6–13. (continued)

b.



[a]$16,000 = 1,600 x $10
$10,000 = 1,000 units sold x $10
[b]Allocate based on good units:
$1,500 = (600/1,600) x $4,000
$2,500 = (1,000/1,600) x $4,000

6–14. (40 minutes) *Normal spoilage, Appalachian Enterprises.*

	(Step 1) Physical Units	*(Step 2) Equivalent Units*
Flow of units:		
Units to be accounted for:		
Beginning WIP inventory	–0–	
Units started this period	1,000	
Total units to account for	1,000	
Units accounted for:		
Good units completed and transferred out	800	800
Spoiled units	200	200
Total units accounted for	1,000	1,000

	Total Costs
Flow of costs (step 3):	
Costs to be accounted for:	
Costs in beginning WIP inventory	$ –0–
Current period costs	20,000
Total costs to be accounted for	$20,000
Cost per equivalent unit (step 4):	
($20,000/1,000)	$ 20.00
Costs accounted for (step 5):	
Costs assigned to good units transferred out	$16,000
Costs assigned to spoiled units	4,000
Cost of ending WIP inventory	–0–
Total costs accounted for	$20,000

6–15. (30 minutes) *Spoilage during the process, Sierra Company.*

	(Step 1) Physical Units	*(Step 2) Equivalent Units*
Flow of units:		
Units to be accounted for:		
Beginning WIP inventory	–0–	
Units started this period	2,000	
Total units to account for	2,000	
Units accounted for:		
Good units completed and transferred out	1,600	1,600
Spoiled units (400 x 50%)	400	200
Total units accounted for	2,000	1,800

	Total Costs
Flow of costs (step 3):	
Costs to be accounted for:	
Costs in beginning WIP inventory	$ –0–
Current period costs	20,000
Total costs to be accounted for	$20,000
Cost per equivalent unit (step 4):	
($20,000/1,800)	$ 11.11
Costs accounted for (step 5):	
Costs assigned to good units transferred out	$17,778
Costs assigned to spoiled units	2,222
Cost of ending WIP inventory	–0–
Total costs accounted for	$20,000

6–16. (30 minutes) *Normal spoilage, Appalachian Enterprises.*

	(Step 1) Physical Units	*(Step 2) Equivalent Units*
Flow of units:		
Units to be accounted for:		
Beginning WIP inventory	–0–	
Units started this period	1,000	
Total units to account for	1,000	
Units accounted for:		
Good units completed and transferred out	800	800
Spoiled units (200 x 40%)	200	80
Total units accounted for	1,000	880

	Total Costs	
Flow of costs (step 3):		
Costs to be accounted for:		
Costs in beginning WIP inventory	$ –0–	
Current period costs	20,000	
Total costs to be accounted for	$20,000	
Cost per equivalent unit (step 4):		
($20,000/880)	$ 22.73	
Costs accounted for (step 5):		
Costs assigned to good units transferred out	$18,182	(rounded)
Costs assigned to spoiled units	1,818	
Cost of ending WIP inventory	–0–	
Total costs accounted for	$20,000	

6–17. (40 minutes) *Normal spoilage, Vail Company.*

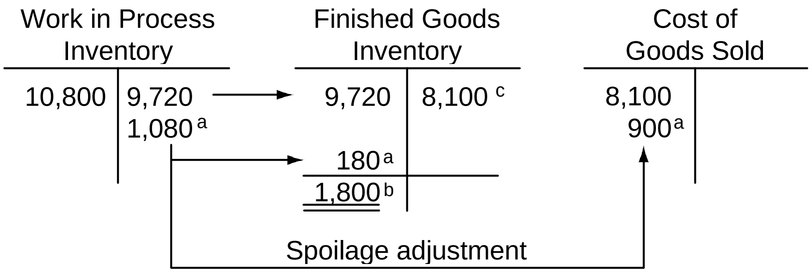
a.

	(Step 1) Physical Units	*(Step 2) Equivalent Units*
Flow of units:		
Units to be accounted for:		
Beginning WIP inventory	–0–	
Units started this period	2,000	
Total units to account for	2,000	
Units accounted for:		
Good units completed and transferred out	1,800	1,800
Spoiled units	200	200
Total units accounted for	2,000	2,000

	Total Costs
Flow of costs (step 3):	
Costs to be accounted for:	
Costs in beginning WIP inventory	$ –0–
Current period costs	10,800
Total costs to be accounted for	$10,800
Cost per equivalent unit (step 4):	
($10,800/2,000)	$ 5.40
Costs accounted for (step 5):	
Costs assigned to good units transferred out	$ 9,720
Costs assigned to spoiled units	1,080
Cost of ending WIP inventory	–0–
Total costs accounted for	$10,800

6–17. (continued)

b.



[a] Spoilage of $1,080 allocated 300/1,800 to Finished Goods Inventory and 1,500/1,800 to Cost of Goods Sold.

[b] $1,800 = [($9,720 x 300 in ending inv.)/1,800 units produced] + $180

[c] $8,100 = [($9,720 x 1,500 units sold)/1,800 units produced]

6–18. (30 minutes) *Spoilage during the process, Vail Company.*

	(Step 1) Physical Units	*(Step 2) Equivalent Units*
Flow of units:		
Units to be accounted for:		
Beginning WIP inventory	–0–	
Units started this period	2,000	
Total units to account for	2,000	
Units accounted for:		
Good units completed and transferred out	1,800	1,800
Spoiled units (200 x 60%)	200	120
Total units accounted for	2,000	1,920

	Total Costs
Flow of costs (step 3):	
Costs to be accounted for:	
Costs in beginning WIP inventory	$ –0–
Current period costs	10,800
Total costs to be accounted for	10,800
Cost per equivalent unit (step 4):	
($10,800/1,920)	$ 5.625
Costs accounted for (step 5):	
Costs assigned to good units transferred out	$10,125
Costs assigned to spoiled units	675
Cost of ending WIP inventory	–0–
Total costs accounted for	$10,800

6–19. (10 min.) *Normal versus abnormal spoilage: Park City Co.*

Abnormal Spoilage Expense......................	120,000	
Work in Process Inventory......................		120,000

6–20. (10 min.) *Normal versus abnormal spoilage: Tree Co.*

Abnormal Spoilage Expense......................	100,000	
Work in Process Inventory......................		100,000

6–21. (10 min.) *Normal versus abnormal spoilage: multiple choice.*

The answer is (2).

Abnormal spoilage is treated as a period expense and appears in the income statement. Normal spoilage is usually treated as an inventoriable cost.

6–22. (45 minutes) *Spoilage During the Process, Davis Company*

	(step 1) *Physical Units*	*(step 2) Equivalent Units* *Materials Eq. Units*	*Conversion Costs Eq. Units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	–0–		
Units started this period	6,000		
Total units to account for	6,000		
Units accounted for:			
Good units completed and transferred out	5,000	5,000	5,000
Spoiled units transferred out:	1,000		
Materials (1,000 x 60%)		600	
Conv. costs (1,000 x 30%)			300
Total units accounted for	6,000	5,600	5,300

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs (step 3):			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ –0–	$ –0–	$ –0–
Current period costs	72,000	27,000	45,000
Total costs to be accounted for	$72,000	$27,000	$45,000
Cost per equivalent unit (step 4):			
Materials ($27,000/5,600 eq. units)		$ 4.821	
Conv. costs ($45,000/5,300 eq. units)			$ 8.491
Costs accounted for (step 5):			
Costs assigned to good units transferred out	$66,560	$24,107[a]	$42,453[a]
Costs assigned to spoiled units	5,440	2,893	2,547
Total costs accounted for	$72,000	$27,000	$45,000

[a] Rounded.

6–23. (30 minutes) *Moving the Inspection Point, Davis Company*

	(step 1) Physical Units	*(step 2) Equivalent Units*	
		Materials Eq. Units	*Conversion Costs Eq. Units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	–0–		
Units started this period	6,000		
Total units to account for	6,000		
Units accounted for:			
Good units completed and transferred out	5,000	5,000	5,000
Spoiled units transferred out:	1,000		
Materials (1,000 x 50%)		500	
Conv. costs (1,000 x 20%)			200
Total units accounted for	6,000	5,500	5,200

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs (step 3):			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ –0–	$ –0–	$ –0–
Current period costs	60,000	20,000	40,000
Total costs to be accounted for	$60,000	$20,000	$40,000
Cost per equivalent unit (step 4):			
Materials ($20,000/5,500 eq. units)		$ 3.636	
Conv. costs ($40,000/5,200 eq. units)			$ 7.692
Costs accounted for (step 5):			
Costs assigned to good units transferred out	$56,643	$18,182[a]	$38,462[a]
Costs assigned to spoiled units	3,357	1,818	1,538
Total costs accounted for	$60,000	$20,000	$40,000

[a] Rounded.

Costs per unit are lower in exercise 23 because the inspection point was moved to a point earlier in the production process.

Solutions to Problems

6–24. (45 minutes) *Spoilage During the Process, Woodland Company*

a.

	(step 1) *Physical Units*	*(step 2) Equivalent Units* *Materials Eq. Units*	*Conversion Costs Eq. Units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	–0–		
Units started this period	20,000		
Total units to account for	20,000		
Units accounted for:			
Good units completed and transferred out	18,500	18,500	18,500
Spoiled units transferred out:	1,500		
Materials (1,500 x 35%)		525	
Conv. costs (1,500 x 55%)			825
Total units accounted for	20,000	19,025	19,325

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs (step 3):			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ –0–	$ –0–	$ –0–
Current period costs	750,000	300,000	450,000
Total costs to be accounted for	$750,000	$300,000	$450,000
Cost per equivalent unit (step 4):			
Materials ($300,000/19,025 eq. units)		$ 15.769	
Conv. costs ($450,000/19,325 eq. units)			$ 23.286
Costs accounted for (step 5):			
Costs assigned to good units transferred out	$722,511	$291,721[a]	$430,789[a]
Costs assigned to spoiled units	27,489	8,279	19,211
Total costs accounted for	$750,000	$300,000	$450,000

[a] Rounded.

b. Spoilage is greater than 1% (3.8% = $27,489/$722,511). Thus, management should bring in the special team.

6–25. (45 minutes) *Spoilage During the Proces—weighted average: Orth & Kids Company.*

a.

	Physical Units	*Equivalent Units*	
		Materials Eq. Units	*Conversion Costs Eq. Units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	3,000		
Units started this period	12,000		
Total units to account for	15,000		
Units accounted for:			
Good units completed and transferred out	11,000	11,000	11,000
Spoiled units transferred out:	1,750		
Materials (1,750 x 50%)		875	
Conv. costs (1,750 x 30%)			525
Units in ending inventory:	2,250		
Materials (2,250 x 30%)		675	
Conv. costs (2,250 x 20%)			450
Total units accounted for	15,000	12,550	11,975

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ 11,000	$ 5,000	$ 6,000
Current period costs	90,000	20,000	70,000
Total costs to be accounted for	$101,000	$25,000	$76,000
Cost per equivalent unit:			
Materials ($25,000/12,550 units)		$ 1.992	
Conv. costs ($76,000/11,975 units)			$ 6.347
Costs accounted for:			
Costs assigned to good units transferred out	$ 91,724	$21,912	$69,812[a]
Costs assigned to spoiled goods	5,075	1,743	3,332
Cost of ending WIP inventory	4,201	1,345	2,856
Total costs accounted for	$101,000	$25,000	$76,000

[a] Rounded.

b. Spoilage is greater than 2% (5.5% = $5,075/$91,724). Thus, management should bring in the special team.

6–26. (45 minutes) *Spoilage During the Process—FIFO: Orth & Kids Company.*

a.

	Physical Units	*Equivalent Units*	
		Materials Eq. Units	*Conversion Costs Eq. Units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	3,000		
Units started this period	12,000		
Total units to account for	15,000		
Units accounted for:			
Good units completed and transferred out			
From beginning WIP inventory	3,000		
Materials 3,000 x (1–75%)		750	
Conv. costs 3,000 x (1–65%)			1,050
Started and completed currently	8,000	8,000	8,000
Spoiled units transferred out	1,750		
Materials (1,750 x 50%)		875	
Conv. costs (1,750 x 30%)			525
Units in ending WIP inventory	2,250		
Materials (2,250 x 30%)		675	
Conv. costs (2,250 x 20%)			450
Total units accounted for	15,000	10,300	10,025

6–26. (continued)

	Total	Direct Materials	Conversion Costs
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ 11,000	$ 5,000	$ 6,000
Current period costs	90,000	20,000	70,000
Total costs to be accounted for	$101,000	$25,000	$76,000
Cost per equivalent unit:			
Materials ($20,000/10,300 units)		$1.942	
Conv. costs ($70,000/10,025 units)			$6.983
Costs accounted for:			
Costs assigned to units transferred out:			
Costs from beginning WIP inventory	$ 11,000	$ 5,000	$ 6,000
Current costs added to complete beginning WIP inventory:	8,788		
Materials ($1.942 x 750 units)		1,456[a]	
Conv. costs ($6.983 x 1,050 units)			7,332
Current costs of units started and completed	71,394		
Materials ($1.942 x 8,000)		15,534[a]	
Conv. costs ($6.983 x 8,000)			55,860[a]
Costs of spoilage	5,365		
Materials ($1.942 x 875)		1,699	
Conv. costs ($6.983 x 525)			3,666
Total costs transferred out	$ 96,547	$23,689	$72,858
Cost of ending WIP inventory:	4,453		
Materials ($1.942 x 675)		1,311	
Conv. costs ($6.983 x 450)			3,142
Total costs accounted for	$101,000	$25,000	$76,000

[a] Your answers may vary slightly due to rounding.

b. Spoilage is greater than 2% (5.9% = $5,365/[$11,000 + $8,788 + $71,394]). Thus, management should bring in the special team.

6–27. (15 minutes) *Equivalent units—multiple choice: Mesa Verde Co.*

The answer is (2)–total equivalent units for conversion costs = 88,000.

	Physical Units	*Conversion Costs Eq. Units*
Flow of units:		
Units to be accounted for:		
Beginning WIP inventory	20,000	
Units started this period	80,000	
Total units to account for	100,000	
Units accounted for:		
Good units completed and transferred out	66,000	66,000
Spoiled units transferred out:	4,000	
Conv. cost (4,000 x 100%)		4,000
Units in ending inventory:	30,000	
Conv. costs (30,000 x 60%)		18,000
Total units accounted for	100,000	88,000

6–28. (20 min.) *Spoilage with rework: Orlando Company.*

Rework:

The cost of rework may be accounted for using the *product identification method* or the *overhead method.* Using product identification, the $250 would be assigned to the 50 defective units and carried through inventory accounts and cost of goods sold. Using the overhead method, the $250 would be debited to Manufacturing Overhead and applied to all units produced, whether defective or not.

Spoiled Units:

The cost of spoiled units could be treated as normal spoilage and tracked separately. If kept separate, the accountants should match the costs of the spoiled units against their revenue of $750. The cost of the spoiled units could also be treated as abnormal spoilage and written off as a period expense. In any case, the $750 would be recorded as revenue when the company made the sale.

Recommendation:

Answers will vary. The most accurate approach is to assign the costs associated with rework and spoiled goods to the reworked and spoiled units (50 units and 100 units, respectively). However, the dollar amounts would probably be considered immaterial, and these costs would likely be recorded as a period expense.

6–29. (45 minutes) *Spoilage During the Process—weighted average: Oregonian, Inc.*

	Physical Units	*Equivalent Units*	
		Materials Eq. Units	*Conversion Costs Eq. Units*
Flow of units:			
Units to be accounted for:			
Beginning WIP inventory	200		
Units started this period	4,800		
Total units to account for	5,000		
Units accounted for:			
Good units completed and transferred out	3,600	3,600	3,600
Spoiled units transferred out:	1,000		
Materials (1,000 x 100%)		1,000	
Conv. Costs (1,000 x 20%)			200
Units in ending inventory:	400		
Materials (400 x 100%)		400	
Conv. Costs (400 x 50%)			200
Total units accounted for	5,000	5,000	4,000

	Total	*Direct Materials*	*Conversion Costs*
Flow of costs:			
Costs to be accounted for:			
Costs in beginning WIP inventory	$ 14,000	$ 10,000	$ 4,000
Current period costs	386,000	190,000	196,000
Total costs to be accounted for	$400,000	$200,000	$200,000
Cost per equivalent unit:			
Materials ($200,000/5,000 units)		$ 40.00	
Conv. costs ($200,000/4,000 units)			$ 50.00
Costs accounted for:			
Costs assigned to good units transferred out	$324,000	$144,000	$180,000
Costs assigned to spoiled goods	50,000	40,000	10,000
Cost of ending WIP inventory	26,000	16,000	10,000
Total costs accounted for	$400,000	$200,000	$200,000

Report to management:

Spoilage is greater than 10% (15.4% = $50,000/$324,000). Thus, further action should be taken to reduce the cost of spoilage.

6–30. (45 minutes) *Spoilage During the Process, Racquet Products, Inc.*

a.

	Physical Units	*Equivalent Units*		
		Prior Dept. costs Eq. Units	*Materials Eq. Units*	*Conversion Costs Eq. Units*
Flow of units:				
Units to be accounted for:				
Beginning WIP inventory	–0–			
Units started this period (transferred in)	6,000			
Total units to account for	6,000			
Units accounted for:				
Good units completed and transferred out	3,300	3,300	3,300	3,300
Spoiled units	100	100	100	100
Units in ending inventory:	2,600			
Prior dept. costs (2,600 x 100%)		2,600		
Materials (2,600 x 80%)			2,080	
Conv. costs (2,600 x 45%)				1,170
Total units accounted for	6,000	6,000	5,480	4,570

	Total	*Prior Dept. Costs*	*Materials*	*Conversion Costs*
Flow of costs:				
Costs to be accounted for:				
Costs in beginning WIP inventory	$ –0–	$ –0–	$ –0–	$ –0–
Current period costs	52,175	43,200	2,500	6,475
Total costs to be accounted for	$52,175	$43,200	$2,500	$6,475
Cost per equivalent unit:				
Prior dept. ($43,200/6,000 units)		$ 7.200		
Materials ($2,500/5,480 units)			$0.456	
Conversion costs ($6,475/4,570 units)				$1.417
Costs accounted for:				
Costs assigned to units transferred out	$29,941	$23,760	$1,505	$4,676
Costs assigned to spoiled goods	907	720	46	141
Cost of ending WIP inventory	21,327	18,720	949	1,658
Total costs accounted for	$52,175	$43,200	$2,500	$6,475

6–30. (continued)

b. Journal entry.

Finished Goods Inv.	605	
Cost of Goods Sold	302	
Work in Process Inv.		907

c. Abnormal spoilage.

Abnormal Spoilage Expense	907	
Work in Process Inv.		907

d. Spoilage is 3% of good units produced. Depending on company guidelines regarding spoilage, this may be cause for management to pursue reductions in spoilage. Given total costs accounted for of $52,175, spoilage of $907 is relatively immaterial. Thus, it would be easier (and more efficient) to record this spoilage as abnormal rather than tracking the cost through inventory in future periods.

6–31. (70 min.) *Process costing with spoilage: Stateside Corp.*

Stateside Corp.
Westcoast Division
Production Cost Report—November

FLOW OF PRODUCTION UNITS

	(Section 1) *Physical units*
Units to be accounted for:	
Beginning WIP inventory	4,000
Units started this period	16,000
Total units to be accounted for	20,000

(Section 2)
COMPUTE EQUIVALENT UNITS
(Weighted Average)

	Physical units	*Materials*	*Labor*	*Overhead*
Units accounted for:				
Units transferred out	15,000	15,000	15,000	15,000
Spoiled units	2,000[a]	2,000	-0-	-0-
Units in ending WIP inventory	3,000	3,000	1,000 (33%)	1,000 (33%)
Total units accounted for	20,000	20,000	16,000	16,000

Note: See footnotes at end of production cost report.

6–31. (continued)

COSTS

	DETAILS			
Costs to be accounted for: (Section 3)	*Total Costs*	*Materials*	*Labor*	*Overhead*
Costs in beginning WIP inventory	$ 69,310	$ 22,800	$ 24,650	$ 21,860[d]
Current period costs	278,290	81,600[b]	103,350	93,340[c]
Total costs to be accounted for	$347,600	$104,400	$128,000	$115,200
Cost per equivalent unit: (Section 4)				
Materials ($104,400 ÷ 20,000)		$5.22		
Labor ($128,000 ÷ 16,000)			$8.00	
Overhead ($115,200 ÷ 16,000)				$7.20
Costs accounted for: (Section 5)				
Costs assigned to good units transferred out:				
Materials ($5.22 x 15,000)	$ 78,300	$ 78,300		
Labor ($8.00 x 15,000)	120,000		$120,000	
Overhead ($7.20 x 15,000)	108,000			$108,000
Total costs of good units transferred out	306,300			

Note: See footnotes at end of production cost report.

6–31. (continued)

	Total Costs	DETAILS		
		Materials	Labor	Overhead
Costs assigned to ending WIP inventory:				
Materials ($5.22 x 3,000)	15,660	15,660		
Labor ($8.00 x 1,000)	8,000		8,000	
Overhead ($7.20 x 1,000)	7,200			7,200
Total ending WIP inventory	30,860			
Costs assigned to spoiled units:				
Materials ($5.22 x 2,000)	10,440	10,440		
Labor	–0–		–0–	
Overhead	–0–			–0–
Total costs assigned to spoiled units	10,440			
Total costs accounted for	$347,600	$104,400	$128,000	$115,200

[a] BB + TI = TO + EB + spoilage
4,000 + 16,000 = 15,000 + 3,000 + spoilage
Spoilage = 2,000 units

[b] $81,600 = $10,000 + $51,000 + (4,000 pounds x $51,500/10,000 pounds)

[c] $93,340 = $52,000 + [$2 per hour x ($103,350/$5)]

[d] $21,860 = $12,000 (Dept. overhead) + $9,860 (Div. Overhead)

b. Report to Management:

Spoilage is 3.4% of the cost of good units transferred out (3.4% = $10,440/$306,300). Thus, management should call in a special team to investigate and fix the problem.

Chapter 7

Allocating Costs to Departments

Solutions to Review Questions

7–1.

Some of the costs include:

(1) additional bookkeeping;

(2) additional management costs in selecting allocation methods and allocation bases; and

(3) costs of making the wrong decision if the allocations provide misleading information.

7–2.

Some of the benefits of cost allocation include:

(1) instilling responsibility for all costs of the company in the division managers;

(2) relating indirect costs to contracts, jobs and products; and

(3) constructing performance measures (“net profit”) for a division that may be more meaningful to management than contribution margins.

7–3.

Aside from regulatory requirements, costs are allocated if the benefits of cost allocation exceed the costs incurred to allocate.

7–4.

Management often uses this type of information for performance evaluation and to assess long-run decisions. That is, in the long run, an activity (e.g., production) must recover all of its costs (both direct and indirect).

7–5.

Cost Category	*Allocation Bases*
Labor-related common costs	number of employees labor hours wages paid some other labor-related base
Machine-related common costs	machine hours current value of machinery number of machines some other machine-related base
Space-related common costs	area occupied volume occupied some other space-related base
Service-related common costs	computer time service hours some other service-related base

7–6.

The essential difference is the allocation of costs among service departments. The direct method makes no inter-service-department allocation, the step method makes a partial inter-service-department allocation, while the simultaneous solution method fully recognizes inter-service-department activities.

7–7.

Allocations usually begin from the service department that has provided the greatest proportion of its services to other departments, or that services the greatest number of other service departments. This criterion is used to minimize the unrecognized portion of reciprocal service department costs. (Recall that the amount of service received by the first department to allocate in the step allocation sequence is ignored.)

Solutions to Critical Analysis and Discussion Questions

7–8.

Management may believe there are benefits to the use of allocated costs. An awareness of total costs may influence managerial behavior and decision making. For example, management may want to make division managers aware of common costs of divisions that must be covered by division margins before the company as a whole earns a profit.

Allocated costs are also used for contractual and regulatory purposes. Many of the exact reasons for the continued use of information based on allocated costs are still unknown. However, its widespread usage by management would indicate the information is beneficial.

7–9.

Allocating zero costs is another allocation method. It too is an arbitrary method. However, an advantage of not allocating costs is that the time saved reduces the expenses of cost allocation. A disadvantage is that common costs must be covered before the company as a whole earns a profit. Cost allocation may make managers more aware of common costs affecting long-run profitability.

7–10.

Costs allocated to word processing were high, thus word processing's charges for typing was high. This created incentives for technical people to type their own work. Allocated costs were higher because high cost lab space, library costs and travel support costs were allocated to Word Processing.

7–11.

When a cost has two or more different relationships between it and the cost object, more than one factor may be used to relate the cost to the cost objects. Costs which have a significant fixed component and a variable component as well are often allocated using dual rates. The fixed portion is allocated on the basis of capacity demanded and the variable portion on the basis of services used. This principle can be extended to even more factors.

7–12.

The concepts of direct and indirect are related to a specific cost object within the organization. Costs that can be attributed to a cost object and can in both a physical and practical sense be related to the cost object with no intermediate allocations are considered direct. Thus, the costs of materials that become an integral part of the final product may be directly identified with the product and with the department which requisitioned the materials and used them in production. However, the costs of the payroll accounting function which represents a service used by many different departments cannot be traced directly to a product, nor to a specific manufacturing department. However, the costs can be traced directly to the office performing the payroll accounting function and then *allocated* to other departments on some rational basis that is expected to reflect a cause and effect relationship between the costs of the service and some activity.

7–13.

The reciprocal method takes into account all of the services rendered among the service departments. It is preferred (assuming cost-effectiveness) since it results in an allocation scheme that reflects the total cost of the use of each service.

7–14.

If no service department performs services for any other service department (or if all service departments render services to producing departments in the same proportions) then the direct method will give the same answer as any other allocation method.

7–15.

The addition of an employee in one department will increase the allocation base and, therefore, reduce the allocation to the department which does not add the employee. The manager of the department which does not add the employee benefits from the actions of the other department. An example may serve to highlight the point. If each producing department has one employee and service department costs total $12,000, then the allocation would be: To P1: 1 employee x ($12,000 ÷ 2 employees) = $6,000. This would be the same as the allocation to P2. Now if P1 adds an employee, the allocation would be:

P1 2 employees x ($12,000 ÷ 3 employees) = $8,000

P2 1 employee x ($12,000 ÷ 3 employees) = $4,000

and the manager in P2 has a $2,000 cost reduction even though the manager of P2 took no action which would warrant such a reduction in costs. One of the problems that may give rise to this situation is that the costs allocated do not bear a relationship to the allocation base. Thus, if a number of employees were an appropriate allocation base, one would not expect the total cost to remain fixed when the number of employees increases. In practice, though, it may not be possible to obtain correlation between a cost and the allocation base.

7–16.

The service costs are being allocated on the basis of use when, in fact, some of the costs were incurred to provide capacity. Dual rates might be established so that the capacity costs would be allocated on the basis of the capacity requested by each of the departments while the use costs would be allocated on the current basis. An interesting problem arises when the joint capacity may be less than the capacity that would be required by each department individually. This problem of the “economies of scale” results in a need to find a basis for allocating the cost savings arising from such economies. No entirely satisfactory and unique solution is readily determinable.

Solutions to Exercises

7–17. (20 min.) *Why costs are allocated: Barfield and McAllister.*

a. The Barfields would prefer costs to be allocated based on the relative volume of the underground oil reservoir (i.e., the acre feet). They would argue that since 3/4 of the oil-bearing rock is under their land, they are entitled to 3/4 of the purchase price. Surface areas are irrelevant because the asset being assigned is the rights to the underground minerals, not the use of the surface.

b. The McAllisters would argue that since each party has one-half of the land, the proceeds should be split equally. They would hold that they must give up their use of the whole 4,000 acres to accommodate the intrusion of the oil developer. It doesn't matter to the McAllisters what the underground deposit looks like. What is important is the impact it will have on their enjoyment of the surface.

NOTE: By agreement, oil producers use method (a) for allocating costs and revenues from common oil deposits which underlie separately owned tracts of land.

7–18. (10 min.) *Alternative allocation bases.*

Common Cost	*Allocation Base*
Building utilities	Space occupied
Payroll accounting	Number of employees
Property taxes on inventories	Value of inventories
Equipment repair	Number of service calls
Quality control inspection	Number of units produced

7–19. (15 min.) *Alternative allocation bases: Cytotech Company.*

a. Wire service hours basis.

TV Station

$$\frac{450}{450 + 300} \times \$100{,}000 = \underline{\underline{\$60{,}000}}$$

Radio Station

$$\frac{300}{450 + 300} \times \$100{,}000 = \underline{\underline{\$40{,}000}}$$

Check: $100,000 = $60,000 + $40,000

b. Hours of news broadcasts

TV Station

$$\frac{100}{100 + 460} \times \$100{,}000 = \underline{\underline{\$17{,}858}}$$

Radio Station

$$\frac{460}{100 + 460} \times \$100{,}000 = \underline{\underline{\$82{,}142}}$$

Check: $100,000 = $17,858 + $82,142

c. Allocation by wire service hours results in an allocation of more costs to the TV station.

The TV station uses relatively more wire service hours than the radio station and when wire service hours is the allocation base, it receives a greater portion of common costs.

Use of hours of news broadcast as a basis allocates more costs to the radio station.

The radio station uses a greater portion of hours of news broadcasts than the TV station and when hours of news broadcasts is the allocation base, it receives the greater cost allocation.

7–20. (20 min.) *Alternative allocation bases: WARP Enterprises.*

a.

	Meat	*Dry Goods*
Operating profit before building occupancy costs	$85,000	$112,500
Building occupancy costs:		
$\frac{10,000}{120,000} \times \$400,000$	33,333	
$\frac{30,000}{120,000} \times \$400,000$		100,000
Operating profit (loss)	$51,667	$ 12,500

b. The front of the store may be more valuable space. If so, “Meat” should be allocated more per square foot than “Dry Goods.” There is little question that store areas with a greater customer traffic count are considered more valuable. An allocation scheme based on traffic count or profits before cost allocation might be considered more reasonable.

7–21. (25 min.) *Alternative allocation bases: The Quality Jacket Company.*

Materials used:

1. Compute rate per dollar of materials used:

$$\text{Rate} = \frac{\$1{,}600{,}000}{\$300{,}000 + \$200{,}000} = \$3.20 \text{ per dollar of materials used}$$

2. Multiply the rate times the materials used per product:

Standard: $300,000 x $3.20 = $960,000
Deluxe: $200,000 x $3.20 = $640,000

3. Divide the total overhead allocated to each product line by the units produced:

$$\text{Standard: } \frac{\$960{,}000}{80{,}000} = \$12.00 \text{ per standard jacket}$$

$$\text{Deluxe: } \frac{\$640{,}000}{15{,}000} = \$42.67 \text{ per deluxe jacket}$$

Direct labor hours:

1. $$\text{Rate} = \frac{\$1{,}600{,}000}{100{,}000 + 150{,}000} = \$6.40 \text{ per hour of direct labor}$$

2. Standard: 100,000 x $6.40 = $640,000
Deluxe: 150,000 x $6.40 = $960,000

3. $$\text{Standard: } \frac{\$640{,}000}{80{,}000} = \$8.00 \text{ per standard jacket}$$

$$\text{Deluxe: } \frac{\$960{,}000}{15{,}000} = \$64.00 \text{ per deluxe jacket}$$

7–21. (continued)

Machine hours:

1. Rate = $\frac{\$1,600,000}{40,000 + 10,000}$ = \$32.00 per machine hour

2. Standard: 40,000 x \$32.00 = \$1,280,000
   Deluxe: 10,000 x \$32.00 = \$320,000

3. Standard: $\frac{\$1,280,000}{80,000}$ = \$16.00 per standard jacket
   Deluxe: $\frac{\$320,000}{15,000}$ = \$21.33 per deluxe jacket

Output:

1. Rate = $\frac{\$1,600,000}{80,000 + 15,000}$ = \$16.84 per jacket

With units of output as the allocation base, the rate will be the same for both types of jackets.

7–22. *Alternative allocation bases: The Quality Jacket Company.*

a. *Allocation base options:*

(Allocations taken from Exercise 7–21)

Standard Jackets

		Allocation
A. Materials used	(Mat)	$12.00
B. Direct labor hours	(DLH)	8.00
C. Machine hours	(MH)................	16.00
D. Output	(Output)...........	16.84

Per unit variable cost calculations:
Direct materials = $300,000/80,000 = $3.75/jacket
Direct labor = ($8 x 100,000)/80,000 = $10.00/jacket

Options:	*Mat*	*DLH*	*MH*	*Output*
Direct Materials	$ 3.75	$ 3.75	$ 3.75	$ 3.75
Direct Labor...................	10.00	10.00	10.00	10.00
Allocated Overhead.......	12.00	8.00	16.00	16.84
Total	$25.75	$21.75	$29.75	$30.59

Deluxe Jackets

		Allocation
A. Materials used	(Mat).......................	$42.67
B. Direct labor hours	(DLH)	64.00
C. Machine hours	(MH).......................	21.33
D. Output	(Output)..................	16.84

Per unit variable cost calculations:
Direct materials = $200,000/15,000 = $13.33/jacket
Direct labor = ($8 x 150,000)/15,000 = $80/jacket

Options:	*Mat*	*DLH*	*MH*	*Output*
Direct Materials	$ 13.33	$ 13.33	$ 13.33	$ 13.33
Direct Labor...................	80.00	80.00	80.00	80.00
Allocated Overhead.......	42.67	64.00	21.33	16.84
Total	$136.00	$157.33	$114.66	$110.17

b. Four different cost numbers per jacket are reflected in the available selection of four different allocation bases. The allocation method chosen does not affect The Quality Jacket Company's total manufacturing costs, only the costs assigned to each product. Management should evaluate the cause and effect relationship comprising overhead costs to determine the most appropriate allocation base.

7–23. (20 min.) *Cost allocations—direct method: Acme Corporation.*

Direct Method:

	To	
From	*P1*	*P2*
S1	\$40,000[a]	\$40,000[a]
S2	62,500[b]	37,500[b]
Total Costs	\$102,500	\$77,500

[a] $\$40,000 = \frac{.10}{.10 + .10} \times \$80,000$ (Since .80 of service department 1's costs used by S2 are ignored, the allocation basis is the .20 used by P1 and P2.)

[b] $\$62,500 = \frac{.50}{(.50 + .30)} \times \$100,000$; $\$37,500 = \frac{.30}{(.50 + .30)} \times \$100,000$; and \$62,500 + \$37,500 = \$100,000

7–24. (30 min.) *Allocating service department costs first to production departments, then to jobs: Acme Corporation.*

		P1	*P2*	*Total*
Costs allocated to each department (from Exercise 7–23)		$102,500	$77,500	$180,000
Allocation bases:				
Job 10:	Labor hours	80	–0–	
	Machine hours	–0–	20	
Job 11:	Labor hours	10	–0–	
	Machine hours	–0–	90	
Total		90	110	

Department rates:

P1 $\dfrac{\$102,500}{90 \text{ labor hours}} = \underline{\underline{\$1,138.89}}$/L.H.

P2 $\dfrac{\$77,500}{110 \text{ mach. hours}} = \underline{\underline{\$704.55}}$/M.H.

Costs assigned to jobs:

Job 10:	Labor hours	80 x $1,138.89 = $91,111		$ 91,111
	Machine hours:		20 x $704.55 = $14,091	14,091
	Total			$105,202
Job 11:	Labor hours:	10 x $1,138.89 = 11,389		$ 11,389
	Machine hours:		90 x $704.55 = $63,410	63,410
	Total			$74,799

Note: The total costs allocated to jobs equals $180,000 after allowing for rounding ($105,202 + $74,799 = $180,001).

7–25. (25 min.) *Cost allocations–direct method: Custom Tailors, Inc.*

	GFA	*Maintenance*	*Cutting*	*Assembly*
Service department costs.....	$20,000	$48,000	NA	NA
GFA allocation......................	(20,000)	NA	$4,000[a]	$16,000[a]
Maintenance allocation		(48,000)	12,000[b]	36,000[b]
Total costs allocated			$16,000	$52,000

[a]

$$\$\ \ 4{,}000 = \frac{100}{(100 + 400)} \times \$20{,}000$$

$$\$16{,}000 = \frac{400}{(100 + 400)} \times \$20{,}000$$

[b]

$$\$12{,}000 = \frac{1{,}000}{(1{,}000 + 3{,}000)} \times \$48{,}000$$

$$\$36{,}000 = \frac{3{,}000}{(1{,}000 + 3{,}000)} \times \$48{,}000$$

7–26. (25 min.) *Cost allocations–step method: Acme Corporation.*

a. Step Method—recommended order:

S1 provides 80% of its services to other service departments while S2 provides 20%. Therefore, S1 should be allocated first.

		To		
From	*Amount*	*S2*	*P1*	*P2*
S1	$ 80,000	$64,000[a]	$ 8,000[a]	$ 8,000[a]
S2	$164,000[b]	(64,000)	102,500[c]	61,500[c]
Total Costs			$110,500	$69,500

[a]$64,000 = 80% x $80,000; $8,000 = 10% x $80,000

[b]$164,000 = $100,000 direct costs + $64,000 from S1

[c] $\$102{,}500 = \dfrac{.50}{(.50 + .30)} \times \$164{,}000$; $\$61{,}500 = \dfrac{.30}{(.50 + .30)} \times \$164{,}000$

$102,500 + $61,500 = $164,000

b. Step Method—reverse order:

		To		
From	*Amount*	*S1*	*P1*	*P2*
S2	$100,000	$20,000[a]	$50,000[a]	$30,000[a]
S1	$100,000[b]	(20,000)	50,000[c]	50,000[c]
Total Costs			$100,000	$80,000

[a]$20,000 = 20% x $100,000; $50,000 = 50% x $100,000 and $30,000 = 30% x $100,000

[b]$100,000 = $80,000 direct costs + $20,000 from S2

[c] $\$50{,}000 = \dfrac{.10}{(.10 + .10)} \times \$100{,}000$

7–27. (15 min.) *Cost allocation—step method: Custom Tailors, Inc.*

	GFA	*Maintenance*	*Cutting*	*Assembly*
Service department costs............	\$ 20,000	\$48,000	NA	NA
Maintenance allocation	9,600[a]	(48,000)	\$ 9,600[a]	\$28,800[a]
GFA allocation..............................	\$(29,600)		5,920[b]	23,680[b]
Total costs allocated			\$15,520	\$52,480

Using this method, more costs are allocated to the Assembly Department than by using the direct method.

[a] $$\$9,600 = \frac{1,000}{(1,000 + 1,000 + 3,000)} \times \$48,000$$

$$\$28,800 = \frac{3,000}{(1,000 + 1,000 + 3,000)} \times \$48,000$$

[b] $$\$5,920 = \frac{100}{(100 + 400)} \times \$29,600$$

$$\$23,680 = \frac{400}{(100 + 400)} \times \$29,600$$

7–28. (45 min.) *Cost allocations—reciprocal method: Acme Corporation.*

Set up the equations:

$S1 = \$80{,}000 + .2S2$

$S2 = \$100{,}000 + .8S1$

$S1 = \$80{,}000 + .2(\$100{,}000 + .8S1)$
$\quad = \$80{,}000 + \$20{,}000 + .16S1$

$S1 = \dfrac{\$100{,}000}{.84}$
$S1 = \underline{\underline{\$119{,}048}}$

$S2 = \$100{,}000 + .8(\$119{,}048)$
$\quad = \underline{\underline{\$195{,}238}}$

Allocating to P1 and P2:
$P1 = .1S1 + .5S2$
$\quad = .1(\$119{,}048) + .5(\$195{,}238)$
$\quad = \underline{\underline{\$109{,}524}}$
$P2 = .1S1 + .3S2$
$\quad = .1(\$119{,}048) + .3(\$195{,}238)$
$\quad = \underline{\underline{\$70{,}476}}$

7–29. (15 min.) *Cost allocations—reciprocal method: two service departments.*

$$\begin{aligned}
P1 &= \$120{,}000 + .30S1 + .20S2\\
P2 &= \$312{,}500 + .20S1 + .15S2\\
P3 &= \$390{,}000 + .10S1 + .55S2\\
S1 &= \$67{,}000 + 0S1 + .10S2\\
S2 &= \$59{,}500 + .40S1 + 0S2
\end{aligned}$$

Computations:

$$S1 = \$67{,}000 + .1(\$59{,}500 + .4S1)$$

$$S1 = \$67{,}000 + \$5{,}950 + .04S1$$

$$.96S1 = \$72{,}950$$

$$S1 = \frac{\$72{,}950}{.96} = \$75{,}990$$

$$\begin{aligned}
\text{So } S2 &= \$59{,}500 + .4(\$75{,}990)\\
&= \$89{,}896
\end{aligned}$$

Next solve for P departments:

$$\begin{aligned}
P1 &= \$120{,}000 + .3(\$75{,}990) + .2(\$89{,}896) = \underline{\underline{\$160{,}776}}\\
P2 &= \$312{,}500 + .2(\$75{,}990) + .15(\$89{,}896) = \underline{\underline{\$341{,}182}}\\
P3 &= \$390{,}000 + .1(\$75{,}990) + .55(\$89{,}896) = \underline{\underline{\$447{,}042}}
\end{aligned}$$

Not required—Costs allocated to P1, P2 and P3:

P1: $160,776 total – $120,000 direct = $40,776 allocated
P2: $341,182 total – $312,500 direct = $28,682 allocated
P3: $447,042 total – $390,000 direct = $57,042 allocated

7–30. (35 min.) *Cost allocation—reciprocal method: Custom Tailors, Inc.*

	GFA	*Maintenance*	*Cutting*	*Assembly*
Service department costs	$20,000	$48,000	NA	NA
GFA allocation[a]	(30,621)	5,104[b]	$5,104[b]	$20,414[b]
Maintenance allocation[a]	10,621[c]	(53,104)	10,621[c]	31,862[c]
Total costs allocated			$15,725	$52,276

[a]

$$\begin{aligned}
G &= \text{GFA costs} = \$20{,}000 + 1/5(M) \\
M &= \text{Maintenance costs} = \$48{,}000 + 1/6(G) \\
G &= \$20{,}000 + 1/5\ (\$48{,}000 + 1/6(G)) \\
G &= \$20{,}000 + \$9{,}600 + 1/30\ (G) \\
G &= \$29{,}600 + 1/30\ (G) \\
29/30\ (G) &= \$29{,}600 \\
G &= \$29{,}600\ (30/29) = \$30{,}621 \\
M &= \$48{,}000 + 1/6\ (\$30{,}621) \\
M &= \underline{\underline{\$53{,}104}}
\end{aligned}$$

[b]

$$\$5{,}104 = \frac{100}{(100 + 100 + 400)} \times \$30{,}621$$

$$\$20{,}414 = \frac{400}{(100 + 100 + 400)} \times \$30{,}621$$

[c]

$$\$10{,}621 = \frac{1{,}000}{(1{,}000 + 1{,}000 + 3{,}000)} \times \$53{,}104$$

$$\$31{,}862 = \frac{3{,}000}{(1{,}000 + 1{,}000 + 3{,}000)} \times \$53{,}104$$

NOTE: Minor discrepancies in the solution are a result of rounding.

7–31. (15 min.) *Evaluate cost allocation methods: Custom Tailors, Inc.*

The answer to this question depends on the cost and benefits of each method. The reciprocal method takes into account the fact that each service department uses the services of the other. While the difference in costs is small, there is a gain of increasing cross-department cost monitoring.

The value of any particular method depends on how the numbers will be used. If the allocations are used only to compute inventory values and cost of goods sold in external financial statements, then it usually makes sense to use the easiest method. If the numbers are to be used for managerial decision making, then the increased precision of the more complex methods may justify the additional cost.

7–32. (15 min.) *Single vs. dual rates: Cytotech Company*.

TV Station

Fixed Costs: $$\frac{100}{100 + 460} \times \$52{,}000 = \$\ 9{,}286$$

Variable Costs: $$\frac{450}{450 + 300} \times (\$100{,}000 - \$52{,}000) = \$28{,}800$$

Total of fixed and variable costs $\underline{\underline{\$38{,}086}}$

Radio Station

Fixed Costs: $$\frac{460}{100 + 460} \times \$52{,}000 = \$42{,}714$$

Variable Costs: $$\frac{300}{450 + 300} \times (\$100{,}000 - \$52{,}000) = \$19{,}200$$

Total of fixed and variable costs $\underline{\underline{\$61{,}914}}$

Check: $100,000 = $38,086 + $61,914

7–33. (20 min.) *Single versus dual rates: Law firm.*

a. Bankruptcy

$$\frac{4{,}000}{4{,}000 + 12{,}000} \times \$200{,}000 = \$50{,}000$$

Personal Injury

$$\frac{12{,}000}{4{,}000 + 12{,}000} \times \$200{,}000 = \$150{,}000$$

Check: $200,000 = $50,000 + $150,000

b. Bankruptcy

$$\frac{1{,}000{,}000}{1{,}000{,}000 + 900{,}000} \times \$200{,}000 = \$105{,}263$$

Personal Injury

$$\frac{900{,}000}{1{,}000{,}000 + 900{,}000} \times \$200{,}000 = \$94{,}737$$

Check: $200,000 = $105,263 + $94,737

7–34. (20 min.) *Single versus dual rates: Law firm.*

Bankruptcy

Fixed Costs:

$$\frac{1{,}000{,}000}{1{,}000{,}000 + 900{,}000} \times \$100{,}000 = \$52{,}632$$

Variable Costs:

$$\frac{4{,}000}{4{,}000 + 12{,}000} \times \$100{,}000 = 25{,}000$$

Total $77,632

Personal Injury

Fixed Costs:

$$\frac{900{,}000}{1{,}000{,}000 + 900{,}000} \times \$100{,}000 = \$\ 47{,}368$$

Variable Costs:

$$\frac{12{,}000}{4{,}000 + 12{,}000} \times \$100{,}000 = 75{,}000$$

Total $122,368

Check: $200,000 = $77,632 + $122,368

7–35. (20 min.) *Multiple factor allocation: Edee Bower Clothing.*

	Percentage factors					
Store	*Payroll*		*Sales*		*Assets*	
A	$\frac{\$85,000}{\$250,000}$ =	34.0%	$\frac{\$1,000,000}{\$4,000,000}$ =	25.0%	$\frac{\$240,000}{\$900,000}$ =	26.7%
B	$\frac{\$35,000}{\$250,000}$ =	14.0%	$\frac{\$1,200,000}{\$4,000,000}$ =	30.0%	$\frac{\$250,000}{\$900,000}$ =	27.8%
C	$\frac{\$60,000}{\$250,000}$ =	24.0%	$\frac{\$1,100,000}{\$4,000,000}$ =	27.5%	$\frac{\$210,000}{\$900,000}$ =	23.3%
D	$\frac{\$70,000}{\$250,000}$ =	28.0%	$\frac{\$700,000}{\$4,000,000}$ =	17.5%	$\frac{\$200,000}{\$900,000}$ =	22.2%
		100.0%		100.0%		100.0%

Allocation percentage

A $$\frac{(34.0\% + 25.0\% + 26.7\%)}{3} = 28.57\%$$

B $$\frac{(14.0\% + 30.0\% + 27.8\%)}{3} = 23.93\%$$

C $$\frac{(24.0\% + 27.5\% + 23.3\%)}{3} = 24.93\%$$

D $$\frac{(28.0\% + 17.5\% + 22.2\%)}{3} = 22.57\%$$

100.00%

Allocation of headquarters' costs

A $300,000 x 28.57% = $ 85,710
B $300,000 x 23.93% = $ 71,790
C $300,000 x 24.93% = $ 74,790
D $300,000 x 22.57% = $ 67,710
$300,000

7–36. (25 min.) *Determine state income tax allocations: Multi-State, Inc.*

Mo: –0– since there is no income tax

Ill. $\frac{1}{3}\left[\frac{\$2.4}{\$2.4 + \$1.8} + \frac{\$.8}{\$2.6 + \$.8 + \$.6} + \frac{\$.3}{\$1.2 + \$.3 + \$.5}\right] \text{ x } \$400{,}000 \text{ x } 5\%$

$= \frac{1}{3}[.5714 + .2 + .15] \text{ x } \$400{,}000 \text{ x } 5\%$

$= \underline{\underline{\$6{,}143}}$ Tax Liability

Cal: $\frac{1}{3}\left[\frac{\$1.8}{\$2.4 + \$1.8} + \frac{\$.6}{\$2.6 + \$.8 + \$.6} + \frac{\$.5}{\$1.2 + \$.3 + \$.5}\right] \text{ x } \$400{,}000 \text{ x } 7\%$

$= \frac{1}{3}[.4286 + .150 + .250] \text{ x } \$400{,}000 \text{ x } 7\%$

$= \underline{\underline{\$7{,}734}}$ Tax Liability

Note: Dollar amounts in millions of dollars

Solutions to Problems

7–37. (25 min.) *Choosing an appropriate allocation base in a high-tech environment: Chips Corp.*

a.

	ROM-A	*RAM-B*
Units produced	200,000	1,600
Direct materials	$25,000	$ 224
Direct labor	1,000	600
Overhead	3,840[a]	2,304[b]
Total costs	$29,840	$3,128
Costs per unit	$.149	$1.955
	$= \frac{\$29,840}{200,000}$	$= \frac{\$3,128}{1,600}$

[a] $3,840 = $1,000/$625,000 x $2,400,000
[b] $2,304 = $600/$625,000 x $2,400,000

b.

	ROM-A	*RAM-B*
Units produced	200,000	1,600
Direct materials	$25,000	$224
Direct labor	1,000	600
Overhead	15,000[a]	120[b]
Total costs	$41,000	$944
Costs per unit	$.205	$.59
	$= \frac{\$41,000}{200,000}$	$= \frac{\$944}{1,600}$

[a] $15,000 = 200,000/32,000,000 x $2,400,000
[b] $120 = 1,600/32,000,000 x $2,400,000

c. Different per unit costs result from using two different allocation bases (direct labor costs and units produced). Since labor costs represent a low proportion of total costs for both products, units produced likely provides a better allocation base. However, one can argue that RAM-B is a specialized product, and thus should cost more than ROM-A.

7–38. (25 min.) *Choosing an appropriate allocation base in an automated environment: Fences Plus Corp.*

a.

	Rails	*Posts*
Units produced	900	30
Direct materials	$5,580	$180
Direct labor	400	500
Overhead................	2,500[a]	3,125[b]
Total costs	$8,480	$3,805
Costs per unit	$9.422	$126.833
	$= \frac{\$8,480}{900}$	$= \frac{\$3,805}{30}$

[a]$2,500 = $400/$88,000 x $550,000

[b]$3,125 = $500/$88,000 x $550,000

b.

	Rails	*Posts*
Units produced	900	30
Direct materials	$5,580	$180
Direct labor	400	500
Overhead................	1,980[a]	66[b]
Total costs	$7,960	$746
Costs per unit	$8.844	$24.867
	$= \frac{\$7,960}{900}$	$= \frac{\$746}{30}$

[a]$1,980 = 900/250,000 x $550,000

[b]$ 66 = 30/250,000 x $550,000

c. The second method appears to relate overhead with the costs of units produced in a more reasonable manner. Since materials costs and time to produce are approximately the same for both units, it would seem that the only difference is the length of the production run. In *a.* the relative cost of posts-to-rails is 13.5:1 which seems excessive for production run differences alone. In *b,* the relative cost is about 2.8:1, which seems more reasonable.

The additional problem with *a*. is that labor costs are not closely related to production. They are related to the number of production *runs,* but not to units produced. Hence, they do not seem to reflect the cause-and-effect criterion for allocating costs to units.

7–39. (50 min.) *Step method with three service departments: Crash Test Corporation.*

a. To facilitate solution, reduce the different allocation bases to proportions used by departments other than the same department.

	Proportion Used By				
	Building Occupancy	*Payroll Accounting*	*Equipment Maintenance*	*Painting*	*Polishing*
Building Area...............	— [a]	.06 [b]	.04 [b]	.72	.18
Employees	.09 [c]	— [a]	.06 [c]	.35	.50
Equipment Value.........	.01 [d]	.20 [d]	— [a]	.52 [d]	.27

[a] Self-usage is ignored

[b] Basis is 250,000 square feet, which ignores Building Occupancy: .06 = 15,000 ÷ 250,000; .04 = 10,000 ÷ 250,000; etc.

[c] Basis is 100 employees, which ignores Payroll Accounting: .09 = 9 ÷ 100; .06 = 6 ÷ 100; etc.

[d] Basis is $1,200, which ignores Equipment Maintenance: .01 = $12 ÷ $1,200; .20 = $240 ÷ $1,200; .52 = $624 ÷ $1,200; etc.

7–39. (continued)

a. (continued)

Rank for allocation:
Equipment Maintenance
Payroll Accounting
Building Occupancy

Crash Test Corp.
Step Method

	To *Equipment Maintenance*	*Payroll Accounting*	*Building Occupancy*	*Painting*	*Polishing*
Direct Costs	$264,000	$500,000	$360,000	$1,350,000	$965,000
FROM					
Equipment Maintenance....	(264,000)	52,800[a]	2,640[a]	137,280	71,280
Payroll Accounting		(552,800)	52,928[b]	205,830[b]	294,042
Building Occupancy			(415,568)	332,454[c]	83,114[c]
Totals..........				$2,025,564	$1,413,436

$2,025,564 + 1,413,436 = $3,439,000 which is the total of the direct costs for all service and producing departments.

[a] $\$52{,}800 = \dfrac{.20}{(.01 + .20 + .52 + .27)} \times \$264{,}000;$

$\$2{,}640 = \dfrac{.01}{(.01 + .20 + .52 + .27)} \times \$264{,}000, \text{etc.}$

[b] $\$52{,}928 = \dfrac{.09}{(.09 + .35 + .50)} \times \$552{,}800;$

$\$205{,}830 = \dfrac{.35}{(.09 + .35 + .50)} \times \$552{,}800, \text{etc.}$

[c] $\$332{,}454 = \dfrac{.72}{(.72 + .18)} \times \$415{,}568;$

$\$83{,}114 = \dfrac{.18}{(.72 + .18)} \times \$415{,}568$

7–39. (continued)

b.

	Painting	*Polishing*
Direct materials	$475,000	–0–
Direct labor	650,000	$820,000
Overhead (direct)	225,000	145,000
Overhead (allocated)	675,564	448,436
Totals	$2,025,564	$1,413,436

Unit cost:

Painting:	$2,025,564/1,000 units	=	$2,026
Polishing:	$1,413,436/1,000 units	=	$1,413
Total			$3,439

c. Unit cost of allocated service department costs:

Painting: $675,564/1,000 units = $675.56

Polishing: $448,436/1,000 units = $448.44

Painting did not meet management's standard of keeping service department costs below $500, but Polishing did meet the standard.

7–40. (40 min.) *Solve for unknowns: Pete's Delicious Foods.*

a. Since the direct method is used, S2's costs are allocated only to P1 and P2, not to S1.

To find the cost of S2's services:

$$\begin{aligned}\$22{,}500 \text{ from S2 to P2} &= \frac{.3}{.5 + .3} \text{ x } (S2)\\ \$22{,}500 &= .375 \text{ x } (S2)\\ S2 &= \frac{\$22{,}500}{.375} = \underline{\underline{\$60{,}000}}\end{aligned}$$

To find the cost of S1's services:

$$\begin{aligned}S1 &= \text{Total} - S2\\ S1 &= \$100{,}000 - \$60{,}000\\ S1 &= \underline{\underline{\$40{,}000}}\end{aligned}$$

Since $40,000 from S1 is allocated to P1, nothing is allocated from S1 to P2.

Total allocated to P2 = $\underline{\underline{\$22{,}500}}$ (= $22,500 + 0).

b. Amount allocated from S2 to P1 = $\$37{,}500 \left(\frac{.5}{.5 + .3} \text{ x } \$60{,}000 \right)$

From	*To*	
	P1	*P2*
S1	$40,000	–0–
S2	$37,500	$22,500

c. All of S1's costs were allocated to P1 and none were allocated to P2.

7–41. (60 min.) *Cost allocation—step method with analysis and decision making: Elektrik Corp.*

a. The company considered only the direct costs of the electric generating plant. It did not include the costs of natural gas received to power the electric plant or other indirect costs.

b. Let:
S1 = Natural gas production
S2 = Electric generating—fixed
S3 = Electric generating—variable
S4 = Equipment maintenance
P1 = Production Department—No. 1
P2 = Production Department—No. 2

Allocation:

			To				
		Amount to be allocated	*S4*	*S2*	*S3*	*P1*	*P2*
From:			$48	$30	$ 80	$600.00	$440.00
Natural gas	(S1)	$ 70			28[a]	7.00[a]	35.00[a]
Equip. Maint.	(S4)	48	(48)	6[b]	3[b]	30.00	9.00
Elec.—fixed	(S2)	36		(36)	0	13.50[c]	22.50[c]
Elec.—var.	(S3)	111			(111)	71.82[d]	39.18[d]
						$722.32	$545.68

Costs allocated from the electric department S2 + S3 = $36 + $111 = $147

If electricity generation *causes* the costs allocated to it, then the company would compare $147,000 internal cost to $160,000 from the outside utility.

[a] S1 allocation: $28 = $70 x .40; $7 = $70 x .10; $35 = $70 x .50

[b] S4 allocation: $\$6 = \frac{.10}{.10 + .05 + .50 + .15} \times \$48$; $\$3 = \frac{.05}{.80} \times \$48$; etc.

[c] S2 allocation:

$$\$13.5 = \frac{.30}{(.30 + .50)} \times \$36; \quad \$22.50 = \frac{.50}{(.30 + .50)} \times \$36$$

[d] S3 allocation:

$$\$71.82 = \frac{.55}{(.55 + .30)} \times \$111; \quad \$39.18 = \frac{.30}{(.55 + .30)} \times \$111$$

7–41. (continued)

c. If the company could realize $58,000 from the sale of the natural gas, then the relevant costs would be:

Natural gas	$58,000[a]
Equipment maintenance	9,000[b]
Direct costs	110,000
	$177,000

which is greater than the proposed $160,000 electric company rates. Management may, of course, want to consider other factors when making this decision.

[a] The $58,000 from the sale of natural gas is an opportunity cost. If Elektrik produces its own electricity, it *loses* $58,000 in potential sales of natural gas.

[b] $\$9{,}000 = \$48{,}000 \text{ equipment maintenance } \times \left[\frac{.10 + .05}{.80}\right]$

7–42. (30 min.) *(Appendix)* *Cost allocations—reciprocal method (computer required): Elektrik Co.*

Services

	Performed By:					
Used By:	*S1*	*S2*	*S3*	*S4*	*P1*	*P2*
S1	–100.0%	10.0%	10.0%	20.0%	0.0%	0.0%
S2	0.0%	–100.0%	0.0%	10.0%	0.0%	0.0%
S3	40.0%	0.0%	–100.0%	5.0%	0.0%	0.0%
S4	0.0%	10.0%	5.0%	–100.0%	0.0%	0.0%
P1	10.0%	30.0%	55.0%	50.0%	100.0%	0.0%
P2	50.0%	50.0%	30.0%	15.0%	0.0%	100.0%
Costs to be allocated:	$70,000	$30,000	$80,000	$48,000		

Inverse Matrix

	S1	*S2*	*S3*	*S4*	*P1*	*P2*
S1	–104.6%	–12.7%	–11.6%	–22.8%	0.0%	0.0%
S2	–0.2%	–101.0%	–0.5%	–10.2%	0.0%	0.0%
S3	–42.0%	–5.6%	–104.9%	–14.2%	0.0%	0.0%
S4	–2.1%	–10.4%	-5.3%	–101.7%	0.0%	0.0%
P1	34.7%	39.9%	61.7%	64.0%	100.0%	0.0%
P2	65.3%	60.1%	38.3%	36.0%	0.0%	100.0%

Cost Allocation

	From:						*Total Allocated to Production*
To:	*S1*	*S2*	*S3*	*S4*	*P1*	*P2*	
S1	$(73,249)	$ (3,823)	$ (9,283)	$(10,936)	$–	$–	
S2	(148)	(30,312)	(424)	(4,883)	–	–	
S3	(29,374)	(1,685)	(83,925)	(6,816)	–	–	
S4	(1,484)	(3,115)	(4,239)	(48,829)	–	–	
P1	24,267	11,960	49,333	30,722	–	–	$116,282
P2	45,733	18,040	30,667	17,278	–	–	$111,718
							$228,000

7–43. (20 min.) *Cost allocations and decision making*: Parker Co.*

To be useful, cost information must be presented so that the differential costs are readily identified. Direct department costs would normally be differential; however, additional detail should be requested and analyzed prior to making decisions to insure that all costs can and will be eliminated. For instance, certain administrative functions within the promotion department may have to be continued even if an outside agency is employed.

Charges from other departments may be useful in making the decision; however, the detail of the costs should be analyzed to make sure all the costs are differential and could be eliminated. Administrative overhead costs allocated to the department would not be useful because these costs would not be eliminated, but rather reallocated to other departments.

In addition to the costs factors, qualitative factors should be considered: Can an outside firm maintain the necessary degree of confidentiality? Can the outside firm match the quality of work performed?

*CMA adapted.

7–44. (35 min.) *Allocate service department costs— direct and step methods: Doxolby Manufacturing.*

a. The answer is 2.

Factory maintenance is allocated based on square footage occupied. The direct method is used. The amount allocated to the fabrication department is

$$\underline{\underline{\$111{,}760}} = \frac{88{,}000}{(88{,}000 + 72{,}000)} \times \$203{,}200.$$

b. The answer is 3.

General factory administration is allocated based on direct labor hours. The direct method is used. The amount allocated to the assembly department is

$$\underline{\underline{\$70{,}000}} = \frac{437{,}500}{(562{,}500 + 437{,}500)} \times \$160{,}000.$$

c. The answer is 3.

$$\underline{\underline{\$3{,}840}} = \frac{8}{(8 + 12 + 280 + 200)} \times \$240{,}000 = .016 \times \$240{,}000$$

d. The answer is 1.

There is no allocation of costs back to the department after costs have been allocated from it. Factory cafeteria costs have already been allocated from it to other departments.

7–45. (40 min.) *Cost allocations—comparison of dual and single rates: Sky Blue Airlines.*

a. Allocations based on time usage:

Department	*Proportion of Total Time*	*Allocated Cost*
Reservations	.161[a]	$1,940,050[b]
Scheduling	.110	1,325,500
Maintenance	.406	4,892,300
Accounting	.323	3,892,150
		$12,050,000

[a] 2,500 ÷ (2,500 + 1,700 + 6,300 + 5,000) = 2,500 ÷ 15,500 = .161; .110 = 1,700 ÷ 15,500; .406 = 6,300 ÷ 15,500; .323 = 5,000 ÷ 15,500

[b] .161 x ($7,050,000 + $5,000,000) = $1,940,050; $1,325,500 = .110 x $12,050,000; $4,892,300 = .406 x $12,050,000; $3,892,150 = .323 x $12,050,000

b. Dual allocations

	(1) Proportion of Time Usage	*(2) Allocated Time Cost*	*(3) Proportion of Capacity*	*(4) Allocated Capacity Cost*	*(5) Total Allocated Cols. 2 + 4*
Reservations	.161[a]	$1,135,050[b]	.600[c]	$3,000,000[d]	$4,135,050
Scheduling	.110	775,500	.240	1,200,000	1,975,500
Maintenance	.406	2,862,300	.084	420,000	3,282,300
Accounting	.323	2,277,150	.076	380,000	2,657,150
					$12,050,000

[a] from part (a)

[b] $1,135,050 = $7,050,000 x .161; $775,500 = $7,050,000 x .110; $2,862,300 = $7,050,000 x .406; $2,277,150 = $7,050,000 x .323

[c] .600 = 1,500 ÷ (1,500 + 600 + 210 + 190) = 1,500 ÷ 2,500; .240 = 600 ÷ 2,500; .084 = 210 ÷ 2,500; .076 = 190 ÷ 2,500

[d] $3,000,000 = .600 x $5,000,000; $1,200,000 = .240 x $5,000,000; etc.

c. Dual rates should be used. If a single rate (time usage) is used, there may not be a causal relationship between time usage and storage-related costs. For example, Maintenance had the highest time usage (and thus, was allocated a large share of total costs using a single rate), but had a relatively low storage capacity requirement. Using dual rates, Maintenance would receive a fairer share of costs.

7–46. (40 min.) *Cost allocation for rate-making purposes: Worryfree Insurance Co.*

a. Consumer Group Presentation:

Insurance income		*Remarks*
Premium revenue	$ 200	
Operating costs:		
Claims	125	
Administrative	31.5	10% charged to investment income
Sales commissions	32	20% charged to investment income
Total operating cost	188.5	
Profit	$ 11.5	

Investment income	
Investment income	$ 15
Administrative costs	3.5
Sales commissions	8
Total operating cost	$ 11.5
Profit	$ 3.5

Check: $15 million = $11.5 million + $3.5 million

b. The argument usually given is that the administrative and sales costs are incurred to operate the insurance activities. These costs would not change regardless of investment activity. The investment income is separate and incidental to the primary underwriting business.

7–47. (30 min.) *Cost allocation for travel reimbursement.*

a. Since the round-trip cost of the Salt Lake City portion (2 x $1,400 = $2,800) is greater than the cost of the excursion ticket, the employee would request the full $2,640.

b. The minimum cost to the company would be $1,400.

c. A reasonable alternative could be computed as follows: The round trip-business portion of the trip was 3,678 miles (= 1,839 + 1,839). Dividing by the total mileage of 4,717 miles equals .78 or 78% of the total fare. This alternative would result in a reimbursement of $2,059 (i.e., .78 x $2,640). Since the trip was primarily for business it would seem appropriate to reimburse a minimum of $2,059. The maximum reimbursement would be $2,640. Depending on policy some amount between $2,059 and $2,640 would usually be suggested as a basis for reimbursement. This problem demonstrates the need for *ex ante* policy when there are arbitrary and potentially contentious allocations.

7–48. (50 min.) *Cost allocation—step method: Wecare Hospital Case.*

Step method solution:

Order of allocation:

1. Buildings depreciation and maintenance
2. Employee health & welfare
3. Laundry & linen
4. Maintenance of personnel
5. Central supply

7–48. (continued)

	TO (Department)							
FROM (Department)	*Employee Health & Welfare*	*Laundry & Linen*	*Maintenance of Personnel*	*Central Supply*	*Operating Rooms*	*Radiology*	*Laboratory*	*Patient Rooms*
Buildings Depreciation and Maintenance..............	–0–	.10	.10	–0–	.05	.02	.02	.71
Employee Health & Welfare..	—	.15	.05	.03	.25	.05	.04	.43
Laundry & linen....................	—	—	–0–	–0–	.353	.118	.059	.470
					(.30/.85[a])	(.10/.85[a])	(.05/.85[a])	(.40/.85[a])
Maintenance of personnel.....	—	—	—	.12	.36	.10	.08	.34
Central supply......................	—	—	—	—	.110	.049	.036	.805
					(.09/.82[b])	(.04/.82[b])	(.03/.82[b])	(.66/.82[b])

Since the services of Buildings Depreciation and Maintenance, Employee Health & Welfare and Maintenance of Personnel are not used by departments ahead of these departments in the allocation order, the denominator of the allocation equation $\frac{X_i}{\sum X_i}$ is equal to one. Therefore, the proportion allocated to each department equals the proportional usage of the total service allocation base.

Additional computations:

[a] .85 = sum of proportions allocated to departments after laundry & linen in the allocation order = .30 + .10 + .05 + .40. The sum of the allocation percentages (i.e., .353 + .118 + .059 + .470) equals 1.000. (The last term was rounded down so the four would sum to one.)

[b] .82 = sum of the proportions allocated to departments after central supply in the allocation order = .09 + .04 + .03 + .66. (The third term was rounded down so the four would sum to one.)

7–48. (continued)

	Buildings Depreciation and Maintenance	*Employee Health & Welfare*	*Laundry & Linen*	*Maintenance of Personnel*	*Central Supply*	*Operating Rooms*	*Radiology*	*Laboratory*	*Patient Rooms*
Direct costs	$830,000	$375,000	$250,000	$210,000	$745,000	$1,450,000	$160,000	$125,000	$2,800,000
Buildings Depreciation and Maintenance	(830,000)	–0–	83,000[a]	83,000	–0–	41,500	16,600	16,600	589,300
Employee Health & Welfare		(375,000)	56,250[b]	18,750	11,250	93,750	18,750	15,000	161,250
Laundry & Linen			(389,250)	–0–[b]	–0–	137,405	45,932	22,966	182,947
Maintenance of personnel				(311,750)	37,410[b]	112,230	31,175	24,940	105,995
Central supply					(793,660)	87,303[b]	38,889	28,572	638,896
Totals						$1,922,188	$311,346	$233,078	$4,478,388
Medicare portion						25%	20%	28%	36%
Medicare reimbursement claim						$ 480,547	$ 62,269	$ 65,262	$1,612,220

[a] $83,000 = .10 x $830,000; $41,500 = .05 x $830,000; $16,600 = .02 x $830,000; $589,300 = .71 x $830,000

[b] These allocations are computed by multiplying the proportions on the previous page times the amount to be allocated.

Chapter 8
Activity-Based Costing

Solutions to Review Questions

8–1.

Companies using a single plantwide rate for their allocation of indirect costs usually select a volume based allocation factor such as direct labor hours, machine hours, direct labor dollars, volume of activity, or material costs.

8–2.

Plantwide allocation is the simplest method and refers to the allocation of indirect costs to products using a single rate, regardless of the type of product or activities that caused the costs. Department allocation is more complex. A cost pool is established for each department and a separate overhead allocation rate is computed for each department. This allows labor intensive departments to use labor hours as an allocation base and machine intensive departments to use machine hours as an allocation base.

8–3.

A cost driver is a term used in activity-based costing. It simply refers to any activity that causes a cost. It can be anything from machine hours, labor hours, number of machine setups, or the number of parts in a product. (See Illustration 8–2)

8–4.

Activity-based costing identifies cost drivers (activities that cause costs) that were not previously accounted for by the costing system. Once known, the production managers can control costs by managing these cost drivers. Furthermore, by providing marketing with more accurate product costs, marketing can make better decisions about pricing.

8–5.

1. Identify activities that consume resources.
2. Identify the cost driver associated with each activity.
3. Compute a cost rate per activity unit (e.g., rate per setup, rate per part, rate per machine hour).
4. Allocate costs to products by multiplying the activity rate times the volume of activity consumed by the product.

8–6.

Low volume products may be more specialized requiring more drawings and specifications, and more inspections. Low volume products often require more machine setups and purchase orders for a given level of production output, because they are produced in smaller batches. Further, the low volume product adds complexity to the operation by disrupting the production flow of the high volume items. Thus, when overhead is applied based on the volume of output, it is easy to see how high volume products are allocated relatively more overhead than low volume products.

8–7.

1. Is there a causal relation? Allocate costs to the product that causes the cost.
2. Are benefits received? Allocate costs to the product that receives the most benefit.
3. Reasonableness—Some costs cannot be linked to products based on either causality or benefits received, so they must be allocated on the basis of fairness or reasonableness.

8–8.

Traditionally many companies have allocated overhead to products based on the volume of direct labor. As companies have become more automated and less labor intensive, it is not surprising that this allocation of overhead to products, based on direct labor, can result in erroneous product costs. These companies should use activity-based costing to determine the real activities that cause the costs.

Solutions to Critical Analysis and Discussion Questions

8–9.

False—this chapter deals with the problem of allocating indirect costs to products. Indirect costs can be the overhead costs incurred in manufacturing a good or providing a service. Direct costs such as direct labor and direct materials are traceable directly to a specific product and, therefore, are not a problem to allocate.

8–10.

False—activity-based costing provides an alternative method of allocating indirect costs for both service and manufacturing products. Products can be goods such as an automobile, or a service such as an X-ray examination in the hospital.

8–11.

Uncertain—While omitting the allocation of service department costs to production departments is definitely simpler, it is also incorrect. If this step is omitted the production department costs will be understated, and ultimately the product costs will be as well. Furthermore, the allocation of these service costs to production departments enables management to assign responsibility for service costs to the people in the production department who requested the services.

8–12.

While it is true that there is really only one correct cost for a product, no cost system can measure these costs perfectly. While direct material and direct labor costs may be the same under different cost systems, the allocation of overhead costs will probably vary according to the cost system and allocation base you use.

8–13.

While activity-based costing may yield more detailed product cost estimates, it must pass a cost benefit test before being implemented. Activity-based costing requires a much more detailed breakdown of costs into activities that cause costs. This can be a complex task involving the teamwork of management, production, accounting, purchasing, marketing and many others. A company should implement ABC only if it thinks the benefit from improved management decisions will outweigh the cost of establishing and maintaining the new cost system.

8–14.

False—The lesson learned from activity-based costing is that costs are a function not only of output volume, but also of other factors such as complexity. A complex multi-product operation will cost more than a simple single product operation, for example.

8–15.

False—activity-based costing breaks down the costs into cost pools according to the activities that cause the costs. While several departments may have the same cost drivers, each department should individually determine which activities cause their costs.

8–16.

Disagree. The estimated amount of total overhead should be the same under both department allocation and activity-based costing. What will differ, however, is the amount allocated to each product. This is because department allocation usually allocates overhead to products based on either direct labor hours or machine hours, while activity based costing uses multiple activities to allocate the overhead to the products.

8–17.

By allocating overhead based on direct labor hours the management at Hitachi is sending a signal to the department managers. The message is simple. Reduce your direct labor or be charged with a large share of the overhead. This incentive will drive the department managers to do exactly what upper management believes will keep Hitachi competitive, mainly becoming more automated.

8–18.

The basic principles of activity-based costing can work for any department. Marketing departments, for example, must concern themselves with the cost of distribution. Several activities that cause distribution costs include the number of shipments per period, the size of the shipments, and the number of products in a shipment. It would be wise to know these costs before making distribution decisions.

Solutions to Exercises

8–19. (30 min.) *Plantwide versus department allocation: Comprehensive Publishers, Inc.*

a.

	Paperbacks	*Hardbacks*
Revenue	$3,600,000	$2,500,000
Direct Labor	600,000	400,000
Direct Materials	1,600,000	800,000
Overhead	400,000[a]	600,000[b]
Profit	$1,000,000	$ 700,000

---

[a] $400,000 = 10,000 hours x $40 per hour
[b] $600,000 = 15,000 hours x $40 per hour

b. Harry was wrong; Paperbacks were more profitable.

	Paperbacks	*Hardbacks*
Revenue	$3,600,000	$2,500,000
Direct Labor	600,000	400,000
Direct Materials	1,600,000	800,000
Overhead	360,000[a]	750,000[b]
Profit	$1,040,000	$ 550,000

---

[a] $360,000 = 10,000 mach. hrs. x $36 per hour
[b] $750,000 = 15,000 mach. hrs. x $50 per hour

c. The plantwide allocation method allocates overhead at $40 per machine hour for both types of books. While this is the simplest method, it is usually not very accurate. It assumes that overhead in both departments has the same rate. When overhead costs are broken down into department cost pools, we see that Department P is allocated a smaller share of the overhead. Each department should try to assess what causes its overhead, and use that as its allocation base.

8–20. (35 min.) *Plantwide versus department allocation: Specialty Sweets, Inc.*

	Chocco Bar	*Chewynutta Bar*	*Marsh Bar*
a. Direct Labor (per case)	$100	$110	$150
Raw Materials (per case)	50	80	60
Overhead	50[a]	55[b]	75[c]
Total cost (per case)	$200	$245	$285

---

[a] $50 = 10 hours x $5 per hour

[b] $55 = 11 hours x $5 per hour

[c] $75 = 15 hours x $5 per hour

b. Department C has an overhead allocation rate of $7.00 per machine hour ($17,640/2,520 machine hours). Department M has an overhead allocation rate of $2.20 per labor hour ($3,960/1,800 labor hours).

	Chocco Bar	*Chewynutta Bar*	*Marsh Bar*
c. Direct Labor (per case)	$100	$110	$150
Raw Materials (per case)	50	80	60
Overhead	70[a]	77	33[c]
Total cost (per case)	$220	$267	$243

---

[a] $70 = 10 machine-hours x $7 per machine

[b] $77 = 11 machine-hours x $7 per machine

[c] $33 = 15 labor-hours x $2.20 per labor-hour

d. Monica was correct in her belief that she was being allocated some of Department C's overhead. Plantwide allocation does not correctly allocate the overhead by department, it simply uses one allocation rate for all products in all departments. Under plantwide allocation, a case of Marsh Bars cost $285.00 per case. Once the overhead was reallocated into department cost pools, the cost of the Marsh Bar fell to $243.00 per case. Although it requires more time and skill to collect and process the information, department allocation generally yields more accurate product cost information.

8–21. (30 min.) *Activity-based costing: Hewlett-Packard.*

a.

				PC BB Special		*Cost of Type*
Activity	*Cost Driver*	*Rate per Cost Driver*		*# of Cost Drivers per Board*	*Cost per Circuit Board*	*67A from Illustration 8–4*
Purchasing materials	Number of parts in each circuit board	$.10 per part	x	100 parts	$ 10.00	$ 9.00
Starting the product	Number of boards in the product	$1.00 per board	x	1 raw board	1.00	1.00
Inserting the components	Number of insertions per board	$.20 per insertion	x	60 insertions	12.00	16.00
Soldering	Number of boards soldered	$3.00 per board	x	1 board	3.00	3.00
Quality testing	Number of hours board is in testing	$70.00 per hour	x	.15 hours	10.50	14.00
Total overhead per printed circuit board					36.50	43.00
Cost of direct materials					85.00	75.00
Total cost of manufacturing each board					$121.50	$118.00

b. The PC BB Special costs $121.50 to produce while Type 67A costs only $118.00 to produce. Hewlett Packard should continue producing Type 67A. However, they should try to incorporate some of the design features of the PC BB Special into Type 67A. Specifically, those that allow for less quality inspection time and less insertions per board.

8–22. (30 min.) *Activity-based costing: SU Company.*

a.

Activity	*Rate*	*Cost Driver*	*Cost Allocated to Standard Product*	*Cost Driver*	*Cost Allocated to Unique Product*
Purchasing materials	$2 per pound	6,000 pounds	$12,000	4,000 pounds	$ 8,000
Machine setups	$2,000 per setup	5 setups	10,000	15 setups	30,000
Inspections	$100 per inspection hour	200 hours	20,000	200 hours	20,000
Running machines	$30 per hour	1,500 hours	45,000	500 hours	15,000
Total allocated to each product			$87,000		$73,000

b. If SU Company had been using machine hours to allocate its overhead to the Standard and Unique products, Ned would have had a much harder time reducing costs. He would not have known which activities were causing the costs or in what amount. An advantage of activity-based costing is that overhead costs are broken down into activities that cause the costs. These activities can then be changed to reduce costs.

The disadvantage of activity-based costing is that it requires a more detailed breakdown of costs. The additional cost required to attain and maintain this detailed information must be less than the benefits received from having such information to justify activity-based costing.

8–23. (30 min.) *Activity-based costing in a nonmanufacturing environment: River Rafting, Inc.*

a. & b.

Activities	*Float Trip (3 day)*		*White Water Trip (3 day)*	
Advertise trips	$ 430		$ 430	
Permit to use the river	60		100	
Equipment use	320	[= $40 + ($10 x 28 people)]	528	[= $80 + ($16 x 28 people)]
Insurance	150		254	
Paying guides	2,400	($600 x 4 guides)	3,200	($800 x 4 guides)
Food	3,360	(= $120 x 28 people)	3,360	(= $120 x 28 people)
Total	$6,720		$7,872	

c. If the manager wants to cover her costs she should charge $280 per customer for the 3 day float trip ($6,720/24 paying customers), and $328 per customer for the 3 day white water trip ($7,872/24 paying customers).

8–24. (35 min.) *ABC versus traditional costing: Audio Corporation.*

a.

	Rate	*Standard*	*High-Grade*	*Total*
Direct labor[a]		$174,000	$ 66,000	$240,000
Direct materials[b]		125,000	114,000	239,000
Overhead costs				
Prod. runs	$2,000[c]	80,000[f]	20,000	100,000
Qual. tests	3,000[d]	36,000[g]	54,000	90,000
Ship. orders	200[e]	20,000[h]	10,000	30,000
Total overhead		136,000	84,000	220,000
Total costs		$435,000	$264,000	$699,000
Total unit cost		$1.36[i]	$2.64[j]	

---

[a] Data given in the first table of the exercise in the text

[b] Data given in the first table of the exercise in the text

[c] $2,000 per run = $100,000 in production costs/50 total runs

[d] $3,000 per test = $90,000 in quality costs/30 total tests

[e] $200 per order = $30,000 in shipping costs/150 processed orders

[f] $80,000 = $2,000 per production run x 40 runs for Standard

[g] $36,000 = $3,000 per quality test x 12 tests for Standard

[h] $20,000 = $200 per order shipped x 100 orders shipped

[i] $1.36 = $435,000 total costs for Standard/320,000 units produced

[j] $2.64 = $264,000/100,000 units produced

Reading from the table above, we can see that the total overhead assigned is $136,000 and $84,000 for Standard and High-Grade, respectively. The total cost per unit is the total cost per product divided by the total units produced; $1.36 per Standard cassette and $2.64 per High-Grade cassette.

8–24. (continued)

b.

	Rate	*Standard*	*High-Grade*	*Total*
Direct labor[a]		$174,000	$ 66,000	$240,000
Direct materials[b]		125,000	114,000	239,000
Total overhead..............	$.917[c]	159,500[d]	60,500	220,000
Total costs		$458,500	$240,500	$699,000
Total unit cost		$1.43[e]	$2.41	

---

[a] Data given in the first table in the exercise

[b] Data given in the first table in the exercise

[c] $.917 = $220,000 total overhead/$240,000 total direct labor

[d] $159,500 = $.917 per direct labor dollar x $174,000

[e] $1.43 = $458,500/320,000 Standard units produced

From the table above, total overhead allocated to Standard and High-Grade is $159,500 and $60,500 respectively. The unit cost for Standard and High-Grade is $1.43 and $2.41 respectively.

c. By allocating overhead on the basis of direct-labor, Audio has been understating the cost to manufacture High-Grade cassettes and overstating High-Grade's profits.

8–25. (30 min.) *Activity-based costing in a service environment: Green Garden Care, Inc.*

a.

	Commercial	*Residential*	*Total*
Revenue	$133,000[a]	$286,000	$419,000
Direct Labor	63,000[b]	117,000	180,000
Overhead	21,700[c]	40,300	62,000
Profit	$ 48,300	$128,700	$177,000

---

[a]$133,000 = 7,000 hours x $19 per hour

[b]$63,000 = 7,000 hours x $9 per hour

[c]$21,700 = ($62,000/20,000 hours) x 7,000 hours

b.

	Rate	*Commercial*	*Residential*	*Total*
Revenue		$133,000[a]	$286,000	$419,000
Direct Labor		63,000[b]	117,000	180,000
Overhead				
Transport	$133[c]	2,000[f]	6,000	8,000
Equipment	3.214[d]	11,250[g]	6,750	18,000
Supplies	0.18[e]	23,400[h]	12,600	36,000
Total Overhead		36,650	25,350	62,000
Profit		$ 33,350	$143,650	$177,000

---

[a]$133,000 = 7,000 hours x $19 per hour

[b]$63,000 = 7,000 hours x $9 per hour

[c]$133.33 per client = $8,000/60 clients served

[d]$3.214 per hour = $18,000/5,600 equipment hours

[e]$0.18 per square yard = $36,000/200,000 square yards

[f]$2,000 = $133.33 x 15 commercial clients

[g]$11,250 = $3.214 x 3,500 equipment-hours

[h]$23,400 = $0.18 x 130,000 square yards

c. The recommendation to Ms. Greenthumb is that she reconsider dropping residential services in favor of the commercial business. From the table in part b of the solution, we can show Ms. Greenthumb that commercial work has a profit margin of 25%, while the residential business has a profit margin of 50%. We can explain the differences in profits under the two cost methods by showing Ms. Greenthumb that there is little correlation in costs between direct labor and the overhead costs.

8–26. (35 min.) *ABC versus traditional costing: Travel Gadgets Corporation.*

Note: Your answer may vary slightly due to rounding.

a.

Cost Driver	*Rate*	*Travel Clocks*	*Watches*
Production Setup..........................	\$2,000[a]	\$20,000[d]	\$30,000
Mat. Handling	277.78[b]	5,000[e]	10,000
Packaging and Shipping..............	0.25[c]	11,250[f]	18,750
Total Overhead............................		\$36,250	\$58,750

---

[a] \$2,000 per setup = \$50,000/25 setups
[b] \$277.78 per part = \$15,000/54 parts
[c] \$0.25 per unit shipped = \$30,000/120,000 units shipped
[d] \$20,000 = \$2,000 x 10 setups
[e] \$5,000 = \$277.78 x 18 parts
[f] \$11,250 = \$0.25 x 45,000 units shipped

b.

	Travel Clocks	*Watches*	*Total*
Direct Labor Hours........	30,000[a]	90,000	120,000
Overhead......................	\$23,750[b]	\$71,250	\$ 95,000

---

[a] 30,000 hours = 0.5 hours per clock x 60,000 clocks produced
[b] \$23,750 = (\$95,000 OH/120,000 hours) x 30,000 hours

c. Not necessarily. Activity-based costing provides a more accurate allocation of overhead costs. However, the more accurate method is also more expensive. The ABC system should be adopted if the benefits from improved information exceed the additional costs required to obtain the information.

8–27. (35 min.) *ABC versus traditional costing in a service company: Jack Chapman & Associates*.

a.

Account	*Rate*	*Tax*	*Consulting*	*Total*
Revenue		$130,000	$270,000	$400,000
Expenses:				
Sec. Salary	$666.67[a]	48,000[d]	32,000	80,000
Supplies......................	144[b]	28,800[e]	43,200	72,000
Computer Deprec.	25[c]	25,000[f]	15,000	40,000
Profit		$ 28,200	$179,800	$208,000

---

[a] $666.67 per client = $80,000/120 clients
[b] $144 per transaction = $72,000/500 transactions
[c] $25 per computer hour = $40,000/1,600 hours
[d] $48,000 = $666.67 per client x 72 clients
[e] $28,800 = $144 per hour x 200 transactions
[f] $25,000 = $25 per computer hour x 1,000 hours

b.

Account	*Rate*	*Tax*	*Consulting*	*Total*
Revenue........................		$130,000	$270,000	$400,000
Expenses	$48[a]	62,400[b]	129,600	192,000
Profit..............................		$ 67,600	$140,400	$208,000

---

[a] $400,000 revenue/$100 per hour = 4,000 hours of labor
$48 per labor hour = $192,000 of expenses/4,000 hours
[b] $62,400 = $48 per labor hour x 1,300 hours of labor

c. Under labor-based costing, tax work appears relatively more profitable than under ABC, and may lead Jack to concentrate more heavily in tax work.

d. ABC and traditional costing systems generally yield comparable product-line profits when overhead is a small portion of costs, or when cost drivers are highly correlated with the volume-related allocation base. In this case, labor hours were distributed 32.5% to Tax and 67.5% to Consulting. If Jack's three cost drivers were each also distributed 32.5% to Tax and 67.5% to Consulting, the labor-hour allocation and ABC would have been identical.

8–28. (30 min.) *ABC: Cost flows through T-accounts: Moss Manufacturing, Inc.*

Materials Inventory

	$200,000

Wages Payable

	$100,000

Overhead Applied:
Materials Handling

	2,500 pounds x $12.00 per pound = $30,000 to WIP

Overhead Applied:
Quality Inspections

	500 inspections x $150 per inspection = $75,000 to WIP

Overhead Applied:
Machine Setups

	25 setups x $1,800 per setup = $45,000 to WIP

Overhead Applied:
Running Machines

	10,000 hours x $15 per hour = $150,000 to WIP

Work in Process (WIP) Inventory
Department F

Direct Materials	200,000	
Direct Labor	100,000	
Mat. Handling OH	30,000	
Qual. Inspect. OH	75,000	600,000
Machine Setup OH	45,000	
Running Machines OH	150,000	

Finished Goods
Inventory

600,000	
600,000	

8–29. (30 min.) *ABC: Cost flows through T-accounts: Fleetfoot, Inc.*

Materials Inventory

	$100,000 to WIP

Wages Payable

	$50,000 to WIP

Overhead Applied:
Materials Handling

	20,000 yards x $.50 per yard = $10,000 to WIP

Overhead Applied:
Quality Inspections

	400 inspections x $50 per inspection = $20,000 to WIP

Overhead Applied:
Machine Setups

	50 setups x $400 per setup = $20,000 to WIP

Overhead Applied:
Running Machines

	10,000 hours x $5 per hour = $50,000 to WIP

Work in Process (WIP) Inventory
Department B

Direct Materials	100,000	250,000
Direct Labor	50,000	
Mat. Handling	10,000	
Qual. Inspect.	20,000	
Machine Setup	20,000	
Running Machines	50,000	

Finished Goods
Inventory

250,000	
250,000	

Solutions to Problems

8–30. (40 min.) *Comparative income statements and management analysis: Nykee, Inc.*

a. Nykee, Inc. Income Statement

Account	*Rate*	*B-Ball*	*Marathon*	*Total*
Revenue		$195,000	$184,000	$379,000
Direct Materials		55,000	50,000	105,000
Direct Labor		40,000	20,000	60,000
Indirect Costs:				
Administration	0.325[a]	13,000[e]	6,500	19,500
Production Setup	1,500[b]	15,000[f]	30,000	45,000
Quality Control	375[c]	15,000[g]	15,000	30,000
Sales & Marketing	1,000[d]	12,000[h]	48,000	60,000
Total Indirect Costs		55,000	99,500	154,500
Operating Profit		$ 45,000	$ 14,500	$ 59,500

---

[a] 0.325 = $19,500 of Administrative costs/$60,000 of direct labor costs
[b] $1,500 = $45,000 of Production setup costs/30 production runs
[c] $375 = $30,000 of Quality control costs/80 inspections
[d] $1,000 = $60,000 of Sales and Marketing costs/60 advertisements
[e] $13,000 = $0.325 x $40,000 direct labor costs
[f] $15,000 = $1,500 per setup x 10 production runs
[g] $15,000 = $375 per inspection x 40 inspections
[h] $12,000 = $1,000 per advertisement x 12 advertisements

b. Activity-based costing highlights the activities that cause costs, and provides insight into which costs could be reduced. For example, management may be able to operate with fewer but larger production runs, thereby reducing setup costs. Focusing on activities can identify non-value adding activities that can be eliminated without reducing the product's value.

8–30. (continued)

c. Nykee, Inc. Income Statement

Account	*Rate*	*B-Ball*	*Marathon*	*Total*
Revenue		$195,000	$184,000	$379,000
Direct Materials.............		55,000	50,000	105,000
Direct Labor		40,000	20,000	60,000
Overhead Costs.............	2.575[a]	103,000[b]	51,500	154,500
Operating Profit.............		$ (3,000)	$ 62,500	$ 59,500

---

[a] 2.575 = $154,500 of Overhead Costs/$60,000 Direct Labor Costs

[b] $103,000 = 2.575 Overhead Rate x $40,000 Direct Labor Costs

d. Dear Members of the Management Board:

The purpose of this report is to explain the differences between the profits of our B-Ball and Marathon product lines using activity-based costing versus our traditional labor-based overhead allocation methods.

The two costing methods differ in their results because of the way overhead costs are allocated between our products; direct costs do not differ under the two methods. Under the labor-based approach, all overhead costs are pooled together and allocated to our products on the basis of direct-labor costs. Under activity-based costing, cost drivers, such as inspections and set-ups, are identified and their costs are applied to the products in relation to usage.

Traditional labor-based allocation is less accurate than activity-based allocations because many overhead costs are not well correlated with labor costs. For instance, our B-Ball product receives twice as much overhead under our traditional approach than does our Marathon product because it uses twice as much labor. However, after analyzing the factors driving the overhead and applying these costs to our products, we find that the B-Ball line should receive only about half as much overhead as the Marathon product.

Our findings suggest that management might make sub-optimal decisions if it were to continue to use labor-based overhead allocations. Under our traditional method, the B-Ball product line is not profitable (losses of $3,000), and management might wish to eliminate the B-Ball product. Under the more accurate method of activity-based costing, the B-Ball product is shown to contribute $45,000 towards profits, more than three-times the profits of the Marathon product line. Management should not drop the B-Ball line, instead we should pursue ways to reduce our costs, such as reducing the number of setups required.

8–31. (40 min.) *Comparative income statements and management analysis: Filmworks, Inc.*

a. Filmworks, Inc.: Income Statement

Account	*Rate*	*Deluxe*	*Standard*	*Total*
Revenue		$720,000	$800,000	$1,520,000
Direct Materials		100,000	100,000	200,000
Direct Labor		360,000	240,000	600,000
Indirect Costs:				
Administration	0.167[a]	60,000[e]	40,000	100,000
Production Setup	$500[b]	75,000[f]	125,000	200,000
Quality Control	$200[c]	60,000[g]	40,000	100,000
Sales & Marketing	$800[d]	48,000[h]	32,000	80,000
Total Indirect Costs		243,000	237,000	480,000
Operating Profit (loss)		$ 17,000	$223,000	$ 240,000

---

[a] 0.1667 = $100,000 administrative costs/$600,000 of direct labor costs
[b] $500 = $200,000 production setup costs/400 photo sessions
[c] $200 = $100,000 quality control costs/500 inspections
[d] $800 = $80,000 sales and marketing costs/100 advertisements
[e] $60,000 = 0.1667 x $360,000 direct labor costs
[f] $75,000 = $500 per session x 150 sessions
[g] $60,000 = $200 per inspection x 300 inspections
[h] $48,000 = $800 per advertisement x 60 advertisements

b. Activity-based costing highlights the activities that cause costs, and provides insight into which costs may be reduced. For instance, Filmworks' management has identified three cost driving activities; production setups, quality control inspections, and advertising. Setups cost $500 each and inspections cost $200 each. Therefore, between setups and inspections, the effort of making a one unit reduction in an activity should be directed at setups, as the savings would be greater than the 'same' effort would produce if directed at inspections. The advertising activity is examined in conjunction with the benefits provided in the form of future sales, which is a separate issue.

8–31. (continued)

c. Filmworks, Inc: Income Statement

Account	*Rate*	*Deluxe*	*Standard*	*Total*
Revenue		$720,000	$800,000	$1,520,000
Direct Materials.....................		100,000	100,000	200,000
Direct Labor		360,000	240,000	600,000
Overhead Costs....................	0.80[a]	288,000[b]	192,000	480,000
Operating Profit (loss)...........		$ (28,000)	$268,000	$ 240,000

---

[a] 0.80 = $480,000 of Overhead Costs/$600,000 Direct Labor Costs

[b] $288,000 = $0.80 Overhead rate x $360,000 Direct Labor Costs

d. Dear Members of the Management Board:

The purpose of this report is to explain the differences between the profits in our Deluxe and Standard product lines using activity-based costing versus our traditional labor-based overhead allocation method.

The two costing methods differ in their results because of the way overhead costs are allocated between our products; direct costs, such as Materials and Labor do not differ under the two methods. Under the labor-based approach, all overhead costs are pooled together and allocated to our products on the basis of direct-labor costs. Under activity-based costing, cost drivers, such as inspections and set-ups, are identified and their costs are applied to the products in relation to usage.

Traditional labor-based allocation is less accurate than activity-based allocations because many overhead costs are not well correlated with labor costs. For instance, our Deluxe portraits receives one-and-a-half as much overhead under our traditional approach as does our Standard portrait because it uses one-and-a-half as much labor. However, after analyzing the factors driving the overhead and applying these costs to our products, we find that the Deluxe line should only receive $243,000 in overhead.

Our findings suggest that management might make sub-optimal decisions if it were to continue to use labor-based overhead allocations. Under our traditional method, the Deluxe Portrait is not profitable (losses of $28,000). Under the more accurate activity-based costing, the Deluxe Portrait line earns $17,000 in profits, a difference of $45,000.

8–32. (50 min.) *ABC and predetermined overhead allocation rates: Import Glass & Crystal Co.*

a. Computing overhead allocation rates

Activity	*Cost Driver*	*Est. Costs*	*Driver Units*	*Allocation Rate*
Order Proc.	# orders	$ 15,000	100	$ 150
Prod. Setup	# runs	60,000	50	1,200
Mat. Hdlg.	lbs. mat.	100,000	80,000	1.25
Mach. Dep.	mach.-hrs.	80,000	8,000	10
Qual. Cntl.	# insp.	20,000	30	666.67
Packing	# units	40,000	320,000	0.125
Total est. overhead		$315,000		

Predetermined rate for direct labor hour = estimated activity/estimated allocation base

= $315,000/5,000 hours

= $63 per hour

b. Production Costs using Direct Labor-Hours

Account	*Unleaded*	*Low-Lead*	*High-Lead*	*Total*
Direct Materials	$13,000	$ 8,000	$ 5,000	$26,000
Direct Labor[a]	2,250	2,250	3,000	7,500
Indirect Costs[b]	9,450	9,450	12,600	31,500
Total Cost	$24,700	$19,700	$20,600	$65,000

---

[a] Number of labor hours x $15 per hour.

[b] Number of labor hours x $63 per hour.

8–32. (continued)

c. Production Costs using ABC

Account	*Unleaded*	*Low-Lead*	*High-Lead*	*Total*
Direct Materials	$13,000	$ 8,000	$ 5,000	$26,000
Direct Labor	2,250	2,250	3,000	7,500
Indirect Costs				
Order Proc.	600	450	300	1,350
Prod. Setup	1,200	1,200	2,400	4,800
Mat. Hdlng.	6,250	2,500	1,250	10,000
Mach. Dep.	5,800	1,400	800	8,000
Qual. Cntl.	667	667	667	2,000[a]
Packing	2,500	1,000	375	3,875
Total Cost	$32,267	$17,467	$13,792	$63,525[a]

---

[a] Rounded across the row.

d. *Internal Memorandum*

The discrepancy between our product costs using direct-labor hours as the allocation base versus activity-based costing is found in the way overhead costs are allocated. Our existing direct-labor cost method distorts our product costs because there is little correlation between our direct-labor costs and overhead. Activity-based overhead is more accurate. It allocates the individual components of our overhead to our products based upon the product's use of that overhead component.

With the more accurate product costs, we should begin to concentrate our efforts upon reducing the costs of our more expensive overhead operations. As seen in the activity-based costing report, a large share of our total overhead is comprised of materials handling and maintenance costs—costs which were not visible under the direct-labor approach. Reducing our materials handling and machine depreciation and maintenance costs should be a new priority.

We recommend assessing the cost of using an activity-based system in our company. We will proceed with activity-based costing if we find the cost of the new system is less than the benefits of the more accurate information we will receive.

8–33. (50 min.) *ABC and predetermined overhead rates: Shades Co.*

a.

Activity	*Recommended Base*	*Allocation Rate*
Production Setup	# of production runs	$600 per run ($60,000/100 runs)
Order Processing	# of Orders	$500 per order ($100,000/200 orders)
Materials Handling	Lbs. of material	$5 per lb. ($40,000/8,000 lbs.)
Equipment Maintenance	Machine hours	$12 per hour ($120,000/10,000 hrs.)
Quality Management	# of inspections	$2,500 per insp. ($100,000/40 insp.)
Packing & Shipping	Units shipped	$4 per unit ($80,000/20,000 units)
Direct labor hour rate		$250 per hour ($500,000/2,000 hrs.)

b.

	Nerds	*Stars*	*Fashions*
Direct Materials	$ 4,000	$ 2,500	$ 2,000
Direct Labor[a]	2,000	2,400	2,200
Overhead[b]	25,000	30,000	27,000
Total Costs	$31,000	$34,900	$31,200

---

[a] Number of hours x $20 per hour

[b] Number of hours x $250 per hour

8–33. (continued)

c.

	Nerds	*Stars*	*Fashions*
Direct Materials	$ 4,000	$ 2,500	$ 2,000
Direct Labor	2,000	2,400	2,200
Order Processing	4,000[a]	4,000	2,000
Production Setup	1,200[b]	2,400	4,800
Mat. Handling	2,000[c]	1,000	1,000
Equip. Maintenance	6,000[d]	3,600	3,600
Quality Management	5,000[e]	5,000	5,000
Shipping	4,000[f]	2,000	1,200
Total Cost	$28,200	$22,900	$21,800

---

[a] $500 per order x 8 orders = $4,000
[b] $600 per run x 2 runs = $1,200
[c] $5 per lb. x 400 lbs. = $2,000
[d] $12 per hour x 500 hours = $6,000
[e] $2,500 per inspection x 2 inspections = $5,000
[f] $4 per unit x 1,000 units = $4,000

d. *Internal Memorandum*

Re: Product-Cost Discrepancy

The discrepancy between our product costs using direct-labor hours as the allocation base versus activity-based costing is found in the way overhead costs are allocated. Our existing direct-labor cost method distorts our product costs because there is little correlation between our direct-labor costs per product and overhead. Activity-based overhead is more accurate. It allocates the individual components of our overhead to our products based upon the products use of that overhead component.

With the more accurate product costs, we should begin to concentrate our efforts upon reducing the costs of our more expensive overhead operations. As seen in the activity-based costing report, a large share of our total overhead is comprised of order processing, quality management, equipment maintenance and shipping costs—costs that were not visible under the direct-labor approach. Reducing these overhead costs should be a top priority.

We should use activity-based costing if we find the benefits from the new system exceed its costs.

8–34. (40 min.) *Choosing an ABC system: Cannonball Corp.*

a.

Cannonball Corporation
Income Statement

	Aerolight	*Summit*	*Spinner*	*Total*
Sales	$380,000	$560,000	$475,000	$1,415,000
Direct Costs:				
Direct Mat.	150,000	240,000	200,000	590,000
Direct Lab.	14,400	24,000	54,000	92,400
Var. OH[a]	52,200	83,520	125,280	261,000
Cont. Mrg.	$163,400	$212,480	$ 95,720	471,600
Fixed OH				
Plant Admin.				88,000
Other				140,000
Gross Profit				$ 243,600

---

[a] (Machine hours/Total machine hours) x $261,000 total var. Overhead

b.

Cannonball Corporation
Income Statement

	Aerolight	*Summit*	*Spinner*	*Total*
Sales	$380,000	$560,000	$475,000	$1,415,000
Direct Costs:				
Direct Mat.	150,000	240,000	200,000	590,000
Direct Lab.	14,400	24,000	54,000	92,400
Var. OH:				
Mach. Setups	5,720	8,840	11,440	26,000
Order Proc.	16,000	24,000	24,000	64,000
Warehousing	23,250	23,250	46,500	93,000
Depreciation	8,400	13,440	20,160	42,000
Shipping	2,400	9,600	24,000	36,000
Cont. Mrg.	$159,830	$216,870	$ 94,900	471,600
Fixed OH				
Plant Admin				88,000
Other				140,000
Gross profit				$ 243,600

8–34. (continued)

c. The activity-based costing method provides a more detailed breakdown of the costs. This additional information should enable Cannonball management to make better decisions. For example, if Cannonball wants to reduce costs then activity-based costing will list the activities on which management should focus its cost reducing efforts. Also, the company will probably have more accurate product cost information for pricing and other decisions.

d. Some costs may have no relationship to any volume or activity base. To artificially allocate these costs would distort the accounting information used for pricing, evaluation, etc. A preferable method of handling such costs might be to require a “contribution margin” from each product that must cover a portion of these costs.

8–35. (15 min.) *Benefits of activity-based costing.*

If management implemented an activity based costing system it should be provided with a more thorough understanding of product costs. By breaking down costs into cost drivers, i.e., those activities that drive the costs, management should be able to see the relationship between product complexity, product volume and product cost. This would be vital information for pricing decisions and profitability strategies. Management should also be able to streamline the production process by reducing those non-value adding activities such as setups and travel time between activity centers or departments. (Management might consider running larger batches, or redesigning the plant layout.)

(CMA adapted)

8–36. (15 min.) *Benefits of activity-based costing: Sparkle Manufacturing*

Activity-based costing would help to clear her confusion by identifying the activities that drive overhead costs. For instance, she might find that the additional $200,000 in overhead costs come from the additional depreciation and maintenance for the new equipment. Further, most companies that become more capital intensive see overhead increase and labor decrease.

8–37. (40 min.) *Choosing an ABC system: Home Manufacturers, Inc.*

a.

Home Manufacturers, Inc.
Income Statement

	Basic	*Home Value*	*Castle*	*Total*
Sales	$6,000,000	$10,000,000	$9,000,000	$25,000,000
Direct Costs:				
Direct Mat.	2,000,000	3,000,000	2,200,000	7,200,000
Direct Labor	400,000	600,000	1,200,000	2,200,000
Var. OH	1,392,000	2,088,000	2,320,000	5,800,000
Cont. Margin	$2,208,000	$4,312,000	$3,280,000	$9,800,000
Plant Admin.				4,000,000
Gross Profit				$ 5,800,000

b.

Home Manufacturers, Inc.
Income Statement

	Basic	*Home Value*	*Castle*	*Total*
Sales	$6,000,000	$10,000,000	$9,000,000	$25,000,000
Direct Costs:				
Direct Mat.	2,000,000	3,000,000	2,200,000	7,200,000
Direct Labor	400,000	600,000	1,200,000	2,200,000
Var. OH:				
Mach. Setup	320,000	640,000	640,000	1,600,000
Order Proc.	270,000	600,000	330,000	1,200,000
Warehousing	400,000	800,000	400,000	1,600,000
Machine operation	192,000	288,000	320,000	800,000
Shipping	160,000	280,000	160,000	600,000
Cont. Margin	$2,258,000	$ 3,792,000	$3,750,000	$ 9,800,000
Plant Admin.				4,000,000
Gross Profit				$ 5,800,000

8–37. (continued)

c. Although both methods yield similar product costs, the activity-based costing method provides a more detailed breakdown of the costs. This additional information should enable Home Manufacturers, Inc. (HMI) management to make better decisions. For example, if HMI wants to reduce costs then activity based costing will list the activities on which management should focus its cost reducing efforts. Further, activity-based costing should increase the accuracy of product costs, which would help decision making (e.g., pricing, make-or-buy decision).

d. If plant administration costs were to be allocated to products, the costs should be allocated in some manner that bears a relationship to the benefits received by the products. In this case, we would want to know more about the contents of the plant administration costs. If the costs are mainly personnel costs, for example, such as the costs of a training program or of a plant cafeteria, we could allocate the costs based upon direct labor hours.

Solutions to Integrative Cases

8–38. (40 min.) *Plant-wide versus departmental overhead allocation: Carryall Corp.*

a.

	Amounts (000 omitted)			
	Molding	*Component*	*Assembly*	*Total*
Manufacturing Departments:				
Variable overhead	$ 3,500	$10,000	$16,500	$30,000
Fixed overhead	17,500	6,200	6,100	29,800
Total manufacturing department overhead	$21,000	$16,200	$22,600	$59,800
Service Departments:				
Power				18,400
Maintenance				4,000
Total estimated overhead				$82,200

Estimated direct labor hours (DLH)	
Molding	500
Component	2,000
Assembly	1,500
Total estimated direct labor hours	4,000

$$\text{Plant-wide overhead rate} = \frac{\text{Estimated overhead}}{\text{Estimated DLH}}$$

$$= \frac{\$82{,}200}{4{,}000 \text{ hrs.}}$$

$$= \$20.55 \text{ per direct labor hour}$$

8–38. (continued)

b.

	Departments (000 omitted)				
	Service		Manufacturing		
	Power	*Maintenance*	*Molding*	*Component*	*Assembly*
Departmental overhead costs	$18,400	$4,000	$21,000	$16,200	$22,600
Allocation of maintenance costs (direct)					
4,000 x each of: 90/125[a]; 25/125[a]; 10/125[a]		(4,000)	2,880	800	320
Allocation of fixed power costs (direct)					
Fixed:					
$12,000 x each of: 500/1,000[b]; 350/1,000[b]; 150/1,000[b]	(12,000)		6,000	4,200	1,800
Variable:					
($5,000 + 1,400) x each of: 360/800[c]; 320/800[c]; 120/800[c]	(6,400)[d]		2,880	2,560	960
Total allocated departmental overhead costs	$ 0	$ 0	$32,760	$23,760	$25,680
Base			875 MH	2,000 DLH	1,500 DLH
Rate (Departmental overhead ÷ Base)			$37.44/MH	$11.88/DLH	$17.12/DLH

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[a] 125 = 90 + 25 + 10

[b] 1,000 = 500 + 350 + 150

[c] 800 = 360 + 320 + 120

[d] 6,400 = 5,000 + 1,400

8–38. (continued)

c. Carryall Corporation should use departmental rates to assign overhead to its products. The ideal criterion for choosing an allocation base is a cause-and-effect relationship. This relationship exists with different bases in Carryall’s different departments, necessitating the use of departmental rates.

A plant-wide rate is appropriate when all products pass through the same processes, all departments are similar, or the company is not interested in cost refinement by departments. Departmental rates are appropriate when the converse is true. Carryall’s departments are dissimilar in that the Molding Department is machine intensive while the other two departments are labor intensive.

8–39. (60 min.) *Distortions caused by inappropriate overhead allocation bases: Chocolate Bars, Inc.*

a.

	Almond Dream	*Krispy Krackle*	*Creamy Crunch*
Product Costs:			
Labor-hours per unit	7	3	1
Total units produced	1,000	1,000	1,000
Material cost per unit	$8.00	$2.00	$9.00
Direct labor cost per unit	$42.00	$18.00	$6.00
Labor-hours per product	7,000	3,000	1,000

Total overhead = $69,500
Total labor-hours = 11,000
Direct labor costs per hour = $6.00
Allocation rate per labor-hour = $6.32 per labor-hour

Costs of products:			
Material cost per unit	$ 8.00	$ 2.00	$ 9.00
Direct labor cost per unit	42.00	18.00	6.00
Allocated overhead per unit	44.24	18.96	6.32
Product cost	$94.24	$38.96	$21.32
Selling price	$85.00	$55.00	$35.00
Gross profit margin	–10.87 %	29.16%	39.09%
Drop product?	Yes	No	No

From the table above, we can see that the overhead allocation system used by CBI would lead them to drop Almond Dream and keep the remaining two bars, Krispy Krackle and Creamy Crunch.

b. Almond Dream has a much higher *proportion* of direct labor hours than Krispy Krackle or Creamy Crunch, so Almond Dream is allocated a greater share of the overhead costs.

8–39. (continued)

c.

	Krispy Krackle	*Creamy Crunch*
Direct labor cost per hour	$6.00	$6.00
Direct labor hours per unit	3	1
Total units produced	1,000	2,000
Labor hours per product	3,000	2,000

Total labor hours: 5,000

Allocation rate per labor hour = Total overhead/Total labor hours
= $69,500/5,000
= $13.90 per labor hour

Allocated Production Costs:	*Krispy Krackle*	*Creamy Crunch*
Material cost per unit	$ 2.00	$ 9.00
Direct labor cost per unit	18.00	6.00
Allocated overhead per unit ($13.90 per labor hour)	41.70	13.90
Product cost	$61.70	$28.90
Gross profit margins:		
Selling price	$55.00	$35.00
Product cost—direct labor allocation base	–61.70	–28.90
	$ (6.70)	$ 6.10
Profit margin percentage	($6.70)/$55.00 = (12.2) %	$6.10/$35.00 = 17.4%

The recommendation to management is to drop Krispy Krackle and increase production of Creamy Crunch.

8–39. (continued)

d.

	Creamy Crunch
Direct labor cost per hour	$6.00
Direct labor hours per unit	1
Total units produced	3,000
Labor hours per product	3,000

Total labor hours: 3,000

Allocation rate per labor hour = Total overhead/Total labor hours
= $69,500/3,000
= $23.17 per labor hour

Allocated Production Costs:	*Creamy Crunch*
Material cost per unit	$ 9.00
Direct labor cost per unit	6.00
Allocated overhead per unit	23.17
Product cost	$38.17
Gross profit margins:	
Selling price	$35.00
Product cost—direct labor allocation base	–38.17
	$ (3.17)
Profit margin percentage	($3.17)/$35.00
	= (9.1)%

The recommendation to management is to drop Creamy Crunch and sell out!

e. The policies and allocation method employed by CBI encourage poor decision making. The direct labor hours are inappropriate as an allocation base and give misleading information. The allocation method and policy to drop products with gross profit margins less than 10 percent could lead to the systematic elimination of all products. CBI is a profitable firm, in total, and misallocation of overhead can lead management to make unprofitable decisions.

8–40. (90 min.) *Multiple allocation bases: Chocolate Bars, Inc.*

a.

	Almond Dream		*Krispy Krackle*		*Creamy Crunch*		*Total*	
Total direct labor hours[a]	7,000	(63.6%)	3,000	(27.3%)	1,000	(9.1%)	11,000	(100%)
Total machine hours[a]	2,000	(13.3%)	7,000	(46.7%)	6,000	(40%)	15,000	(100%)
Factory space (sq. ft.)	1,000	(10%)	4,000	(40%)	5,000	(50%)	10,000	(100%)

Total rent for factory space: $15,000 per month

Total machine operating costs: $30,000 per month

Total other overhead: $24,500 per month (= $69,500 – $15,000 – $30,000)

Total units produced/month: 3,000 units

Product allocation base:

Fraction:	*Labor (%)*	*Machine hours (%)*	*Factory space (%)*
Almond Dream	63.6	13.3	10%
Krispy Krackle	27.3	46.7	40%
Creamy Crunch	9.1	40.0	50%

Allocated Costs:		*Total*	*Per Unit*
Almond Dream (63.6% x $24,500) + (13.3% x $30,000) + (10% x $15,000)	=	$21,072	$21.07
Krispy Krackle (27.3% x $24,500) + (46.7% x $30,000) + (40% x $15,000)	=	26,699	26.70
Creamy Crunch (9.1% x $24,500) + (40% x $30,000) + (50% x $15,000)	=	21,730	21.73

Allocated production costs:	*Almond Dream*	*Krispy Krackle*	*Creamy Crunch*
Material cost	$ 8.00	$ 2.00	$ 9.00
Direct labor	42.00	18.00	6.00
Allocated OH	21.07	26.70	21.73
Production cost per unit	$71.07	$46.70	$36.73
Selling price	$85.00	$55.00	$35.00
Product cost	–71.07	–46.70	–36.73
Profit (loss)	$13.93	$ 8.30	$ (1.73)
Profit margin ratio	16.4%	15.1%	(4.9)%

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[a] Totals equal hours per unit times 1,000 units.

8–40. (continued)

b. Based upon the table above and the gross profit margin rule, management would recommend dropping Creamy Crunch. Two characteristics of Creamy Crunch appear to make it appear relatively unprofitable: one, the selling price is comparatively low as compared to the other two products; two, Creamy Crunch uses 50% of the factory space and thus is allocated half of the rent costs.

c.

	Almond Dream	*Krispy Krackle*
Direct labor hours per unit	7	3
Machine hours per unit	2	7
Factory space (sq. ft.)[a]............	2,000(33.3%)	4,000(66.7%)
Unit of output per month	2,000	1,000
Labor hours required	14,000(82.4%)	3,000(17.6%)
Machine hours required...........	4,000(36.4%)	7,000(63.6%)

Total rent for factory space:	$15,000 per month
Total machine operating costs:	$30,000 per month
Total other overhead:	$24,500 per month
Total labor hours/month:	17,000
Total units produced/month:	3,000 units
Total machine hours	11,000 hours

Product allocation base:

Fraction:	*Labor (%)*	*Machine hours (%)*	*Factory space (%)*
Almond Dream...........	82.4	36.4	33.3 (rounded)
Krispy Krackle............	17.6	63.6	66.7 (rounded)

---

[a] This product mix leaves 4,000 square feet of space available.

8–40. (continued)

Allocated Cost:		*Total*	*Per Unit*
Almond Dream (82.4% x $24,500) + (36.4% x $30,000) + (33.3% x $15,000)	=	$36,108	$18.05
Krispy Krackle (17.6% x $24,500) + (63.6% x $30,000) + (66.7 x $15,000)	=	33,392	33.39

Allocated production costs:	*Almond Dream*	*Krispy Krackle*
Material cost	$ 8.00	$ 2.00
Direct labor	42.00	18.00
Allocated OH	18.05	33.39
Production cost per unit.......................	$68.05	$53.39
Selling price	$85.00	$55.00
Product cost	–68.05	–53.39
	$16.95	$ 1.61
Profit margin ratio:		
Ratio = Gross Margin/Price	19.9%	2.9%

Based on the gross profit margins of Almond Dream and Krispy Krackle, management should drop Krispy Krackle and continue to produce Almond Dream. Almond Dream appears to be the most profitable product. In fact, its margin ratio is only 13.9%, computed as follows:

Units Produced = 3,000

Overhead Allocation = $69,500/3,000 = $23.17

Allocated production costs:	*Almond Dream*
Material cost	$ 8.00
Direct labor	42.00
Allocated OH	23.17
Production cost per unit.......................	$73.17
Selling price	$85.00
Product cost	–73.17
	$11.83
Profit margin ratio:	
Ratio = Gross Margin/Price	13.9%

8–40. (continued)

c. (continued)

If we compute the gross margin for the three products at maximum production, we find Almond Dream and Krispy Krackle to be equally profitable, computed as follows:

	Almond Dream	or	*Krispy Krackle*	or	*Creamy Crunch*
Units	3,000		3,000		3,000
Costs					
Materials	$ 24,000		$ 6,000		$ 27,000
Labor	126,000		54,000		18,000
Overhead	+ 69,500		+ 69,500		+ 69,500
	$219,500		$129,500		$114,500
Revenue	$255,000		$165,000		$105,000
– Total Costs	– 219,500		– 129,500		– 114,500
Gross Margin	$ 35,500		$ 35,500		$ (9,500)

Moral: Don't make too much of allocated cost numbers in decision making.

Chapter 9
Activity-Based Management

Solutions to Review Questions

9–1.
Activity-based costing provides management with detailed costing information. Activity-based management focuses on the use of activity-based costing information to make decisions. Activity-based management is based on activity analysis and finding ways to be more efficient with activities within the organization.

9–2.
Activity-based management can be implemented without an activity-based costing system. However, since the focus of activity-based management is on those activities that cause the most costs, activity-based costing provides data useful to the implementation of activity-based management.

9–3.

1) Identify the process objectives defined by what the customer wants or expects from the process.
2) Record by charting, from start to finish, the activities used to complete the product or service.
3) Classify all activities as value-added or nonvalue-added.
4) Continuously improve the efficiency of all value-added activities and develop plans to eliminate or reduce nonvalue-added activities.

9–4.
Value-added activities add value to the product or service whereas nonvalue-added activities do not add value. By identifying activities that do not add value, management is able to focus on eliminating or reducing nonvalue-added activities. By identifying value-added activities, management knows which activities to retain and make more efficient.

9–5.
Common nonvalue-added activities include movement of inventory, storage of inventory, and waiting for work. Many other items in the production process are also often found to be nonvalue-added.

9–6.
Customer response time is the time it takes the company to provide the product or service starting from the time the customer places the order. This time is broken down into four categories: order receipt time; order waiting time; order manufacturing time; and order delivery time.

Activity-based management helps to reduce customer response time by identifying activities that consume the most resources—both in dollars and time, and by identifying nonvalue-added activities.

9–7.

1) Capacity-related costs: Costs that are fixed by management's decisions to have a particular size of store, factory, hospital, or other facility.

2) Product- and customer-level costs: Costs that support customer requests and product specifications.

3) Batch-related costs: Costs related to producing products in batches.

4) Unit-level costs: Costs that can be associated with specific units.

9–8.
Capacity-sustaining costs are fixed by management's decisions to have a particular size of store, factory, hospital, or other facility. Unit-level costs are associated with specific units. Managers can use the hierarchy of costs to better understand which activities (and the costs the activities cause) can be manipulated in the short-run and which activities can be manipulated only in the long-run (capacity-sustaining costs).

Solutions to Critical Analysis and Discussion Questions

9–9.
Answers will vary.

1) University: Litter pickup and equipment storage.

2) Restaurant: Throwing out spoiled food and turnover of personnel.

9–10.
Answers will vary.

1) Hospital: Storage of supplies and on-duty nurses without patients.

2) Bicycle repair shop: Sending incorrect part back to supplier and customer returns resulting from faulty assembly.

9–11.
Answers will vary.

1) Automobiles: Rework on cars in the production process and warranty claims.

2) Computers: Inventory storage costs and materials scrap.

9–12.
Answers will vary.

1) Lumber: Inventory movement and scrap lumber materials.

2) Furniture: Inventory storage and repair of defective products.

9–13.
Answers will vary.

1) Clothing retail store: Returning defective product to suppliers and customer returns.

2) Record store: Shrinkage (inventory theft) and inventory storage.

9–14.
Nurses are employed in shifts of several hours, not in increments of minutes. A reduction of a few minutes for a patient did not eliminate a few minutes of nurse time.

9–15.
Unused resources are typically found in capacity-sustaining activities because they are the least changeable in the short-run.

9–16.
Used resources are found by taking the cost driver rate and multiplying it by the cost driver volume.

9–17.
Unused resource capacity is measured by subtracting resources used from resources supplied. This represents the cost of idle capacity within different activities of the business.

9–18.
A traditional income statement only shows management resources supplied but gives no indication of the resources used and unused resource capacity. Management has no way of knowing the amount of unused resource capacity or the cost of unused resource capacity. The activity-based income statement provides management with resources supplied information (as does the traditional income statement) and includes resources used and unused resource capacity. It also includes the type of cost (unit, batch, product & customer sustaining, and capacity sustaining) which allows management to assess its flexibility in controlling costs.

9–19.
Activity-based management looked at activities within Chrysler that likely had never been scrutinized before. As a result, inefficient processes were identified which may have been hidden by the previous cost accounting system. This is the equivalent of “changing the rules of the game” which can cause employees to resist implementing activity-based management.

Chrysler could mitigate the resistance of employees by showing them the benefits of activity-based management and providing the proper incentives (for example, giving bonuses for efficiency improvement ideas and providing profit sharing to employees thereby telling employees “if the company benefits, the employees benefit”).

Solutions to Exercises

9–20. (15 min.) *Resources used vs. resources supplied: Great Lakes Corp.*

	Resources Used	*Resources Supplied*	*Unused Resource Capacity*
Energy	\$3,000 (\$0.6 × 5,000)	\$3,300 (given)	\$300 (\$3,300 – \$3,000)
Repairs	\$5,000 (\$1.00 × 5,000)	\$6,000 (given)	\$1,000 (\$6,000 – \$5,000)

9–21. (15 min.) *Resources used vs. resources supplied: Steamboat Industries, Inc.*

	Resources Used	*Resources Supplied*	*Unused Resource Capacity*
Setups....................	\$8,750 (\$175 × 50)	\$8,925 (given)	\$175 (\$8,925 – \$8,750)
Clerical..................	\$6,000 (\$30 × 200)	\$6,300 (given)	\$300 (\$6,300 – \$6,000)

9–22. (40 min.) *Resources used vs. resources supplied: Eagle Products, Corp.*

	Resources Used	*Resources Supplied*	*Unused Resource Capacity*
Materials.................	$48,000 ($6 × 8,000)	$48,000 (given)	$ —
Energy....................	$8,160 ($24 × 340)	$ 9,120 (given)	$ 960
Setups....................	$12,000 ($150 × 80)	$12,600 (given)	$ 600
Purchasing	$9,600 ($120 × 80)	$11,000 (given)	$1,400
Customer service ...	$4,000 ($80 × 50)	$ 4,800 (given)	$ 800
Long-term labor......	$12,800 ($40 × 320)	$13,250 (given)	$ 450
Administrative.........	$12,600 ($30 × 420)	$13,500 (given)	$ 900

Unused resource capacity is the difference between resources supplied and resources used. Unit-related costs typically have little or no unused resources since they vary directly with output. At the other end of the cost spectrum are capacity-related costs which typically have unused resources (unless the company is operating at full capacity) since these costs are long-term costs and cannot be changed quickly in the short-term.

9–23. (45 min.) *Resources used vs. resources supplied: Eagle Products, Corp.*

a.

Sales		$150,000
Materials	$48,000	
Energy	9,120	
Setups	12,600	
Purchasing	11,000	
Customer service	4,800	
Long-term labor	13,250	
Administrative	13,500	
Total costs		112,270
Operating profit		$ 37,730

b.

	Resources Used	*Unused Resource Capacity*	*Resources Supplied*	
Sales				$150,000
Costs				
Unit				
Materials	$ 48,000	$ —	$ 48,000	
Energy	8,160	960	9,120	
	56,160	960	57,120	
Batch				
Setups	12,000	600	12,600	
Purchasing	9,600	1,400	11,000	
	21,600	2,000	23,600	
Product and customer sustaining				
Customer service	4,000	800	4,800	
Capacity sustaining				
Long-term labor	12,800	450	13,250	
Administrative	12,600	900	13,500	
	25,400	1,350	26,750	
Total costs	107,160	5,110	112,270	112,270
Operating profit				$ 37,730

9–24. (30 min.) *Resources used vs. resources supplied: Eagle Products, Corp.*

a. A traditional income statement only shows management resources supplied but gives no indication of the resources used and unused resource capacity. Management has no way of knowing the amount of unused resource capacity or the cost of unused resource capacity. The activity-based income statement provides management with resources supplied information (as does the traditional income statement) and includes resources used and unused resource capacity. It also includes the type of cost (unit, batch, product & customer sustaining, and capacity sustaining) which allows management to assess its flexibility in controlling costs. For example, unit costs are typically easier to control in the short-run than capacity-sustaining costs.

b. The memo to management should include the points outlined in (a) above and perhaps expand on the definitions of resources used, resources supplied, and unused resource capacity. The memo should also explain the cost hierarchy (unit, batch, product & customer-sustaining, and capacity-sustaining) and how it allows management to assess the affect management's decisions have on these costs.

   Three costs have relatively high unused capacity resources—purchasing, energy, and administration. Management should look at these areas carefully and decide whether this unused capacity is necessary.

9–25. (30 min.) *Resources used vs. resources supplied: Inntell, Corp.*

	Resources Used	*Resources Supplied*	*Unused Resource Capacity*
Materials	$16,500 ($22 × 750)	$16,500 (given)	$ —
Energy	$3,825 ($15 × 255)	$ 4,400 (given)	$ 575
Setups	$17,600 ($80 × 220)	$18,750 (given)	$ 1,150
Purchasing	$12,000 ($75 × 160)	$16,500 (given)	$ 4,500
Customer service	$ 3,600 ($30 × 120)	$ 5,500 (given)	$ 1,900
Long-term labor	$37,500 ($30 × 1,250)	$51,650 (given)	$14,150
Administrative	$21,000 ($50 × 420)	$26,250 (given)	$5,250

Unused resources capacity is the difference between resources supplied and resources used. Unit-related costs typically have little or no unused resources since they vary directly with output. At the other end of the cost hierarchy spectrum are capacity-related costs which typically have unused resources (unless the company is operating at full capacity) since these costs are long-term costs and cannot be changed quickly in the short-term.

9–26. (45 min.) *Resources used vs. resources supplied: Inntell, Corp.*

a.

Sales		$215,000
Materials	$16,500	
Energy	4,400	
Setups	18,750	
Purchasing	16,500	
Customer service	5,500	
Long-term labor	51,650	
Administrative	26,250	
Total costs		139,550
Operating profit		$ 75,450

b.

	Resources Used	*Unused Resource Capacity*	*Resources Supplied*	
Sales				$215,000
Costs				
Unit				
Materials	$16,500	$ —	$16,500	
Energy	3,825	575	4,400	
	20,325	575	20,900	
Batch				
Setups	17,600	1,150	18,750	
Purchasing	9,600	6,900	16,500	
	27,200	8,050	35,250	
Product and customer sustaining				
Customer service	3,600	1,900	5,500	
Capacity sustaining				
Long-term labor	37,500	14,150	51,650	
Administrative	21,000	5,250	26,250	
	58,500	19,400	77,900	
Total costs	109,625	29,925	139,550	139,550
Operating profit				$ 75,450

9–27. (30 min.) *Resources used vs. resources supplied: Inntell, Corp.*

a. A traditional income statement only shows management resources supplied but gives no indication of the resources used and unused resource capacity. Management has no way of knowing the amount of unused resource capacity or the cost of unused resource capacity. The activity-based income statement provides management with resources supplied information (as does the traditional income statement) and includes resources used and unused resource capacity. It also includes the type of cost (unit, batch, product & customer sustaining, and capacity sustaining) which allows management to assess its flexibility in controlling costs. For example, unit costs are typically easier to control in the short-run than capacity sustaining costs.

b. The memo to management should include the points outlined in (a) above and perhaps expand on the definitions of resources used, resources supplied, and unused resource capacity. The memo should also explain the cost hierarchy (unit, batch, product & customer sustaining, and capacity sustaining) and how it allows management to assess the affect management's decisions have on these costs.

   Three costs have relatively high unused capacity resources—long-term labor, purchasing, and administration. Management should look at these areas carefully and decide whether this unused capacity is necessary.

9–28. (30 min.) *Resources used vs. resources supplied: Arther Consultants*

	Resources Used	*Resources Supplied*	*Unused Resource Capacity*
Energy	$ 32,520 ($6 × 5,420)	$ 35,500 (given)	$ 2,980
Human resources	$ 30,000 ($1,000 × 30)	$ 40,000 (given)	$ 10,000
Customer service	$ 5,500 ($20 × 275)	$9,800 (given)	$ 4,300
Long-term labor	$450,000 ($90 × 5,000)	$560,000 (given)	$110,000
Administrative	$ 21,000 ($50 × 420)	$ 22,750 (given)	$ 1,750

Unused resource capacity is the difference between resources supplied and resources used. Unit-related costs typically have little or no unused resources since they vary directly with output. At the other end of the cost hierarchy spectrum are capacity-related costs which typically have unused resources (unless the company is operating at full capacity) since these costs are long-term costs and cannot be changed quickly in the short-term.

9–29. (45 min.) *Resources used vs. resources supplied: Arther Consultants*

a.

Sales		$825,000
Energy	35,500	
Human resources	40,000	
Customer service	9,800	
Long-term labor	560,000	
Administrative	22,750	
Total costs		668,050
Operating profit		$156,950

b.

	Resources Used	*Unused Resource Capacity*	*Resources Supplied*	
Sales				$825,000
Costs				
Unit				
Energy	$ 32,520	$ 2,980	$ 35,500	
Product and customer sustaining				
Customer service	5,500	4,300	9,800	
Capacity sustaining				
Human resources	30,000	10,000	40,000	
Long-term labor	450,000	110,000	560,000	
Administrative	21,000	1,750	22,750	
	501,000	121,750	622,750	
Total costs	539,020	129,030	668,050	668,050
Operating profit				$156,950

9–30. (30 min.) *Resources used vs. resources supplied: Inntell, Corp.*

a. A traditional income statement only shows management resources supplied but gives no indication of the resources used and unused resource capacity. Management has no way of knowing the amount of unused resource capacity or the cost of unused resource capacity. The activity-based income statement provides management with resources supplied information (as does the traditional income statement) and includes resources used and unused resource capacity. It also includes the type of cost (unit, batch, product & customer sustaining, and capacity sustaining) which allows management to assess its flexibility in controlling costs. For example, unit costs are typically easier to control in the short-run than capacity sustaining costs.

b. The memo to management should include the points outlined in (a) above and perhaps expand on the definitions of resources used, resources supplied, and unused resource capacity. The memo should also explain the cost hierarchy (unit, batch, product & customer sustaining, and capacity sustaining) and how it allows management to assess the affect management's decisions have on these costs.

As one might expect with a service organization, the largest unused resource capacity is in the area of long-term labor. Management should look at this area carefully and decide whether this amount of unused resource capacity is necessary.

Solutions to Problems

9–31. (50 min.) *Beam Corporation*

a.

Sales		$85,000
Parts management	3,500	
Energy	5,000	
Quality inspections	5,000	
Long-term labor	3,500	
Short-term labor	2,400	
Setups	10,000	
Materials	15,000	
Depreciation	10,000	
Marketing	7,500	
Customer service	2,000	
Administrative	7,000	
Engineering changes	2,500	
Outside contracts	3,000	
Total costs		76,400
Operating profit		$ 8,600

9–31. (continued)

b. Sales $85,000

	Resources Used	*Unused Resource Capacity*	*Resources Supplied*	
Costs				
Unit				
Parts management	$ 3,000	$ 500	$ 3,500	
Energy	5,000	0	5,000	
Short-term labor	2,000	400	2,400	
Materials	15,000	0	15,000	
Outside contracts	3,000	0	3,000	
	28,000	900	28,900	
Batch				
Quality inspections	4,500	500	5,000	
Setups	7,000	3,000	10,000	
	11,500	3,500	15,000	
Product and customer sustaining				
Marketing	7,000	500	7,500	
Customer service	1,000	1,000	2,000	
Engineering changes	2,500	0	2,500	
	10,500	1,500	12,000	
Capacity sustaining				
Long-term labor	2,500	1,000	3,500	
Depreciation	6,000	4,000	10,000	
Administrative	5,000	2,000	7,000	
	13,500	7,000	20,500	
Total costs	63,500	12,900	76,400	76,400
Operating profit				$ 8,600

c. A traditional income statement shows only management resources supplied but gives no indication of the resources used and unused resource capacity. Management has no way of knowing the amount of unused resource capacity or the cost of unused resource capacity ($12,900). The activity-based income statement provides management with resources supplied information (as does the traditional income statement) and includes resources used and unused resource capacity. It also includes the type of cost (unit, batch, product & customer sustaining, and capacity sustaining) which allows management to assess its flexibility in controlling costs. Based on the information in (a) and (b), we can see that depreciation and setups provide the majority of unused resource capacity ($4,000 and $3,000, respectively). This is useful for managers in that it indicates what actions might be taken to reduce costs (for example, reduce excess machine capacity by eliminating any unneeded machinery).

9–32. (50 min.) *Almay Corporation*

a.

Sales		$375,000
Marketing	30,000	
Depreciation	40,000	
Outside Contracts	12,000	
Materials	60,000	
Setups	20,000	
Energy	21,000	
Parts management	16,000	
Engineering changes	12,000	
Short-term labor	7,000	
Long-term labor	14,000	
Administrative	26,000	
Quality inspections	22,000	
Customer service	8,000	
Total costs		288,000
Operating profit		$87,000

9–32. (continued)

b. Sales $375,000

	Resources Used	Unused Resource Capacity	Resources Supplied	
Sales				$375,000
Costs				
Unit				
Outside contracts	$ 12,000	$ —	$ 12,000	
Materials	60,000	0	60,000	
Energy	20,000	1,000	21,000	
Short-term labor	7,000	0	7,000	
	99,000	1,000	100,000	
Batch				
Setups	14,000	6,000	20,000	
Quality inspections	20,000	2,000	22,000	
	34,000	8,000	42,000	
Product and customer sustaining				
Marketing	28,000	2,000	30,000	
Parts management	15,000	1,000	16,000	
Engineering	10,000	2,000	12,000	
Customer service	6,000	2,000	8,000	
	59,000	7,000	66,000	
Capacity sustaining				
Depreciation	24,000	16,000	40,000	
Long-term labor	10,000	4,000	14,000	
Administrative	20,000	6,000	26,000	
	54,000	26,000	80,000	
Total costs	246,000	42,000	288,000	288,000
Operating profit				$ 87,000

9–32. (continued)

c. A traditional income statement shows only management resources supplied but gives no indication of the resources used and unused resource capacity. Management has no way of knowing the amount of unused resource capacity or the cost of unused resource capacity ($42,000). The activity-based income statement provides management with resources supplied information (as does the traditional income statement) and includes resources used and unused resource capacity. It also includes the type of cost (unit, batch, product & customer sustaining, and capacity sustaining) which allows management to assess its flexibility in controlling costs. Based on the information in (a) and (b), we can see that depreciation, setups and administration provide the majority of unused resource capacity ($16,000, $6,000, and $6,000, respectively). This is useful for managers in that it indicates what actions might be taken to reduce costs (for example, reduce excess machine capacity by eliminating unneeded machinery).

9–33. (50 min.) *Allbrite Corporation*

a.

Sales		$650,000
Marketing	70,000	
Depreciation	52,250	
Materials	145,000	
Setups	35,000	
Energy	42,000	
Parts management	16,000	
Short-term labor	14,000	
Long-term labor	88,000	
Administrative	52,000	
Quality inspections	44,000	
Customer service	10,000	
Total costs		568,250
Operating profit		$ 81,750

9–33. (continued)

b. Sales $650,000

	Resources Used	*Unused Resource Capacity*	*Resources Supplied*	
				$650,000
Costs				
Unit				
Materials	$145,000	$ —	$145,000	
Energy	40,000	2,000	42,000	
Short-term labor	14,000	0	14,000	
	199,000	2,000	201,000	
Batch				
Setups	28,000	7,000	35,000	
Quality inspections	40,000	4,000	44,000	
	68,000	11,000	79,000	
Product and customer sustaining				
Marketing	56,000	14,000	70,000	
Parts management	15,000	1,000	16,000	
Customer service	8,250	1,750	10,000	
	79,250	16,750	96,000	
Capacity sustaining				
Depreciation	50,500	1,750	52,250	
Long-term labor	80,000	8, 000	88,000	
Administrative	40,000	12,000	52,000	
	170,500	21,750	192,250	
Total costs	516,750	51,500	568,250	568,250
Operating profit				$ 81,750

c. A traditional income statement shows only management resources supplied but gives no indication of the resources used and unused resource capacity. Management has no way of knowing the amount of unused resource capacity or the cost of unused resource capacity ($51,500). The activity-based income statement provides management with resources supplied information (as does the traditional income statement) and includes resources used and unused resource capacity. It also includes the type of cost (unit, batch, product & customer sustaining, and capacity sustaining) which allows management to assess its flexibility in controlling costs. Based on the information in (a) and (b), we can see that marketing and administration provide the majority of unused resource capacity ($14,000 and $12,000, respectively). This is useful for managers in that it indicates what actions might be taken to reduce costs (for example, reduce excess marketing capacity by eliminating salespeople with overlapping sales territories).

9–34. (50 min.) *Freefall Engineering Corporation*

a.	Sales		$1,350,000
	Marketing	120,000	
	Depreciation	89,500	
	Training personnel	54,000	
	Energy	85,500	
	Short-term labor	310,000	
	Long-term labor	425,000	
	Administrative	79,000	
	Quality inspections	42,000	
	Total costs		1,205,000
	Operating profit		$ 145,000

9–34. (continued)

b. Sales	*Resources Used*	*Unused Resource Capacity*	*Resources Supplied*	$1,350,000
Costs				
Unit				
Energy	80,000	5,500	85,500	
Short-term labor	245,000	65,000	310,000	
	325,000	70,500	395,500	
Batch				
Quality inspections	37,500	4,500	42,000	
	37,500	4,500	42,000	
Product and customer sustaining				
Marketing	112,000	8,000	120,000	
Training personnel	45,000	9,000	54,000	
	157,000	17,000	174,000	
Capacity sustaining				
Depreciation	87,000	2,500	89,500	
Long-term labor	415,000	10,000	425,000	
Administrative	70,000	9,000	79,000	
	572,000	21,500	593,500	
Total costs	1,091,500	113,500	1,205,000	1,205,000
Operating profit				$ 145,000

c. A traditional income statement shows only management resources supplied but gives no indication of the resources used and unused resource capacity. Management has no way of knowing the amount of unused resource capacity or the cost of unused resource capacity ($113,500). The activity-based income statement provides management with resources supplied information (as does the traditional income statement) and includes resources used and unused resource capacity. It also includes the type of cost (unit, batch, product & customer sustaining, and capacity sustaining) which allows management to assess its flexibility in controlling costs. Based on the information in (a) and (b), we can see that short-term labor provides much of the unused resource capacity ($65,000). This is useful for managers in that it indicates what actions might be taken to reduce costs (for example, by reducing the short-term labor force).

9–35. (50 min.) *Investment Advisory Services, Inc.*

a.

Sales		$345,000
Marketing	5,000	
Depreciation	19,500	
Training	28,000	
Energy	16,500	
Short-term labor	36,000	
Long-term labor	107,000	
Administrative	22,000	
Customer service	9,000	
Total costs		243,000
Operating profit		$102,000

9–35. (continued)

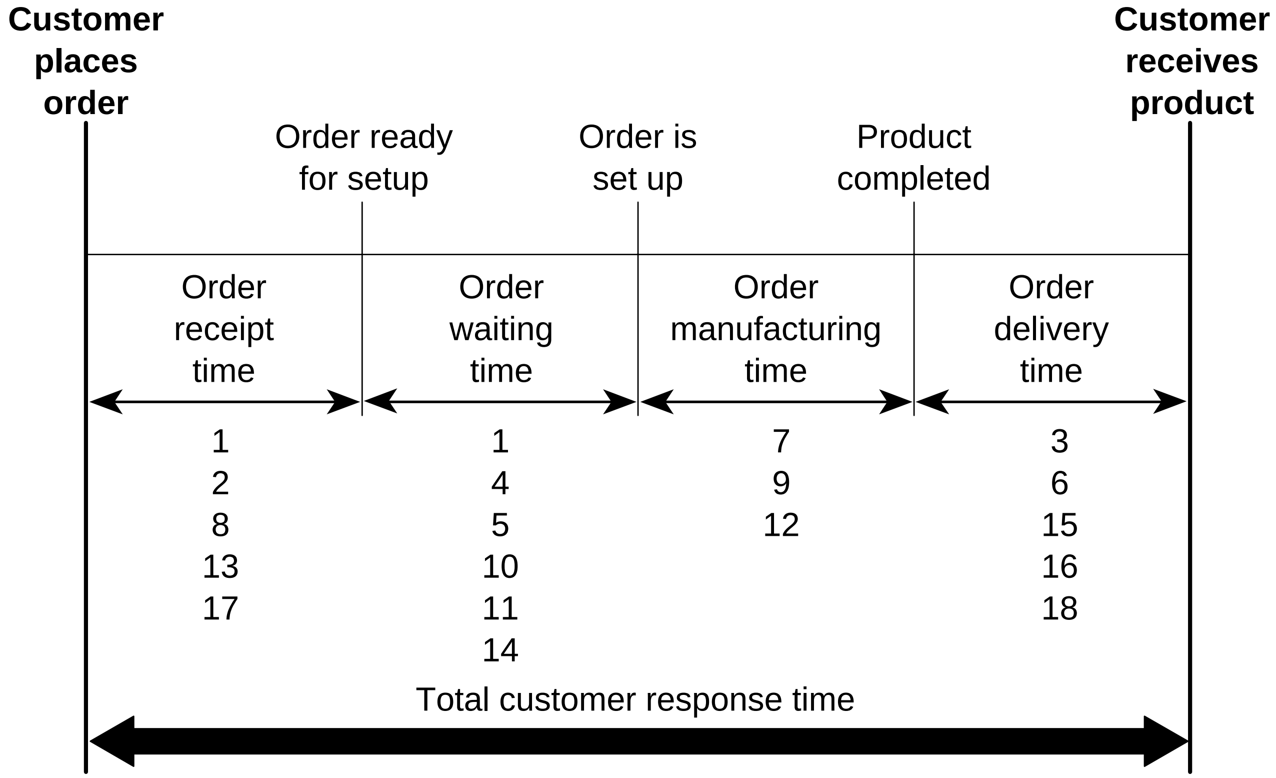
b. Sales $345,000

	Resources Used	Unused Resource Capacity	Resources Supplied	
Sales				$345,000
Costs				
Unit				
Energy	14,000	2,500	16,500	
Short-term labor	32,000	4,000	36,000	
	46,000	6,500	52,500	
Product and customer sustaining				
Marketing	5,000	0	5,000	
Training	25,000	3,000	28,000	
Customer service	7,875	1,125	9,000	
	37,875	4,125	42,000	
Capacity sustaining				
Depreciation	15,000	4,500	19,500	
Long-term labor	94,000	13,000	107,000	
Administrative	19,000	3,000	22,000	
	128,000	20,500	148,500	
Total costs	211,875	31,125	243,000	243,000
Operating profit				$102,000

c. A traditional income statement shows only management resources supplied but gives no indication of the resources used and unused resource capacity. Management has no way of knowing the amount of unused resource capacity or the cost of unused resource capacity ($31,125). The activity-based income statement provides management with resources supplied information (as does the traditional income statement) and includes resources used and unused resource capacity. It also includes the type of cost (unit, batch, product & customer sustaining, and capacity sustaining) which allows management to assess its flexibility in controlling costs. Based on the information in (a) and (b), we can see that long-term labor provides much of the unused resource capacity ($13,000). This is useful for managers in that it indicates what actions might be taken to reduce costs (for example, by reducing the long-term labor force).

9–36. (45 minutes) *Kurt Corporation*

a.



b. Answers will vary. The following items are examples of actions that can be taken to reduce customer response time:

- Ship orders immediately upon completion rather than queuing orders for shipment.
- Send orders to the production department immediately upon receipt of the order rather than at the end of the day.
- Take call-in orders from on-site salespeople throughout the day rather than at the end of each day.

Chapter 10
Allocating Joint Costs

Solutions to Review Questions

10–1.
Joint cost allocations are usually made to assign a cost to a product after the split-off point. This is usually done for external reporting, tax, or rate-making purposes or to satisfy contract requirements. Because the joint costs are common to the outputs, it is not possible to find a direct way of relating the costs. Rather, the costs are related to economic benefits on the basis of some measure of relative outputs.

10–2.
Because net realizable values of the output product provide a measure of the economic benefit received from each output from the production process, this method is usually preferred when it can be implemented.

10–3.
It may be preferable to use a physical quantities measure if it reflects the economic benefit ultimately obtainable from the production process, particularly if there is no objective selling price for joint products. Some examples include public utility rate setting, energy price regulation, new market setting, and new product price setting. In all of these cases it is not possible to use the relative sales value method. Of course, the physical quantity measure used must make sense. Thus, ounces of lead should not be added to ounces of silver for joint cost allocation purposes.

10–4.
For joint products, costs of the inputs up to the split-off point are allocated to each of the products. Costs prior to split-off are not allocated to by-products.

10–5.
An output from a joint production process should be treated as a by-product if it has a relatively low value and/or is not the primary product the company intended to produce.

10–6.
The two common methods of allocation are: net realizable value method and physical quantities method. Net realizable value method can be used if a measure of net realizable value is readily available. Physical quantities method can be used when it is difficult to arrive at a fair measure of net realizable value.

10–7.
The joint costs are the same regardless of whether one sells or processes further. Thus, no matter how the costs are allocated, they will cancel out in the sell or process further decision. To test this, one could use the example in the text and try alternative allocations to Grade AA Lumber or Grade B Lumber. Even if one of these products is charged with all $180,000 of joint costs, the sell or process further decision is unchanged.

10–8.
Joint products represent a major part of the relative value of the output from the production process. By-products represent a minor part of the value of the output, and always have positive net realizable values.

Scrap is also a minor part of the output. It may take on a negative net realizable value, such as when there are costs of disposal.

Solutions to Critical Analysis and Discussion Questions

10–9.
Some people use fully allocated cost numbers for long-run pricing and other long-run decisions.

10–10.
The two situations are similar in that the conceptual treatment of the allocation problem is the same: the costs cannot be separately identified for each department or product; therefore, an allocation method must be chosen which reflects to the best possible extent a matching of the costs incurred with the benefits received. The resulting allocated costs must be used with care, if at all, in any decision-making context.

10–11.
Examples include timber, livestock, petroleum, real estate development (produces lots), railroad (many cars on the same train), and many other processing industries.

10–12.
The costs of disposing of scrap can be reduced or eliminated. In fact, wood scrap may provide incremental revenue for the company. Also, the image of the company being sensitive to the environment will likely add value to the company's reputation.

Solutions to Exercises

10–13. (15 min.) *Net realizable value method.*

Total joint costs are $150,000 (based on the $50,000 materials plus $100,000 conversion). These costs are allocated as follows:

To Output L:

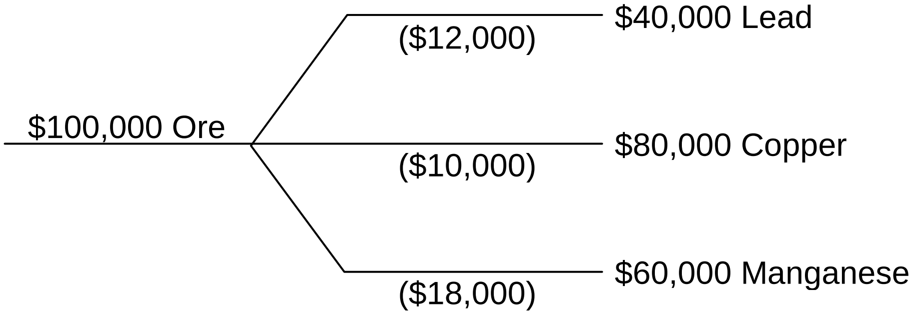
$$\frac{\$200{,}000}{\$250{,}000} \text{ x } \$150{,}000 = \underline{\underline{\$120{,}000}}$$

To Output T:

$$\frac{\$250{,}000 - \$200{,}000}{\$250{,}000} \text{ x } \$150{,}000 = \underline{\underline{\$30{,}000}}$$

10–14. (20 min.) *Net realizable value method: Durango Corporation.*

Although not required, the process may be diagrammed as follows:



The diagram can be used to help organize the solution which follows:

	Lead	*Copper*	*Manganese*	*Total*
Selling price	$40,000	$80,000	$60,000	$180,000
Additional processing..........................	(12,000)	(10,000)	(18,000)	(40,000)
Approximate sales value at split-off	$28,000	$70,000	$42,000	$140,000
% of total sales values at split-off........	20%[a]	50%[a]	30%[a]	100%
Cost Allocation:				
20% x $100,000	$20,000			
50% x $100,000		$50,000		
30% x $100,000			$30,000	

Check:
Total allocated = $100,000 = $20,000 + $50,000 + $30,000

[a] $20\% = \dfrac{\$28{,}000}{\$140{,}000}$; $50\% = \dfrac{\$70{,}000}{\$140{,}000}$; $30\% = \dfrac{\$42{,}000}{\$140{,}000}$

10–15. (20 min.) *Net realizable value method to solve for unknowns: Green Products, Inc*.

Since the sales value of each product at the split-off point is available, the appropriate basis for allocation using the net realizable value method is $17,500 (which is $10,500 + $7,000).

Let X equal the unknown total costs. The allocation of $6,000 to leprechauns must have been the result of the allocation equation:

$$\frac{\$10{,}500}{\$10{,}500 + \$7{,}000} \text{ times } X = \underline{\underline{\$6{,}000}}$$

So, solving for X, we obtain:

$$\frac{10{,}500}{17{,}500} X = \underline{\underline{\$6{,}000}}$$

$$X = \underline{\underline{\$10{,}000}}$$

10–16. (20 min.) *Net realizable value method: multiple choice.*

a. The answer is 4.

Net realizable value at split-off is used to allocate joint costs to joint products. For joint products saleable at the split-off point, the net realizable value is the selling price at split-off. If further processing is needed, the net realizable value is approximated by subtracting the additional processing costs from the final sales value.

b. The answer is 3.

The net realizable value for each product is used to allocate joint costs. The costs beyond the split-off point can be identified and thus assigned to each product. Therefore, no allocation is needed.

c. The answer is 2.

To determine the net realizable value at split-off, it is sometimes necessary to work backwards from the point of sale. For joint products saleable at the split-off point, net realizable value is the selling price at split-off. If further processing is needed, the net realizable value is approximated by subtracting additional processing costs from the final sales value.

d. The answer is 1.

The net realizable value method produces the same gross margin ratio.

10–17. (30 min.) *Net realizable value method: multiple choice.*

a. The answer is 3.

The net realizable value method allocates joint costs in proportion to the net realizable value of the individual products. Given total joint costs of $120,000 and total sales value at split-off of $200,000 ($140,000 product C + $60,000 product R), the calculation is:

140/200 x $120,000 = $84,000

b. The answer is 3.

The net realizable value method allocates joint costs in proportion to the net realizable value of the individual products. Given total joint costs of $117,000 and the total sales value at split-off for main products of $225,000 ($125,000 product A + $100,000 product B), the calculation is:

100,000/225,000 x $117,000 = $52,000

c. The answer is 4.

The net realizable value method is a cost allocation method that allocates joint costs in proportion to the net realizable value of the individual products. The calculation is:

	Net Realizable Value at Split-Off	*Allocation*	*Joint Costs Allocated*
W	$ 70,000	70/200 x $80,000	$28,000
X	60,000	60/200 x 80,000	24,000
Y	40,000	40/200 x 80,000	16,000
Z	30,000	30/200 x 80,000	12,000
	$200,000		$80,000

Note: The costs incurred after split-off are not joint costs and are therefore not included.

10–18. (20 min.) *Physical quantities method: The Rote Co.*

a. The answer is 4.

Total units of X	=	14,000 units
Total units produced	=	28,000 units
Joint product costs	=	$63,000

Amount allocated from joint costs:

$$\frac{14{,}000}{28{,}000} \times \$63{,}000 = \$31{,}500$$

Additional processing costs.........	18,000
Total costs of Product X	$49,500

b. The answer is 2.

Net realizable value of Y at split-off	=	$ 70,000
Total net realizable value at split-off	=	$200,000
Joint product costs	=	$ 63,000

Amount allocated from joint costs:

$$\frac{70{,}000}{\$200{,}000} \times \$63{,}000 = \$22{,}050$$

Additional processing costs......	14,000
Total costs allocated to Y	$36,050

10–19. (20 min.) *Physical quantities method with by-product: Friendly Fertilizer Corporation.*

The net realizable value of the methane ($2,000) is deducted from the total processing costs ($90,000) to obtain the net processing costs to be allocated ($88,000).

The allocation computations are:

To Nitro:

$$\frac{50{,}000 \text{ units}}{50{,}000 \text{ units} + 75{,}000 \text{ units}} \times \$88{,}000 = \underline{\underline{\$35{,}200}}$$

and to Phospho:

$$\frac{75{,}000 \text{ units}}{50{,}000 \text{ units} + 75{,}000 \text{ units}} \times \$88{,}000 = \underline{\underline{\$52{,}800}}$$

10–20. (40 min.) *By-products: Leather Products, Inc.*

	Method 1	*Method 2*	
Sales revenue	$70,000	$70,000	
Other income	-0-	175	($225 – $50)
Total revenue	$70,000	$70,175	
Cost of goods sold:			
Unadjusted	36,000	36,000	
Less: By-product net realizable value	(175)		
Adjusted cost of goods sold	$35,825	$36,000	
Gross margin	$34,175	$34,175	

10–21. (25 min.) *By-products: multiple choice: Seinfeld Corp.*

a. The answer is 3.

Net amount from by-product = $9,600 [= 2,400 units x ($5 – $1)]

Cost of goods sold = $200,000 – $9,600
= $190,400

Gross margin = $400,000 – $190,400 = $209,600

b. The answer is 1.

Gross margin would not be affected.

Sales	$400,000
Other income	9,600
	409,600
COGS	200,000
Gross margin	$209,600

c. The answer is 1.

There would be no effect on the company's profits.

10–22. (35 min.) *Sell or process further: Yuba Sawmill, Inc.*

First, determine the normal volume of bark chips:

$900,000/$12 per hundred cubic feet = 75,000 hundred cubic feet (ccf)

Second, compute the revenue from sales of horticultural bark:

Large	75,000 ccf	x	30%	x	$32/ccf	=	$720,000
Medium	75,000 ccf	x	60%	x	$16/ccf	=	$720,000
Mulch	75,000 ccf	x	10%	x	$ 4/ccf	=	$ 30,000

which results in total revenue of $1,470,000 ($720,000 + $720,000 + $30,000).

The contribution from additional processing equals:

Revenue	$1,470,000
Incremental processing costs	520,000
Contribution from additional processing	$ 950,000

This contribution is compared to the foregone bark sales of $900,000. We recommend processing further.

10–23. (30 min.) *Constant Gross Margin Method: Durango Corp.*

	Lead	*Copper*	*Manganese*	*Total*
Sales value	$40,000	$80,000	$60,000	$180,000
Joint costs	19,111	52,222	28,667	100,000
Additional process costs	12,000	10,000	18,000	40,000
Gross margin	8,889	17,778	13,333	40,000
Gross margin percentage	22.222%	22.222%	22.222%	22.222%

Solutions to Problems

10–24. (45 min.) *Net realizable value of joint products—multiple choice: Bryce Manufacturing Company.*

a. The answer is 3.

Since there is no further processing for argon after split-off, the net realizable value is simply the sales value of *all* units produced.

$$\text{Price per unit} = \frac{\$60{,}000}{15{,}000 \text{ units sold}} = \$4.00$$

Units produced = 25,000[a] units

Total net realizable value = $100,000 (= 25,000 units x $4.00)

---

[a] 15,000 sold + 10,000 in ending inventory = 25,000 units

b. The answer is 2.

The joint costs to be allocated are all costs up to split-off, that is, all costs in Department 1.

Cost of zeon	$192,000
Direct labor	48,000
Overhead	40,000
Total	$280,000

10–24. (continued)

c. The answer is 1.

Net realizable value of argon	\$100,000[a]
Net realizable value of xon..........	60,000[b]
Net realizable value of neon	140,000[c]
Total	\$300,000

Allocation of joint costs to xon:

$$\frac{\$60{,}000}{\$300{,}000} \times \$280{,}000^{d} = \$\ 56{,}000$$

Additional processing costs:

Direct labor	90,000
Overhead	42,000
Total cost of xon	\$188,000

---

[a] $\frac{\$60{,}000}{15{,}000 \text{ units}} \times 25{,}000 \text{ units} = \$100{,}000$

[b] \$192,000 – \$90,000 – \$42,000 = \$60,000

[c] $\left(\frac{\$283{,}500}{45{,}000 \text{ units}} \times 60{,}000 \text{ units}\right) - \$130{,}000 - \$108{,}000 = \$140{,}000$

[d] \$192,000 + \$48,000 + \$40,000 = \$280,000

d. The answer is 2.

Using information from c above, the allocation to argon is:

$$\frac{\$100{,}000}{\$300{,}000} \times \$280{,}000 = \$93{,}333$$

$$\text{Cost per unit} = \frac{\$93{,}333}{25{,}000^{a} \text{ units produced}} = \$3.733/\text{unit}$$

Cost of ending inventory:

10,000 units x \$3.733 = \$37,333

---

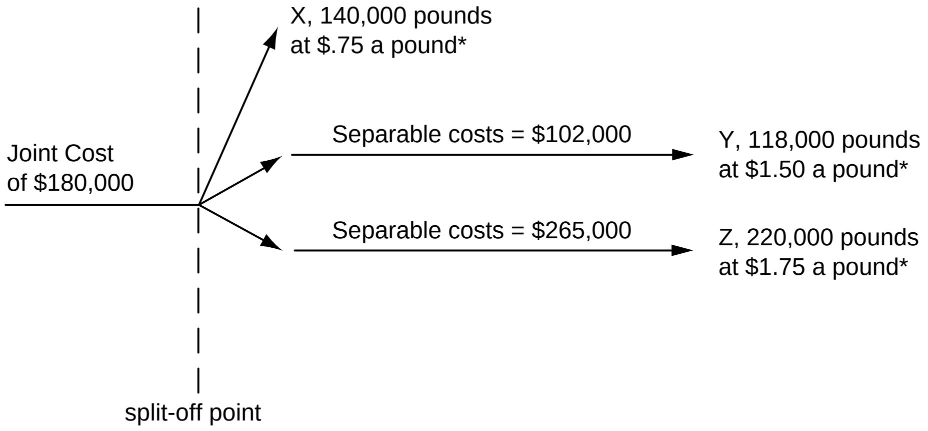
[a] 15,000 sold + 10,000 in ending inventory = 25,000 units

10–25. (40 min.) *Net realizable value and effects of processing further: Miller Manufacturing Co.*

a.

	Departments		
Production Costs	*A*	*B*	*C*
Raw materials	$112,000	—	—
Direct labor	48,000	80,900	191,750
Manufacturing overhead	20,000	21,100	73,250
Total	$180,000	$102,000	$265,000

A diagram of the problem follows:



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*$.75 = $30,000/40,000 lbs; $1.50 = $177,000/118,000 lbs; $1.75 = $245,000/140,000 lbs.

10–25. (continued)

	Product X	*Product Y*	*Product Z*	*Total*
1. Selling price per pound:				
X: $30,000 ÷ 40,000	$.75			
Z: $245,000 ÷ 140,000			$1.75	
Multiply by pounds produced:				
X: 40,000 + 100,000	140,000			
Z: 140,000 + 80,000			220,000	
Gross sales values	$105,000	$177,000*	$385,000 **	
Less costs of separate processing:				
X: —	—	—	—	
Y: $80,900 + $21,100	—	102,000	—	
Z: $191,750 + $73,250	—	—	265,000	
Estimated net realizable values at split-off point	$105,000	$ 75,000	$120,000	$300,000
Percentage of total	35%	25%	40%	100%

* Given

**Or: $\$245,000 \times \frac{110,000}{70,000} = \$385,000$

2. Total joint costs: $112,000 + $48,000 + $20,000 = $180,000

Allocation:

X: 35% x $180,000 = $63,000
Y: 25% x $180,000 = 45,000
Z: 40% x $180,000 = 72,000

10–25. (continued)

3. and 4.	*Total Costs*	*Cost of Goods Sold*	*Ending Inventory*
Product X:			
Joint costs allocated	$ 63,000		
Sold: (40,000 ÷ 140,000) x $63,000		$ 18,000	
Inventory			$ 45,000
Product Y:			
Joint costs allocated	$ 45,000		
Separate processing costs	102,000		
Total, all sold	$147,000	147,000	0
Product Z:			
Joint costs allocated	$ 72,000		
Separate processing costs	265,000		
Total costs of Z	$337,000		
Sold: (140,000 ÷ 220,000) x $337,000		214,455	
Inventory			122,545
Totals	$547,000	$379,455	$167,545
Proof of total:			
Raw material cost Dept. A	$112,000		
Direct labor cost—A	48,000		
Direct labor cost—B	80,900		
Direct labor cost—C	191,750		
Manufacturing overhead—A	20,000		
Manufacturing overhead—B	21,100		
Manufacturing overhead—C	73,250		
Total costs accounted for	$547,000		

b. Incremental revenue of further processing	
X: ($4.30 – $.75 forgone) x 140,000	$497,000
Incremental costs of further processing	
X: $2.00 x 140,000	280,000
Incremental income from further processing X	$217,000

c. The memo should recommend that Miller process product X further. By doing so, profit will increase $217,000.

10–26. (35 min.) *Find missing data: Net realizable value: Air Extracts, Inc.*

Air Extracts must use net realizable value method because the ratio of nitrogen's joint costs to the total does not equal the ratio of nitrogen's physical units to the total.

1. Allocate joint costs to hydrogen:

   $15,000 hydrogen net realizable value/$100,000 x $60,000 joint costs = $9,000 (answer to *b*)

2. Joint costs allocated to oxygen:

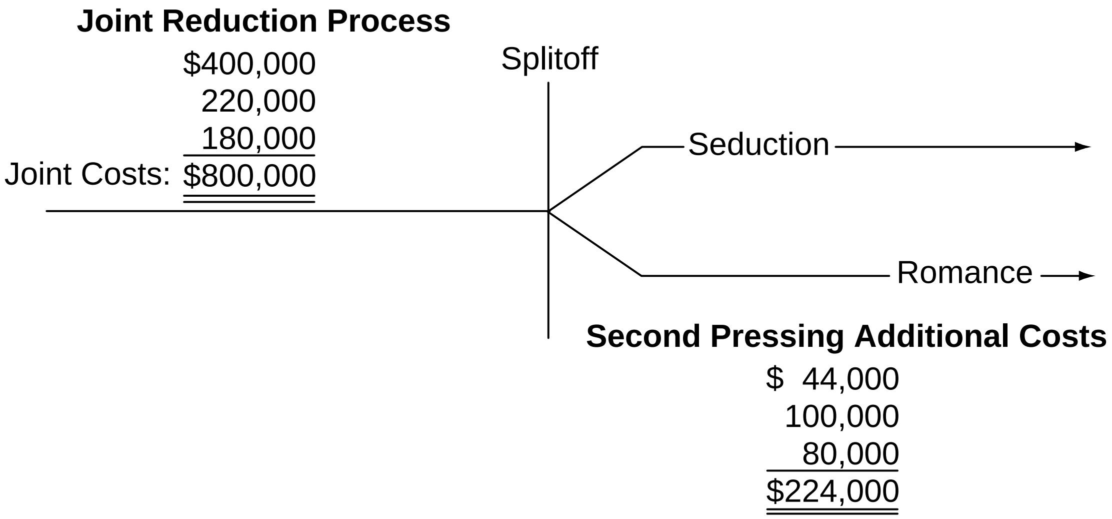
   $60,000 total – $30,000 to nitrogen – $9,000 to hydrogen = $21,000 (answer to *a*)

3. The ratio of sales value at split-off for each product to total sales value at split-off equals the joint cost ratio:

   Nitrogen: ($30,000/$60,000) x $100,000 = $50,000 (answer to *c*)
   Oxygen: ($21,000/$60,000) x $100,000 = $35,000 (answer to *d*)

10–27. 45 min.) *Joint cost allocations: Exotic Aroma Company.*

a.



Calculation of Net Realizable Value at Split-off:

	Seduction	*Romance*	*Total*
Revenue	$1,800,000[a]	$2,646,000[b]	
Packaging Costs	120,000	308,000	
Additional Processing Cost	—	224,000	
Net Realizable Value at Split-off	$1,680,000	$2,114,000	$3,794,000

---

[a] $1,800,000 = 10,000 x $180.00

[b] $2,646,000 = 42,000 x $63.00

	Seduction	*Romance*
Percent of Net Realizable Value at Split-off	$\frac{\$1,680,000}{\$3,794,000} = 44.3\%$	$\frac{\$2,114,000}{\$3,794,000} = 55.7\%$

Allocation of Joint Costs Incurred in July:

Seduction	44.3%	x	$800,000	=	$354,400
Romance	55.7%	x	$800,000	=	$445,600
	100%				$800,000

10–27. (continued)

b. Physical quantities method.

	Seduction	*Romance*
Percent of Total Units Completed	$\frac{10{,}000}{52{,}000}$ = 19.2%	$\frac{42{,}000}{52{,}000}$ = 80.8%

Allocation of Joint Costs:

Seduction	$800,000	x	19.2%	=	$153,600
Romance	$800,000	x	80.8%	=	646,400
			100%		$800,000

c. Physical quantities method:

Seduction, which has a high sales price, incurred very little of the joint cost because so few ounces are produced. Romance, on the other hand, has a much lower sales price but has a large volume. Therefore, Romance is allocated a large portion of the joint costs and looks relatively less profitable.

Estimated net realizable value method:

Even though Seduction has relatively few ounces produced, its sales price is significantly higher than Romance. Thus, Seduction is allocated a greater share of joint costs if the allocation is based on sales value. However, these results are merely from the joint allocation method and have no sound economic basis.

d. Net Realizable Value Method:

Total Costs in Joint Reduction Process	$800,000
Less Net Realizable Value from Squeezed Petals (12,000 lbs. x $1.50)	18,000
Cost to Allocate	$782,000

Seduction	$782,000	x	44.3%	=	$346,426
Romance	$782,000	x	55.7%	=	435,574
			100%		$782,000

Physical Quantities Method:

Seduction	$782,000	x	19.2%	=	$150,144
Romance	$782,000	x	80.8%	=	631,856
			100%		$782,000

10–28. (30 min.) *Cost flows through T-accounts: Exotic Aroma Co.*

Work in Process Inventory (Reduction)

800,000	435,574 (Romance)
	346,426 (Seduction)
	18,000

Work in Process Inventory (Second Pressing)

435,574	659,574
224,000	

Finished Goods Inventory

659,574	1,434,000
346,426	
428,000	

Cost of Goods Sold

1,434,000	

Work in Process Inventory (Packaging)

120,000	
	428,000
308,000	

By-Product Revenue

18,000[b]	18,000[a]

Cash or Accts. Rec.

18,000[a]	

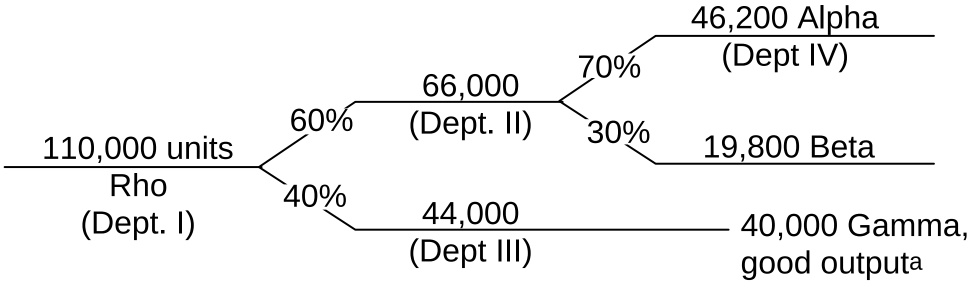
---

[a] Entry made when by-product was sold.

[b] Entry made to credit by-product revenue to work-in-process inventory.

10–29. (50 min.) *Ninja Turtle Company. Joint costing in a process costing context: Estimated net realizable value method:*

It is helpful to diagram the flow of units before attempting to solve the problem.



[a]40,000 good output = 44,000/110%

The next step is to determine the net realizable values of Alpha and Gamma at the first split-off.

	Alpha		*Gamma*	
Sales value after completion	$462,000	(= 46,200 @ $10)	$960,000	(= 40,000 @ $24)
Separate processing costs:				
Department II	$ (76,000)			
Department III			(330,000)	
Department IV	(32,960)			
Sales revenue from Beta	83,160	(= 19,800 @ $4.20)		
Additional processing cost for Beta	(16,200)			
Approximate net realizable values	$420,000		$630,000	

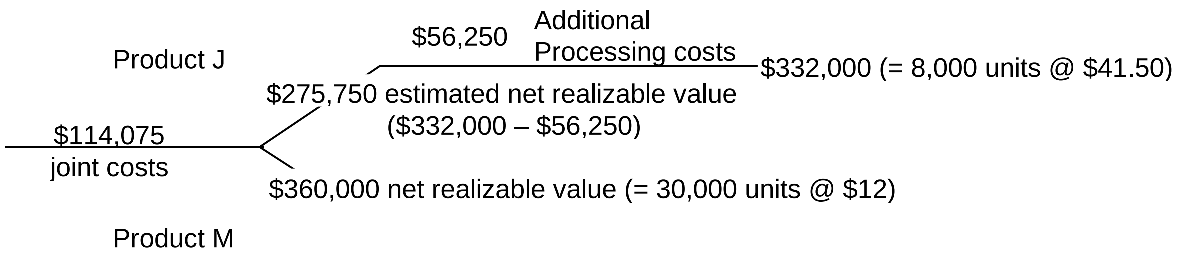
Cost allocation:

To Alpha: $\dfrac{\$420{,}000}{\$420{,}000 + \$630{,}000} \times \$290{,}000 = \underline{\underline{\$116{,}000}}$

To Gamma: $\dfrac{\$630{,}000}{\$420{,}000 + \$630{,}000} \times \$290{,}000 = \underline{\underline{\$174{,}000}}$

10–30. (35 min.) *Find maximum input price: Net realizable value method: Harrison Corporation.*

A diagram of the operation appears as follows:


Product J
$56,250
Additional
Processing costs
$332,000 (= 8,000 units @ $41.50)
$275,750 estimated net realizable value
($332,000 – $56,250)
$114,075
joint costs
$360,000 net realizable value (= 30,000 units @ $12)
Product M

The total allowable materials costs would then be:

Sales value of J at split-off	$275,750
Sales value of M at split-off	360,000
Joint conversion costs	(114,075)
Balance (maximum materials cost)	$521,675

Max materials price per unit = $13.728 (= $521,675/38,000 units).

b. Given the current product mix (30,000 units of Product M and 8,000 units of Product J), Harrison should pay no more than $13.728 per unit of material. If the materials price exceeds this amount, the company will incur an operating loss. See calculations in (a) for further detail.

10–31. (30 min.) *Effect of by-product versus joint cost accounting: Rambling Rose Corporation.*

a. (1) Accounted for as a joint product.

Allocation:

$$\text{Michaelangelo: } 60\% \times \$365{,}500 = \underline{\underline{\$219{,}300}}$$
$$\text{Raphael: } 30\% \times \$365{,}500 = \underline{\underline{\$109{,}650}}$$
$$\text{Donatello: } 10\% \times \$365{,}500 = \underline{\underline{\$\ 36{,}550}}$$

(2) Allocated for as a by-product.

Allocation:

$$\text{Michaelangelo: } \frac{60\%}{60\% + 30\%} \times \$327{,}900^{a} = \$218{,}600$$

$$\text{Raphael: } \frac{30\%}{60\% + 30\%} \times \$327{,}900^{a} = \$109{,}300$$

Donatello: No joint cost is allocated to Donatello.

[a] \$327,900 = \$365,500 – \$37,600 net realizable value of Donatello.

b. The net realizable value of the by-product (Donatello) reduces the joint costs of the other two products. Thus, there is no need to allocate joint costs to the by-product.

10–32. (30 min.) *Joint cost allocations and product profitability: Silicon Materials, Inc.*

Total cost = $60,000 + $25,600 = $85,600

a. Allocation on the basis of units of output

Purified wafers

$$\frac{45{,}000}{45{,}000 + 15{,}000} \times \$85{,}600 = \$64{,}200$$

Chips

$$\frac{15{,}000}{45{,}000 + 15{,}000} \times \$85{,}600 = \$21{,}400$$

$$\text{Total} \quad \underline{\underline{\$85{,}600}}$$

b. Allocation on the basis of market value

Purified wafers

$$\frac{\$20{,}000}{\$20{,}000 + \$140{,}000} \times \$85{,}600 = \$10{,}700$$

Chips

$$\frac{\$140{,}000}{\$20{,}000 + \$140{,}000} \times \$85{,}600 = \$74{,}900$$

$$\text{Total} \quad \underline{\underline{\$85{,}600}}$$

c. It is not possible to determine which product is more profitable. One cannot be produced without the other—hence only the profitability of the *total* output is relevant. Use of the physical quantities measured in Part (a) would suggest that there is a loss on purified wafers. This loss would be calculated as:

Revenue from purified wafers.........	$ 20,000
Allocated cost of purified wafers.....	(64,200)
Loss on purified wafers..................	$(44,200)

However, if purified wafers were not sold, the $20,000 revenue would be lost but total costs would be unchanged. Hence, net income would fall if this "losing" product were discontinued. This illustrates the potentially misleading effects of cost allocations.

10–33. (60 min.) *Effect of cost allocation on pricing and make versus buy decisions: Ag-Coop.*

a. Output:

	Output Mix	*Kwh/lb.*	*Kwh/100 lbs. Input*
Greenup	50	32	1,600
Maintane	30	20	600
Winterizer	20	40	800
			3,000

Maximum processing: $\frac{750{,}000 \text{ kwh}}{3{,}000 \text{ kwh/100 lbs.}}$

= 25,000 lbs. of input

Fixed cost allocation	$81,250 ÷ 25,000 =	$3.25	per lb.
Feedstock cost...............		1.50	
Joint costs......................		$4.75	per lb.

Allocated cost per lb. = $4.75 for Greenup, Maintane, and Winterizer.

10–33. (continued)

b. Total joint cost incurred in processing 30,000 lbs. of input =
$81,250 + (25,000 x $1.50) = $118,750

Quantities of each product produced:

Greenup	25,000	x	.5	=	12,500
Maintane	25,000	x	.3	=	7,500
Winterizer	25,000	x	.2	=	5,000
					25,000

	Sales Price/lb.	*Selling Cost/lb. (20% of Sales Price)*	*NRV/lb.*	*Number of Lbs.*	*Total NRV*
Greenup	$10.50	$2.10	$8.40	12,500	$105,000
Maintane	9.00	1.80	7.20	7,500	54,000
Winterizer	10.40	2.08	8.32	5,000	41,600
					$200,600

Allocated cost/lb. of Greenup

$$= \$118{,}750 \text{ x } \left[\frac{\$105{,}000}{\$200{,}600}\right] \div 12{,}500 \text{ lbs.}$$

$$= \underline{\underline{\$4.97}}$$

Allocated cost/lb. of Maintane

$$= \$118{,}750 \text{ x } \left[\frac{\$54{,}000}{\$200{,}600}\right] \div 7{,}500 \text{ lbs.}$$

$$= \underline{\underline{\$4.26}}$$

Allocated cost/lb. of Winterizer

$$= \$118{,}750 \text{ x } \left[\frac{\$41{,}600}{\$200{,}600}\right] \div 5{,}000 \text{ lbs.}$$

$$= \underline{\underline{\$4.93}}$$

10–33. (continued)

c. The profit under current production schedule A is:

Total net realizable value =	\$200,600 (from *b* above)
Less joint costs incurred	118,750
	\$ 81,850

Outputs under alternative production schedule B:

Product	*Output Mix*	*Unit kwh Usage*	*Usage/100 Lbs. of Input*
Greenup	60	32	1,920
Maintane	10	20	200
Winterize	30	40	1,200
			3,320

$$\text{Pounds of input processed} = \frac{750{,}000 \text{ kwh}}{3{,}320 \text{ kwh per hundred pounds}} = 22{,}590 \text{ pounds}$$

Amount of Greenup produced = 22,590 x .6 = 13,554
Amount of Maintane produced = 22,590 x .1 = 2,259
Amount of Winterizer produced = 22,590 x .3 = 6,777
22,590

The margin under alternate production schedule B is:

(\$8.40 x 13,554) + (\$7.20 x 2,259) + (\$8.32 x 6,777) – (\$1.50 x 22,590) – \$81,250

= \$113,853.60 + \$16,264.80 + \$56,384.64 – \$33,885 – \$81,250 = \$71,368.04

∴Current production schedule A yields a higher operating profit of \$81,850 versus \$71,368.04 for schedule B.

d. The decision would not be different, even if joint costs are allocated based on the net realizable value method, because the joint costs are the same for either production schedule.

Chapter 11
Variable Costing

Solutions to Review Questions

11–1.
Under full-absorption costing, all manufacturing costs—fixed and variable—are assigned to units produced. However, under variable costing *only variable manufacturing costs* are assigned to units produced, fixed costs are treated as period costs.

11–2.
Under both full-absorption and variable costing, all marketing and administrative costs are treated as period costs.

11–3.
Variable costing profits equal full-absorption profits when units produced equal units sold. (If the unit cost of inventory differs from period to period, then not only must production volume equal sales volume, but also the same units must be produced and sold in a particular period.) Variable costing profits are smaller when production exceeds sales. Variable costing profits are larger when sales exceed production.

11–4.
Variable costing is valuable as an aid in managerial decisions; for example, (1) actual fixed costs are reported, increasing the likelihood of better control of those costs; (2) profits are more directly correlated with sales.

In general, variable costing tends to fit managerial decision making better than full-absorption costing. It focuses attention on *variable costs as unit costs* and *fixed costs as period costs.*

The main criticisms of variable costing are:

1. The emphasis on variable costs may cause managers to ignore fixed costs.
2. Variable costing appears to penalize those companies that increase inventory in anticipation of higher future sales.

11–5.
When a company produces more than it sells, it defers the expensing of its fixed manufacturing costs because they are carried in inventory. Hence, by increasing production, reported profits can increase without a corresponding increase in sales.

11–6.

Multiple Choice

a. The answer is 4.
Under variable costing, fixed manufacturing costs are expensed during the period in which they are incurred. Therefore, they are a period cost.

b. The answer is 2.
All variable manufacturing costs are considered product costs under variable costing. These costs include prime costs (direct material and direct labor) and also variable overhead. Variable marketing costs are not considered product costs.

11–7.

a. The answer is 2.
Variable costing includes all variable manufacturing costs: direct materials, direct labor, and variable factory overhead.

b. The answer is 1.
Variable costing requires that fixed costs be separated from variable costs.

11–8.

a. When sales exceed production, the decrease in inventory is larger under full-absorption costing.

b. Conversely, when production exceeds sales, the increase in inventory is smaller under variable costing. Inventory variations are larger under full-absorption costing.

11–9.

The manager's decision to increase production to increase profits in the current period was unethical because he intended to deceive his superiors and did not fully disclose how profits were increased. Increasing ending inventory could hurt the company if the cost of storing or insuring inventory is high. However, increasing ending inventory could also help the company if the costs of production are expected to increase dramatically in the following period.

11–10.

Full-absorption costing is no more or less ethical than variable costing (although it can allow more manipulation of profits). Full-absorption costing is required for external reporting under GAAP. However, variable costing is more appropriate for internal reporting since it is consistent with the cost-behavior assumptions used in managerial decision making.

11–11.

An analysis at American National Bank revealed that few, if any, of the indirect costs allocated to the product lines would be saved if the check processing service was dropped. Furthermore, some of the processing costs included depreciation and other costs that would not be a cash saving if the service was discontinued. Finally, the analysis indicated that the bank could lose several million dollars in contribution margin if the service was dropped.

Solutions to Exercises

11–12. (30 min.) *Variable costing versus full-absorption costing: Comparison of operating profit: Jarrard, Inc.*

		Unit Cost
a.	Direct materials	\$ 6.50[a]
	Direct labor	3.75[b]
	Variable manufacturing overhead	1.50[c]
	Total variable unit cost	\$11.75

b.	Sales revenue	\$2,236,000[d]
	Less: Variable cost of goods sold	1,222,000[e]
	Variable marketing and administrative	140,000
	Contribution margin	874,000
	Less: Fixed manufacturing costs	180,000
	Fixed marketing and administrative	120,000
	Operating profit	\$574,000

c.	Sales revenue	\$2,236,000
	Less: Cost of goods sold	1,378,000[f]
	Gross margin	858,000
	Less: Marketing and administrative costs	260,000
	Operating profit	\$598,000

---

[a] \$6.50 = \$780,000/120,000 units

[b] \$3.75 = \$450,000/120,000 units

[c] \$1.50 = \$180,000/120,000 units

[d] \$2,236,000 = \$21.50 x 104,000 units

[e] \$1,222,000 = \$11.75 x 104,000 units

[f] Cost of goods sold

$$= 104{,}000 \text{ units sold} \times \left(\frac{\$780{,}000 + \$450{,}000 + \$180{,}000 + \$180{,}000}{120{,}000 \text{ units produced}}\right)$$

$$= \$1{,}378{,}000$$

11–13. (25 min.) *Comparison of variable and full-absorption costing—multiple choice: Larue Corporation.*

a. The answer is 1.

Raw materials	$2.40
Direct labor	1.60
Variable overhead	.80
Fixed overhead	2.40[a]
	$7.20

[a] $\$2.40 = \dfrac{\$240{,}000}{100{,}000 \text{ units produced}}$

b. The answer is 3.

Under variable costing, fixed factory overhead is not included in inventory, only variable costs are.

Raw materials	$2.40
Direct labor	1.60
Variable overhead	.80
	$4.80

c. The answer is 3.

Revenue (80,000 units x $12.00)		$960,000
Variable costs:		
Cost of goods sold (80,000 units x $4.80)		384,000
Marketing and admin. (80,000 units x $.80)		64,000
Contribution margin		512,000
Fixed costs:		
Manufacturing	$240,000	
Marketing and admin.	128,000	368,000
Operating profit		$144,000

11–13. (continued)

d. The answer is 2.

Revenue (80,000 x $12.00)		$960,000
Cost of goods sold (80,000 x $7.20)		576,000
Gross margin		384,000
Marketing and admin:		
Variable	$ 64,000	
Fixed	128,000	192,000
Operating profit		$192,000

e. The answer is 2.

Unit cost under full-absorption costing is $7.20. There are 20,000 units in ending inventory. The value of ending inventory is $144,000 ($7.20 x 20,000 units).

f. The answer is 4.

Unit cost under variable costing is $4.80. There are 20,000 units in ending inventory. The value of ending inventory is $96,000 ($4.80 x 20,000 units).

11–14. (20 min.) *Comparison of variable and full-absorption costing: Analyzing profit performance: Tammari Enterprises.*

a. Full-Absorption

	Year 1	*Year 2*
Sales revenue	$10,000,000	$10,000,000
Less cost of goods sold	6,860,000[a]	6,625,000[b]
Gross margin	3,140,000	3,375,000
Less: Variable marketing and admin.	600,000[c]	600,000[c]
Fixed marketing and admin.	840,000	840,000
Operating profit	$1,700,000	$1,935,000

b. Variable Costing

Sales revenue	$10,000,000	$10,000,000
Less: Variable cost of goods sold	6,000,000[d]	6,000,000[d]
Variable marketing and admin.	600,000[c]	600,000[c]
Contribution margin	3,400,000	3,400,000
Less: Fixed manufacturing	860,000	860,000
Fixed marketing and admin.	840,000	840,000
Operating profit	$ 1,700,000	$ 1,700,000

c. Despite the appearance of higher profit on Tammari's full-absorption income statement, they were no more profitable in Year 2 than they were in Year 1. They have merely shifted part of their fixed costs into inventory.

The $235,000 difference in profits in Year 2 occurs because $235,000[e] in fixed costs are included in inventory under full-costing whereas under variable costing, all of the fixed costs are expensed during the period.

---

[a] $$\$6{,}860{,}000 = \left(\$24 \text{ variable} + \left[\frac{\$860{,}000 \text{ fixed}}{250{,}000 \text{ units produced}}\right]\right) \text{ x } 250{,}000 \text{ units sold}$$

[b] $$\$6{,}625{,}000 = \left[\$24 + \left(\frac{\$860{,}000}{344{,}000}\right)\right] \text{ x } 250{,}000 \text{ units sold}$$

[c] $600,000 = $2.40 x 250,000 units sold

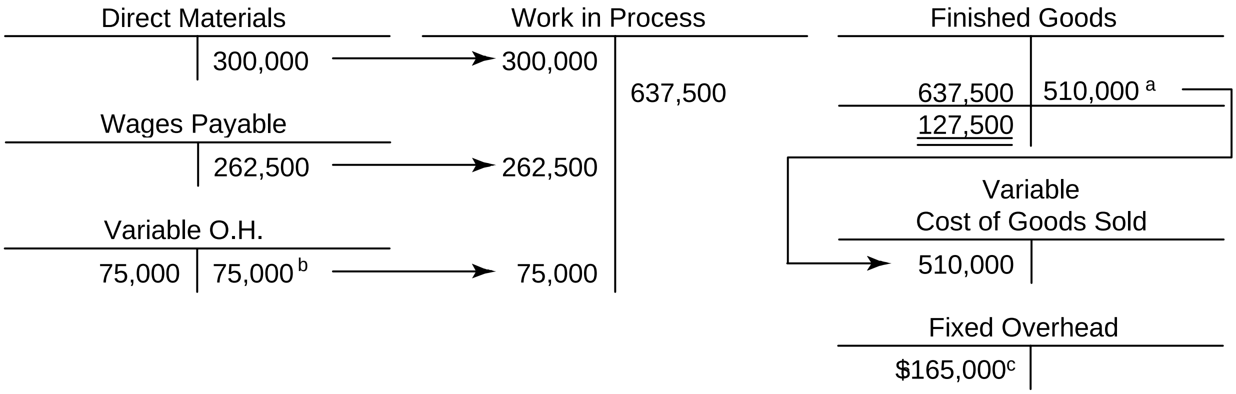
[d] $6,000,000 = $24 x 250,000 units sold

[e] $$\$235{,}000 = \frac{\$860{,}000 \text{ fixed}}{344{,}000 \text{ units produced}} \text{ x } 94{,}000 \text{ units in ending inventory}$$

11–15. (25 min.) *Comparison of cost flows under full-absorption and variable costing: H_2O Products.*

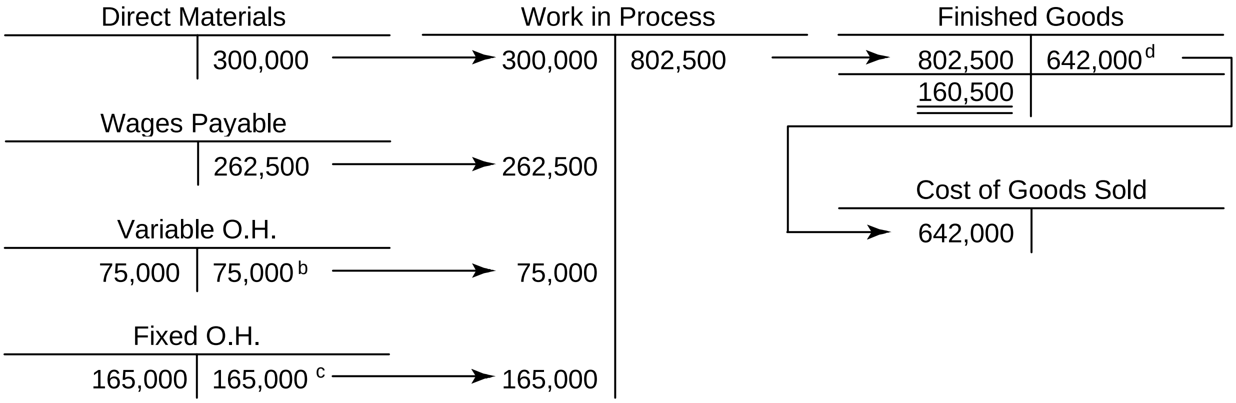
a.

Variable Costing



b.

Full-Absorption Costing



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[a] $\$510,000 = \dfrac{\$637,500}{100,000 \text{ units produced}} \times 80,000 \text{ units sold}$

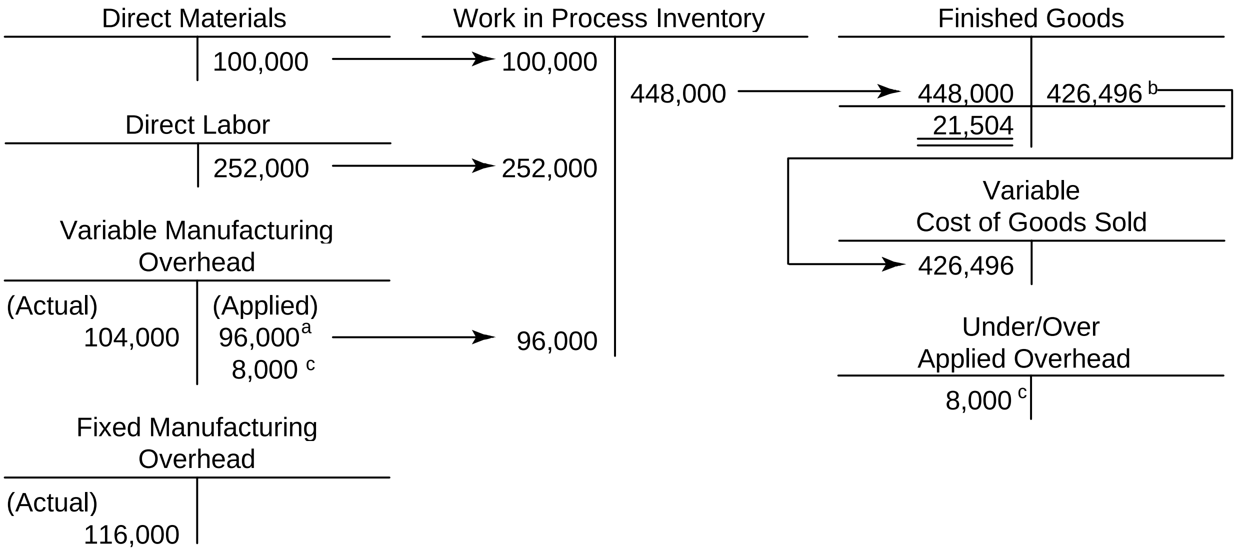
[b] \$75,000 = \$40,000 supplies + \$20,000 repairs + \$15,000 other mfg

[c] \$165,000 = \$85,000 + \$60,000 + \$20,000 fixed manufacturing costs from problem

[d] $\$642,000 = \dfrac{\$802,500}{100,000 \text{ units produced}} \times 80,000 \text{ units sold}$

11–16. (25 min.) *Comparison of full-absorption and variable cost flows using normal costing: Jumpin' Jimminy Products.*

a. Variable costing



Note: The company used 30,000 labor hours (30,000 hours = $252,000/$8.40 per hour).

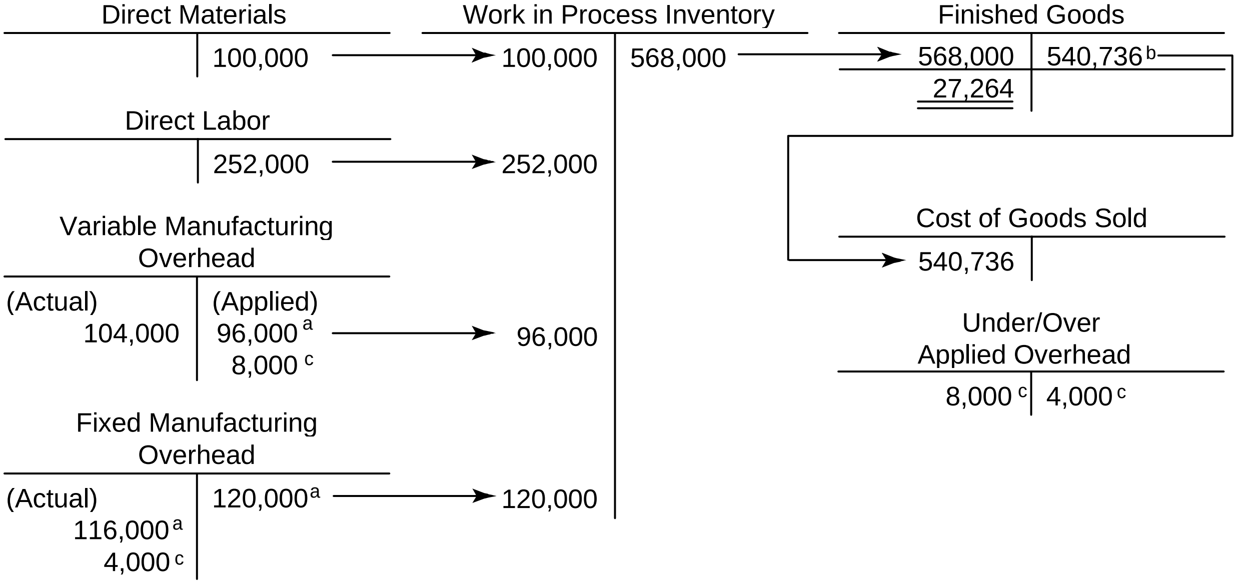
[a] $96,000 = $3.20 x 30,000 labor hours

[b] $\$426{,}496 = \dfrac{\$448{,}000}{50{,}000 \text{ units}} \times 47{,}600 \text{ units}$

[c] Closing entry

11–16. (continued)

b. Full absorption costing



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[a] $120,000 = $4.00 x 30,000 labor hours

[b] $$\$540,736 = \frac{\$568,000}{50,000 \text{ units}} \times 47,600 \text{ units}$$

[c] Closing entry

11–17. (20 min.) *Comparison of full-absorption and variable costing income statements using normal costing: Jumpin' Jimminy Products.*

a.

Sales Revenue	$952,000
Less: Variable cost of goods sold	426,496
Under/over applied overhead	8,000*
Variable marketing and administrative	90,000
Contribution margin	427,504
Less: Fixed manufacturing costs	116,000
Fixed marketing and administrative	56,000
Operating profit	$255,504

b.

Sales Revenue	$952,000
Less: Cost of goods sold	540,736
Under/over applied overhead	4,000**
Gross margin	407,264
Less: Variable marketing and administrative	90,000
Fixed marketing and administrative	56,000
Operating profit	$261,264

*Underapplied
**Net underapplied ($8,000 underapplied variable; $4,000 overapplied fixed)

11–18. (25 min.) *Comparison of full-absorption and variable costing—income statement formats.*

Variable costing: Contribution margin format
(000 omitted)

	Year 1	*Year 2*	*Total*
Sales	$150	$450	$600
Variable cost of goods sold:			
Beginning inventory	–0–	112.5	–0–[a]
Current period manufacturing costs	225	225	450
Less ending inventory	112.5	–0–	–0–[b]
Variable cost of goods sold	112.5	337.5	450
Total contribution margin	37.5	112.5	150
Fixed manufacturing costs	50	50	100
Nonmanufacturing costs	25	25	50
Operating profits (Loss)	$(37.5)	$ 37.5	$–0–

Full-absorption costing: Traditional income statement format
(000 omitted)

	Year 1	*Year 2*	*Total*
Sales	$150	$450	$600
Full cost of goods sold:			
Beginning inventory	–0–	137. 5	–0–[a]
Current period manufacturing costs	275	275	550
Less ending inventory	137.5	–0–	–0–[b]
Full-absorption cost of goods sold	137.5	412.5	550
Gross margin	12.5	37.5	50
Nonmanufacturing costs	25	25	50
Operating profits	$ (12.5)	$ 12.5	$–0–

---

[a] Beginning of Year 1

[b] End of Year 2

11–19. (40 min.) *Compare income statement amounts using actual costing: Barrett, Inc.*

a.

Sales revenue	$2,600,000
Less: Variable cost of goods sold	1,729,000[a]
Variable marketing and admin.	135,200[b]
Contribution margin	735,800
Less: Fixed manufacturing overhead	140,000[c]
Fixed marketing and admin.	91,000[d]
Operating profit	$ 504,800

b. Since sales exceed production, profits reported under variable costing will be greater, as shown by comparing the variable costing results in *a* with the following full-absorption results.

Sales revenue	$2,600,000
Less: Cost of goods sold	1,911,000[e]
Gross margin	689,000
Less: Variable marketing and admin.	135,200[b]
Fixed marketing and admin.	91,000[d]
Operating profit	$ 462,800

Note: Full-absorption costing expenses $21,000 (= 1,500 units x $14) in this period from prior period's production that variable costing already expensed in the prior period.

---

[a] $1,729,000 = 6,500 units x $266 = 6,500 units x ($164 + $70.80 + $31.20), including 1,500 units from beginning inventory.

[b] $135,200 = 6,500 units x $20.80

[c] $140,000 = 5,000 units x $28

[d] $91,000 = 6,500 units x $14

[e] $1,911,000 = 6,500 units x $294 = 6,500 units x ($164 + $70.80 + $31.20 + $28), including 1,500 units from beginning inventory.

11–20. (40 min.) *Conversion of variable to full-absorption costing: Hathaway Company.*

a.

Sales		$1,200,000
Variable cost of goods sold (20,000 times $30.00)	$600,000	
Underapplied variable manufacturing overhead	8,000	608,000
Contribution margin		592,000
Less period costs:		
Production	180,000	
Selling and administrative	200,000	380,000
Operating profit		$ 212,000

b.

Sales		$1,200,000
Cost of goods sold (20,000 times $36.00)[a]	$720,000	
Underapplied fixed and variable manufacturing overhead	44,000[b]	764,000
Gross margin		436,000
Less selling and administrative costs		200,000
Operating profit		$ 236,000

---

[a] $\$36 = \$30 \text{ variable mfg.} + \dfrac{\$180{,}000}{30{,}000 \text{ units}} \text{ fixed.}$

[b] $\$44{,}000 = \$8{,}000 + \$36{,}000$

$$\$36{,}000 = \left[(30{,}000 \text{ units} - 24{,}000 \text{ units}) \times \left(\frac{\$180{,}000}{30{,}000}\right)\right]$$

$$\$36{,}000 = 6{,}000 \text{ units} \times \$6 \text{ per unit.}$$

c. Inventory increased 4,000 units. Each added unit absorbs $6.00 in fixed overhead, or a total of $24,000.

11–21. (60 min.) *Variable costing operating profit and reconciliation with full-absorption: Emerson Corporation.*

Emerson Corporation

a. Revenues		$415,000
Cost of goods sold:		
Beginning inventory ($22,000 x 45%)	$ 9,900[a]	
Cost of goods manufactured ($315,000 x 70%)	220,500	
Ending inventory ($86,000 x 70%)	(60,200)[a]	170,200
Variable marketing costs ($83,000 x 80%)		66,400
Variable admin. costs ($49,800 x 40%)		19,920
Contribution margin		158,480
Fixed manufacturing costs ($315,000 x 30%)		94,500
Fixed marketing costs ($83,000 x 20%)		16,600
Fixed administrative costs ($49,800 x 60%)		29,880
Operating profit before tax (variable costing)		$ 17,500

---

[a] Amounts given in footnote to annual income statement. They can also be derived from knowing what percent of manufacturing costs are variable last year and this year.

b. (1) Reconciliation of full-absorption operating profit to variable costing operating profit.

Operating profit before tax—full-absorption costing	$ 31,200
Add fixed costs in beginning inventory ($22,000 x 55%)	12,100
Deduct fixed costs in ending inventory ($86,000 x 30%)	(25,800)
Operating profit before tax—variable costing	$ 17,500

(2) Operating profit using full-absorption costing is high (relative to variable costing) because fixed manufacturing costs are assigned both to goods sold and goods in inventory at the end of the period. Although some of the fixed manufacturing costs are deferred on the income statement, they are likely paid for with cash in the current period.

11–22. (40 min.) *Full-absorption versus variable costing: Korona Company.*

a. Full-absorption operating profit:

	Year 1	*Year 2*	*2 year Total*
Sales revenue (10,000 x $46)	$460,000	$460,000	$920,000
Cost of goods sold:			
Beginning inventory	–0–	75,000	–0–
Current production	225,000	225,000	450,000
Ending inventory	(75,000)	–0–	–0–
Cost of goods sold	150,000	300,000	450,000
Gross margin	310,000	160,000	470,000
Marketing and admin. costs	140,000	140,000	280,000
Operating profit	$170,000	$ 20,000	$190,000

b. Variable costing operating profit:

	Year 1	*Year 2*	*2 year Total*
Sales revenue (10,000 x $46)	$460,000	$460,000	$920,000
Variable costs	–0–	–0–	–0–
Contribution margin	460,000	460,000	920,000
Fixed manufacturing costs	225,000	225,000	450,000
Fixed marketing and admin. costs	140,000	140,000	280,000
Operating profit	$ 95,000	$ 95,000	$190,000

c. Reconciliation:

	Year 1	*Year 2*
Full-absorption operating profit	$170,000	$ 20,000
Add fixed costs in beginning inventory	–0–	75,000
Less fixed costs in ending inventory	75,000	–0–
Variable costing operating profit	$ 95,000	$ 95,000

11–23. (40 min.) *Effect of changes in production and costing method on operating profit ("I Enjoy Challenges"): Brassinni Company.*

This is a classic problem in full-absorption costing that is based on actual practice in a large manufacturing company.

a. The Year 2 income statement is based on the accounting convention of full-absorption costing. This may not be the most appropriate income statement to use for internal performance evaluation because two-thirds of the current fixed manufacturing costs are deferred in ending inventory. A variable costing income statement would be a better measure of performance.

The fixed costs deferred in inventory amount to $32,000,000. Under variable costing, these would be period costs and the Year 2 operating profit would be an $18,000,000 loss, as shown below. Under these circumstances, the president is not entitled to a bonus.

b.

	Year 1	*Year 2*
Sales	$ 60,000,000	$ 60,000,000
Variable cost of goods sold	20,000,000	20,000,000
Contribution margin	40,000,000	40,000,000
Fixed manufacturing costs	48,000,000	48,000,000
Marketing and admin. costs	10,000,000	10,000,000
Operating profit (loss) before bonus	(18,000,000)	(18,000,000)
Bonus		1,400,000
Operating profit (loss) after bonus	$(18,000,000)	$(19,400,000)

Ending inventory value at end of Year 2 = 20,000,000 units not sold
x $2 variable manufacturing cost per unit
= $40,000,000

11–24. (25 min.) *"I Enjoy Challenges" normal costing: Brassinni Company.*

Full-absorption—normal costing.

Here is how the president could have *really* made money (for himself)!

	Year 2
Sales	$60,000,000
Cost of goods sold[a]	68,000,000
Gross margin	(8,000,000)
Adjustment for overapplied fixed manufacturing costs[b]	96,000,000
Adjusted gross margin	88,000,000
Marketing and administrative	10,000,000
Operating profit	$78,000,000

---

[a] Variable cost per unit = $2.00
Applied fixed manufacturing cost per unit = $4.80
Cost per unit of production = $6.80

$6.80 x 10,000,000 units = $68,000,000 cost of goods sold

[b] Applied fixed manufacturing overhead ($4.80 x 30,000,000) = $144,000,000
Actual fixed manufacturing overhead = 48,000,000
Total overapplied fixed manufacturing overhead = $ 96,000,000

Be careful. This works to the president's advantage only if overapplied overhead is not prorated to inventory and to cost of goods sold.

11–24. (continued)

Diagram of Cost Flows

Work in Process Inventory

Variable	60,000,000	60,000,000
Fixed overhead	144,000,000	144,000,000

Finished Goods Inventory

60,000,000	68,000,000
144,000,000	
136,000,000	

Cost of Goods Sold

68,000,000	

Fixed Manufacturing Overhead

Actual	Applied
48,000,000	144,000,000
96,000,000[c]	

Under/Over Applied Overhead

	96,000,000[c]

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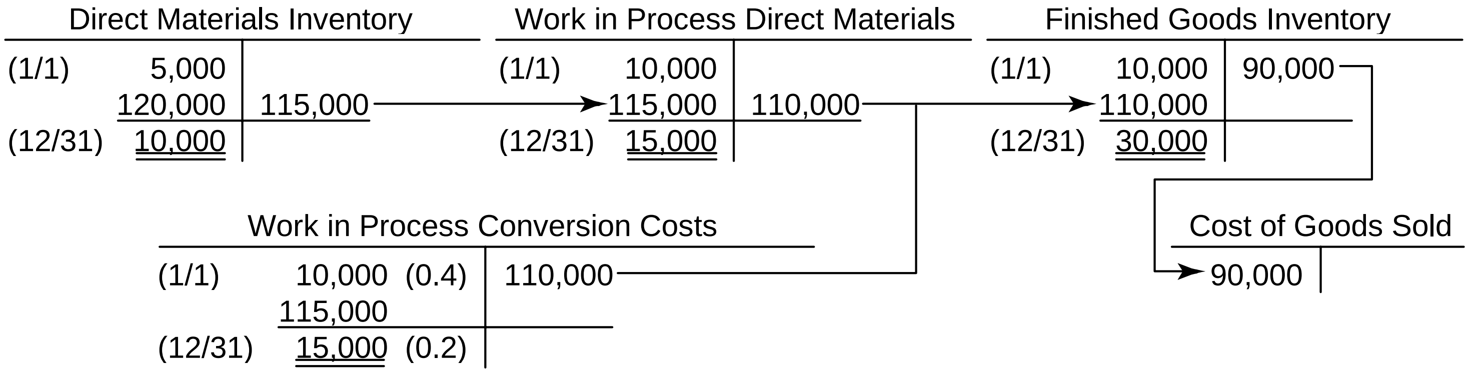
[c] refers to closing entry

11–25. (65 min.) *Comparison of full-absorption and variable normal costing in a process operation: Devonelli Company.*

Note: This problem requires an elementary knowledge of process costing.

a. Flow of units



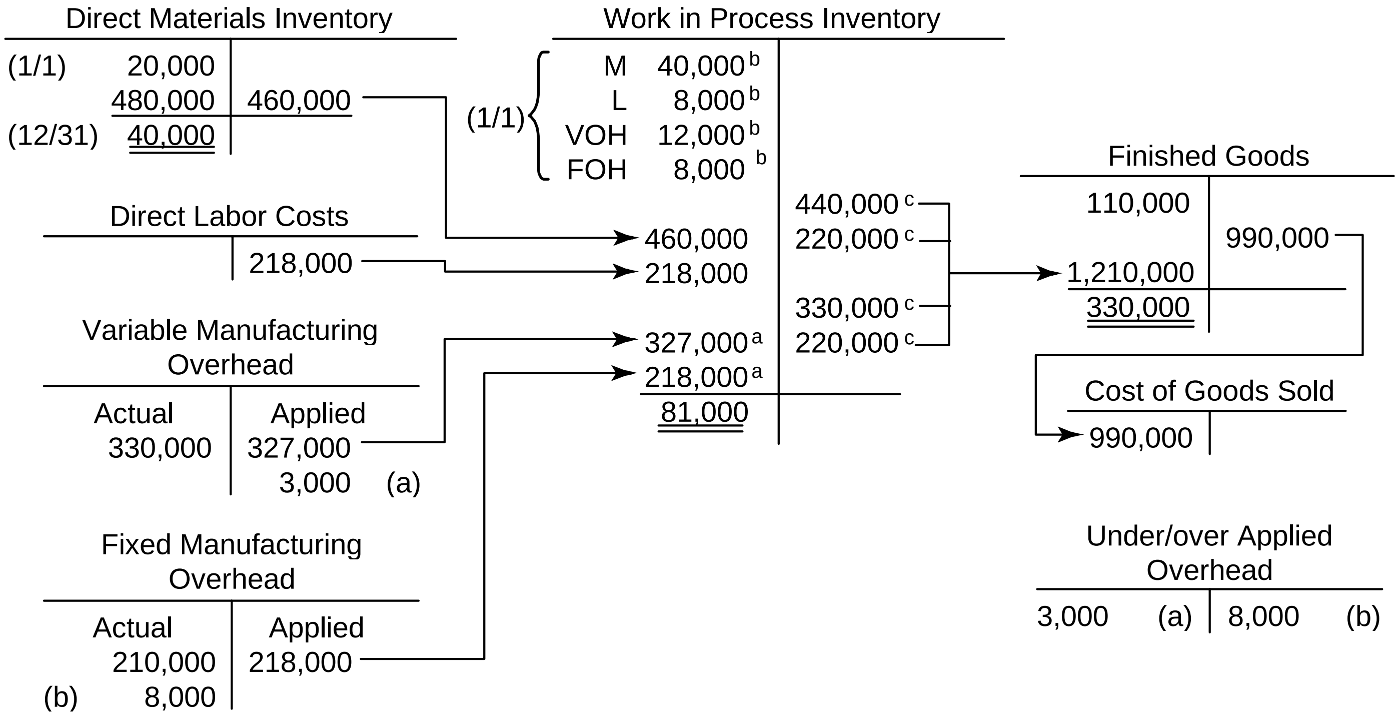
Equivalent units of Direct Materials = 115,000 = same as units transferred from Materials Inventory

Equivalent units of Conversion Costs = 109,000:

Completed: 10,000 x (1 – .4)		6,000
Started and completed:		
Started	115,000	
Less Ending inventory	15,000	100,000
Ending inventory: 15,000 x .2		3,000
Equivalent units		109,000

11–25. (continued)

b. Flow of dollars.



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[a] Equivalent units, 115,000 for materials and 109,000 for other costs, times unit costs given in the problem.

[b] Equivalent units, 10,000 for materials and 4,000 for other costs, times unit costs given in the problem.

[c] 110,000 units transferred out times unit cost given in the problem.

11–25. (continued)

c. **Full Absorption Costing**

Sales Revenue	$1,800,000
Less: Cost of goods sold	990,000
Under/over applied overhead	(5,000)
Gross margin	815,000
Less marketing and administrative	580,000
Operating profit	$ 235,000

Variable Costing

Sales Revenue	$1,800,000
Less: Variable cost of goods sold	810,000
Under/over applied overhead	3,000
Contribution margin	987,000
Less: Fixed manufacturing overhead	210,000
Marketing and administrative	580,000
Operating profit	$ 197,000

Note: Problem states that Finished Goods beginning inventory costs $11 per unit.

11–26. (50 min.) *Incomplete records: Solano Company.*

a. Comparative income statements.

	Variable Costing
Sales	$450,000
Variable cost of goods sold	270,000[a]
Variable marketing and administrative costs	–0–
Contribution margin	180,000
Fixed manufacturing costs	66,000
Fixed marketing and administrative costs	21,000
Operating profit	$ 93,000

	Full-Absorption
Sales	$450,000
Cost of goods sold	369,000[b]
Gross margin	81,000
Fixed marketing and administrative costs	21,000
Operating profit	$ 60,000

Calculations:

[a]Sales – contribution margin = $450,000 – $180,000
= $270,000

[b]Sales – gross margin = $450,000 – $81,000 = $369,000

b. (1) Units sold $= \dfrac{\text{Variable cost of goods sold}}{\text{Variable manufacturing cost}}$

$= \dfrac{\$270{,}000}{\$3/\text{unit}}$

= 90,000 units

11–26. (continued)

(2) Full-absorption cost per unit $= \$4.10 = \dfrac{\$369{,}000}{90{,}000 \text{ units}}$

Fixed cost per unit = $1.10 (= $4.10 – $3.00 variable costs)

Difference in income = $33,000. Since variable costing operating profit is $33,000 higher than full-absorption costing, sales must have exceeded production by 30,000 units $\left(= \dfrac{\$33{,}000}{\$1.10/\text{units}}\right)$ Therefore, production was 60,000 units (= 90,000 – 30,000).

$$\text{Also, Fixed manufacturing cost per unit} = \frac{\text{Fixed mfg. costs}}{\text{Units produced}}$$

$$\$1.10 = \frac{\$66{,}000}{\text{Units produced}}$$

$$\text{Units produced} = \underline{\underline{60{,}000}}\ \text{units}$$

(3) Last year's costs were the same as this year's costs. Therefore, the cost per unit for last year for variable costs is $3.00 per unit, and $4.10 per unit for full-absorption.

c. See part (2) of b above. We also reconcile by asking students what fixed manufacturing costs are expensed under each method:

Variable costing:	Fixed manufacturing costs expensed =	$66,000
Full-absorption:	From current period's production	
	60,000 units x $1.10 =	66,000
	From beginning inventory	
	30,000 units x $1.10 =	33,000
		$99,000
Difference (excess of full-absorption costing expenses over variable costing)		$33,000

11–27. (40 min.) *Comparative income statements: Tenna Company.*

a.

Tenna Company
Projected Income Statement
For the Month of June
(Full-Absorption Costing)

Sales (7,500 units x $80)		$600,000
Cost of goods sold before adjustment (7,500 x $60[a])	450,000	
Adjustment for underapplied overhead ("normal" production is 10,000 units but projected actual = 9,000. So 1,000 units underapplied x $5 fixed manufacturing overhead)	5,000	
Cost of goods sold		455,000
Gross margin		145,000
Variable selling, general, and administrative (7,500 units x $4)	30,000	
Fixed selling, general, and administrative (10,000 units x $2.80)	28,000[b]	58,000
Projected operating profit		$ 87,000

---

[a] $60 = Direct materials + direct labor + variable overhead + fixed overhead = $30 + $19 + $6 + $5

[b] $28,000 is a fixed cost. The $2.80 was *derived* for a volume of 10,000 units.

b.

Tenna Company
Projected Income Statement
For the Month of June
(Variable Costing)

Sales (7,500 units x $80)		$600,000
Variable cost of goods sold (7,500 x $55[a])	412,500	
Variable nonmanufacturing (7,500 units x $4)	30,000	
Total variable costs		442,500
Contribution margin		157,500
Fixed manufacturing overhead (10,000 units x $5)	50,000	
Fixed nonmanufacturing (10,000 units x $2.80)	28,000	
Total fixed costs		78,000
Projected operating profit		$ 79,500

---

[a] $55 = Direct materials + direct labor + variable overhead = $30 + $19 + $6

Note (Not Required*)*: The difference in the two projected profit figures ($87,000 – $79,500) equals $7,500. This is accounted for as the increase in inventory times the fixed manufacturing overhead application rate (1,500 units x $5). The $7,500 of fixed manufacturing overhead is included in ending inventory under full-absorption costing, but it is expensed under variable costing.

11–28. (30 min.) *Evaluate full-absorption and variable costing; normal costing: Lockard Company.*

a. First find units sold. Units sold = Variable cost of goods sold divided by Variable manufacturing cost per unit = $1,200,000/$12 = 100,000 units.

(1)

Lockard Co.
Income Statement: Full-Absorption Cost Basis
For the Month of November

Sales (100,000 units @ $24 per unit)		$2,400,000
Cost of goods sold	$1,600,000[a]	
Underapplied overhead (5,000[b] units @ $4)	20,000	1,620,000
Gross margin		780,000
Less: Fixed nonmanufacturing costs		400,000
Operating profit		$ 380,000

---

[a] Cost x volume = ($12 + $4) x 100,000 = $1,600,000

[b] Estimated volume = 150,000; actual volume = 145,000

(2) Reconciliation of Variable and Full-Absorption Operating Profits ($000 omitted)

	Variable Costing	*Full-Absorption Costing*
Report operating profit before taxes	$200	$380
Difference: Increase in inventory of 45,000 units during November @ $4 fixed cost per unit =	$180	

Full-absorption costing attaches a $4 fixed manufacturing cost per unit to each unit produced in November. Because the production during November (145,000 units) exceeded sales of November (100,000 units), the fixed cost assigned to the 45,000 unit increase in the inventory balance results in $180,000 (45,000 units @ $4 fixed cost per unit) less fixed costs being charged to the income statement in November and the resultant increase of $180,000 in operating profit before taxes.

b. The Vice President for Sales should find the variable costing approach to profit determination desirable for many reasons, including:

- Variable costing income varies with units sold, not units produced.
- Fixed manufacturing costs are charged against revenues in the period in which they were incurred; consequently, manufacturing cost per unit does not change with a change in production levels.
- The contribution margin offers a useful tool for making decisions.

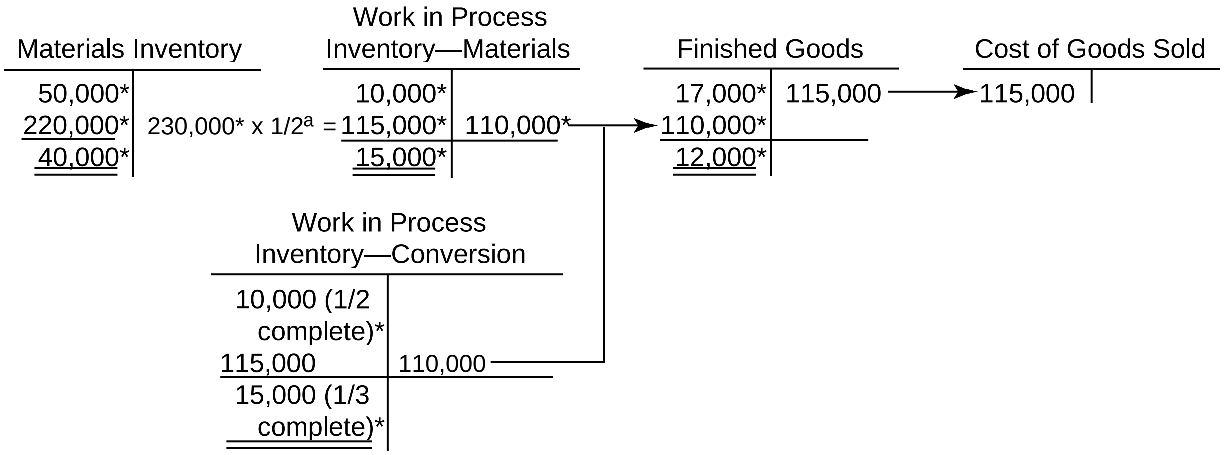
Solutions to Integrated Cases

11–29. (90 min.) *Comprehensive problem on process costing, variable costing, and full-absorption costing: Sega Corporation.*

a. and b.

Note: This problem requires an elementary knowledge of process costing. The following flow of units and costs, and calculations answer requirements a and b.

Units



Equivalent Production: Materials = 115,000 units

Processing = 110,000 units:

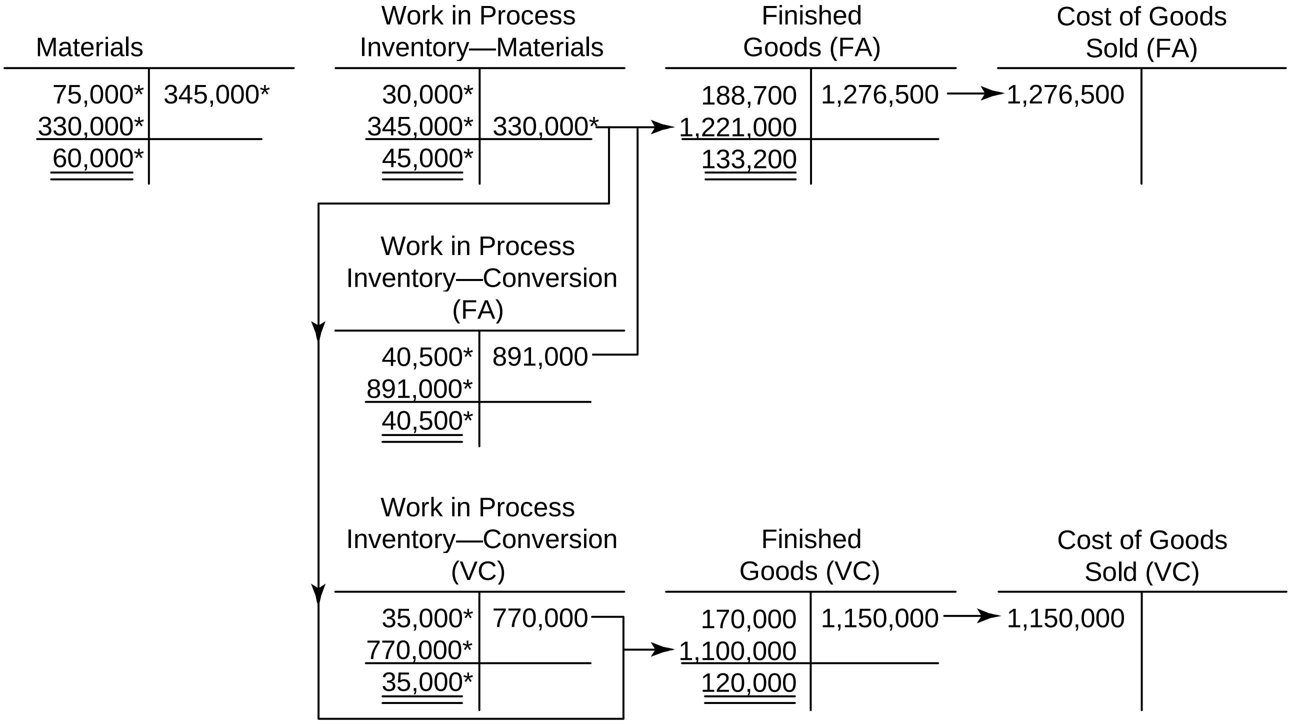
Completed 10,000 x (1 – 1/2)	=	5,000	
Started and completed		100,000	
Ending inventory 15,000 x 1/3	=	5,000	
		110,000	E.U.

*Units given in the problem.

[a] To convert from 2 units of Harsh required to make one unit of Jink.

11–29. (continued)

Dollars



Materials

75,000*	345,000*
330,000*	
60,000*	

Work in Process Inventory—Materials

30,000*	
345,000*	330,000*
45,000*	

Finished Goods (FA)

188,700	1,276,500
1,221,000	
133,200	

Cost of Goods Sold (FA)

1,276,500	

Work in Process Inventory—Conversion (FA)

40,500*	891,000
891,000*	
40,500*	

Work in Process Inventory—Conversion (VC)

35,000*	770,000
770,000*	
35,000*	

Finished Goods (VC)

170,000	1,150,000
1,100,000	
120,000	

Cost of Goods Sold (VC)

1,150,000	

FA refers to full-absorption; VC refers to variable costing
*Dollars given in the problem.

11–29. (continued)

c.

	Comparative Income Statements			
	Full-Absorption		*Variable Costing*	
Sales		$2,300,000		$2,300,000
Cost of sales:				
Manufacturing costs:				
Beginning work in process	$ 70,500		$ 65,000	
Current period costs	1,236,000		1,115,000	
Ending work in process	(85,500)		(80,000)	
Manufacturing costs	1,221,000		1,100,000	
Beginning finished goods	188,700		170,000	
Ending finished goods	(133,200)		(120,000)	
Cost of goods sold		1,276,500		1,150,000
Fixed conversion costs	—	—		121,000
Under/over applied overhead		–0–	—	–0–
Gross margin		1,023,500		1,029,000
Marketing & administrative		145,000		145,000
Net income		$1,878,500		$ 884,000

11–29. (continued)

d. Assume FIFO flow.

Reconciliation of Variable
and Full-Absorption
Costing

Fixed costs expensed this period under Variable Costing	$121,000
Add previous period fixed costs Expensed under Full-Absorption	24,200[a]
Less current period fixed costs Retained in inventory under Full-Absorption	18,700[b]
Fixed costs expensed under Full-Absorption	$126,500[c]

---

[a] (WIP + FG) x $1.10
= (5,000 + 17,000) x $1.10
= $24,200

[b] (WIP + FG) x $1.10
= (5,000 E.U. + 12,000 E.U.) x $1.10 = $18,700

[c] $1.10 x 115,000 = $126,500

11–30. (45 min.) *Full absorption and variable costing—Importing decisions: Cotierre.*

The key to this problem is to realize that the purchase and duty costs for the lot of 1,000 dresses are essentially fixed, even though one might normally think that these costs are variable. The reason the costs are fixed is that it is necessary to acquire the full 1,000 dresses even though only a fraction of the lot will be sold. In this situation, neither full-absorption nor variable costing gives a totally satisfactory answer. Part d of the case calls for development of a method that will relate costs and revenues better than either full-absorption or variable costing even though the method may not be suitable for external reporting purposes.

a. Under full-absorption costing, the inventoriable cost of each dress is:

Purchase price	$25,000	
Import duty	5,000	
Total cost.........................	$30,000	
÷ # of dresses.................	1,000	units
Cost per dress................	$30	

b.

Revenues:	300 dresses @ $75	$22,500
Costs: Cost of goods sold	300 @ $30	9,000
Commissions	300 @ $ 7	2,100
Total costs		$11,100
Operating profits		$11,400

c.

Revenues:	100 dresses @ $75	$ 7,500
	300 dresses @ $37.50	11,250
Total revenues		$18,750
Costs:		
Cost of goods sold	400 @ $30	12,000
Commissions	400 @ $7	2,800
Disposal costs	300 @ $3	900
Inventory loss	300 @ $30	9,000
Total costs		$24,700
Operating loss		($5,950)

11–30. (continued)

d. One alternative considers the inventoriable cost of the dresses to be zero and charges the full $30,000 to the first period since it is a fixed cost. This generates a loss in the first period as follows:

Revenues:	300 dresses @ $75	$22,500
Costs: Fixed costs		30,000
Commissions	300 @ $7	2,100
Total costs		$32,100
Operating loss		($9,600)

In the second period, an operating profit is computed as follows:

Revenues:	100 dresses @ $75	$ 7,500
	300 dresses @ $37.50	11,250
Total revenues		$18,750
Costs:		
Commissions	400 @ $7	2,800
Disposal costs	300 @ $3	900
Total costs		$ 3,700
Operating profit		$15,050

This solution is not much better than the previous one. An alternative would be to relate the $30,000 cost to the revenue expected from the dresses that are expected to be sold. The inventory value would not be a standard one, but it would tend to match the expected dollars revenue with the costs of the lot of dresses. Provision could also be made for the expected disposal costs. Thus, the company could consider that it incurred $30,900 in costs to obtain the following revenues:

Full price dresses	400 @ $75	$30,000
Half price dresses	300 @ $37.50	11,250
Expected revenue		$41,250

$30,900 ÷ $41,250 = 74.91%

11–30. (continued)

d. (continued)

For each dollar of revenue, 74.91¢ would be deducted to cover the cost of the dresses and the disposal costs. Each period's operating profits would appear as follows:

Revenues:	300 dresses @ $75	$22,500
Costs: Dress costs	@ 74.91%	16,855
Commissions	300 @ $7	2,100
Total costs		$18,955
Operating profit		$ 3,545

Second period:

Revenues:	100 dresses @ $75	$ 7,500
	300 dresses @ $37.50	11,250
Total revenues		$18,750
Costs:		
Dress costs	$18,750 x 74.91%	14,046
Commissions	400 @ $7	2,800
Total costs		$16,846
Operating profit		$ 1,904

Chapter 12
Cost Estimation

Solutions to Review Questions

12–1.
Engineering estimates are based on the operations in the company and industry standards.

12–2.
The relevant range may be limited to the range of observations included in the data set because extrapolation beyond the observed activity levels is a very hazardous undertaking. The relevant range may actually be smaller than the range of observations in the data set. This would occur if, for example, at some point there is a break in the observed data–e.g., the data set becomes nonlinear.

12–3.
Engineering estimates are particularly helpful when:

a. attempting to compare company operations with standards;

b. trying to estimate costs for projects that have not been undertaken in the past (e.g., new construction, major special orders such as defense items);

c. considering alternatives to present operations, such as assembly line reorganization and similar changes, where it would be too costly to carry out the change and then see if it was cost-effective.

12–4.
The biggest problem likely to be encountered from the indiscriminate use of regression methods is that the model may not have any logical foundation. This may result in a model that appears sound on a statistical basis, but with no logical relationship between Y and X's the model may not continue to provide good predictions. A number of spurious correlation and regression studies have been presented in the literature. For example, a simple run of correlations between average education levels in the U.S. and U.S. inflation rates might lead one to conclude that education causes inflation.

12–5.
The longer the data series used in the analysis, the easier it is to see a trend in the data when using the scattergraph method. When using any method, the longer the data series, the greater the likelihood of having the widest possible range of observations. When using statistical methods, the more observations, the smaller the standard deviations and the tighter the resulting estimates. On the other hand, the longer the data series, the more likely that operating conditions, technology, prices and costs have changed. Thus, the order data may not be very representative of the operations expected over the period for which the estimate is made.

12–6. (Appendix)
First, select the desired confidence level (e.g., 95 percent). Then calculate the t value for the confidence level selected. To find the upper and lower limits, use the following formula: $b \pm t \times SE_b$, where

b = coefficients of the independent variables.
SE_b = Standard error for b
$t = \frac{b}{SE_b}$

Recognize the confidence interval assumes normally distributed residuals and the greater the standard error of the estimate (SEY) the wider the confidence interval.

12–7.
Accurate estimates improve decision making. Inaccurate estimates result in inefficiencies and increase nonvalue-added decisions.

Solutions to Critical Analysis and Discussion Questions

12–8.

a. Direct labor would be fixed if a union contract limited the company's ability to lay off unneeded personnel or if management were contemplating a change in facilities but maintaining the same labor force.

b. Equipment depreciation would be a variable cost if computed on a unit-of-production basis.

c. Utilities are variable above the minimum, but if the company's usage falls to the minimum or below, the costs would be fixed.

d. Supervisory salaries normally increase in steps. If the activity range is narrow, the costs are fixed; but if the range is wide enough so that several "steps" would fall within the range, then the costs would appear to be variable.

e. A certain level of spoilage may be a fact of life in some operations.

12–9.
Account analysis incorporates the judgment of the executive where experience would be quite helpful. As a result it may include factors that are not easily captured in statistical models. In an application setting, the best overall cost estimate may be derived by considering both account analysis results and statistical results.

12–10.
Data in the historical accounting records should only be used insofar as they are likely to continue in the future. In periods of price instability or technological innovation, use of the historical data without adjustment is likely to result in incorrect estimates. A better alternative is to use the costs that are expected to be incurred during the period for which the cost estimate is prepared.

12–11.
One may:

a. adjust the data to present all costs in some common dollar measure;

b. use activity measures that are expressed in dollars that move with the price change effects in the cost to be estimated,

c. use a multiple regression approach with a suitable price index as one of the predictor variables.

12–12.
The scattergraph can be useful in checking for outliers in the data—the regression model will not pick this up. Also, the scattergraph may point out changes in the data series that need to be considered when constructing the regression data base.

If the appendix has been assigned, one can add that scattergraphs are often used to check for autocorrelation in residuals (using a diagram of the residuals) and trends in the variance around the regression line (heteroscedasticity).

12–13.
If more than one factor is used, multicollinearity is a potential problem. If the predictors are correlated (a common problem with accounting and cost data), then there are overlapping effects which are being explained by the correlated variables. The specific effect of one variable on the cost estimate cannot be determined independently.

12–14.
It is possible for empirical data to show a negative intercept even though fixed costs cannot be negative. It may be that the slope of the cost curve is particularly steep over the values used in the estimation process. This would be particularly likely if the company were operating close to capacity. Negative intercepts usually mean that there is some error in the specification of the cost estimate. If the company is operating close to capacity, for example, then the assumption of a linear cost function may be in error—or may only be a reasonable approximation in the range of activity close to capacity.

12–15. (Appendix)
How well defined is the model? That is, does the one independent variable explain variation in the dependent variable? Are the residuals normally distributed?

Solutions to Exercises

12–16. (15 min.) *Methods of estimating costs—account analysis.*

a.

Cost Item	*Last Year's Cost*	*This Year's Cost at Last Year's Volume*		*This Year's Cost at This Year's Volume*	
Direct materials..........	$ 420,000	$ 504,000	(1.2 x $420,000)	$ 576,000	($504,000 x 80,000/70,000)
Direct labor.................	350,000	364,000	(1.04 x $350,000)	416,000	($364,000 x 80,000/70,000)
Variable overhead......	308,000	308,000		352,000	($308,000 x 80,000/70,000)
Fixed overhead	480,000	516,000	(1.075 x $480,000)	516,000	
Total costs..................	$1,558,000	$1,692,000		$1,860,000	

b. Costs per unit:

Last year	$22.257	($1,558,000/70,000 units)
This year	$23.25	($1,860,000/80,000 units)

12–17. (15 min.) *Methods of estimating costs—account analysis.*

a.

Cost Item	*Year 1 Cost*	*Year 2 Cost at Year 1 Volume*		*Year 2 Cost at Year 2 Volume*	
Direct materials..........	$307,500	$338,250	(1.1 x $307,500)	$439,725	($338,250 x 65,000/50,000)
Direct labor.................	239,500	275,425	(1.15 x $239,500)	358,053	($275,425 x 65,000/50,000)
Variable overhead......	142,500	142,500		185,250	($142,500 x 65,000/50,000)
Fixed overhead	237,500	249,375	(1.05 x $237,500)	249,375	
Total costs..................	$927,000	$1,005,550		$1,232,403	

b. Costs per unit:

Year 1	$18.54	($927,000/50,000 units)
Year 2	$18.96	($1,232,403/65,000 units)

12–18. (10 min.) *Methods of estimating costs—High-low: Continental Company.*

a. Variable costs

$$= \frac{\text{Cost at highest activity} - \text{Cost at lowest activity}}{\text{Highest activity} - \text{Lowest activity}}$$

$$= \frac{\$1.6 \text{ million} - \$1.2 \text{ million}}{33{,}600 \text{ miles} - 20{,}800 \text{ miles}}$$

$$= \frac{\$.4 \text{ million}}{12{,}800}$$

$$= \underline{\underline{\$31.25}} \text{ per mile}$$

Fixed costs

$$\begin{aligned} &= \text{Total costs} - \text{variable costs} \\ &= \$1.6 \text{ million} - (33{,}600 \times \$31.25) \\ &= \underline{\underline{\$550{,}000}} \\ &= \$1.2 \text{ million} - (20{,}800 \text{ miles} \times \$31.25) \\ &= \underline{\underline{\$550{,}000}} \end{aligned}$$

b. Maintenance cost

$$\begin{aligned} &= \$550{,}000 + (\$31.25 \times \text{miles}) \\ &= \$550{,}000 + (\$31.25 \times 32{,}000 \text{ miles}) \\ &= \underline{\underline{\$1{,}550{,}000}} \\ &= \$550{,}000 + (\$31.25 \times 40{,}000 \text{ miles}) \\ &= \underline{\underline{\$1{,}800{,}000}} \end{aligned}$$

Note that 40,000 miles is outside the range of the cost observations, so this estimate is subjective.

12–19. (25 min.) *Methods of estimating costs—High low: Nate Corporation.*

a. High-low estimate

	Machine Hours (MH)	*Overhead Costs*
Highest (month 9)..........	420	$5,475
Lowest (month 12)	290	$3,975

$$\text{Variable cost estimate} = \frac{\text{Cost at highest activity} - \text{Cost at lowest activity}}{\text{Highest activity} - \text{Lowest activity}}$$

$$= \frac{\$5,475 - \$3,975}{420 \text{ MH} - 290 \text{ MH}}$$

$$= \frac{\$1,500}{130 \text{ MH}}$$

$$= \underline{\underline{\$11.538}} \text{ per MH}$$

Fixed costs = Total costs – Variable costs

= $5,475 – ($11.538 x 420 MH)

= $5,475 – $4,846

= $\underline{\underline{\$629}}$

= $3,975 – ($11.538 x 290 MH)

= $3,975 – $3,346

= $\underline{\underline{\$629}}$

The cost equation then is:

Overhead costs = $629 + ($11.538 per MH x Machine hours)

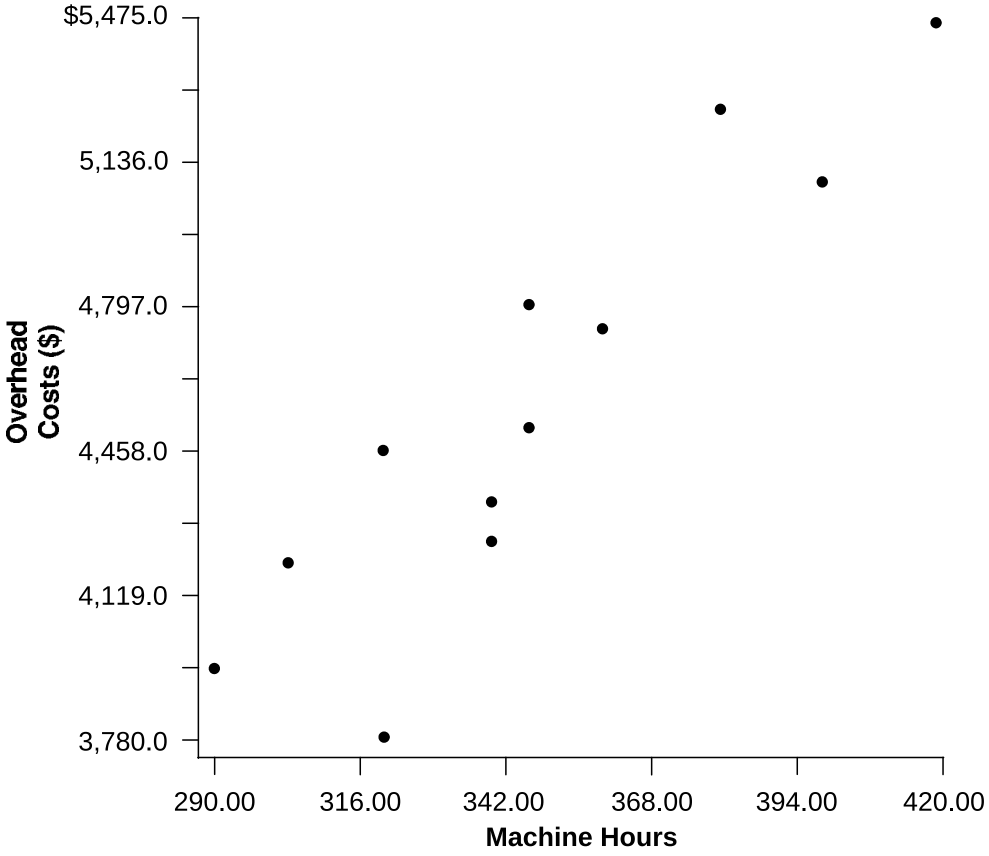
b. For 380 MH:

Overhead costs = $629 + ($11.538 x 380 MH)

= $5,013

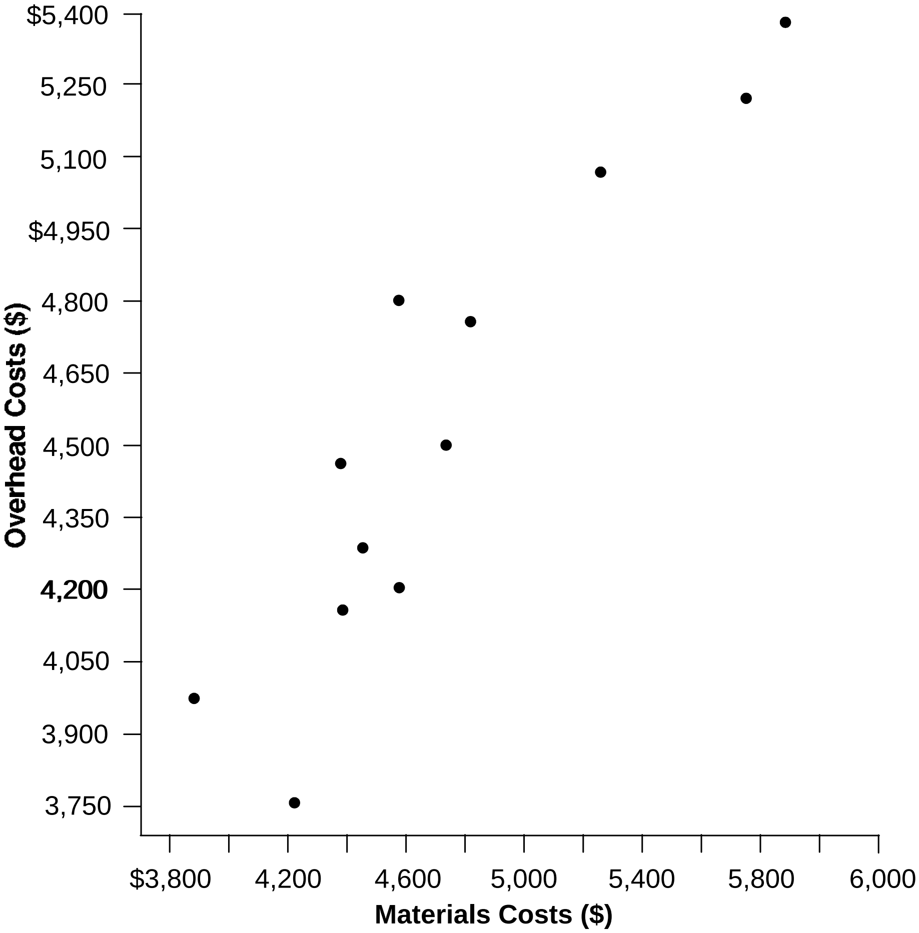
12–20. (15 min.) *Methods of estimating costs—Scattergraph: Nate Corporation.*

SCATTERGRAPH



12–21. (15 min.) *Methods of estimating costs—Scattergraph: Nate Corporation.*

Scattergraph



12–22. (20 min.) *Estimating costs—Simple regression: Yamahonda Motors Company.*

Simple regression estimate

Overhead = \$348.17 + (\$12.149 x MH)
= \$348.17 + (\$12.149 x 380)
= \$348.17 + \$4,616.62
= $\underline{\underline{\$4,964.79}}$

12–23. (10 min.) *Estimating costs—Simple regression: Ginfee, Inc.*

The answer is (1).

Q = \$6,000 + (\$5.25 x 1,000 machine hours)
= \$6,000 + \$5,250
= \$11,250

12–24. (20 min.) *Estimating costs—Multiple regression: Nate Company.*

Multiple regression estimate:

Overhead = \$694.24 + (\$4.5920 x MH) + (.2392 x MC)
= \$694.24 + (\$4.5920 x 380) + (.2392 x \$5,000)
= \$694.24 + \$1,744.96 + \$1,196.00
= $\underline{\underline{\$3,635.20}}$

12–25. (20 min.) *Interpreting regression results—Multiple choice: Pentag Company.*

a. (1) $R^2 = .908$, the explanation of variation in Y from the X regressor.

b. (4) $238,000. The equation resulting from this regression analysis is

TC = $110,000 + ($6.40 x DLH)
= $110,000 + ($6.40 x 20,000)
= $110,000 + $128,000
= $238,000

c. (1) $9.56.

$1,200,000	selling price ($12 x 100,000)
100,000	direct materials
80,000	direct labor
64,000	variable overhead ($6.40 x 10,000)
$ 956,000	contribution

$956,000 ÷ 100,000 = $9.56 per unit

d. (3) $2.44. The variable costs per unit are:

$1.00	direct materials ($100,000 ÷ 100,000 units)
.80	direct labor ($80,000 ÷ 100,000 units)
.64	overhead [($6.40 x 10,000 hours) ÷ 100,000 units]
$2.44	

The regression analysis provides a figure of $6.40 in variable overhead per direct labor hour. It is expected that 10,000 direct labor hours will be needed to produce 100,000 units.

e. (2) TC = $110,000 + $2.44X.

The fixed costs, given by the regression analysis, are $110,000. The variable costs from *d* above are $2.44.

*CMA adapted

12–26. (15 min.) *Interpreting regression results: Leonine Company.*

This problem is frequently encountered when applying analytical techniques to certain costs. Quite often the advertising expenditures result in sales being generated in the following month or so. In addition, many companies increase their advertising when sales are declining and cut back on advertising when there is capacity business. A better model might be developed by relating this month's sales to last month's advertising.

Similar problems exist for repair and maintenance costs since machines are usually given routine repairs and maintenance during slow periods. An inverse relationship often exists between salespersons' travel expenses and sales because the salesperson spends more time traveling when the sales are more difficult to make.

12–27. (15 min.) *Interpreting regression results—simple regression: Ben's Big Burgers.*

a. Overhead = \$37,650 + (1.15 x food costs)

b. At \$25,000 in food costs:

Overhead = \$37,650 + (1.15 x \$25,000)
= \$37,650 + \$28,750
= <u>\$66,400</u>

12–28. (30 min.) *Interpreting regression data: Comador Commercial Bank.*

a. At 4,200 employees, the cost estimate would be:

Personnel costs = $8,420 + ($492 x 4,200 employees)
= $8,420 + $2,066,400
= $2,074,820

b. The confidence interval for the slope coefficient is:

$492 ± (2.074 x $34.25)

So the upper confidence limit is:

$492 + (2.074 x $34.25) = $563

and the lower confidence limit is:

$492 – (2.074 x $34.25) = $421

12–29. (20 min.) *Learning curves: Paradigm Stainless Steel Company.*

Cumulative Number of Units Produced, X	*Average Manufacturing Costs per Unit*		*Total Manufacturing*
1	$ 4,000		$ 4,000
2	3,000		6,000
4	2,250	($3,000 x 75%)	9,000
8	1,687.50	($2,250 x 75%)	13,500
16	1,265.62	($1,687.50 x 75%)	20,250

12–30. (30 min.) *Learning curves: Dianetics Manufacturing.*

Units	*Average per unit (Y)*	*Total hours*	
1	100	100	
2	80	160	($Y = 100 \times 2^{-.322} = 80$)
4	64	256	($Y = 100 \times 4^{-.322} = 64$)

Cost of 2 units

Direct materials	$1,500	($750 x 2)
Direct labor	2,400	($15 x 160)
Var. Overhead	2,000	[($100 x 2) + ($2,400 x .75)]
Total	$5,900	
per unit	$2,950	

Cost of 4 units

Direct materials	$ 3,000	($750 x 4)
Direct labor	3,840	($15 x 256)
Var. Overhead	3,280	[($100 x 4) + ($3,840 x .75)]
Total	$10,120	
per unit	$ 2,530	

Solutions to Problems

12–31. (40 min.) *Methods of estimating costs—high-low, scattergraph, and regression: Nilsine Company.*

a. High-low estimate

	Machine Hours (MH)	*Overhead Costs*
Highest (Month 2)	25,000	$99,000
Lowest (Month 8)	10,000	64,500

$$\text{Variable cost estimate} = \frac{\text{Cost at highest activity} - \text{Cost at lowest activity}}{\text{Highest activity} - \text{Lowest activity}}$$

$$= \frac{\$99{,}000 - \$64{,}500}{25{,}000 \text{ MH} - 10{,}000 \text{ MH}}$$

$$= \$34{,}500 \div 15{,}000 \text{ MH}$$

$$= \$2.30 \text{ per MH}$$

Fixed costs = Total costs – Variable costs
= $99,000 – ($2.30 x 25,000 MH)
= $99,000 – $57,500
= $\underline{\underline{\$41{,}500}}$

Check:
Fixed costs = $64,500 – ($2.30 x 10,000 MH)
= $64,500 – $23,000
= $\underline{\underline{\$41{,}500}}$

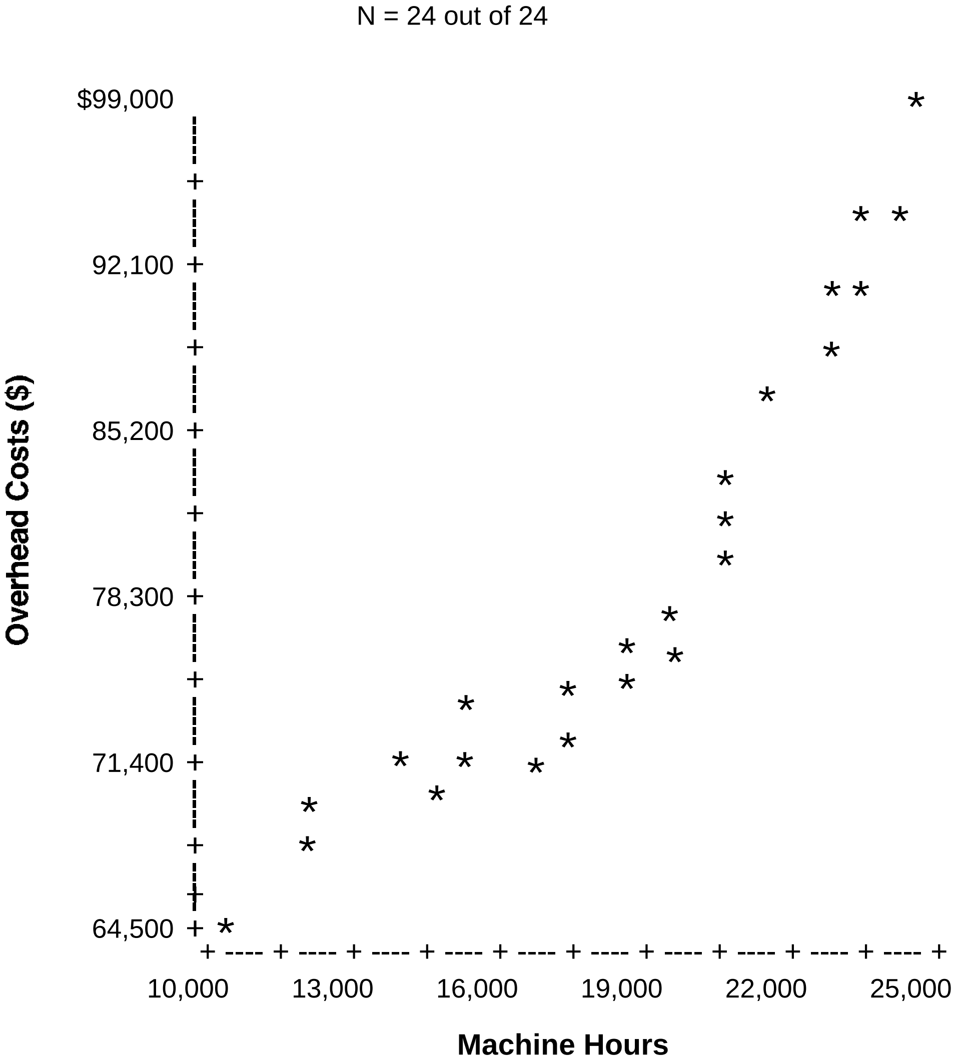
The cost equation, then is:

Overhead costs = $41,500 + ($2.30 x Machine hours)

12–31. (continued)

b.

Scattergraph



c. The regression results indicate an equation of the form:

Overhead costs = $39,859 + ($2.1549 x Machine hours)

Which for 22,500 hours would be:

Overhead costs = $39,859 + ($2.1549 x 22,500)
= $39,859 + $48,485
= $88,344

12–32. (60 min.) *Methods of cost estimation—account analysis, simple and multiple regression: Dellila Undersea Gear Corporation.*

a. Account analysis approach:

Cost Item	*Total*	=	*Fixed*	+	*Variable*
Indirect material	$ 37,500				$ 37,500
Indirect labor	194,200		$171,000		23,200
Building occupancy	236,420		236,420		
Power	27,210				27,210
Equipment depreciation	181,000		181,000		
Equipment maintenance	24,330		8,500		15,830
Personal property taxes	14,100		6,350		7,750
Data processing	11,220		9,470		1,750
Technical support	16,940		16,940		
Totals	$742,920		$629,680		$113,240

Cost equation:

Overhead = $629,680 + ($113,240/80,000 units)
= $629,680 + $1.4155 per unit

b. High-low method:

(Note: Rounding affects the answers.)

$$\text{Variable cost estimate} = \frac{\text{Cost at highest activity} - \text{Cost at lowest activity}}{\text{Highest activity} - \text{Lowest activity}}$$

$$= \frac{\$777{,}640 - \$717{,}670}{98{,}000 \text{ units} - 56{,}900 \text{ units}}$$

$$= \frac{\$59{,}970}{41{,}100 \text{ units}}$$

$$= \underline{\underline{\$1.459 \text{ per unit}}} \text{ (rounded)}$$

Fixed costs = Total costs – Variable costs
= $777,640 – ($1.459 x 98,000)
= $777,640 – $142,982
= $634,658

Check:
Fixed costs = $717,670 – ($1.459 x 56,900)
= $717,670 – $83,017
= $634,653 (allowing rounding error)

12–32. (continued)

b. (continued)

For 80,000 units, estimated costs are:

$634,658 + ($1.459 x 80,000)
= $634,658 + $116,720
= $751,378

(Note: Your answer may differ somewhat because of rounding.)

c. Simple regression estimate:

Overhead = $626,547 + ($1.504 x Production units)
= $626,547 + ($1.504 x 80,000 units)
= $626,547 + $120,320
= $746,867

d. Multiple regression estimate:

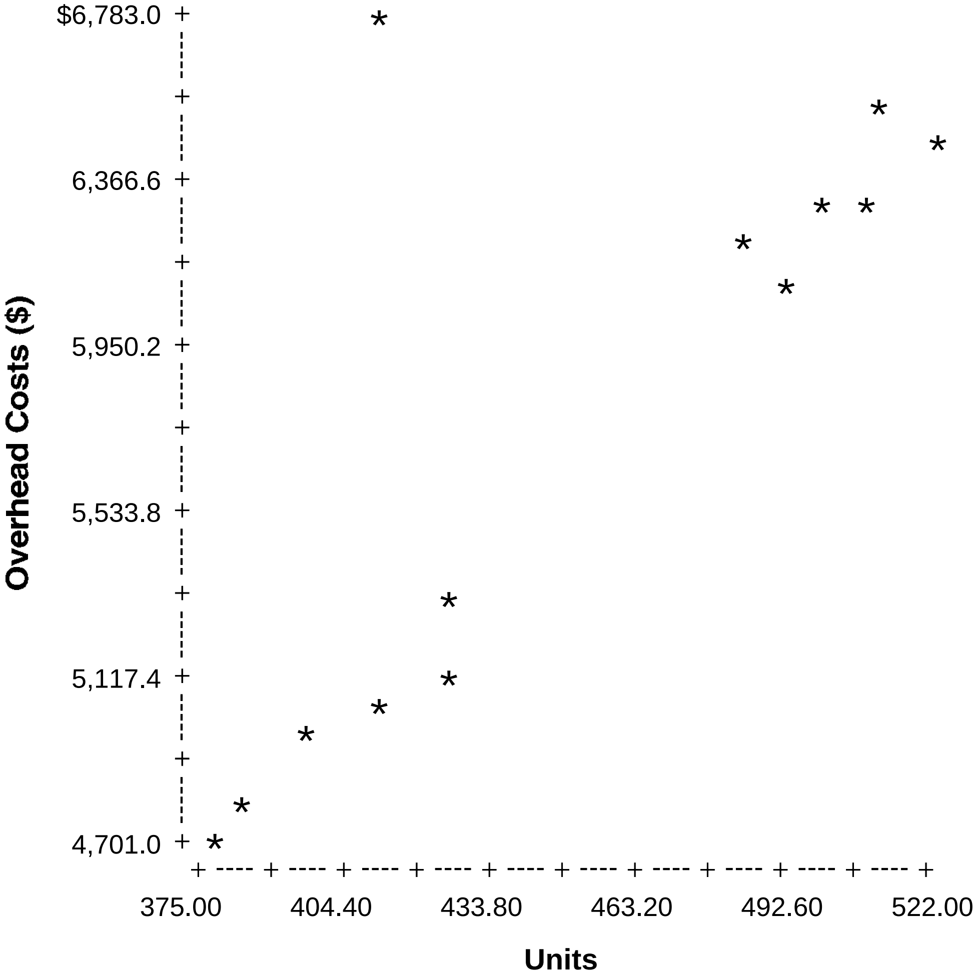
Overhead = $632,640 + ($1.501 x 80,000 units) – ($59.067 x 113 index level)
= $632,640 + $120,080 – $6,675
= $746,045

e. The multiple regression does not improve the fit over the simple regression (R^2 is virtually unchanged). Hence, multiple regression benefits may not justify data collection, analysis, and interpretation costs. Since the high-low method uses only two data points, its results are subject to some question. The simple regression has a high correlation coefficient and seems to "make sense." It would appear to offer the best estimate based on projections from past data. The account analysis approach is based on considerations of future prices and costs. A combination of account analysis and either simple or multiple regression would probably provide the best estimated relation between costs and activity.

12–33. (45 min.) *Interpreting regression results—simple regression.*

In the first place, the correlation coefficient of .82 implies that approximately 67% of the variation in overhead is explained by the equation. The unadjusted R-square is .67 (i.e., .82 squared). Of course, this is not a bad correlation for real data.

If we were to run the regression with the data given, the results would be as Gearld reported them. However, it would be helpful to see if the data meet the requirements of regression. Plotting the data on a scattergraph will show the following:



12–33. (continued)

As can be seen from an inspection of the scattergraph, observation number five appears to be an outlier. Such an outlier has affected the regression results.

Your comment to Gearld should be that the regression could be recomputed excluding the outlier. If this is done, the following regression results would be obtained (not required):

*****Regression Results*****

Equation:

Overhead = $326 + $11.686 per unit

Statistical data:

Correlation coefficient	.992
Adjusted R-square	.983
Standard error of the slope	.466
t-statistic for the slope	25.077

This estimate is substantially different than the initial regression. It indicates the effect that one substantial outlier can have on the results of a regression.

12–34. (30 min.) *Interpreting regression results—Multiple choice: Lerner, Inc.**

a. (4) Variable cost coefficient

b. (2) Dependent variable

c. (1) Independent variable

d. (2) $V = \$7.50 = \dfrac{\$1,650}{220 \text{ hours}} = \left(\dfrac{\$4,470 - \$2,820}{520 \text{ hours} - 300 \text{ hours}}\right);$

$F = \$570 = \$4,470 - (520 \text{ hours} \times \$7.50)$

e. (4) $\$3,746 = \$684.65 + (\$7.2884 \times 420 \text{ hours})$

f. (3) $\sqrt{.99724}$

g. (1) 99.724%

12–35. (45 min.) *Learning curves: Jammin' Corporation.*

a. The basic premise of the learning curve is that operating efficiency and/or productivity increases as experience is gained in the performance of repetitive tasks. Various inputs to the production process may be used more efficiently as cumulative output increases, but in most production processes the majority of cost savings associated with a learning phenomenon involve the use of human labor.

b. In the case of direct labor hours used in the production of Inexcess, i.e., lots of 8 units, this quantity can be calculated as:

$$\frac{(3{,}200 + 2{,}240)/16}{3{,}200/8} = \frac{340 \text{ average direct labor hours}}{400 \text{ average direct labor hours}}$$

$$= 85\%$$

c. Assuming this learning rate up to a cumulative output of 32 units, average direct labor hours used to produce these 32 units should equal 85% of the average direct labor hours used to produce the first 16 units. In short, average hours employed for each unit when 32 units are completed should equal:

$$340 \times .85 = 289 \text{ hours per unit.}$$

This implies a total of 289 x 32 = 9,248 hours used in the production of the first 32 units, or

$$9{,}248 - (3{,}200 + 2{,}240) = 3{,}808 \text{ hours}$$

used in the production of units 17 through 32. If the average hours per unit in this production batch is taken as the direct labor standard, the standard per unit becomes:

$$\frac{3{,}808 \text{ hours}}{16 \text{ units}} = 238 \text{ hours per unit.}$$

d. Given the direct labor standard determined above and Jammin's bid price formula, the bid price for the additional 96 units can be calculated as follows:

Input	*Quantity per Electrocal Unit*	*Cost per Input Unit*	*Cost per Electrocal Unit*
Materials	50 sq. feet	$30	$ 1,500
Direct labor	238 hours	25	5,950
Variable overhead	238 hours	40	9,520
Total variable manufacturing cost			$ 16,970
Markup (30%)			5,091
Bid price per unit			$ 22,061
x 96 units			x 96
Total bid price			$2,117,856

e. Some applications of the learning curve in the planning and controlling of business operations are preparing cost estimates in competitive bidding, determining budget allowances for labor and labor-related costs, scheduling labor requirements, and determining performance evaluations in which periodic progress reports are compared with accomplishments expected under the curve.

12–36. (40 min.) *Learning curves: Krylon Company.*

a. The analysis prepared by the engineering, manufacturing, and accounting departments of Krylon Company was not correct unless the potential labor cost improvements are ignored. A differential cost analysis similar to the one shown below should have been prepared to determine whether the gauges should be purchased or manufactured. In the analysis below, fixed factory overhead costs and general and administrative costs have not been included because they are not relevant; these costs would not increase because no additional equipment, space, or supervision would be required if the gauges were manufactured. Therefore, if potential labor cost improvements are ignored, Krylon Company should purchase the gauges because the purchase price of $68.00 is less than the $72.00 differential cost to manufacture them.

	Differential Cost Analysis	
	Cost of 10,000 Unit Assembly Run	*Per Unit*
Purchased components............	$120,000	$12.00
Assembly labor.........................	300,000	30.00
Variable factory overhead	300,000	30.00
Total incremental cost...........	$720,000	$72.00

12–36. (continued)

b. The following labor cost and variable overhead cost behavior by lots would occur (assuming 80% learning curve).

Quantity		*Cumulative Average Labor Cost per Unit*	*Total Cumulative Labor Cost*
Per Lot	*Cumulative*		
10,000	10,000	$30.00	$ 300,000
10,000	20,000	24.00(= 30 x .8)	480,000
20,000	40,000	19.20(= 24 x .8)	768,000
40,000	80,000	15.36(= 19.2 x .8)	1,228,800

This means the average cumulative cost of the assembly labor for the first 80,000 gauges is $15.36 per gauge. A revised analysis which considers an 80% learning factor is shown below:

	Cost per Unit	*Total*
Differential costs to manufacture 80,000 gauges		
Purchased components	$12.00	$ 960,000
Assembly labor	15.36	1,228,800
Variable factory overhead	15.36	1,228,800
Total incremental cost	$42.72	3,417,600
Cost to purchase	68.00	5,440,000
Savings if gauges are manufactured	$25.28	$2,022,400

(Note: We use the 80% learning curve here only as an example; other learning patterns exist in practice.)

If Krylon Company can experience a learning factor, it probably should manufacture the gauges rather than purchase them. The total incremental cost to manufacture the gauges is $3,417,600 or $42.72 per gauge as compared to the purchase price of $68.00 per unit or a total cost of $5,440,000 (= $68 x 80,000). This results in a total savings of $2,022,400 or $25.28 per gauge in the first year. With (say) an 80% learning curve by lot, Krylon's assembly labor and variable overhead costs should decrease by 20% every time there is a doubling of cumulative production. The reduction is possible as the laborers become more efficient in performing the tasks. (A steady-state phase will probably occur after a time as the operations become more routine or the production life is sufficiently long.)

Chapter 13

Cost-Volume-Profit Analysis

Solutions to Review Questions

13–1.

$$\begin{aligned}\pi &= TR - TC\\ &= PX - VX - F\\ &= (P - V)X - F\end{aligned}$$

where

π = operating profit,
TR = total revenue,
TC = total costs,
P = average unit selling price,
V = average unit variable cost,
X = quantity of units,
F = total fixed costs for the period.

13–2.
Total costs = Total variable costs plus total fixed costs.

13–3.
The total “contribution margin” is the excess of total revenue over total variable costs. The unit contribution margin is the excess of the unit price over the unit variable costs.

13–4.
Total contribution margin: Total Selling price – variable manufacturing costs expensed – variable nonmanufacturing costs expensed = Total contribution margin.

Gross margin: Total Selling price – variable manufacturing costs expensed – fixed manufacturing costs expensed = Gross margin.

13–5.
Profit-volume analysis plots only the contribution margin line against volume, while cost-volume-profit analysis plots total revenue and total costs against volume. Profit-volume analysis is a simpler, but less complete, method of presentation.

13–6.
Both unit prices and unit variable costs are expressed on a *per product basis,* as:

$$\pi = (P_1 - V_1)X_1 + (P_2 - V_2)X_2 + ... + (P_n - V_n)X_n - F,$$

for all products 1 to n. (The terms are defined in the solution to 13–1.)

13–7.
A constant product mix is assumed to simplify the analysis. Otherwise, there may be no unique solution.

13–8.
Contribution margin = $W_i(P_i - V_i)$ for i = 1 ... n: that is, $W_1(P_1 - V_1) + W_2(P_2 - V_2) + ... +$ Wn(Pn – Vn), where W refers to the weight assigned to each product. Usually this weight is each product's percent of total volume.

13–9.
The difference is:
Economic profits = Accounting net income minus the opportunity cost of owner-invested capital.

13–10.
Assumptions:

1. Revenues change proportionately with volume.
2. Variable costs change proportionately with volume.
3. Fixed costs do not change at all with volume.

(Other assumptions may include constant product mix and/or all CVP costs are expensed.)

13–11.
Costs that are "fixed in the short run" are usually not fixed in the long run. In fact few, if any, costs are fixed over a very long time horizon.

13–12.
Step costs included advertising, instructor's fees, room rent and audio-visual equipment rent. These costs would not be affected by the number of people attending the seminar (within the relevant range). If, however, more people than anticipated attend the seminar then these costs might increase, or step up, to a higher level. For example, at a certain point new instructors will have to be hired and new space and equipment will have to be rented.

Solutions to Critical Analysis and Discussion Questions

13–13.
A company operating at "break-even" is probably not covering costs which are not recorded in the accounting records. An example of such a cost is the opportunity cost of owner-invested capital. In some small businesses, owner-managers may not take a salary as large as the opportunity cost of forgone alternative employment. Hence, the opportunity cost of owner labor may be excluded.

13–14.
In the short run, without considering asset replacement, net operating cash flows would be expected to exceed net income, because the latter includes depreciation expense, while the former does not. Thus, the cash basis break-even would be lower than the accrual break-even if asset replacement is ignored. However, if asset replacement costs are taken into account, (i.e., on a "cradle to grave" basis), the long-run net cash flows equal long-run accrual net income, and the *long-run* break-even points are the same.

13–15.
If the relative proportions of products (i.e., the product "mix") is not held constant, products may be substituted for each other. Thus, there may be almost an infinite number of ways to achieve a target operating profit. As shown from the multiple product profit equation, there are several unknowns for one equation:

$$\pi = (P_1 - V_1)X_1 + (P_2 - V_2)X_2 + ... + (P_n - V_n)X_n - F,$$

for all products 1 to n.

13–16.
The sum of the break-even quantities would not be the break-even point for the company if there are common fixed costs which have not been allocated to the products.

13–17.
A forecasted cost-volume-profit line can be used as the flexible budget. It would show expected costs and revenues for a range of volume levels. These expected costs could later be compared to actual results for performance evaluation.

13–18.
There may be a difference between costs used in cost-volume-profit analysis and costs expensed in financial statements. A common example is fixed manufacturing costs. Cost-volume-profit analysis assumes fixed manufacturing costs are period costs, while they are treated as product costs for financial reporting. If part of current production is inventoried, some fixed manufacturing costs would not be expensed for financial reporting. On the other hand, if current sales include all of current production plus some from inventory, all fixed costs from this period plus some from previous periods would be expensed for financial reporting.

13–19.
The accountant makes use of a linear representation to simplify the analysis of costs and revenues. These simplifying assumptions are generally reasonable within a *relevant range* of activity. Within this range, it is generally believed that the additional costs required to employ nonlinear analysis cannot be justified in terms of the benefits obtained. Thus, within this range, the linear model is considered the "best" in a cost-benefit sense.

13–20.
As volume rises, it is likely that product markets will be saturated, leading to a need to cut prices to maintain or increase volume. This price cutting would result in a curvilinear revenue function. Moreover, as activity increases and approaches capacity constraints, costs tend to rise more than proportionately. Overtime premiums and shift pay differentials increase the unit labor costs. Similar costs may be incurred in terms of excess maintenance costs for running machines beyond their optimal performance levels, higher materials costs for any input commodity that is in short supply, and similar factors. These factors tend to cause costs to rise more than proportionately with an increase in activity.

13–21.
CVP analysis is usually conducted on a short-term basis. In the short run, there is usually not much that can be done to change the level of fixed costs. For this reason, fixed costs are usually accepted as given in a CVP setting. However, when management wishes to see the effect of a change in a company's cost structure (such as would arise from the purchase of labor-saving equipment), the fixed cost changes would become of interest to the analysis in conjunction with the changes in variable costs.

13–22.

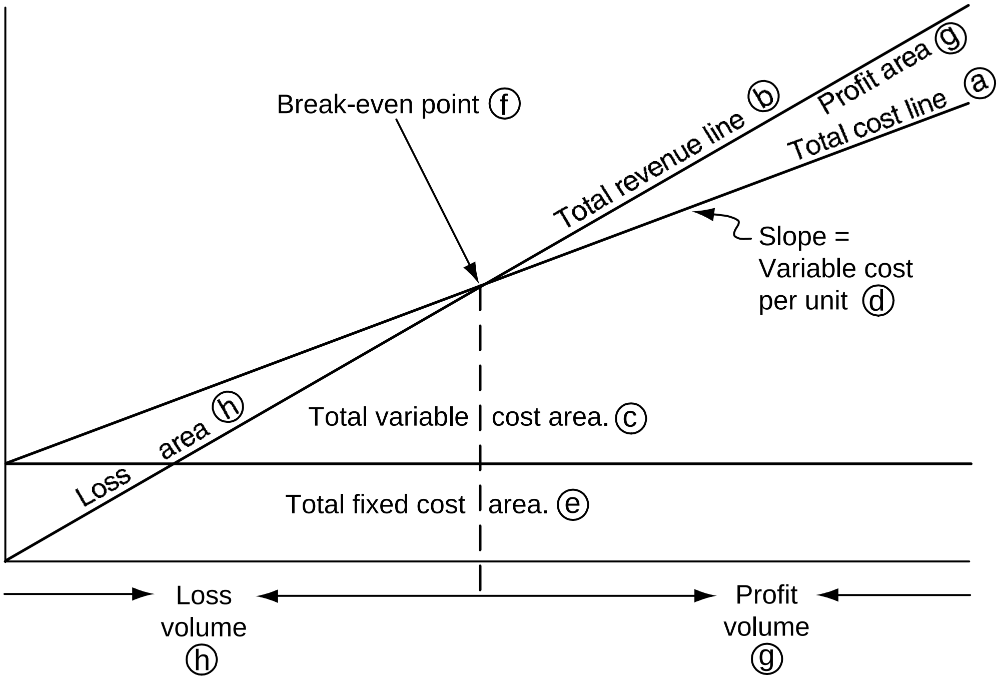
Under certain circumstances, the use of very simple representations of complex processes may be both useful and necessary. Insights can be gained by viewing a profit-volume graph that are not readily obtained by looking at detailed income statements. The simplifications of CVP analysis are intentional so that the decision maker will not be lost in details. However, there are a number of simplifying assumptions that should be noted when employing CVP analysis. For example, extrapolation beyond the relevant range can result in erroneous conclusions about probable profit levels. Such errors should be avoided when using this method. Moreover, if a more complex analysis is called for, then CVP analysis should not be employed.

13–23.

If the U.S. auto companies are unable to raise prices then they could decrease costs or change the product mix toward higher contribution margin cars in order to break even. For cost reduction, either reduce fixed costs, or reduce variable costs to increase the contribution margin.

Solutions to Exercises

13–24. (15 min.) *Profit equation—Components.*



13–25. (15 min.) *Profit equations—Components.*

a. Total fixed costs (loss at zero volume)

b. Break-even point

c. Slope = contribution margin per unit

d. Profit line

e. Profit area

f. Net loss area

g. Zero profit line

13–26. (20 min.) *Cost-volume-profit analysis: Galaxy Cinema.*

a. $3,600,000 ÷ 800,000 tickets = $4.50 per ticket

b. $2,400,000 ÷ 800,000 tickets = $3 per ticket

c. $4.50 – $3 = $1.50 per ticket

d. π = ($4.50 – $3)X – $750,000
Let π = 0

0 = ($4.50 – $3)X – $750,000

$$X = \frac{\$750{,}000}{(\$4.50 - \$3)} = \underline{\underline{500{,}000}} \text{ tickets}$$

e. Let π = $2,000,000

$2,000,000 = ($4.50 – $3)X – $750,000

$$X = \frac{\$2{,}750{,}000}{(\$4.50 - \$3)} = \underline{\underline{1{,}833{,}333}} \text{ tickets}$$

13–27. (10 min.) *CVP analysis—Planning and decision making.*

a. (1) Unit selling price must be increased.

b. (2) Decrease by the same amount.

c. (4) An increase in variable costs.

13–28. (25 min.) *CVP analysis—Planning and decision making: Airpower Corporation.*

a.

7,000 units:	(7,000)($8,000)	$56,000,000	PX
	(7,000)($4,800)	33,600,000	VX
	(7,000)($3,200)	22,400,000	(P – V)X
		24,000,000	F
		$(1,600,000)	π
10,000 units:	(10,000)($8,000)	$80,000,000	PX
	(10,000)($4,800)	48,000,000	VX
	(10,000)($3,200)	32,000,000	(P – V)X
		24,000,000	F
		$ 8,000,000	π

b. Break-even point:

$$\begin{aligned} \pi &= (P - V)X - F \\ \$0 &= (\$3{,}200)X - \$24{,}000{,}000 \\ \$3{,}200X &= \$24{,}000{,}000 \\ X &= \frac{\$24{,}000{,}000}{\$3{,}200} \\ X &= \underline{\underline{7{,}500}} \text{ units} \end{aligned}$$

13–29. (25 min.) *CVP analysis—Planning and decision making: Esmark, Inc.*

a. $\pi = (P - V)X - F$

$$0 = (\$100 - \$60)X - \$150{,}000$$

$$X = \frac{\$150{,}000}{(\$100 - \$60)} = \underline{\underline{3{,}750}} \text{ units}$$

b. $\$100{,}000 = (\$100 - \$60)X - \$150{,}000$

$$X = \frac{\$250{,}000}{(\$100 - \$60)} = \underline{\underline{6{,}250}} \text{ units}$$

13–30. (15 min.) *CVP analysis—Planning and decision making: Plume, Inc.*

a. $\pi = (\$100 - \$60)8{,}000 - \$150{,}000$

$= \underline{\underline{\$170{,}000}}$

b. 10% price decrease. Now P = $90

$\pi = (\$90 - \$60)8{,}000 - \$150{,}000$

$= \underline{\underline{\$90{,}000}}$. π decreases by $80,000

20% price increase. Now P = $120

$\pi = (\$120 - \$60)8{,}000 - \$150{,}000$

$= \underline{\underline{\$330{,}000}}$. π increases by $160,000

c. 10% variable cost decrease. Now V = $54

$\pi = (\$100 - \$54)8{,}000 - \$150{,}000$

$= \underline{\underline{\$218{,}000}}$. π increases by $48,000

20% variable cost increase. Now V = $72

$\pi = (\$100 - \$72)8{,}000 - \$150{,}000$

$= \underline{\underline{\$74{,}000}}$. π decreases by $96,000

d. $\pi = (\$100 - \$66)8{,}000 - \$135{,}000$

$= \underline{\underline{\$137{,}000}}$. π decreases by $33,000

13–31. (20 min.) *CVP analysis—Planning and decision making.*

a. (2)

b. (4)

c. (4) Cannot be determined without knowing variable cost per unit. (For example, if V = $.10, break-even increases; if V = $.90, break-even decreases; if V = $.50, break-even is not changed.)

13–32. (20 min.) *Extensions of the basic model—Semifixed (step) costs: Luress Co.*

a. Break-even points:

$$X = \frac{F}{P - V}$$

$$X(\text{Level } 1) = \frac{\$84{,}000}{\$15 - \$9} = 14{,}000 \text{ units}$$

$$X(\text{Level } 2) = \frac{\$123{,}000}{\$15 - \$9} = 20{,}500 \text{ units}$$

$$X(\text{Level } 3) = \frac{\$162{,}000}{\$15 - \$9} = 27{,}000 \text{ units}$$

The break-even for Level 3 is less than the minimum production for that level. Level 3 provides a profit for its entire range of activity; hence, there is no break-even point for Level 3.

b. Optimal level of production.

Level 1: $\pi = (\$15 - \$9)16{,}000 - \$84{,}000 = \underline{\underline{\$12{,}000}}$

Level 2: $\pi = (\$15 - \$9)28{,}000 - \$123{,}000 = \underline{\underline{\$45{,}000}}$

Level 3: $\pi = (\$15 - \$9)38{,}000 - \$162{,}000 = \underline{\underline{\$66{,}000}}$

Luress Company should operate at Level 3 and earn a maximum profit of $66,000 per month.

13–33. (15 min.) *Extensions of the basic model—Taxes: Melborne Surfboard Shop.*

a. (3) 30,000 units $= \dfrac{\$984{,}000}{(\$80.00 - \$47.20)}$

b. (4) 55,000 units

$$\begin{aligned}
\$492{,}000 &= [(\$80.00 - \$47.20)X - \$984{,}000](1 - .4) \\
\$492{,}000 &= \$32.80X\ (.6) - \$984{,}000\ (.6) \\
\$32.80X\ (.6) &= \$492{,}000 + \$984{,}000\ (.6) \\
\$19.68X &= \$492{,}000 + \$590{,}400 \\
X &= \frac{\$492{,}000 + \$590{,}400}{\$19.68} \\
&= \frac{\$1{,}082{,}400}{\$19.68} \\
&= 55{,}000 \text{ units}
\end{aligned}$$

13–34. (20 min.) *Extensions of the basic model—Taxes: Luxurious Hair Products.*

Sales Price: $8 per unit
V: $2 per unit
F: $216,000 per year

a.

$$\begin{aligned}
\pi &= (P - V)X - F \\
0 &= (\$8 - \$2)X - \$216{,}000 \\
\$216{,}000 &= (\$8 - \$2)X \\
X &= \frac{\$216{,}000}{(\$8 - \$2)} \\
&= \underline{\underline{36{,}000}} \text{ units}
\end{aligned}$$

b.

$$\begin{aligned}
X &= \frac{\$216{,}000 + \$60{,}000}{(\$8 - \$2)} \\
&= \underline{\underline{46{,}000}} \text{ units}
\end{aligned}$$

c.

$$\begin{aligned}
\pi_a &= [(P - V)X - F](1 - t) \\
\$60{,}000 &= [(\$8 - \$2)X - \$216{,}000](1 - .40) \\
\$60{,}000 &= (\$6X - \$216{,}000)(.60) \\
\frac{\$60{,}000}{.60} &= \$6X - \$216{,}000 \\
\$216{,}000 + \frac{\$60{,}000}{.60} &= \$6X \\
\$6X &= \$216{,}000 + \$100{,}000 \\
X &= \frac{\$316{,}000}{\$6} \\
X &= \underline{\underline{52{,}667}} \text{ units (rounded)}
\end{aligned}$$

13–35. (30 min.) *Using CVP analysis to measure volume: Hose's Herbal Remedies.*

Break-even point in sales dollars:

a.
$$PX = \frac{F}{\text{CM ratio}}$$

$$PX = \frac{\$56{,}000}{1/3}$$

$$1/3\ PX = \$56{,}000$$

$$PX = \$168{,}000$$

b.
$$PX = \frac{F}{\text{CM ratio}}$$

$$PX = \$56{,}000/(4/10)$$

$$PX = \$56{,}000 \times (10/4)$$

$$PX = \$140{,}000$$

Note: CM ratio refers to contribution margin ratio.

13-36. (30 min.) *CVP analysis–multiple products: Lorocette's Sandwich Shop.*

a.

$$\begin{array}{ccccrc}
\textit{6-Inch Sandwich} & & \textit{12-Inch Sandwich} & & & \\
(10{,}000)(\$4) & + & (15{,}000)(\$6) & = & \$130{,}000 & PX \\
\underline{(10{,}000)(\$2)} & + & \underline{(15{,}000)(\$3.50)} & = & \underline{72{,}500} & \underline{VX} \\
(10{,}000)(\$2) & + & (15{,}000)(\$2.50) & & \$\ 57{,}500 & (P-V)X \\
 & & & & \underline{34{,}500} & \underline{F} \\
 & & & & \underline{\underline{\$\ 23{,}000}} & \pi
\end{array}$$

b. Compute weight times contribution margins for each product.

$$\left(\frac{10{,}000}{10{,}000+15{,}000}\right)\left(\$2\right) + \left(\frac{15{,}000}{10{,}000+15{,}000}\right)\left(\$2.50\right)$$

$$\begin{aligned}
&= (0.4)(\$2) + (0.6)(\$2.50) \\
&= \$.80 + \$1.50 \\
\text{Weighted average CM} &= \underline{\underline{\$2.30}}
\end{aligned}$$

Compute break-even:

$$\begin{aligned}
\pi &= (P-V)X - F \\
\$0 &= \$2.30X - \$34{,}500 \\
\$2.30X &= \$34{,}500 \\
X &= \frac{\$34{,}500}{\$2.30} \\
X &= \underline{\underline{15{,}000}} \text{ total units}
\end{aligned}$$

6-inch: produce (0.4)(15,000) = 6,000 units

12-inch: produce (0.6)(15,000) = 9,000 units

13–36. (continued)

c. New weights:

$$\left(\frac{4}{4+1}\right)\left(\$2\right) + \left(\frac{1}{4+1}\right)\left(\$2.50\right)$$

$$= (0.8)(\$2) + (0.2)(\$2.50)$$
$$= \$1.60 + \$.50$$
$$= \underline{\underline{\$2.10}}$$

Break-even:

$$\pi = (P - V)X - F$$
$$\$0 = \$2.10X - \$34{,}500$$
$$\$2.10X = \$34{,}500$$
$$X = \frac{\$34{,}500}{\$2.10}$$
$$X = \underline{\underline{16{,}429}} \text{ total units}$$

6-inch: produce (0.8)(16,429) = 13,143 units

12-inch: produce (0.2)(16,429) = 3,286 units

13–37. (30 min.) *CVP analysis—Multiple products: Almay.*

a. To compute break-even sales dollars, find weighted-average price (P*) and variable costs (V*):

$$P^* = (1/2 \times \$6) + (1/3 \times \$10) + (1/6 \times \$16)$$
$$= \underline{\underline{\$9}}$$

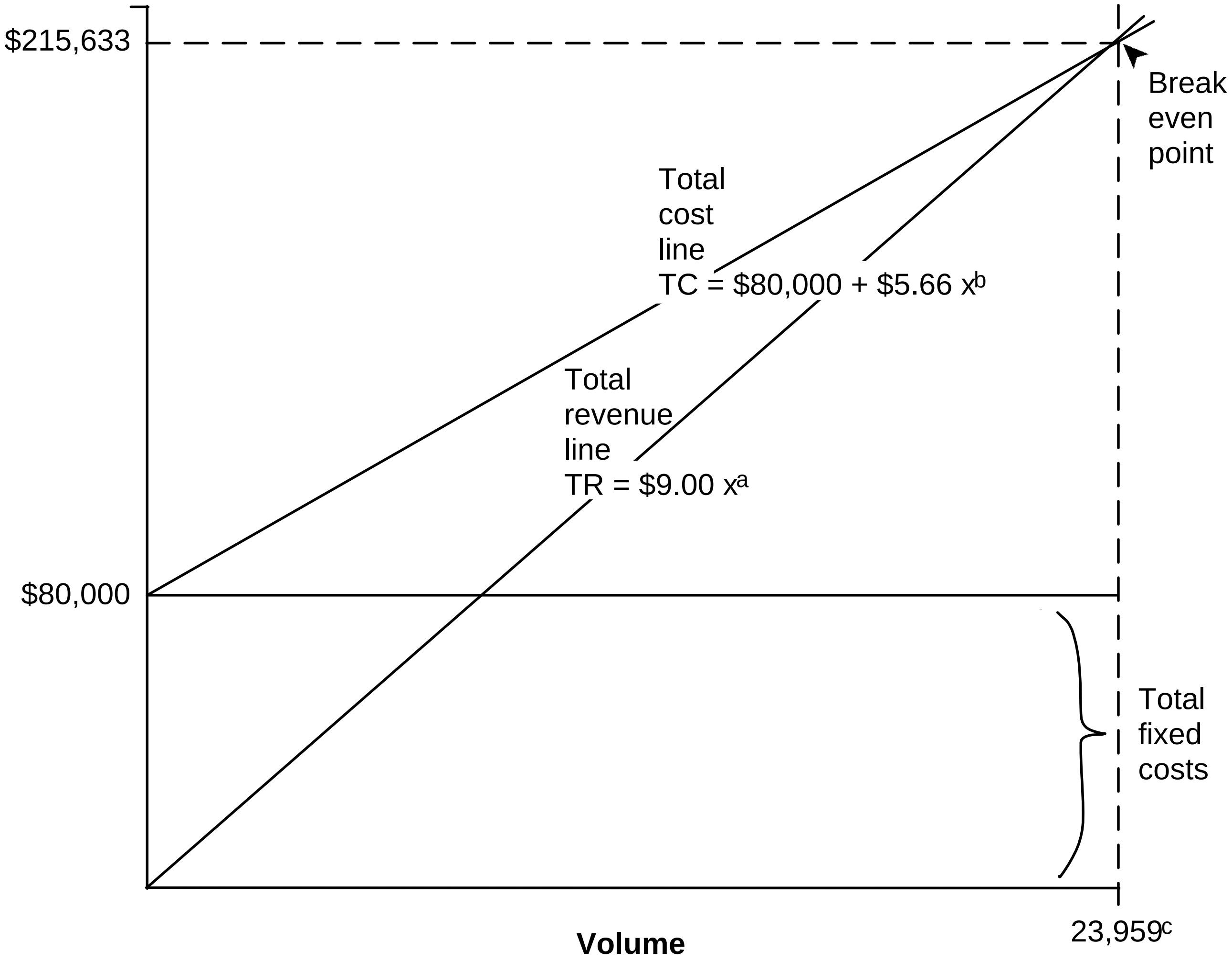
$$V^* = (1/2 \times \$4) + (1/3 \times \$6) + (1/6 \times \$10)$$
$$= \underline{\underline{\$5.66}}$$

$$\text{Break-even sales} = \$80{,}000/\left(\frac{\$9.00 - \$5.66}{\$9.00}\right)$$
$$= \frac{\$80{,}000}{.371} \quad \text{(rounded)}$$
$$= \underline{\underline{\$215{,}633}}$$

13–37. (continued)

b.

Cost-Volume-Profit Graph



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[a] Weighted-average revenues = (50% x \$6) + (33.3% x \$10) + (16.7% x \$16) = $\underline{\underline{\$9.00}}$.

[b] Weighted-average costs = (50% x \$4) = (33.3% x \$6) + (16.7% x \$10) = $\underline{\underline{\$5.66}}$.

[c] $23{,}959 = \dfrac{\$215{,}633}{\$9.00}$

13–38. (30 min.) *Analysis of Cost Structure. Meribell Co. vs. Forshiem Co.*

	Meribell Co.		*Forshiem*	
	Amount	*Percentage*	*Amount*	*Percentage*
Sales	$1,000,000	100	$1,000,000	100
Variable costs	700,000	70	200,000	20
Contribution margin	300,000	30	800,000	80
Fixed costs	60,000	6	560,000	56
Operating profit	$ 240,000	24	$ 240,000	24

b. Meribell profits increase by $30,000 [= .30 x ($1,000,000 x .10)] and Forshiem profits increase by $80,000 [= .80 x ($1,000,000 x .10)].

13–39. (15 min.) *Thyme Corporation.*

a. Contribution margin ratio $= \frac{\text{Contribution margin}}{\text{Sales}}$

$= \frac{\$800{,}000}{\$2{,}000{,}000}$

$= \underline{\underline{40\%}}$

b. Contribution margin per unit $= \frac{\$800{,}000}{500{,}000} = \underline{\underline{\$1.60}}$

Solutions to Problems

13–40. (35 min.) *CVP and decisions: Schill Education Corporation.*

Sales Price:	$90 per unit
Fixed costs:	$800,000 office and administration
	$720,000 publishing
Variable costs:	$15 promotion
	$6 administration
	$12 materials
Present units sold:	25,000 per year

a. Break-even

Price	$90 per unit
Var. costs	33 per unit
Cont. margin	$57 per unit

Sales:

$$\begin{aligned} \pi &= (P - V)X - F \\ 0 &= (\$90 - \$33)X - \$1{,}520{,}000 \\ \$1{,}520{,}000 &= (\$90 - \$33)X \\ X &= \frac{\$1{,}520{,}000}{\$57} \\ X &= \underline{\underline{26{,}667}} \text{ units} \end{aligned}$$

13–40. (continued)

b. Profit effect

Present profit

Sales	25,000 x $90 =	$2,250,000
Variable Costs	25,000 x $33 =	825,000
Contribution margin		1,425,000
Fixed costs		1,520,000
Operating profit (loss)		$ (95,000)

With Representative

Sales	35,000 x $90 =	$3,150,000
Promo. (new)	10,000 x $20 =	200,000
Sales com.	10,000 x $90 x 25% =	225,000
Promo. (old)	25,000 x $15 =	375,000
Admin.	35,000 x $ 6 =	210,000
Materials	35,000 x $12 =	420,000
Cont. margin		1,720,000
Fixed costs		1,520,000
Operating profit		$ 200,000

Improved profit performance by $295,000.

c. Profit effect at sales of 25,000 units

Sales	25,000 x $90 =	$2,250,000
Promo.	25,000 x $15 =	375,000
Admin.	25,000 x $ 6 =	150,000
Publisher cost	25,000 x $40 =	1,000,000
Cont. margin		725,000
Fixed costs		800,000
Operating profit		$ (75,000)

Profit improves (loss lessens) by $20,000 over present profit (loss).

Profit effect at sales of 40,000 units

Sales	40,000 x $90 =	$3,600,000
Promo.	40,000 x $15 =	600,000
Admin.	40,000 x $ 6 =	240,000
Pub. cost	40,000 x $40 =	1,600,000
Cont. margin		1,160,000
Fixed costs		800,000
Operating profit		$ 360,000

Improved profit performance by $455,000.

13–41. (35 min.) *CVP analysis and price changes: Knoll's Manufacturing.*

a. Variable costs. New variable cost per unit:

$$\overset{\textit{Labor}}{(110\%)(25\%)(\$8)} + \overset{\textit{Materials}}{(115\%)(50\%)(\$8)} + \overset{\textit{Overhead}}{(105\%)(25\%)(\$8)} = \$8.90$$

Price: New price = (108%)($15) = $16.20

Fixed costs: New fixed costs = (102%)($1,120,000) = $1,142,400

Sales: Profit target = $280,000

$$\pi = (P - V)X - F$$

$$\$280{,}000 = (\$16.20 - \$8.90)X - \$1{,}142{,}400$$

$$X = \frac{\$1{,}142{,}400 + \$280{,}000}{\$16.20 - \$8.90}$$

$$= 194{,}849 \text{ units (rounded)}$$

or sales of

$$(194{,}849)(\$16.20) = \underline{\underline{\$3{,}156{,}554}}$$

b. Profit target = ($280,000)(106%) = $296,800

$$\pi = (P - V)X - F$$

$$\$296{,}800 = (\$16.20 - \$8.90)X - \$1{,}142{,}400$$

$$X = \frac{\$1{,}142{,}400 + \$296{,}800}{\$16.20 - \$8.90}$$

$$= \underline{\underline{197{,}151}} \text{ units, or sales of}$$

$$(197{,}151)(\$16.20) = \underline{\underline{\$3{,}193{,}846}}$$

c.

$$\pi = PX - VX - F$$

$$\$296{,}800 = P(200{,}000) - (\$8.90)(200{,}000) - \$1{,}142{,}400$$

$$P = \frac{\$296{,}800 + \$1{,}780{,}000 + \$1{,}142{,}400}{200{,}000}$$

$$P = \underline{\underline{\$16.10}} \text{ (rounded) or a 7.3\% increase}$$

13-42. (20 min.) *CVP analysis: Softcush Company.*

a. (1) $97{,}500 \text{ units} = \dfrac{\$468{,}000}{(\$25.00 - \$20.20^{a})}$

b. (1) \$25.51

Current contribution-margin ratio: $\dfrac{(\$25.00 - \$19.80)}{\$25.00} = .208$

New sales price:

$$\begin{aligned} \frac{(X - \$20.20)}{X} &= .208 \\ X - \$20.20 &= (.208)X \\ (1 - .208)X &= \$20.20 \\ X &= \frac{\$20.20}{.792} \\ &= \$25.51 \end{aligned}$$

---

[a] Reflects 8% increase in direct labor.

13–43. (35 min.) *CVP analysis with changes in cost structure: Pallamer Prefab.*

Present Facilities	*Semiautomatic Machine*	*Fully Automatic Machine*

Break-even point:

Present Facilities

$$\begin{aligned} \pi &= (P - V)X - F \\ 0 &= (\$1.50)X - \$300{,}000 \\ \$300{,}000 &= \$1.50X \\ X &= \frac{\$300{,}000}{\$1.50} \\ &= \underline{\underline{200{,}000}} \text{ units} \end{aligned}$$

Semiautomatic Machine

$$\begin{aligned} \pi &= (P - V)X - F \\ 0 &= (\$2.75)X - \$550{,}000 \\ \$550{,}000 &= \$2.75X \\ X &= \frac{\$550{,}000}{\$2.75} \\ &= \underline{\underline{200{,}000}} \text{ units} \end{aligned}$$

Fully Automatic Machine

$$\begin{aligned} \pi &= (P - V)X - F \\ 0 &= (\$4.00)X - \$800{,}000 \\ \$800{,}000 &= \$4.00X \\ X &= \frac{\$800{,}000}{\$4.00} \\ &= \underline{\underline{200{,}000}} \text{ units} \end{aligned}$$

175,000 units

Sales	(175,000)($6) =	$1,050,000		$1,050,000		$1,050,000
Var. costs	(175,000)($4.50) =	787,500	(175,000)($3.25) =	568,750	(175,000)($2) =	350,000
Cont. margin	(175,000)($1.50) =	262,500	(175,000)($2.75) =	481,250	(175,000)($4) =	700,000
Fixed costs		300,000		550,000		800,000
Operating profit		$ (37,500)		$ (68,750)		$ (100,000)

250,000 units

		Alt. 1		*Alt. 2*		*Alt. 3*
Sales	(250,000)($6) =	$1,500,000		$1,500,000		$1,500,000
Var. costs	(250,000)($4.50) =	1,125,000	(250,000)($3.25) =	812,500	(250,000)($2) =	500,000
Cont. margin	(250,000)($1.50) =	375,000	(250,000)($2.75) =	687,500	(250,000)($4) =	1,000,000
Fixed costs		300,000		550,000		800,000
Operating profit		$ 75,000		$ 137,500		$ 200,000

13–44. (35 min.) *CVP analysis with semifixed costs: Le Muir Preschool.*

a. Operating profit = [($400 – $100)30 students] – [$1,200 x 6 teachers] – $1,000

= $9,000 – $7,200 – $1,000

= $\underline{\underline{\$800}}$

b. π = ($400 – $100)X – $1,200Q – $1,000,

where X = number of students and Q = number of teachers. (Note: An incorrect but common method is to substitute the ratio X/6 for Q and solve for X. This gives 9 students, but it assumes 1 1/2 teachers are employed.)

This part demonstrates the impact of step costs on cost-volume-profit analysis.

0–6 students: $\pi = \$300X - \$1{,}200 - \$1{,}000$

$$X = \frac{\$2{,}200}{\$300} = \underline{\underline{7\ 1/3}}\text{ students, which is infeasible}$$

7–12 students: $\pi = \$300X - \$2{,}400 - \$1{,}000$

$$X = \frac{\$3{,}400}{\$300} = \underline{\underline{11\ 1/3}}\text{ students}$$

13–18 students: $\pi = \$300X - \$3{,}600 - \$1{,}000$

$$X = \frac{\$4{,}600}{\$300} = \underline{\underline{15\ 1/3}}\text{ students}$$

The Center shows a profit at 12 students, but a loss at 13, 14, or 15 students, then showing a profit again at 16 students.

c. π = $300X – $1,200Q – $1,000, where X = the number of students and Q = the number of teachers.

0–10 students: $\pi = \$300X - \$1{,}200 - \$1{,}000$

$$X = \frac{\$2{,}200}{\$300} = \underline{\underline{7\ 1/3}}\text{ students}$$

11–20 students: $\pi = 300X - \$2{,}400 - \$1{,}000$

$$X = \frac{\$3{,}400}{\$300} = \underline{\underline{11\ 1/3}}\text{ students}$$

That is, at 10 students, the center would show a profit of $800 (i.e., ($300 x 10) – $1,200 – $1,000), but at 11 1/3 students it would just break even.

13–44. (continued)

d. *Yes.* The Center would increase profit by $1,800. Two methods are presented here:

1) Total method:

Status quo: π = $800, (From Part a)
Alternative: π = ($300 x 36 students) – ($1,200 x 6 teachers) – $1,000
= $10,800 – $7,200 – $1,000
= $\underline{\underline{\$2,600}}$

2) Differential method:

Increase in total contribution = $300 x 6 = $1,800. No change in fixed or step costs.

e. Profit would decrease by $900. Although the total contribution would increase by $300, another teacher would be hired at a cost of $1,200, if the *maximum* 6:1 student-teacher ratio is to be maintained.

13–45. (40 min.) *Profit-targets: Maus and Company.*

a.

$$\begin{aligned} \pi_a &= [(P - V)X - F](1 - t) \\ \pi_a &= [(\$25 - \$13.75)(20{,}000) - \$135{,}000](1 - .4) \\ &= \underline{\underline{\$54{,}000}} \end{aligned}$$

b.

$$\begin{aligned} \pi_a &= [(P - V)X - F](1 - t) \\ 0 &= [(\$25 - \$13.75)X - \$135{,}000](1 - .4) \\ &= [\$11.25X - \$135{,}000](.6) \\ &= \$6.75X - \$81{,}000 \\ \$81{,}000 &= \$6.75X \\ X &= \frac{\$81{,}000}{\$6.75} \\ &= \underline{\underline{12{,}000}}\text{ units} \end{aligned}$$

c.

$$\begin{aligned} \pi_a &= [(P - V)X - F](1 - t) \\ \pi_a &= [(\$11.25)(22{,}000) - \$135{,}000 - \$11{,}250](1 - .4) \\ &= \underline{\underline{\$60{,}750}} \end{aligned}$$

d.

$$\begin{aligned} \pi_a &= [(P - V)X - F](1 - t) \\ 0 &= [(\$11.25)X - \$135{,}000 - \$11{,}250](1 - .4) \\ 0 &= \$6.75X - \$87{,}750 \\ X &= \frac{\$87{,}750}{\$6.75} \\ &= 13{,}000\text{ units} \\ (13{,}000)(\$25) &= \underline{\underline{\$325{,}000}} \end{aligned}$$

13–45. (continued)

e.

$$\begin{aligned}
\pi_a &= [(P - V)X - F](1 - t) \\
\$54{,}000 &= [(\$11.25)X - \$146{,}250](1 - .4) \\
\$54{,}000 &= \$6.75X - \$87{,}750 \\
\$141{,}750 &= \$6.75X \\
X &= \frac{\$141{,}750}{\$6.75} \\
&= 21{,}000 \text{ units} \\
(21{,}000)(\$25) &= \underline{\underline{\$525{,}000}}
\end{aligned}$$

f.

$$\begin{aligned}
\pi_a &= [(P - V)X - F](1 - t) \\
\$60{,}000 &= [(\$11.25)(22{,}000) - F](1 - .4) \\
\$60{,}000 &= \$148{,}500 - .6F \\
\$88{,}500 &= .6F \\
F &= \frac{\$88{,}500}{.6} \\
&= \$147{,}500
\end{aligned}$$

Subtracting fixed costs of $135,000 from $147,500 leaves $12,500 available for advertising.

Note: Parts *d* and *e* can also be solved using the contribution margin ratio.

13–46. (40 min.) *CVP analysis with semifixed costs and changing unit variable costs: Theloneous & Company.*

First find the variable cost last year:

$$
\begin{aligned}
\pi &= PX - VX - F \\
-\$20{,}000 &= (\$50)(12{,}000 \text{ units}) - (V)(12{,}000 \text{ units}) - \$200{,}000(\text{level } 1) \\
-\$20{,}000 &= \$600{,}000 - V(12{,}000 \text{ units}) - \$200{,}000 \\
V &= \frac{\$420{,}000}{12{,}000} \\
&= \underline{\underline{\$35.00}} \text{ per unit}
\end{aligned}
$$

a. Level 1: $P - V = \$50 - \$35 = \underline{\underline{\$15}}$ per unit

Level 2: $P - (1.2)V = \$50 - 1.2(\$35) = \$50 - \$42 = \underline{\underline{\$8.00}}$ per unit

b. Level 1: $X = \dfrac{F}{P - V} = \dfrac{\$200{,}000}{\$50 - \$35} = \underline{\underline{13{,}333}}$ units (rounded)

Level 2:

$$
\begin{aligned}
0 &= (\$15)(15{,}000 \text{ units}) + \$8(X - 15{,}000) - \$264{,}000 \\
&= \$225{,}000 + \$8X - \$120{,}000 - \$264{,}000 \\
\$8X &= \$120{,}000 + \$264{,}000 - \$225{,}000 \\
\$8X &= \$159{,}000 \\
X &= \underline{\underline{19{,}875}} \text{ units}
\end{aligned}
$$

c. Level 1:

$$
\begin{aligned}
\pi &= (P - V)X - F \\
\pi &= (\$50 - \$35)15{,}000 - \$200{,}000 = \underline{\underline{\$25{,}000}}
\end{aligned}
$$

Level 2:

$$
\pi = (\$50 - \$35)15{,}000 + (\$50 - \$42)10{,}000 - \$264{,}000 = \underline{\underline{\$41{,}000}}
$$

The company is more profitable in Level 2 at 25,000 units.

Solution to Integrative Case

13–47. (60 min.) *Converting full-absorption costing income statements to CVP analysis: Crandell Products.**

Here is a version of the income statement using a contribution margin format.

a.

Crandell Products
Income Statement
For the Year Ended April 30, Year 4
(in thousands)

	Cereals	*Breakfast Bars*	*Dog Food*	*Total*
Sales in pounds	2,000	500	500	3,000
Revenue from sales	$1,000	$400	$200	$1,600
Variable manufacturing costs				
Direct materials	$ 330	$160	$100	$ 590
Direct labor	90	40	20	150
Factory overhead	27	12	6	45
Total variable manufacturing costs	447	212	126	785
Manufacturing contribution margin	553	188	74	815
Other variable costs				
Commissions	50	40	20	110
Contribution margin	503	148	54	705
Direct operating costs				
Advertising	50	30	20	100
Licenses	50	20	15	85
Total direct operating costs	100	50	35	185
Product contribution	$ 403	$ 98	$ 19	520
Fixed costs				
Factory overhead[a]				135
Sales salaries & benefits				60
G & A salaries & benefits				100
Total fixed expenses				295
Operating profit before taxes				$ 225

CMA adapted

[a] Assumes supervisory and plant occupancy costs are fixed.

13–47. (continued)

b. (1) Advantages which CVP analysis could provide would include:

   - Determining the marginal contribution of products which can assist management in planning sales volume and profitability including the calculation of a break-even point.
   - Identify products which can support heavy sales promotion expenditures.
   - Assist in decisions relating to eliminating a product.
   - Accepting a special order at a discounted price.

   (2) Difficulties Crandell Products could expect to have on the CVP calculations include:

   - Separating mixed costs into their fixed and variable components.
   - Determining how to treat joint or common costs.
   - Determining efficiency and productivity within the relevant range.
   - Determining a constant sales mix within the relevant range.

   (3) Crandell Products should be aware of the following dangers when using CVP analysis:

   - The use of inaccurate assumptions for the calculations.
   - CVP analysis tends to focus on the short term.
   - CVP analysis tends to focus on incremental variable costs, but fixed costs must also be managed and controlled.

Chapter 14
Differential Cost and Revenue Analysis

Solutions to Review Questions

14–1.
Fixed costs are differential if capacity is changed or in other cases when fixed costs can be eliminated. For example, a transportation authority might decide that they need to add another bus to a heavily used route. The fixed costs of the additional bus would be differential.

14–2.
A sunk cost has taken place in the past and cannot be changed. A differential cost is one that will change with a given decision.

14–3.
Strictly speaking, sunk costs can never be differential costs. However, sunk costs can determine the amounts of certain differential costs. For example, federal income taxes are based on historical (sunk) costs. The disposal of a fixed asset may result in a tax based on the difference between the sales proceeds and the undepreciated sunk cost. Many contracts are based on sunk costs as well. Decisions may have contract implications that arise with changes in plans.

14–4. (10 min.) *Multiple Choice.**

a. (5) The differential cost of producing the order.

b. (2) Depreciation.

---

*CPA adapted

14–5.
Short-run decisions affect operations within one year (for example, the decision to accept a special order). Long-run decisions affect operations for greater than one year (for example, expansion of plant capacity).

14–6.
The full cost of a product is the sum of all fixed and variable costs of manufacturing and selling a unit. Full cost is not always appropriate for making decisions—especially short-run decisions. Fixed costs are often irrelevant for short-run decisions (i.e., fixed costs often remain unchanged from the status quo to the alternative).

14–7.
The three major influences on pricing are customers, competitors, and costs. If customers are not willing to pay a price above the company's cost, or if competitors are able to sell the product below a company's cost, then using cost to set prices may result in low sales and unprofitable product lines.

14–8.
The product life cycle covers the time from initial research and development to the time at which support to the customer is withdrawn. Managers estimate revenues and costs throughout the product's life cycle to make pricing decisions.

14–9.
Cost-plus pricing is most likely to be used for unique products where no market price information exists—areas like construction jobs, defense contracts, and custom orders.

14–10.
Target cost is the target price minus some desired profit margin. Target price is a price set by management based on customers' perceived value for the product and the price competitors charge. There are four steps to developing target prices and target costs:

1. Develop a product that satisfies the needs of potential customers.
2. Choose a target price based on consumers' perceived value of the product and the prices competitors charge.
3. Derive a target cost by subtracting the desired profit margin from the target price.
4. Perform value engineering to achieve target costs.

Solutions to Critical Analysis and Discussion Questions

14–11.
Variable costs are usually relevant when talking about changes in production volumes. However, if the change in production volume extends beyond the "relevant range," some fixed costs may also be differential. In addition, there are opportunity costs that may be differential for a certain decision. In some cases there may be no change in variable costs. For example, if a company were to add a second copier in the office workroom to expedite copying, the number of copies produced would be unchanged, but the fixed costs of the equipment would approximately double.

14–12.
In the short-run, sales revenues need only cover the differential costs of production and sale. So, from a short-run perspective so long as the sale does not affect other output prices or normal sales volume, a "below cost" sale may result in a net increase in income so long as the revenues cover the differential costs. However, in the long-run all costs must be covered or management would not reinvest in the same type of assets. If the company must continually sell below the full cost of production then they will most likely get out of that particular business when it comes time to replace those facilities.

14–13.
Variable costs:

Fuel

Wear and tear related to miles driven such as tires, mileage-related maintenance, lube and oil

Parking and tolls, if any

Car wash if needed due to the trip

Risk of casualties that vary with mileage

Other costs that vary with mileage

14–14.

Differential costs:

Cost of the car

Forgone interest income on funds paid for the car

Interest on debt on the car

Insurance

Maintenance that is time-related

License and taxes

These costs are different than the costs in 14-13. The costs in 14-13 are those required to operate the car for an additional few miles. The costs that vary with the number of cars do not vary with mileage. The costs in 14.14 vary with the number of cars and not with the mileage driven.

Of course, there is the possibility that if you buy a new car you will be asked to drive your friends around more often than otherwise.

14–15.

Activity-based costing may actually provide better cost information than costing systems that allocate indirect costs based on one volume-based cost driver. Activity-based costing provides more detailed cost data that might lead to more informed decision making regarding prices. Since market prices are typically not available for custom orders, many companies use cost-plus pricing. Since this company uses activity-based costing, it has the cost information necessary to use a cost-plus costing approach.

14–16.

The most difficult part of this task will likely be assigning indirect costs to each customer. For example, how will fixed costs (rent, salaries, insurance, etc.) be allocated to each customer? Whatever the allocation base, there will be some level of arbitrariness to the allocation. Also, if the accounting system does not easily track revenues and direct costs by customer, this project will be difficult to carry out.

14–17.

First, if the customers are dropped will overall company profits increase? (The amount of indirect costs allocated to each customer that will not necessarily be eliminated by dropping these customers will be the primary factor in answering this question.) If overall company profits do not increase by dropping these customers, they should be retained.

Next, other nonfinancial factors must be considered in deciding whether to drop these customers: Will the company’s reputation be tarnished? Will these customers be profitable in the future?

Solutions to Exercises

14–18. (15 min.) *Using differential analysis: Peterson Publishing Machinery.*

Revenue	$4,500
Less:	
Cost to remachine	2,500
Opportunity cost of scrap sale	1,500
Contribution from remachining	$ 500

It is optimal to retool the binding machines.

Alternative presentation:

	Status Quo (Scrap Sale)	*Alternative (Remachining)*	*Difference*
Revenue	$1,500	$4,500	$3,000 (higher)
Cost to remachine	–0–	2,500	2,500 (higher)
Contribution	$1,500	$2,000	$ 500 (higher)

The $10,000 original cost is sunk.

14–19. (25 min.) *Special orders: Torous Company.*

	Status Quo 400,000 Units	*Alternative 450,000 Units*	*Difference*
Revenues	$8,000,000	$8,650,000	$650,000 (higher)
Variable costs:			
Manufacturing[a]	3,600,000	4,050,000	450,000 (higher)
Marketing[b]	400,000	400,000	–0–
Contribution margin	4,000,000	4,200,000	200,000 (higher)
Fixed costs	3,000,000	3,000,000	–0–
Operating profit	$1,000,000	$1,200,000	$200,000 (higher)

[a] $\$16 \times \frac{\$6{,}400{,}000 - \$2{,}800{,}000}{\$6{,}400{,}000} = \$9.00$ unit

$9.00 per unit x 50,000 = $450,000 additional cost.

[b] No additional marketing costs according to the exercise.

Alternative presentation.

	Per Unit	*50,000 Units*
Revenues	$13.00	$650,000
Variable costs:		
Manufacturing costs:		
$\$16 \times \frac{\$6{,}400{,}000 - \$2{,}800{,}000}{\$6{,}400{,}000} =$	9.00	450,000
Contribution to operating profit	$4.00	$200,000

14–20. (40 min.) *Special orders: Pralina Products Company.**

a. The difference in unit cost was caused by the difference in average unit cost of factory overhead. The computations for costs per unit follow:

	Cost per Unit	
	100,000 Units of Output	*160,000 Units of Output*
Direct material:		
$150,000/100,000 units	$1.50	
$240,000/160,000 units		$1.50
Direct labor:		
$150,000/100,000 units	1.50	
$240,000/160,000 units		1.50
Factory overhead:		
$400,000/100,000 units	4.00	
$496,000/160,000 units		$3.10
Cost per unit	$7.00	$6.10

The reason for the difference in average unit cost of factory overhead probably was because some of the overhead was fixed within the given levels of output. In this instance the fixed component of factory overhead may be estimated using the following reasoning.

$$\frac{\text{Change in cost } (\$496{,}000 - \$400{,}000)}{\text{Change in output } (160{,}000 - 100{,}000)} = \frac{\$96{,}000}{60{,}000}$$

$$\text{Variable costs per unit} = \underline{\underline{\$1.60}}$$

If variable factory overhead is incurred at $1.60 per unit, the amount of fixed costs would be computed as follows:

$400,000 factory overhead – ($1.60 x 100,000 units) variable overhead

= $240,000 fixed factory overhead

or

$496,000 factory overhead – ($1.60 x 160,000 units) variable overhead

= $240,000 fixed factory overhead

At 100,000 units of output the fixed portion of factory overhead is $2.40 per unit ($240,000 ÷ 100,000 units). And at 160,000 units of output the fixed portion of factory overhead is $1.50 per unit ($240,000 ÷ 160,000 units). Thus, the $.90 per unit decrease in average unit cost apparently results from spreading the fixed costs over an increased number of units of production.

---

*CPA adapted

14–20. (continued)

b. Yes, the order should be accepted. Using differential analysis, there will be an increase in profits as follows:

Increase in revenue	$360,000
Increase in costs:	
Direct materials	90,000
Direct labor	90,000
Factory overhead (probably variable)	96,000
Increase in profits	$ 84,000

14–21. (20 min.) *Pricing decisions: Lucky Locks.*

Differential costs:

	Per Unit	*20,000 Units*
Variable manufacturing costs	$1.00	$20,000
Variable marketing costs	2.00	40,000
Profit target	1.50	30,000
Required revenue	$4.50	$90,000

14–22. (30 min.) *Pricing decisions: Ben & Jerry's.*

a.

	Status Quo 20,000 quarts	*Alternative 20,400 quarts*	*Difference*
Sales revenue	\$60,000[a]	\$60,900[b]	\$900 (higher)
Less variable costs:			
Materials	20,000	20,400	400 (higher)
Labor	10,000	10,200	200 (higher)
Variable overhead	5,000	5,100	100 (higher)
Total variable cost	35,000	35,700	700 (higher)
Contribution margin	25,000	25,200	200 (higher)
Less fixed costs	20,000	20,000	–0– (higher)
Operating profit	\$ 5,000	\$ 5,200	\$200 (higher)

Operating profits would be higher with the additional order by \$200.

---

[a] \$60,000 = 20,000 quarts x \$3.00 per quart

[b] \$60,900 = (20,000 quarts x \$3.00 per quart) + (400 quarts x \$2.25 per quart)

b. The lowest price the ice cream could be sold without reducing profits is \$1.75 per quart, which would just cover the variable costs of the ice cream.

14–23. (25 min.) *Cost analysis pricing decisions: Easton, Inc.*

a.

	Status Quo $50 Price	*Alternative $25 Price*	*Difference*	
Sales revenue				
10,000 @ $50	$500,000			
50,000 @ $25		$1,250,000	$750,000	(higher)
Variable costs				
10,000 @ $19.50[a]	195,000			
50,000 @ $19.50		975,000	780,000	(higher)
Contribution margin	$305,000	$275,000	$ 30,000	(lower)

---

[a] $7.50 + $10 + (.25 x $8) = $19.50 per unit.

b. The total contribution is greater if the lower volume is accepted. Both alternatives result in a net loss, but the loss is less if Easton holds the price at $50 per case.

14–24. (15 min.) *Differential Customer Analysis: Hillson & Brady.*

	Status Quo Total	*Alternative Drop Super 6*	*Difference*	
Revenues (fees charged)	$580	$350	$230	(lower)
Operating costs				
Cost of services (variable)	517	305	212	(lower)
Salaries, rent, and general administration (fixed)	50	50	0	
Total operating costs.......................	567	355	212	(lower)
Operating profits.....................................	$ 13	$ (5)	$ 18	(lower)

H&B should not drop the Super 6 account in the short run as profits would drop by $18,000.

14–25. (15 min.) *Differential Customer Analysis: How Clean.*

	Status Quo Total	*Alternative Drop Hospital*	*Difference*
Revenues (fees charged)	$2,320	$1,400	$920 (lower)
Operating costs			
Cost of services (variable)	2,068	1,220	848 (lower)
Salaries, rent, and general administration (fixed)	200	200	0
Total operating costs	2,268	1,420	848 (lower)
Operating profits	$ 52	$ (20)	$ 72 (lower)

How Clean should not drop the Hospital account in the short run as profits would drop by $72,000.

14–26. (15 min.) *Differential Customer Analysis: Wee One's.*

	Status Quo Total	*Alternative Drop Hospital*	*Difference*
Revenues (fees charged)	$290	$185	$105 (lower)
Operating costs			
Cost of services (variable)	259	153	106 (lower)
Salaries, rent, and general administration (fixed)	25	25	0
Total operating costs	284	178	106 (lower)
Operating profits	$ 6	$7	$ 1 (higher)

Wee One's should drop the Hospital account in the short run as profits would increase by $1,000.

14–27. (15 min.) *Special Order: Sam's Sport Shop.*

	Status Quo	*Alternative*	*Difference*	
Revenues	\$40,000[b]	\$41,440[a]	\$1,440	(higher)
Variable Costs	30,000[d]	31,200[c]	1,200	(higher)
Contribution Margin	10,000	10,240	240	(higher)
Fixed costs	7,000	7,000	0	
Operating profit	\$ 3,000	\$ 3,240	\$ 240	(higher)

Sam's should accept the order because it will increase profits by \$240 for the period.

---

[a] \$41,440 = (2,000 jerseys × \$20) + (80 jerseys × \$18)

[b] \$40,000 = (2,000 jerseys × \$20)

[c] \$31,200 = (2,000 jerseys + 80 jerseys) (\$12 + \$3)

[d] \$30,000 = 2,000 jerseys x (\$12 + \$3)

14–28. (10 min.) *Target Costing and Pricing: Brown's Wheels.*

$$\frac{\text{Price}}{\text{Costs + 20\%}} = \text{Highest acceptable costs}$$

$$\frac{\$6.00}{1.2} = \$5.00$$

The highest acceptable manufacturing costs for which Brown's would be willing to produce the wheels is \$5.00

14–29. (10 min.) *Target Costing and Pricing: Durham Industries.*

$$\frac{\text{Price}}{\text{Costs + 10\%}} = \text{Highest acceptable costs}$$

$$\frac{\$11}{1.1} = \$10.00$$

The highest acceptable manufacturing costs for which Durham would be willing to produce the lines is \$10.00 a foot.

Solutions to Problems

14-30. (20 min.) *Special order: Gilbert Company.*

a.

	Status Quo	*Alternative*	*Difference*	
Revenue	$1,200,000	$1,920,000[a]	$720,000	(higher)
Variable costs	780,000	1,560,000[b]	780,000	(higher)
Contribution margin	420,000	360,000	60,000	(lower)
Fixed costs	600,000	600,000	0	
Operating profit	$ (180,000)	$ (240,000)	$ 60,000	(lower)

---

[a] $1,920,000 = (300,000 tubes × $2.40) + $1,200,000

[b] $1,560,000 = (300,000 tubes × $2.60) + $780,000

Alternative Solution: ($2.40 – $2.60) 300,000 tubes = $(60,000).

b. Disagree. The differential costs of the order are greater than the incremental revenues, therefore losses will be increased by $60,000.

14-31. (20 min.) *Target Costing and Pricing: Marklee Industries.*

a. Cost XII (1 + .10) = Cost-plus price

$42(1.10) = $46.20

b. Price = $46

$$\frac{\text{Price}}{\text{Cost + 10\%}} = \frac{\$46}{1.1} = \$41.82 \text{ Highest cost acceptable}$$

c. No. The cost of $42 per unit is higher than the highest acceptable cost of $41.82, so Marklee would not make an acceptable profit. However other factors, such as excess capacity, future growth in demand, etc., could change the decision if included.

14-32. (50 min.) *Special Order: Marshall's Electronics, Inc.*

a. $\frac{\text{Direct labor}}{\text{Wage Rate}} = \text{XBP400 Labor Hours per unit}$

$$\frac{\$750}{\$20} = 37.5 \text{ hours per unit}$$

37.5 hours × 40 units = 1,500 hours to produce 40 units. Capacity would not need to be expanded to accept the order.

Incremental Revenues ($3,000 × 40 units)	$120,000
Differential costs ($2,200* × 40 units)	88,000
Increase in profits	$ 32,000

*Total variable costs per unit.

b. 37.5 hours × 60 units = 2,250 hours to produce 60 units

Capacity 21,000 hrs – BP041 Labor hrs ($600/$20 = 30 hrs each; 30 hrs × 400 units =) 12,000 hrs. = Hours available to XBP400 production 9,000 hrs

XBP400 hrs 9,000 hrs – Special order hrs 2,250 hrs = Hours available for current sales 6,750 hrs

6,750 Current sales hrs / 37.5 Hours per unit = 180 units

To accept the special order Marshall's would have to cut back current sales of XBP400 to 180 units due to capacity constraints.

	XBP400 Status Quo	*XBP400 Alternative*	*Difference*	
Revenues	$780,000[b]	$882,000[a]	$102,000	(higher)
Variable costs...............................	440,000[d]	528,000[c]	88,000	(higher)
Contribution margin......................	340,000	354,000[e]	14,000	(higher)
Fixed costs	150,000	150,000	0	
Operating profits...........................	$190,000	$204,000	$ 14,000	(higher)

---

[a] $882,000 = (180 units × $3,900) + (60 units × $3,000)

[b] $780,000 = 200 units × $3,900

[c] $528,000 = (180 units + 60 units) x $2,200

[d] $440,000 = 200 units × $2,200

[e] $150,000 = $750 × 200 units

14–32. (continued)

b. (continued)

Alternative Solution:

Special order increase in profits = (60 units × $3,000) – (60 units × $2,200)	=	$48,000
Lost profits due to cutback of current sales (20 units × $3,900) – (20 units × $2,200)	=	$34,000
Total increase in operating profits		$14,000

c. As calculated in (b), accepting the special order plus current production is 20 units over current capacity. Therefore, the differential costs for the 20 units would be:

DLH = 20 units × 37.5 hrs × $30	=	$22,500
DM = 20 units × $550	=	11,000
VO = 20 units × $900(1.5)	=	27,000
Total differential costs of 20 units over capacity		$60,500

In (b) we calculated the alternative based on accepting the special order and cutting back current sales at $3,900 per unit. So the 20 units over capacity would be sold at $3,900 per unit.

Differential revenues = $3,900 × 20 units = $78,000

Differential revenues	$78,000
Differential costs	60,500
Total increase in operating profits for 20 units over capacity	$17,500

If the special order is accepted and current sales maintained, the total operating profit would be $221,500 ($204,000 + $17,500). A total increase of $31,500 ($14,000 + $17,500).

14–33. (30 min.) *Special order costs: Golden Company.*

a. *Differential Costs*

	10,000 Robes	*Per Unit*
Sales revenue	$160,000	$16
Less:		
Variable costs:		
Manufacturing	125,000	12.50
Marketing	27,000	2.70[a]
Contribution on lost sales [2,000 units x ($25.00 – $12.50 – $3.60)]	17,800	1.78
Decrease in contribution from special order	$ (9,800)	$ (.98)

---

[a] $3.60 x .75 = $2.70

Alternative presentation:

	Status Quo	*Alternative*	*Difference*	
Revenue	$2,500,000			
($2,500,000 + $160,000 – $50,000[a])		$2,610,000	$110,000	(higher)
Variable mfg. costs	1,250,000			
($1,250,000 + $125,000 – $25,000)		1,350,000	100,000	(higher)
Variable marketing costs	360,000			
($360,000 + $27,000[b] – $7,200[c])		379,800	19,800	(higher)
Fixed costs				
($350,000 + $290,000)	640,000	640,000	–0–	
Operating profit	$ 250,000	$ 240,200	$ 9,800	(lower)

---

[a] $50,000 = 2,000 units x $25.00

[b] $27,000 = 10,000 units x (.75)(3.60)

[c] $7,200 = 2,000 units × $3.60

b. Golden Company should not take the special order because overall company profits would fall from $250,000 to $240,200. The contribution margin from the special order of $8,000 does not exceed the lost contribution margin (for 2,000 units in lost sales) of $17,800. Thus, profits would decrease by $9,800 (= $17,800 – $8,000) if the special order is accepted.

14–34. (20 min.) *Pricing based on costs—multiple choice: Cruizers Unlimited.*

a. (2) 40% = ($150,000 – $90,000) ÷ $150,000

b. (3) 10% = 25% x 40% (Total overhead application rate times variable percentage from a)

c. (4) $1,200 Differential costs associated with accepting the order are:

Sales price	$15,000	
Direct materials	5,000	
Direct labor	8,000	
Variable overhead	800	(10% x direct labor)
Impact on profit	$ 1,200	

d. (1) $13,800 (= $5,000 + $8,000 + $800)

14–35. (40 min.) *Special order: R. A. Ro.*

On the basis of the data in the question it would pay Jackson to accept the order.

New sales (10,000 units × $7)	$70,000	
Less: standard sales	12,500	
Differential revenue		$57,500
Differential costs[a]		49,050
Net advantage to special units		$ 8,450

Other factors must be considered such as the long-run consequences of failing to satisfy standard parts customers, the reliability of the cost estimates, and the importance of this valued customer.

---

[a] Differential cost of the order is:

Costs incurred to fill order*	
Material (10,000 units × $2)	$20,000
Labor (10,000 units × $3.60)	36,000
Special overhead	2,000
	$58,000
Costs reduced for standard products	
Material	$ 4,000
Labor	4,500
Other	450
	$ 8,950
Total Differential Costs	$49,050

*Depreciation, rent, and heat and light are not affected by the order. Power might be dependent upon the particular requirements of the special units. It is assumed here that the same amount of power will be used in each case.

14–36. (40 min.) *Special order: Multiple choice—Aggie Enterprises, Inc.*

a. (4) $8,000 = $8 per unit × 1,000 units

b. (2) $6,000 = ($4 + $2) × 1,000 units

c. (1) $0 Total fixed costs do not change as a result of the special order.

d. (4) Decrease $0.25;

Fixed costs per unit without the special order ($10,000 + $8,000) ÷ 8,000 units	$2.25
Fixed costs per unit with the special order ($10,000 + $8,000) ÷ 9,000 units	2.00
Decrease as a result of special order	$0.25

e. (1) Increase;

Differential revenues (from (a))	$8,000	(higher)
Differential costs (from (b))	6,000	(higher)
Increase in operating profit	$2,000	(higher)

14–37. (90 min.) *Comprehensive differential costing problem: Garden Bay, Inc.*

This problem gives students a good understanding of the fixed/variable cost dichotomy. It is worthwhile to emphasize to students that fixed costs may be “unitized” (i.e., allocated to individual units of product) for certain purposes, and that this allocation procedure may make such costs *appear* to be variable. Indeed, many students treat the $120 per unit fixed manufacturing overhead and $140 per unit fixed marketing costs as though they were variable costs, despite the fact that they are clearly labeled “fixed.”

This problem can be used to introduce the concept of opportunity cost. Question b can be used in this way, as can Question d if you postulate a scrap value for the obsolete hoists.

a. Recommendation: Lowering prices reduces operating profit. Other factors, such as the reduction of available capacity and the impact on market share, could also affect the decision.

	Before Price Reduction	*After Price Reduction*	*Impact*		
Price	$ 740	$ 650			
Quantity	3,000	3,500			
Revenue	$2,220,000	$2,275,000	$ 55,000		
Var. mfg. costs	900,000	1,050,000	150,000		
Var. mktg. costs	150,000	175,000	25,000		
Cont. margin	1,170,000	1,050,000	120,000	decrease	
Fixed mfg. costs	360,000	360,000	—		note
Fixed mktg. costs	420,000	420,000	—		equality
Income	$ 390,000	$ 270,000	$120,000	decrease	

14–37. (continued)

b. Recommendation: Don’t accept contract.

Impact:

	Without Govt. Contract	With Government Contract				
		Regular	Government	Total	Impact	
Revenue	$2,960,000	$2,590,000	$245,000[a]	$2,835,000	$125,000	
Var. Mfg. Costs	1,200,000	1,050,000	150,000	1,200,000	—	
Var. Mktg. Costs	200,000	175,000	—	175,000	25,000	
Contribution Margin	1,560,000	$1,365,000	$95,000	1,460,000	100,000	decrease
Fixed Mfg. Costs	360,000			360,000	—	
Fixed Mktg. Costs	420,000			420,000	—	
Income	$780,000			$680,000	$100,000	decrease

---

[a] Government revenue 500 x $300 + 1/8($360,000) + $50,000 = $245,000, assuming the government’s “share” of March fixed manufacturing costs is 12.5% (= 500 units ÷ 4,000 units). Alternatives are to get 1/6 x $360,000 fixed manufacturing costs, which would increase revenue from $245,000 to $260,000; or get no reimbursement for fixed manufacturing costs, which would reduce revenue to $200,000.

14–37. (continued)

b. (continued)

A shorter approach to Requirement b (but harder for some students to understand) is this:

Forgone contribution (equals forgone income) on regular sales if government contract is accepted..	500 x $390 =	$(195,000)	lost
Profit from government contract:			
Fixed fee		50,000	gained
Share of fixed mfg. costs (1/8 x $360,000)....		45,000	gained
Gain		95,000	gained
Differential profit if contract accepted................		$(100,000)	

c. Minimum price = variable mfg. costs + shipping costs + order costs = $300 + $75 + $4,000/1,000 = $379.

At this price per unit, the $379,000 of differential costs caused by the 1,000 unit order will just be recovered.

Some students solve for this price using the break-even formula:

$$\frac{F}{P - V} = X$$

$$\frac{\$4{,}000}{P - \$375} = 1{,}000 \text{ units}$$

$$\$4{,}000 = 1{,}000P - \$375{,}000$$

$$\$379{,}000 = 1{,}000P$$

$$\underline{\underline{\$379}} = P$$

d. The manufacturing costs are *sunk;* therefore, any price in excess of the *differential* costs of selling the hoists will add to income. In this case, those differential costs are apparently the $50 per unit variable marketing costs, since the hoists are to be sold through regular channels; thus the minimum price is $50. (If the instructor wishes to reinforce the concept of opportunity cost, the most general answer to this question is that the price should exceed the sum of 1) the differential marketing costs and 2) the potential scrap proceeds, which are an opportunity cost of selling the hoists rather than scrapping them.)

Chapter 15

Using Differential Analysis for Production Decisions

Solutions to Review Questions

15–1.
Unit gross margins are typically computed with an allocation of fixed costs. Total fixed costs generally will not change with a change in volume within the relevant range. Unitizing the fixed costs results in treating them as though they are variable costs when, in fact, they are not. Moreover, when multiple products are manufactured, the relative contribution becomes the criterion for selecting the optimal product mix. Fixed costs allocations can distort the relative contributions and result in a suboptimal decision.

15–2.
Management will want to maximize the profit obtainable from the scarce resource. This will necessitate analyzing the contribution per unit of scarce resource from each product which the company manufactures. Profit will be maximized if the company produces the output which gives the greatest contribution per unit of scarce resource.

15–3.
The feasible production region is the area which contains all possible combinations of production outputs. It is bounded by the constraints imposed on production possibilities. The production schedule which management chooses must come from the feasible production region.

15–4.
Corner points are important for analytical purposes because the optimal production schedule will be located at one or more of these corner points.

15–5.
The opportunity cost of a constraint is the cost of not having additional availability of the constrained resources. This is also called a shadow price.

15–6.
The three factors are:

1) Throughput contribution: Sales dollars minus direct materials and other variable costs.
2) Investments: Inventories, equipment, buildings, and other assets used to generate throughput contribution.
3) Operating costs: All operating costs other than direct materials and other variable costs.

Solutions to Critical Analysis and Discussion Questions

15–7.
This approach will maximize profits only if there are no constraints on production or sales, or if both products use all scarce resources at an equal rate. Otherwise management would want to maximize the contribution per unit of scarce resource.

15–8.
Fixed costs are relevant anytime they change with the product-mix decision. For example, if there are fixed costs that can be eliminated with the elimination of one or more of the individual products, then those fixed costs might be relevant in a multi-product setting. They would be relevant if the contribution from production of any one product was insufficient to cover the fixed costs that could be eliminated.

15–9.
Performance can be improved at the bottleneck by increasing capacity or shifting resources from non-bottleneck areas to the bottleneck.

15–10.
Profits can be increased by decreasing investments, increasing throughput, and decreasing operating expenses. Most who subscribe to the theory of constraints focus on increasing throughput contribution.

Solutions to Exercises

15–11. (20 min.) *Make-or-buy decisions: Dabelles Company.*

The $25,000 savings could not be achieved. In fact, Trice Company's offer is more expensive than making the part.

	Status Quo[a]	*Alternative*	*Difference*	
Trice's offer	$ –0–	$600,000	$600,000	(higher)
Materials	70,000		70,000	(lower)
Labor	300,000		300,000	(lower)
Variable overhead	120,000		120,000	(lower)
Fixed overhead applied	160,000	60,000[b]	100,000	(lower)
Total costs	$650,000	$660,000	$ 10,000	(higher)

---

[a] Based on 20,000 units.

[b] ($8 – $5) × 20,000 = $60,000; or $160,000 – $100,000 = $60,000

Alternative presentation.

Differential costs to make:

Direct materials	$ 3.50	
Direct labor	15.00	
Variable overhead	6.00	
Avoidable fixed overhead	5.00	(= $100,000/20,000 units)
	$29.50	

This is less than the $30 purchase price from Trice Company.

15–12. (25 min.) *Make-or-buy decisions: Collins, Inc.*

It is less costly to buy.

	Make Part # 10541	*Buy Part #10541*	*Difference*	
Direct materials, direct labor and variable overhead [5,000 × ($6 + $22 + $8)]	$180,000	$ –0–	$180,000	(saved)
Fixed overhead	60,000[a]	40,000[b]	20,000	(saved)
Total manufacturing costs	240,000	40,000	200,000	(saved)
Contribution from RAC	–0–	30,000	30,000	(earned)
Net mfg. cost with cont'n	240,000	10,000	230,000	(saved)
Cost to purchase (5,000 × $44)	–0–	220,000	220,000	(incurred)
Total	$240,000	$230,000	$ 10,000	(net saved)

---

[a] 5,000 x $12 = $60,000

[b] 5,000 x $12 x 2/3 = $40,000

15–13. (20 min.) *Make-or-buy decisions: Casio Company.*

		Differential Cost to Make
Direct materials	20,000 units × $3	$ 60,000
Direct labor	20,000 units × $10.50	210,000
Variable overhead	20,000 units × $4	80,000
Fixed overhead	40% × 20,000 units × $5	40,000
Total cost to make		$390,000
Cost to buy	20,000 units × $21	$420,000

It costs $30,000 less to make the part.

15–14. (15 min.) *Make or buy decisions: Columbus.*

Sam could save $100 per sail by making the sails rather than buying them.

	Status Quo (Buy)	*Alternative (Make)*	*Difference (Buy–Make)*	
Cost to buy	$560	$–0–	$560	(higher)
Direct material	–0–	180	180	(lower)
Direct labor	–0–	160	160	(lower)
Variable OH	–0–	120	120	(lower)
	$560	$460	$100	(higher)

15–15. (10 min.) *Make or buy with opportunity costs: Columbus.*

No. He should continue to buy the sails. The cost of making 1,500 sails is $690,000 (= $460 × 1,500 sails). The cost of buying the sails and renting out the space is $680,000 [($560 × 1,500 sails) – $160,000].

15–16. (20 min.) *Dropping product lines: Campus Bookstore.*

Campus Bookstore
Comparison of Three Alternatives
(in thousands)

Alternative 1: Drop general merchandise
Alternative 2: Drop general merchandise, increase book sales

	Status Quo	*Alternative 1*	*Alternative 2*
Sales revenue	$400	$280	$435
Cost of goods sold (variable)	300	205	325
Contribution margin	100	75	110
Less fixed costs			
Rent	18	18	32
Salaries	40	40	40
Marketing and administrative	36	30	34
	$ 6	$(13)	$ 4
	Best	Worst	

15–17. (30 min.) *Dropping product lines: Sierra Ski Company.*

	Status Quo	*Drop Cross-Country Skis*	*Difference (all lower under the alternative)*
Revenue	$253,200	$167,600	$85,600
Less Variable Costs...	(201,400)	(124,200)	(77,200)
Contribution Margin ...	$ 51,800	$ 43,400	$ 8,400
Less Fixed Costs	(35,600)	(30,260)[a]	(5,340)
Operating Profit..........	$ 16,200	$ 13,140	$ 3,060

Sierra Ski Company should keep cross-country skis because the loss of its contribution margin is greater than the reduction in fixed costs.

---

[a] $30,260 = $35,600 × .85

15–18. (20 min.) *Dropping product lines: Cliff & Bassman.*

Status quo: Keep all three services, audit, tax, and consulting
Alternative 1: Drop consulting
Alternative 2: Drop consulting, increase tax

	Status Quo	*Alternative 1*	*Alternative 2*
Sales revenue	\$1,400,000[a]	\$1,100,000[d]	\$1,325,000[g]
Variable costs.......................	900,000[b]	650,000[e]	785,000[h]
Contribution margin.............	500,000	450,000	540,000
Fixed costs	190,000[c]	165,000[f]	177,000[i]
Operating profit	\$ 310,000	\$ 285,000	\$ 363,000
		worst	best

---

[a] \$1,400,000 = \$300,000 + \$500,000 + \$600,000
[b] \$ 900,000 = \$250,000 + \$300,000 + \$350,000
[c] \$ 190,000 = \$ 50,000 + \$ 60,000 + \$ 80,000
[d] \$1,100,000 = \$500,000 + \$600,000
[e] \$ 650,000 = \$300,000 + \$350,000
[f] \$ 165,000 = \$190,000 – (50% × \$50,000)
[g] \$1,325,000 = (1.45 × \$500,000) + \$600,000
[h] \$ 785,000 = (1.45 × \$300,000) + \$350,000
[I] \$ 177,000 = (1.2 × \$60,000) + \$80,000 + (.5 × \$50,000)

15–19. (15 min.) *The role of accounting data: Burnett, Inc.*
Compute the contribution from each product.

	A	*B*	*C*
Selling price	$15	$20	$25
Manufacturing costs:			
Materials	2.50	3.00	3.50
Direct labor	3.50	3.50	5.50
Variable overhead	1.50	1.50	3.00
Variable marketing	2.25	3.00	3.75
Variable administrative	0.50	0.50	0.50
Total variable costs	$10.25	$11.50	$16.25
Contribution	$ 4.75	$ 8.50	$ 8.75

Maximize

Total Contribution Margin = $4.75A + $8.50B + $8.75C

15–20. (30 min.) *The role of accounting data: Quicksilver Corporation.*

a. Necklace production = 120 hrs./.5 per hour = 240 units

Profit = (240 units x $20/unit) – $2,500
= $2,300

b.

	Contribution per Unit of Machining Time	*Maximum Profit Obtainable*		
Necklaces	$\frac{\$20}{0.5} = \$40.00$	Contribution	$40 x 120 =	$ 4,800
		Less fixed costs		2,500
		Profit		$ 2,300
Bracelets	$\frac{\$15}{0.25} = \$60.00$	Contribution	$60 x 120 =	$ 7,200
		Less fixed costs		2,500
		Profit		$ 4,700
Rings	$\frac{\$10}{0.3} = \$33.33$	Contribution	$33.33 x 120 =	$ 4,000
		Less fixed costs		2,500
		Profit		$ 1,500

The maximum profit obtainable is $4,700, which is obtained by producing and selling bracelets exclusively.

15–21. (30 min.) *Theory of constraints: Racketeer, Inc.*

a. Yes. Operating profit would increase by $2,000 (as shown below).

Differential revenues ($100 × 200 units)	$20,000
Differential costs:	
Fixed	(10,000)
Variable ($40 × 200 units)	(8,000)
Net differential operating profit	$ 2,000

b. No. Operating profit would decrease by $8,000 (as shown below).

Differential revenues ($100 × 200)	$20,000
Differential costs:	
Fixed	(20,000)
Variable ($40 × 200)	(8,000)
Net differential operating profit (loss)	$ (8,000)

15–22. (30 min.) *Theory of constraints: Bud’s Bakery.*

a. No. Operating profit would decrease by $50.

Differential revenues ($9 × 10 units)	$90
Differential costs:	
Fixed	(100)
Variable ($4 × 10 units)	(40)
Net differential operating profit (loss)	$ (50)

b. Yes. Operating profit would increase by $10.

Differential revenues ($9 × 10)	$90
Differential costs:	
Fixed	(40)
Variable ($4 × 10)	(40)
Net differential operating profit	$ 10

15–23. (15 min.) *Linear programming: Classic Corporation.*

Maximize: Total Contribution Margin = 3 Small + 4 Large

Subject to: Machining-hours = 1 Small + 4 Large ≤ 100
Polishing-hours = 2 Small + 3 Large ≤ 90

15–24. (15 min.) *Linear programming: Snead Company.*

a. The answer is (4).
For process 1 the maximum available hours are 1,000. Therefore, the constraint is:

2 Zeta + 1 Beta ≤ 1,000 hours

b. The answer is (3).
For Beta, the labor constraint limits production to 400 units. Therefore, the constraint is:

Beta ≤ 400

c. The answer is (2).

Snead wants to maximize total contribution margin. Therefore, the objective function is:

Maximize $4.00 Zeta + $5.25 Beta

15–25. (15 min.) *Sensitivity of cost data: Servo Company*.

No, they didn't make the right decision. They included fixed costs which do not differ in the short run. If they had used contribution margin instead of gross margin, they would have had $4 for G1 and $5.50 for G2, therefore they would have decided to produce G2 exclusively.

15–26. (60 min.) *Decision whether to add or drop a product: Justa Corporation.*

a. The regional market should not be dropped as this market not only covers all the variable costs and separable fixed costs but also gives net market contribution of $65,000 toward the common fixed costs.

Sales = $300,000
Variable manufacturing costs = (.6 × $100,000) + (.7 × $100,000) + (.6 × $100,000)
= $190,000
Marketing costs = $45,000
Net market contribution = $65,000 (= $300,000 – $190,000 – $45,000)

b. Quarterly income statement (in thousands):

	Product A	*Product B*	*Product C*	*Total*
Sales revenue	$500	$400	$400	$1,300
Less variable costs:				
Manufacturing	300	280	240	820
Marketing	15	8	8	31
Total variable cost	315	288	248	851
Contribution margin	185	112	152	449
Less fixed costs:				
Manufacturing ($1,010 – $820)				190
Marketing ($105 – $31)				74
Administrative				52
Total fixed costs				316
Operating profit				$ 133

c. The new product must contribute at least $162,000 (= $152,000 + $10,000) per quarter so as not to leave the company worse off when product C is replaced.

15–27. (60 min.) *Decision whether to make or buy a product: Hospital Supply, Inc.*

a. What price is equivalent to in-house cost of production?

	All Production In-house	*1,000 Units Contracted*
Total revenue	$2,220,000	$2,220,000
Total variable manufacturing costs	900,000	600,000[a]
Total variable marketing costs	150,000	140,000[b]
Total contribution margin	1,170,000	1,480,000
Total fixed manufacturing costs	360,000	252,000[c]
Total fixed marketing costs	420,000	420,000
Payment to contractor	—	(X)
Income	$ 390,000	$ 808,000– X

$808,000 – X = $390,000
X = $418,000 or $418 per unit maximum purchase price

Therefore, a $425 purchase price is not acceptable; it would decrease income by $7,000 [= ($425 – $418) x 1,000 units].

A shorter (but more difficult) approach uses the concept of opportunity costs:

Variable manufacturing cost	$300
Variable marketing opportunity cost ($50 – $40)	10
Fixed manufacturing opportunity cost	108[d]
Equivalent in-house cost	$418

---

[a] $600,000 = 2/3 × 3,000 units × $300/unit.
[b] $140,000 = (2,000 units × $50 per unit) + (1,000 units × .8 × $50 per unit)
[c] $252,000 = $360,000 – (.3 × $360,000)
[d] $108 = ($360,000 – $252,000) ÷ 1,000 units

15–27. (continued)

b.

	3,000 Regular Hoists Produced	Contract 1,000 Regular Hoists; Produce 800 Modified Hoists and 2,000 Regular Hoists			
	In-house	Regular (In)	Regular (Out)	Modified	Total
Revenue	$2,220,000	$1,480,000	$740,000	$720,000	$2,940,000
Var. mfg. costs	900,000	600,000	—	440,000	1,040,000
Mar. mktg. costs	150,000	100,000	40,000	80,000	220,000
Cont. margin	1,170,000	$ 780,000	$700,000	$200,000	1,680,000
Fixed mfg. costs	360,000				360,000
Fixed mktg. costs	420,000				420,000
Payment to contractor	—	—	(X)	—	(X)
Income	$ 390,000				$ 900,000 – X

Maximum payment = $510,000, or $510 per unit. Now the proposal should be accepted at a price of $425.

15–28. (50 min.) *Analyze alternative products: Ocean Company.*

Ocean Company
Analysis of Effect of Alternative on Projected Total Operating Profit

Alternative:	
Additional units of Zee (125,000 × 150%)	187,500
Revenue, Zee ($575,000 × 150%)	$862,500
Total variable costs ($150,000 + $80,000) × 150%	345,000
Contribution margin	517,500
Total fixed costs (allocated)	245,000
Operating profit:	
Product Zee	272,500
Product Why	25,000
Rental income	157,500
Total	455,000
Less unallocated total fixed costs, Ex. ($430,000 – $30,000)[a]	400,000
Projected company operating profit	$ 55,000

---

[a] The $155,000 of allocated rent continues to be incurred and is therefore not relevant to the decision. The $30,000 of fixed costs are eliminated.

15–29. (45 min.) *Differential costs and CVP analysis: Arcadia Corporation.*

a.

Arcadia Corporation
Computation of Estimated Profit from Operations after Expansion of Montana Factory

Montana factory—		
Sales		$2,100,000
Fixed costs:		
Factory	$336,000	
Administration	121,000	
Variable costs[a]	672,000	
Allocated home office costs	175,000	
Total		1,304,000
Estimated operating profit		796,000
Texas factory—estimated operating profit		540,000
Less home office exp. allocated to Maine factory		100,000
Estimated operating profit		$1,236,000

---

[a] $\$672{,}000 = \$8 \text{ per unit} \times \dfrac{\$2{,}100{,}000 \text{ Revenue}}{\$25 \text{ Sales price per unit}}$

b.

Arcadia Corporation
Computation of Estimated Profit from Operations after Negotiation of Royalty Contract

Estimated operating profit:	
Texas factory	$ 540,000
Montana factory	410,000
Estimated royalties to be received (30,000 × $4)	120,000
	1,070,000
Less home office expense allocated to Maine factory	100,000
Estimated operating profit	$ 970,000

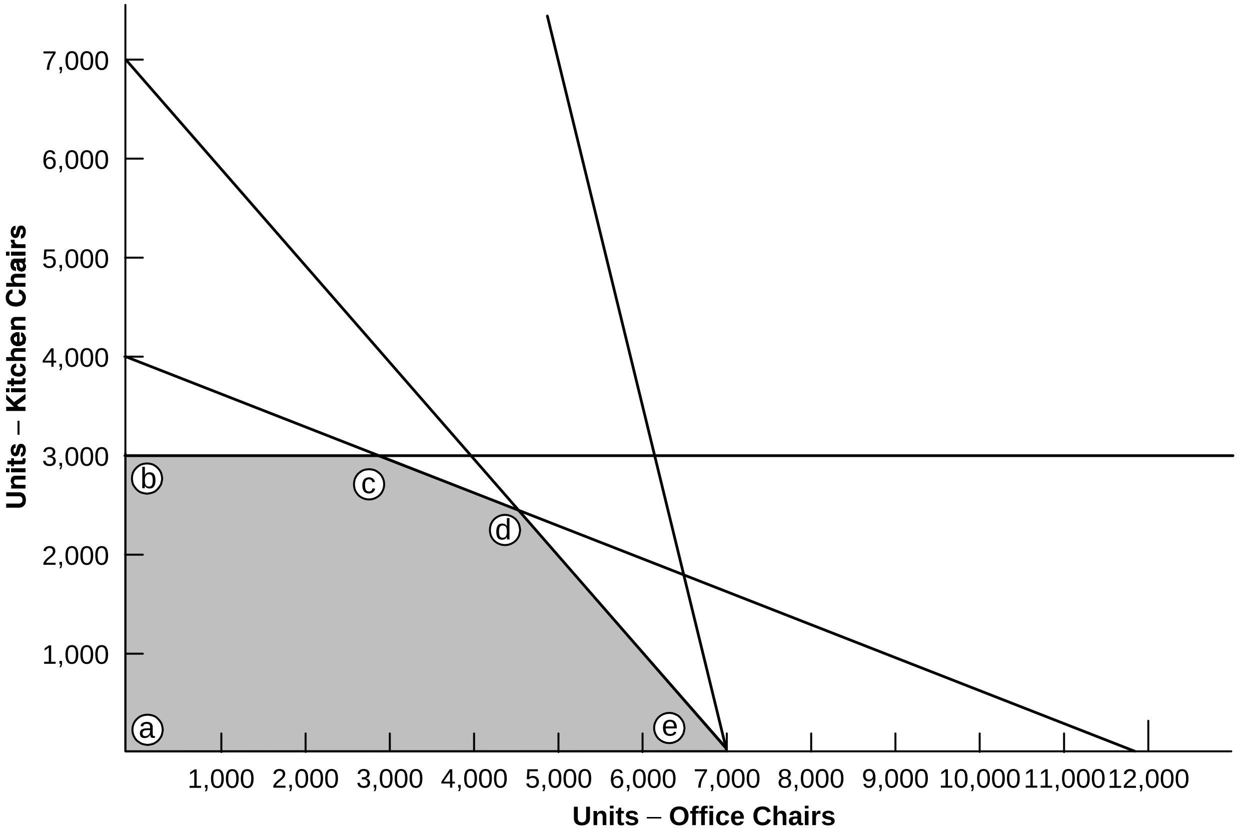
c.

Arcadia Corporation
Computation of Estimated Profit from Operations after Shutdown of Maine Factory

Estimated operating profit:	
Texas factory	$540,000
Montana factory	410,000
	950,000
Less home office expense allocated to Maine factory	100,000
Estimated operating profit	$850,000

Solutions to Problems

15–30. (40 min.) *Product Mix–graphic analysis.*



15–30. (continued)

	Kitchen	*Office*	*Contribution[a] Margin*
a	–0–	–0–	–0–
b	3,000	–0–	24,000
c	3,000[b]	3,000[b]	$39,000
d	2,500[c]	4,500[c]	$42,500*
e	–0–	7,000	$35,000

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*Optimal Solution

[a] Contribution margin = $8 kitchen + $5 office

[b] Solve simultaneously:

$$\begin{aligned} 3\text{ kitchen} + 1\text{ office} &= 12{,}000 \\ \text{kitchen} &= 3{,}000 \\ 3(3{,}000) + \text{office} &= 12{,}000 \\ \text{office} &= 3{,}000 \text{ units} \end{aligned}$$

[c] Solve simultaneously:

$$\begin{aligned} \text{kitchen} + \text{office} &= 7{,}000 \\ 3\text{ kitchen} + \text{office} &= 12{,}000 \\ 3\text{ kitchen} + 7{,}000 - \text{kitchen} &= 12{,}000 \\ 2\text{ kitchen} &= 5{,}000 \\ \text{kitchen} &= \underline{\underline{2{,}500}} \text{ units} \\ 2{,}500 + \text{office} &= 7{,}000 \\ \text{office} &= \underline{\underline{4{,}500}} \text{ units} \end{aligned}$$

15–31. (60 min.) *Determining optimum product mix: Jackson Enterprises.*

a.

	Bears	*Cows*	*Dogs*
Total revenue[a]	$300,000	$320,000	$2,850,000
Less variable manufacturing costs:			
Direct materials[b]	100,000	30,000	180,000
Direct labor[c]	112,000	160,000	1,680,000
Variable overhead[d]	28,000	40,000	420,000
Variable marketing[e]	30,000	32,000	285,000
Total costs	270,000	262,000	2,565,000
Contribution margin	$ 30,000	$ 58,000	$ 285,000
Total contribution margin[f]	$373,000		
Total fixed costs[g]	37,000		
Total operating profit	$336,000		

---

[a] Revenue:

Bears	$ 300,000	=	$15 x 20,000 units
Cows	$ 320,000	=	$32 x 10,000 units
Dogs	$2,850,000	=	$95 x 30,000 units

[b] Direct materials:

Bears	$ 100,000	=	$10 x .5 yards x 20,000 units
Cows	$ 30,000	=	$10 x .3 yards x 10,000 units
Dogs	$ 180,000	=	$10 x .6 yards x 30,000 units

[c] Direct labor:

Bears	$ 112,000	=	$ 8 x .7 hours x 20,000 units
Cows	$ 160,000	=	$ 8 x 2 hours x 10,000 units
Dogs	$1,680,000	=	$ 8 x 7 hours x 30,000 units

[d] Variable overhead:

Bears	$ 28,000	=	$ 2 x .7 hours x 20,000 units
Cows	$ 40,000	=	$ 2 x 2 hours x 10,000 units
Dogs	$ 420,000	=	$ 2 x 7 hours x 30,000 units

[e] Variable marketing:

Bears	$ 30,000	=	10% x $300,000 revenue
Cows	$ 32,000	=	10% x $320,000 revenue
Dogs	$ 285,000	=	10% x $2,850,000 revenue

[f] Total contribution margin:

$373,000 = $30,000 + $58,000 + $285,000

[g] Total fixed costs:

$ 37,000 = $18,000 + $4,000 + $15,000

15–31. (continued)

b. Contribution margin per constrained resource, labor:

Bears $2.143 = $30,000/20,000 units/.7 hours
Cows $2.9 = $58,000/10,000 units/2 hours
Dogs $1.357 = $285,000/30,000 units/7 hours

The Cows would be the most profitable product line given the constrained resource, direct labor.

c. The most profitable combination is to produce up to the demand of Cows with a contribution of $2.9, and the remaining hours spent on Bears with a contribution of $2.143.

10,000 Cows x 2 hours per Cow = 20,000 hours

10,000 hours[a]/.7 hours per Bear = 14,285 Bears

Therefore, Farside should produce 10,000 Cows and 14, 285 Bears.

[a] 10,000 hours = 30,000 hours – 20,000 hours.

15–31. (continued)

d.

	Bears	*Cows*
Total revenue[a]	$214,275	$320,000
Less variable manufacturing costs:		
Direct materials[b]	71,425	30,000
Direct labor[c]	79,996	160,000
Variable overhead[d]	19,999	40,000
Variable marketing[e]	21,428	32,000
Total costs	192,848	262,000
Contribution margin	$ 21,427	$ 58,000
Total contribution margin[f]	$ 79,427	
Total fixed costs[g]	37,000	
Total operating profit	$ 42,427	

---

[a] Revenue:

Bears $214,275 = $15 x 14,285 units
Cows $320,000 = $32 x 10,000 units

[b] Direct materials:

Bears $71,425 = $10 x .5 yards x 14,285 units
Cows $30,000 = $10 x .3 yards x 10,000 units

[c] Direct labor:

Bears $ 79,996 = $ 8 x .7 hours x 14,285 units
Cows $160,000 = $ 8 x 2 hours x 10,000 units

[d] Variable overhead:

Bears $19,999 = $ 2 x .7 hours x 14,285 units
Cows $40,000 = $ 2 x 2 hours x 10,000 units

[e] Variable marketing:

Bears $ 21,428 = 10% x $214,275 revenue
Cows $ 32,000 = 10% x $320,000 revenue

[f] Total contribution margin:

$ 79,427 = $21,427 + $58,000

[g] Total fixed costs:

$ 37,000 = $18,000 + $4,000 + $15,000

15–31. (continued)

e. At an increase in the cost of labor from $8 to $9.50, the contribution margins per constrained resource of labor (10,000 additional hours) would be as follows:

Contribution margins before labor cost increase:

Bears $1.50 = $30,000/20,000 units
Cows $5.80 = $58,000/10,000 units
Dogs $9.50 = $285,000/30,000 units

Additional labor costs would change contribution margins as follows:

Bears $ .45 = $1.50 – (.7 hours x $1.50 additional labor cost/hour)
Cows $ 2.80 = $5.80 – (2 hours x $1.50 additional labor cost/hour)
Dogs $(1.00) = $9.50 – (7 hours x $1.50 additional labor cost/hour)

The contribution per unit of constrained resource would be as follows:

Bears $.643 = $.45/.7 hours
Cows $1.40 = $2.80/2 hours
Dogs $(.14) = $(1.00)/7 hours

Since Farside would already be producing as many Cows as demand allows, the additional production would be Bears. Farside could produce an additional 5,715 Bears (20,000 annual demand minus 14,285 already being produced). Farside should not produce Dogs because the contribution from Dogs is negative.

The addition to profit would be $2,571.75 (5,715 Bears x $.45).

15–32. (45 min.) *Theory of constraints: University Hospital.*

	Alternatives		
	a	*b*	*c*
Revenues	$60,000	$60,000	$60,000
Variable costs	30,000[a]	26,000[b]	18,000[c]
Contribution margin	30,000	34,000	42,000
Fixed costs	–0–	2,000	15,000
Operating profit	$30,000	$32,000	$27,000

---

[a] $30,000 = ($300 x 30) + ($700 x 30)
[b] $26,000 = ($300 x 40) + ($700 x 20)
[c] $18,000 = $300 x 60

The most profitable alternative is to rebuild the recovery rooms so that some of the Phase II space could be used for Phase I recovery (as shown in (b) above). This approach would increase operating profit by $2,000 per day from $30,000 to $32,000.

15–33. (30 min.) *Interpreting computer output—one constraint.*

a. Objective function:
Maximize
Contribution margin = $50.00X + $40.00Y + $25.00Z

b. Optimal production level for Product X = 600 units

c. Total contribution is $30,000
$30,000 = $50 x 600 units of Product X

d. They would be willing to pay $166.67 since it is the opportunity cost of machining.

e. If a decision to produce one unit of Product Y was made, the total contribution margin would decrease by $1.67.

f. The optimal production level for Product Y would still be zero, since the increase of $1 ($41 – $40) is within the allowable increase range of the objective function coefficient.

15–34. (30 min.) *Interpreting computer output–multiple constraints.*

a. The optimal production level for P1 is 500 units. The optimal production level for P2 is 500 units.

b. The total contribution margin obtained at the optimal production level is $38,500.00
($41.50 x 500) + ($35.50 x 500) = $38,500.00

c. 250 of the 2,000 available machining hours are unused.

None of the 3,000 available assembly hours are unused.

d. Since the machining constraint is not binding, the company still has available machine hours and therefore would pay $0.00 for more machining hours.

The company would be willing to pay $13.83 for an additional hour of assembly. From the printout, this is the opportunity cost for an hour of assembly.

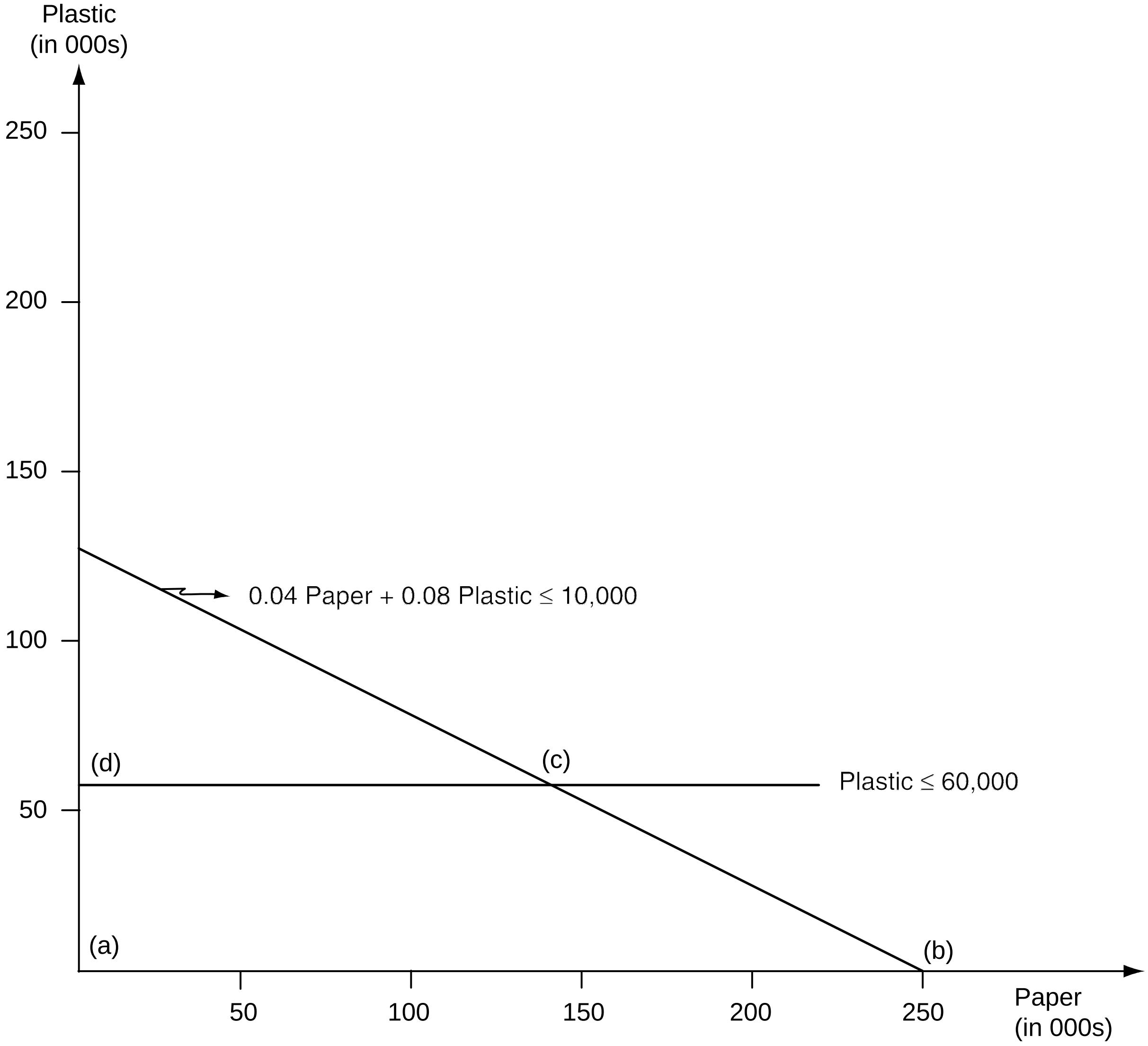
15–35. (30 min.) *Product mix choice: Rupee Corporation.*

a. Maximize:

Total Contribution Margin = \$0.40[a] Paper + \$0.47[a] Plastic

Subject to:

$$0.04^{b}\ \text{Paper} + 0.08^{b}\ \text{Plastic} \le 10{,}000$$
$$\text{Plastic} \le 60{,}000$$



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[a] Computation of contributions:

	Paperboard	*Plastic*
Net sales	\$212,000	\$212,250
Variable mfg. costs (all except depreciation)	153,000	153,750
Variable nonmfg. costs, inc. commissions	19,000	23,250
Total contribution	\$ 40,000	\$ 35,250
Amount per unit	\$0.40	\$0.47

[b] .04 = 4,000 labor hours/100,000 containers; .08 = 6,000 labor hours/75,000 containers.

15–35. (continued)

	Produce & Sell		*Total Contribution*
Critical Points	*Paper*	*Plastic*	*Margin*[b]
(a)	–0–	–0–	–0–
(b)	250,000	–0–	$100,000*
(c)	130,000[a]	60,000[a]	$80,200
(d)	–0–	60,000	$28,200

---

*Optimal Solution

[a] 0.04 Paper + 0.08 Plastic = 10,000
Plastic = 60,000

Solving simultaneously:

0.04 Paper + 0.08(60,000) = 10,000
Paper = 130,000

[b] Total Contribution Margin = $0.40 Paper + $0.47 Plastic

b. The optimal product mix is calculated given two constraints: (1) maximum labor hours available of 10,000; and (2) limited direct materials to produce plastic containers (enough for 60,000 containers). Paper containers provide the highest contribution margin per scarce resource of $10 per labor hour ($40,000 ÷ 4,000 hrs.) versus plastic containers ($5.88 per labor hour = $35,250 ÷ 6,000 hrs.). Thus, the optimal product mix is to produce 250,000 units of paper containers and 0 units of plastic containers.

15–36. (25 min.) *Multiple choice.*

a. The answer is (3).
The company wants to maximize its total contribution margin. Alpha is X_1, Gamma is X_2.
Maximize

$$\$5X_1 + \$4X_2 = \text{Total contribution margin}$$

b. The answer is (5).
The total use of D must be less than 16,000 gallons.

Constraint:

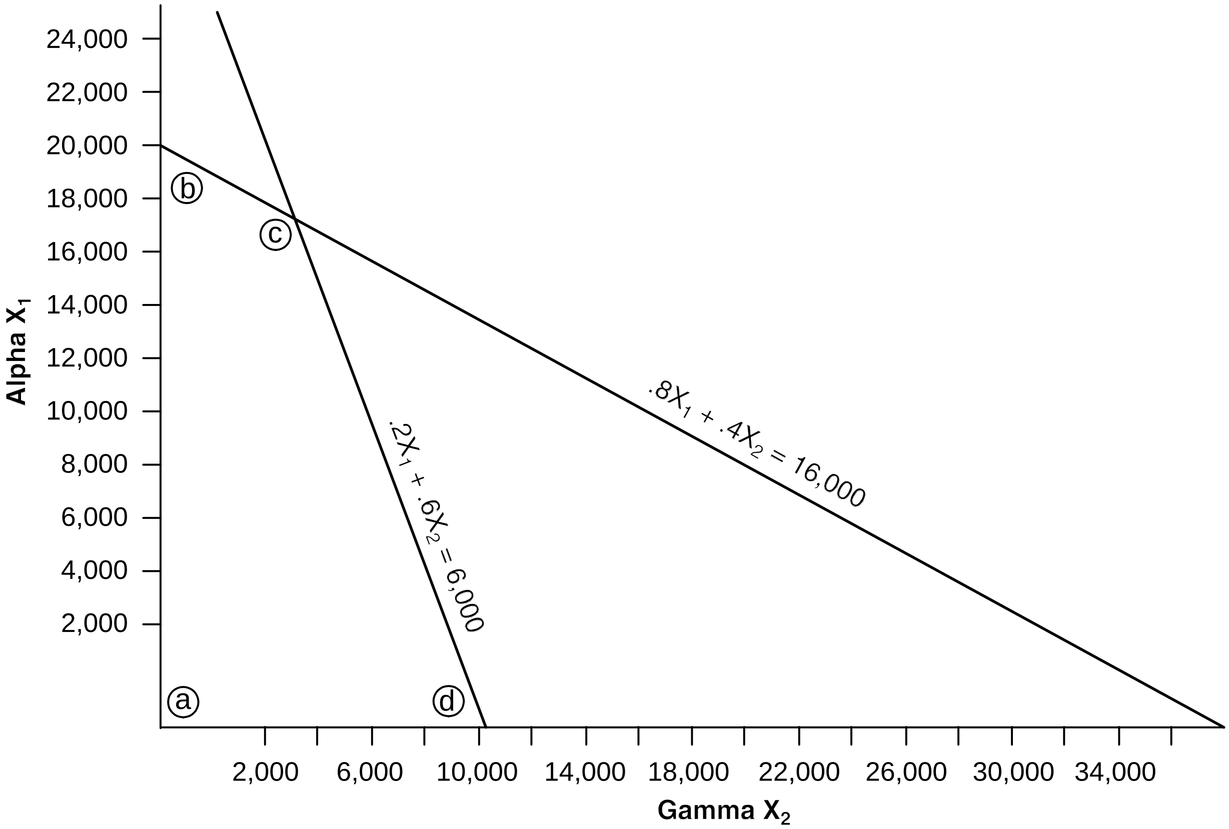
$.8X_1 + .4X_2 \leq 16{,}000$ gallons

c. The answer is (5).
The total use of K must be less than 6,000 gallons.

Constraint:

$.2X_1 + .6X_2 \leq 6{,}000$ gallons

d. The answer is (4).



15–36. (continued)

d. (continued)

Point	*Produce*		*Total Contribution*
	X_1	*X_2*	*Margin*[a]
a	–0–	–0–	–0–
b	20,000	–0–	$100,000
c	18,000[b]	4,000[b]	$106,000*
d	–0–	10,000	$40,000

---

*Optimal Solution

[a] $5X_1 + 4X_2$ = Total contribution margin

[b]

$$\begin{array}{rrrcr} & .8X_1 & + \quad .4X_2 & = & 16,000 \\ \underline{-(4)(.2X_1} & \underline{+} & \underline{.6\ X_2} & \underline{=} & \underline{6,000)} \\ & 0 & -2X_2 & = & -8,000 \\ & & X_2 & = & \underline{\underline{4,000}} \end{array}$$

Substitute X_2 back into equation

$$\begin{array}{rcl} 8X_1 \quad + \quad .4(4,000) & = & 16,000 \\ 8X_1 & = & 14,400 \\ X_1 & = & \underline{\underline{18,000}} \end{array}$$

e. The answer is (4).

Since the constraints do not change, the possible optimal solutions remain the same. The calculation of total contribution margin changes to:

$$7X_1 + 9X_2 = \text{Total contribution margin}$$

Point	*Produce*		*Total Contribution*
	X_1	*X_2*	*Margin*
a	–0–	–0–	–0–
b	20,000	–0–	$140,000
c	18,000	4,000	$162,000*
d	–0–	10,000	$90,000

---

*Optimal solution

15–37. (35 min.) *Analyze alternative actions with multiple products: Essen Corporation.*

Contribution per unit is first computed:

	Average	*Deluxe*[a]
Revenues	$135	$200
Variable Costs:		
Manufacturing	(25)	(50)
Marketing	(27)	(40)
Contribution Margin	$ 83	$110

Problem formulation:

Maximize:

Total Contribution Margin = $83 Average + $110 Deluxe

Subject to:

10 Average + 15 Deluxe ≤ 22,000

Average ≤ 1,800

Deluxe ≤ 1,200

Avoidable fixed costs:

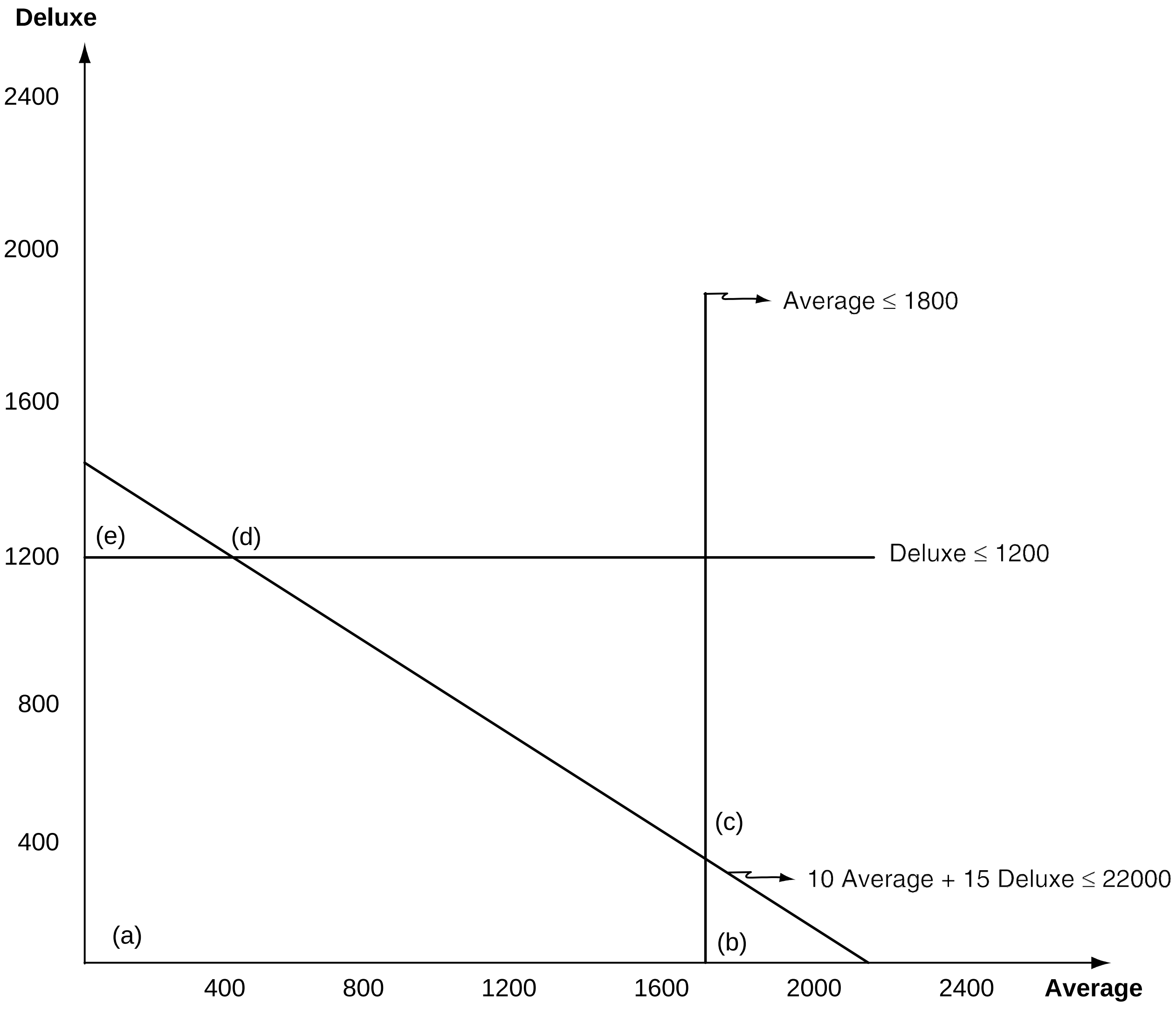
Average = $45,000

Deluxe = $50,000

---

[a] $200 = $160,000/800 units; $50 = $40,000/800; $40 = $32,000/800.

15–37. (continued)



15–37. (continued)

Critical Point	*Produce & Sell*		*Total Contribution Margin*[c]	*Profit*[d]
	Average	*Deluxe*		
a	–0–	–0–	–0–	–$45,000
b	1,800	–0–	$149,400	$59,400*
c	1,800[a]	267[a]	$178,770	$38,770
d	400[b]	1,200[b]	$165,200	$25,200
e	–0–	1,200	$132,000	$37,000

---

*Optimal Solution

[a] 10 Average + 15 Deluxe = 22,000
Average = 1,800
Solving simultaneously:
10(1,800) + 15 Deluxe = 22,000
Deluxe = 267

[b] 10 Average + 15 Deluxe = 22,000
Deluxe = 1,200
10 Average + 15(1,200) = 22,000
Average = 400

[c] Total contribution margin = $83 Average + $110 Deluxe

[d] $$\text{Profit} = \begin{array}{c}\text{Total Contribution}\\ \text{Margin}\end{array} - \begin{array}{c}\text{Administrative}\\ \text{Fixed Costs}\end{array} - \begin{array}{c}\text{Relevant Unavoidable}\\ \text{Fixed Costs}\end{array}$$

15–38. (30 min.) *Analyze alternative products with differential fixed costs: Edmonton Company.*

a.

	Model	
	Mountaineering	*Touring*
Selling Price	$88.00	$80.00
Variable Costs	52.80	52.80
Contribution Margin	$35.20	$27.20

Production Alternatives:

Produce & Sell		*Contribution Margin*	*Operating Profit*
Mountaineering	*Touring*		
12,000	–0–	$422,400[a]	$52,800[b]
–0–	12,000	$326,400[c]	$ 9,600[d]

---

[a] $35.20(12,000) = $422,400

[b] $422,400 – $369,600 = $52,800

[c] $27.20(12,000) = $326,400

[d] $326,400 – $316,800 = $9,600

Edmonton will choose to produce the Mountaineering model, earning an operating profit of $52,800.

b. Let X be the break-even number of units.

$$\begin{aligned} \$35.20X - \$369{,}600 &= \$27.20X - \$316{,}800 \\ \$35.20X - \$27.20X &= \$369{,}600 - \$316{,}800 \\ \$8.00X &= \$52{,}800 \\ X &= \underline{\underline{6{,}600}} \text{ units} \end{aligned}$$

Edmonton will be indifferent at 6,600 units.

c. *Production Alternatives:*

Produce & Sell		*Contribution Margin*	*Operating Profit*
Mountaineering	*Touring*		
6,000	–0–	$211,200[a]	($158,400)[b]
–0–	12,000	$326,400[c]	$ 9,600 [d]

---

[a] $35.20(6,000) = $211,200

[b] $211,200 – $369,600 = –$158,400

[c] $27.20(12,000) = $326,400

[d] $326,400 – $316,800 = $9,600

Edmonton will choose to produce the Touring model, earning an operating profit of $9,600.

15–39. (35 min.) *Formulate and solve linear program: Baxter, Inc.*

a. The errors in the formulation of the linear programming equations are:

1. The objective function should relate to the maximization of profit (that is, contribution to profit) not the minimization of costs.
2. The coefficients for X-10 (variable A) and Y-12 (variable B) in the objective function should be the contribution margin of the two products (sales price less variable costs), not the full cost of each product.
3. The constraint on the machine time in the two departments was not recognized.

b. Let A = number of units of X-10.
Let B = number of units of Y-12.

Objective function:

Maximize: \$16.5A + \$35.0B

Subject to:

Direct Material

$$4A + 2B \leq 1{,}800 \text{ pounds}$$

Direct Labor–Department 1

$$2/3A + B \leq 400 \text{ hours}$$

Direct Labor–Department 2

$$1\ 1/4A + B \leq 600 \text{ hours}$$

Machine Time–Department 1

$$1/2A + 1/2B \leq 250 \text{ hours}$$

Machine Time–Department 2

$$B \leq 300 \text{ hours}$$

Supporting Calculations

	X-10			*Y-12*		
Unit sales price.........			\$90.00			\$85.00
Variable costs...........						
Direct material	4 lb @ \$12 =	\$48.00		2 lb @ \$12 =	\$24.00	
Direct labor						
Department 1	2/3 hr @ \$6 =	4.00		1 hr @ \$6 =	6.00	
Department 2	1 1/4 hr @ \$8 =	10.00		1 hr @ \$8 =	8.00	
Variable overhead	1.9167 hr @ \$6 =	11.50	73.50	2 hr @ \$6 =	12.00	50.00
Contribution margin..			\$16.50			\$35.00

15–39. (continued)

c. *Initial Table*

Objective function: Maximize \$16.50A + \$35.00B

Constraints:

Material .... $4.00A + 2.00B < 1{,}800$
Labor (1) .... $0.66667A + 1.00B < 400$
Labor (2) .... $1.25A + 1.00B < 600$
Machine (1) .... $0.50A + 0.50B < 250$
Machine (2) .... $1.00B < 300$

Note: The following answers may differ due to rounding of the constraint Labor (1) for variable A.

Summary of Problem

Variables	*Value*	*Reduced Value*
A	149.9993	—
B	300.0000	—

Constraints		*Shadow Price*
Material	600.0030	—
Labor (1)	—	\$24.7499
Labor (2)	112.5009	—
Machine (1)	25.0004	—
Machine (2)	—	10.2501

Optimal Value of Solution is \$12,975

Objective Function Coefficient Ranges

Variable	*Allowable Increase*	*Allowable Decrease*	*Current Coefficient*
A	6.83	16.5	16.5
B	Infinity	10.25	35

15–39. (continued)

c. (continued)

Right Hand Side Ranges

Constraint	*Allowable Decrease*	*Allowable Increase*	*Current RHS*
Material	Inf.	600	1,800
Labor (1)	33	100	400
Labor (2)	Inf.	112.5	600
Machine (1)	Inf.	25	250
Machine (2)	100	100	300

Looking at the ranges of objective function coefficients, we find that if the contribution margin of A drops to $0, then the optimal product mix will change.

The increase in the price of direct materials that would be required to change the product mix is:

$$\frac{\$16.50 - 0}{4 \text{ lbs.}} = \underline{\underline{\$4.125/\text{lb.}}}$$

For Product B, if the contribution margin drops to $24.75, then the mix will change. The required materials price change would be:

$$\frac{\$35.00 - \$24.75}{2 \text{ lbs.}} = \underline{\underline{\$5.125/\text{lb}}}.$$

Chapter 16

Managing Quality and Time

Solutions to Review Questions

16–1.
See text or glossary at the end of the book.

16–2.
The three factors that relate to meeting customer requirements are defined below.

1) **Service:** A product's tangible features (performance, functionality, etc.) and intangible features (courtesy of salespeople, on-time deliveries, etc.).
2) **Quality:** The organization's ability to deliver on its service commitments (i.e. to meet or exceed customer expectations).
3) **Cost:** The company's ability to efficiently use resources to obtain its objectives—and to provide a competitive price to its customers.

16–3.
The quality-based view holds that if quality is established prior to inspections, then there is no need to inspect defect-free goods. The traditional view is that product inspections are the only way to ensure quality.

16–4.
The quality-based view holds that high quality leads to loyal, repeat customers, thus maximizing long-run profits.

16–5.
Service refers to the product's features (both tangible and intangible) including performance, functionality, knowledge of salespeople, and number of on-time deliveries. Quality refers to the company's ability to meet or exceed customer expectations of the product's features.

16–6.
The two costs of controlling quality are: prevention costs (costs incurred to prevent defects in the products or services being produced) and appraisal costs (costs incurred to detect individual units of products that do not conform to specifications).

16–7.
The two costs of failing to control quality are: internal failure costs (costs incurred when nonconforming products and services are detected before being delivered to customers) and external failure costs (costs incurred when nonconforming products and services are detected after being delivered to customers).

Solutions to Critical Analysis and Discussion Questions

16–8.
Service refers to the product's features (both tangible and intangible) including performance, functionality, knowledge of salespeople, and number of on-time deliveries. These features are ultimately defined by customers' expectations. If customers' do not expect a specific product feature, and are just as satisfied without certain features, then their expectations have likely been met and the appropriate amount of service has been provided.

16–9.
Answers will vary but should include reasons why the elements are not important. For instance, when purchasing a low cost item, like fingernail polish, service may not be important. The color is visible through the bottle, so assistance ("intangible" service) may not be required.

16–10.
Answer will vary. One example follows. The quality-based view would encourage continuous improvement of the production process and might offer incentives (i.e. cash bonuses) for production employees to make recommendations about how the production process can be improved. The result would be fewer product defects and more efficient operations. Conversely, the traditional view would assume that defective products are a natural part of the production process and are very difficult to eliminate. Thus, thorough inspections throughout the production process are necessary to ensure minimal defects.

16–11.
Answers will vary but may include any of the following. If a company only has one supplier and inventory of the supplied parts is relatively low (as is the goal of JIT), and the supplier is unable to supply the part (employees go on strike, downtime of production machinery, etc.), then the company is unable to continue production until another supplier can be found. Another problem might exist if demand suddenly surges for a company's product. It may be difficult to meet customer demand if inventories are relatively low and production capacity is inadequate.

16–12.
A control chart shows the results of a statistical process control measure designed to provide warning signals that something is wrong. Cause-and-effect analysis and Pareto charts are used to provide diagnostic signals.

16–13.
Answers will vary, but should address the monitoring of a production process. Any time variations exceed some predetermined level, a warning signal is sent that something may be wrong. For example, when machining a valve for an automobile engine, if the part size falls outside of a specified range, the control chart would send a warning signal that a problem exists with the production process.

16–14.
Just-in-time (JIT) requires the highly efficient coordination of purchasing and production processes. Total quality management (TQM) seeks to continuously improve the production process. JIT is very difficult to implement without TQM since both approaches to quality have the same goal—to make the production process as efficient as possible while producing the best product possible.

16–15.
Time is important because success in competitive markets is increasingly based on shorter new product development time and more rapid response to customers. Companies that are not able to quickly respond to customer needs and wants will have a difficult time competing in today's highly competitive global market.

16–16.
Major improvements in response time will likely require making improvements in the production process, which in turn will typically improve productivity and quality. For example, the automobile industry is beginning to realize the need to quickly respond to customer demands. As a result, the industry has shortened the time it takes to develop and produce automobiles. The only way to do this is to improve the efficiency of both the design phase and production processes.

16–17.
Improving on-time arrivals increases customer satisfaction, not only for the passengers on the on-time flight, but also for the passengers on subsequent flights who would otherwise be delayed. This improves the reputation of the airline which encourages repeat business and attracts new customers. On-time arrivals also reduce costs because delays increase personnel overtime and other costs.

16–18.
The company is measuring customer satisfaction and providing incentives for its claims adjusters and processors to provide quality service.

16–19.
Course evaluations were introduced to help assess teaching performance and to provide feedback to teachers and administrators. They were introduced in the 1960s partly because it was a period of student activism; course evaluations were part of the response to protests by students. (There were other reasons, too, often reflecting local conditions and personalities.)

16–20.
Answers will vary but should include how being compensated by accounting performance may not create goal congruence for quality management. For example, if managers' are evaluated strictly on minimizing costs, total quality management would not likely be their primary concern (i.e., the incentive system does not promote TQM).

Solutions to Exercises

16–21. (15 min.) *Quality according to the customer.*

Answers will vary but may include:

(a) style, timeliness, and fit.

(b) safety, looks, and size.

(c) quality of professor, personable professor, and time offered.

(d) length, destination, and activities offered.

(e) taste, cost, and size.

16–22. (15 min.) *Quality according to the customer*.

Answers will vary but may include:

(a) fit, design, and cost.

(b) size, channel capacity, and cost.

(c) taste, friendly wait-persons, and atmosphere.

(d) accuracy, cost, and comprehensiveness.

(e) cost, quietness, and energy efficiency.

16–23. (15 min.) *Quality according to the customer.*

Answers will vary but may include:

(a) brand compatibility, cost, and number of keys.

(b) life span, disc capacity, and clarity of sound.

(c) accuracy, interest rate, and accessibility.

(d) quality of car, honesty of driver, and driver competence.

(e) cost, stitch capabilities, and attachment capabilities.

16–24. (20 min.) *Costs of quality: Vedral Industries.*

a. Prevention: Preventive maintenance, materials inspection, process inspection, quality training.

Appraisal: Field testing, testing equipment.

Internal failure: Scrap, rework.

External failure: Customer complaints, warranty repairs.

b.

	Year 1	*Year 2*
Prevention		
$414,500/$2,450,000	16.9%	
$291,800/$2,200,000		13.3%
Appraisal		
$164,000/$2,450,000	6.7%	
$194,000/$2,200,000		8.8%
Internal failure		
$188,500/$2,450,000	7.7%	
$204,300/$2,200,000		9.3%
External failure		
$71,000/$2,450,000	2.9%	
$82,000/$2,200,000		3.7%

16–25. (20 min.) *Costs of quality: Owenborrogh Corporation.*

a. Prevention: Process inspection, preventive maintenance, materials inspection, quality training.

Appraisal: Testing equipment, field testing.

Internal failure: Scrap, rework.

External failure: Warranty repairs, customer complaints.

b.

	Year 1	*Year 2*
Prevention		
$331,200/$1,960,000	16.9%	
$234,000/$1,760,000		13.3%
Appraisal		
$131,000/$1,960,000	6.7%	
$155,000/$1,760,000		8.8%
Internal failure		
$150,800/$1,960,000	7.7%	
$163,500/$1,760,000		9.3%
External failure		
$56,500/$1,960,000	2.9%	
$65,200/$1,760,000		3.7%

16–26. (15 min.) *Costs of quality: Ramirez Corporation.*

a. Prevention: Process inspection, quality training, preventive maintenance, materials inspection.

Appraisal: Testing equipment, field testing.

Internal failure: Rework, Scrap.

External failure: Customer complaints, warranty repairs.

b.

	Year 1	*Year 2*
Prevention		
$656,400/$3,920,000	16.7%	
$477,000/$3,520,000		13.6%
Appraisal		
$265,000/$3,920,000	6.8%	
$315,000/$3,520,000		8.9%
Internal failure		
$300,800/$3,920,000	7.7%	
$225,100/$3,520,000		6.4%
External failure		
$114,500/$3,920,000	2.9%	
$129,200/$3,520,000		3.7%

16–27. (15 min.) *Trading off costs of quality: Vedral Industries.*

VEDRAL INDUSTRIES
Cost of Quality Report

	Year 1	*%*	*Year 2*	*%*
Sales	$2,450,000		$2,200,000	
Prevention costs:				
Preventive maintenance	135,000		95,000	
Materials inspection	65,000		48,000	
Process inspection	16,500		18,800	
Quality training	198,000		130,000	
Total prevention costs	414,500	16.9%	291,800	13.3%
Appraisal costs:				
Field testing	94,000		124,000	
Testing equipment	70,000		70,000	
Total appraisal costs	164,000	6.7	194,000	8.8
Internal failure costs:				
Scrap	18,500		19,300	
Rework	170,000		185,000	
Total internal failure costs	188,500	7.7	204,300	9.3
External failure costs:				
Customer complaints	28,000		34,000	
Warranty repairs	43,000		48,000	
Total external failure costs:	71,000	2.9	82,000	3.7
Total Costs of Quality	$ 838,000	34.2%	$ 772,100	35.1%

16–28. (15 min.) *Trading off costs of quality: Owenborrogh Corp.*

OWENBORROGH CORPORATION
Cost of Quality Report

	Year 1	%	*Year 2*	%
Sales	$1,960,000		$1,760,000	
Prevention:				
Process inspection	13,200		15,000	
Preventive maintenance	108,000		76,000	
Materials inspection	52,000		38,000	
Quality training	158,000		105,000	
Total prevention costs	331,200	16.9%	234,000	13.3%
Appraisal:				
Field testing	75,000		99,000	
Testing equipment	56,000		56,000	
Total appraisal costs	131,000	6.7	155,000	8.8
Internal failure:				
Scrap	14,800		15,500	
Rework	136,000		148,000	
Total internal failure costs	150,800	7.7	163,500	9.3
External failure:				
Warranty repairs	34,000		38,000	
Customer complaints	22,500		27,200	
Total external failure costs	56,500	2.9	65,200	3.7
Total Costs of Quality	$ 669,500	34.2%	$ 617,700	35.1%

16–29. (15 min.) *Trading-off costs of quality: Ramirez Corporation.*

RAMIREZ CORPORATION
Costs of Quality Report

	Year 1	%	*Year 2*	%
Sales	$3,920,000		$3,520,000	
Prevention:				
Process inspection	26,400		30,000	
Quality training	305,000		220,000	
Preventive maintenance	220,000		152,000	
Materials inspection	105,000		75,000	
Total prevention costs	656,400	16.7%	477,000	13.6%
Appraisal:				
Testing equipment	115,000		115,000	
Field testing	150,000		200,000	
Total appraisal costs	265,000	6.8	315,000	8.9
Internal failure:				
Scrap	28,800		30,100	
Rework	272,000		195,000	
Total internal failure costs	300,800	7.7	225,100	6.4
External failure:				
Warranty repairs	70,000		75,000	
Customer complaints	44,500		54,200	
Total external failure costs	114,500	2.9	129,200	3.7
Total Costs of Quality	$1,336,700	34.1%	$1,146,300	32.6%

16–30. (20 min.) *Quality versus costs: Canadian Seltzers.*

	Present	*New Mix Regulator*	*Additional Employee*
Costs:			
Waste	$3,000	$1,000	$1,500
Lost business	2,500	500	700
Lease		4,000	
Wages			2,500
Total	$5,500	$5,500	$4,700

Canadian is indifferent between maintaining the status quo and leasing the new mix regulator. Canadian would likely hire an additional employee to manually monitor the existing regulator since this approach is the least costly.

16–31. (20 min.) *Quality versus costs: Hillman Industries.*

	Present	*New Mix Regulator*	*Additional Employee*
Costs:			
Waste	$5,000	$1,500	$2,500
Lost business	3,500	1,500	1,500
Lease		3,500	
Wages			3,000
Total	$8,500	$6,500	$7,000

Hillman should lease the new mix regulator since this approach is the least costly.

16–32. (20 min.) *Quality versus costs: Carlson Corporation.*

	Present	*New Welder*	*Additional Employee*
Costs:			
Waste	$3,000	$1,500	$ 500
Lost business	1,500	500	500
Lease		3,500	
Wages			3,000
Total	$4,500	$5,500	$4,000

Carlson should hire an additional employee since this approach is the least costly.

16–33. (10 min.) *Break-even time: Dallas Oil Company.*

$$\text{Break-even time} = \frac{\text{Investment}}{\text{Annual discounted cash flow}} + \begin{array}{l}\text{Time period from approval}\\ \text{to providing product}\end{array}$$

$$= \frac{\$300 \text{ million}}{\$125 \text{ million}} + 3 \text{ years}$$

$$= 2.4 \text{ years} + 3 \text{ years}$$

$$= \underline{\underline{5.4 \text{ years}}}$$

16–34. (10 min.) *Break-even time: Nugget Company.*

$$\text{Break-even time} = \frac{\text{Investment}}{\text{Annual discounted cash flow}} + \begin{array}{l}\text{Time period from approval}\\ \text{to providing product}\end{array}$$

$$= \frac{\$500{,}000}{\$200{,}000} + 2 \text{ years}$$

$$= 2.5 \text{ years} + 2 \text{ years}$$

$$= \underline{\underline{4.5 \text{ years}}}$$

16–35. (10 min.) *Break-even time: Peugeot Corporation.*

$$\text{Break-even time} = \frac{\text{Investment}}{\text{Annual discounted cash flow}} + \begin{array}{l}\text{Time period from approval}\\ \text{to providing product}\end{array}$$

$$= \frac{\$8 \text{ million}}{\$1.5 \text{ million}} + 2 \text{ years}$$

$$= 5.33 \text{ years} + 2 \text{ years}$$

$$= \underline{\underline{7.33 \text{ years}}}$$

Solutions to Problems

16–36. (90 min.) *Just-in-time.*

Answers will vary. Companies with computerized inventory systems are more likely to log in an order at the point of sale. Students should not assume a retail store uses just-in-time in a literal sense, but should recognize the difference between keeping a stock of items that are replenished as customers order them (perpetual approach) compared to looking at inventory from time to time to see what needs to be ordered (the supply cabinet approach).

16–37. (90 min.) *Total quality management.*

Look for management observation, questionnaires, logs of customer complaints, evaluations by company employees posing as customers and measures of repeat business.

16–38. (90 min.) *Theory of constraints.*

Look for questionnaires, logs of customer complaints, management by walking about and measures of repeat business. Recommendations as to how to use control charts, Pareto charts, and cause-and-effect analysis will vary.

16–39. (25 min.) *Break-even time: Dallas Oil Company.*

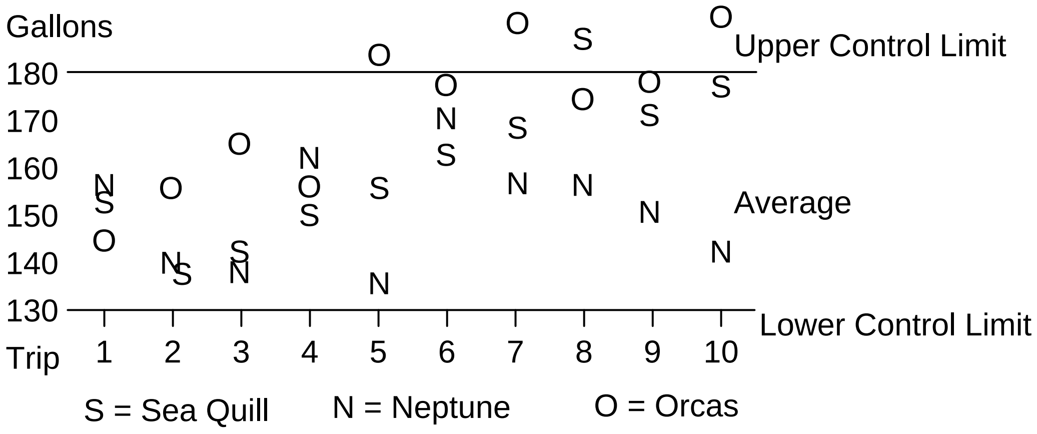
Answers will vary, but the primary focus will likely be on reducing the research, development, and design time to get the product to the market as soon as possible. This might mean investing more in years 1 and 2 so the product can be introduced in year 3.

16–40. (25 min.) *Break-even time: Nugget Company.*

Answers will vary, but the primary focus will likely be on reducing the research, development, and design time to get the product to the market as soon as possible. This might mean investing more in year 1 so the product can be introduced in year 2.

16–41. (50 min.) *Quality control: Norsk Ferries.*

a.



Answers are interpretational. However, some generalities may be:

The Neptune appears to have random variation within the limits and should not be investigated.

The Sea Quill has one fuel usage above the upper control limit. Investigating the cause would be appropriate.

The Orcas has three occurrences of fuel usage above the control limit. Investigating the cause would be appropriate.

b. The advantage of using dollar fuel costs is that it focuses on a primary concern of top managers (operating costs). The disadvantages may include different people being responsible for usage and purchasing, and the difficulty in identifying the cause of changes in costs (price per gallon and/or gallons per trip).

16–42. (25 min.) *Break-even time, working backward: Tiju Instruments.*

a. With a maximum break-even time of four years the cash investment would be:

Sales – Costs = Cash Inflow
$5 million – $3 million = $2 million

$2 million x 4 years = $8 million maximum investment.

b. Tiju might make such a policy because of the short product life cycle. Rapid technological changes might make the product obsolete after a four year period.

16–43. (40 min.) *Quality improvement: Billington Corporation.*

a. $2 increase in direct materials costs.

b.

	Present	*Alternative (New material)*	*Difference*	
	(90,000 units)	(100,000 units)		
Sales ($50 each)	$4,500,000	$5,000,000	$500,000	(higher)
Costs:				
Design	220,000	220,000		
Inspection	85,000	85,000		
Manufacturing ($35 each)	3,150,000	3,500,000	350,000	(higher)
Scrap ($35 each)	350,000	0	350,000	(lower)
New material ($2 each)	0	200,000	200,000	(higher)
Operating profit	$ 695,000	$ 995,000	$300,000	(higher)

The benefit is the difference between the present and the alternative $300,000 (= $3,495,000 – $3,195,000).

c. Yes, Billington should spend the additional $200,000 on new materials as this would increase operating profits by $300,000.

d. Billington should consider other benefits of improving quality. Improved quality will enhance Billington’s reputation with customers and make the company more competitive with its industry counterparts.

Chapter 17
Planning and Budgeting

Solutions to Review Questions

17–1.
More detail appears in the current budget because it is closer in time than the longer-range forecasts. The budget plan is a blueprint for operations in the coming period. It must be sufficiently detailed so that it provides adequate direction to the various people responsible for operations.

17–2.
Cash receipts and disbursements often take place in different time periods from when items are recognized in the income statement and balance sheet. Thus, a company needs to prepare a cash budget to ensure that cash needs will be met.

17–3.

a. Econometric methods;

b. Delphi technique;

c. Estimates from sales people and other knowledgeable personnel;

d. Trend analysis;

e. Market research.

17–4.
Organization goals are broad-based statements of purpose. Strategic plans take the broad-based statements and express them in terms of detailed steps needed to attain those goals. Budgets are the short-term plans used to implement the steps included in the strategic plans.

For example, a company may have a goal of "Becoming the number 1 company in the industry." The strategic plans would include such statements as: "Increase sales volume by 20% per year." The master budget would state the number of units that are needed to be produced and sold in the coming period to meet the 20% volume increase as well as the production and marketing costs necessary to attain that objective. The master budget would also include estimates of the levels of cash, accounts receivable, inventories, and fixed assets needed to support the budgeted level of activity.

17–5.
Since middle management has better knowledge about operations at lower levels in the organization, and since budgets are usually used to evaluate performance or compute bonuses for middle management, middle management may have a tendency to underestimate revenues and overestimate costs. This bias arises because if the biased plans are adopted, middle management will find it easier to meet targets and to achieve bonus awards. Of course, if upper management always "tightens" the budget plans suggested by middle management, gaming may result. The disadvantage of this gaming is that the planning effectiveness may be reduced.

17–6.
Budgeting aids in coordination in a number of ways. By relating sales forecasts to production activities it is possible to reduce the likelihood of over or under production. It coordinates production so that plants making subassemblies are making the appropriate number at the right time as needed by the plant making the final assemblies. In addition, the budget process is used to make certain that adequate cash is on hand to finance company activities for the coming period. Guidelines are set for administrative and selling departments so that their costs are commensurate with the company's income and output goals.

17–7.
Zero-base budgeting requires that all expenditures be justified as if the company or division is new. Most other budgeting practices only require that incremental expenditures be justified.

Solutions to Critical Analysis and Discussion Questions

17–8.
Strategic plans are long-run targets for a company. They usually include targeted sales, production and income levels. They are usually expressed in very highly aggregated levels. The budget plan represents next year's operating plan. It is expressed in a greater level of detail than the strategic plan. Each one year budget plan may be viewed as a step in achieving the long-run strategic plans of the company.

17–9.
As long as the employees are willing to have all direction come down from above, there may be no problem with this executive's approach. However, employees throughout the organization generally are perceived to prefer some input into organization decisions. Indeed, managers at lower levels of the organization usually have more technical expertise about their specific organization subunit than the chief executive officer has. Therefore, inputs from the lower ranks may improve organization operations because plans will be based on better information. In addition, employees will be more likely to support a plan that they have participated in preparing.

17–10.
Since inventories would be eliminated, the timing of purchases would be closer to the time of production. This would minimize the differences between the timing of cash outflows for materials purchases, work in process and finished goods, and the time when the related costs are recognized in the production budget.

17–11.
Behavioral studies indicate that when the budget is an upper limit on expenditures, employees will have a strong incentive to create budget slack. Thus, in a governmental setting, we would expect a strong incentive to overestimate costs to provide a cushion for future expenditures.

17–12.
First there is an incentive for members of various subunits to overestimate costs in order to achieve bonus awards. Of course, if the targets are set so tight that they cannot be reasonably achieved then there may be a problem for the entire incentive system. In addition, there may be a disincentive to increase sales if it means increasing costs.

17–13.
Frequently managers will wait until near the end of the budget period to make discretionary expenditures. Sometimes managers will use "excess" funds from one period to stock up on supplies and other items that would normally be a part of the next budget period’s costs. (Managers have incentives to spend the money requested to maintain the credibility of their requests.) These activities are sometimes considered detrimental to the organization because they result in a waste of resources and improper timing of expenditures. Nonetheless, in many situations the cost of controlling these potentially adverse activities exceeds the benefits.

17–14.
The budgeted income statement would normally be more useful to management to plan and control operations and to coordinate various activities, such as purchasing and planning production levels.

Solutions to Exercises

17–15. (15 min.) *Estimate sales revenues: Orcutt & Daughter.*

.85 = market volume in the coming year (as a percent of last year)
.90 = number of trades in the coming year (as a percent of last year)
1.20 = average commission per trade in the coming year (as a percent of last year)

60,000 trades x $220 per trade x .85 x .90 x 1.20 = $12,117,600

17–16. (15 min.) *Estimate sales revenues: Jackson City Bank.*

	Portfolio Amount	*Interest Rate*	*Income*
Commercial loans.................	$19 million	11%	$2,090,000
Consumer loans....................	17 million	16	2,720,000
Securities..............................	5 million	8	400,000
Total..............................			$5,210,000

17–17. (15 min.) *Estimate sales revenues: Reiser Co.*

Market size last year $= \dfrac{225{,}000 \text{ units}}{.2} = 1{,}125{,}000$ units

Market size next year = 1.05 x 1,125,000 units
= 1,181,250 units

Company share = 24% x 1,181,250 units
= 283,500 units

Sales revenue = 283,500 units x $2.10 per unit
= $595,350

17–18. (15 min.) *Estimate production levels: Cordelias Corporation.*

Cordelias Corporation
Production Budget
For the Year Ended December 31
(in units)

Expected Sales	960,000 units
Add: Desired ending inventory of finished goods $\left(\frac{\text{2 months}}{\text{12 months}} \text{ x } 960{,}000\right)$	160,000
Total needs	1,120,000
Less: Beginning inventory of finished goods	52,000
Units to be produced	1,068,000 units

Alternative method:

$$\begin{aligned} BB + P &= \text{Sales} + EB \\ 52{,}000 + P &= 960{,}000 + \left(\frac{2}{12}\right)(960{,}000) \\ P &= 960{,}000 + 160{,}000 - 52{,}000 \\ &= \underline{\underline{1{,}068{,}000}} \text{ units} \end{aligned}$$

17–19. (25 min.) *Estimate production and materials requirements: Visions, Inc.*

Visions, Inc.
Production Budget
For the Year Ended December 31
(in units)

Expected Sales	320,000 units
Add: Desired ending inventory of finished goods	40,000
Total needs	360,000
Less: Beginning inventory of finished goods	80,000
Units to be produced	280,000 units

Visions, Inc.
Direct Materials Requirements
For the Year Ended December 31
(in units)

Units to be produced	280,000
Direct materials needed per unit	5 feet
Total production needs (amount per unit times 280,000 units)	1,400,000 feet
Add: Desired ending inventory $\left(\frac{3 \text{ months}}{12 \text{ months}} \text{ x } 320{,}000 \text{ x } 5\right)$	400,000
Total direct materials needs	1,800,000
Less: Beginning inventory of materials	200,000
Direct materials to be purchased	1,600,000 feet

Alternative Method

Production (assumes finished goods in inventory reduced to 40,000 units at the end of this year):

$$\begin{aligned} BB + P &= \text{Sales} + EB \\ 80{,}000 + P &= 320{,}000 + 40{,}000 \\ P &= \underline{\underline{280{,}000}} \text{ units} \end{aligned}$$

Materials Requirements:

$$\begin{aligned} BB + P &= \text{Usage} + EB \\ 200{,}000 + P &= (5)(280{,}000) + \left(\frac{3}{12}\right)(320{,}000)(5 \text{ ft}) \\ P &= 1{,}400{,}000 + 400{,}000 - 200{,}000 \\ &= \underline{\underline{1{,}600{,}000}} \text{ ft.} \end{aligned}$$

17–20. (25 min.) *Estimate purchases and cash disbursements: Lazarus Company.*

a.

Lazarus Company
Merchandise Purchases Budget
For the Period Ended August 31
(in units)

	June	*July*	*August*
Estimated sales	6,200	8,900	6,600
Add: Estimated sales inventory	15,500	13,700	11,900
Total merchandise needs	21,700	22,600	18,500
Less: Beginning inventory	14,000	15,500	13,700
Merchandise to be purchased	7,700	7,100	4,800
Estimated cost per unit	$.70	$.70	$.70
Total estimated cost of merchandise	$5,390	$4,970	$3,360

Alternative method:

June purchases: P = Sales + EB – BB
= 6,200 + (8,900 + 6,600) – 14,000
= 7,700 units

July purchases = 7,100 = September production requirements

August purchases = 4,800 = October production requirements.

b. Cash required:

June: $5,390 = 7,700 x $.70
July: $4,970 = 7,100 x $.70
August: $3,360 = 4,800 x $.70

17–21. (25 min.) *Estimate purchases and cash disbursements: Oleander Products.*

a.

Oleander Products
Merchandise Purchase Budget
For the Period Ended May 31
(in units)

	February	*March*
Estimated sales	8,600	7,000
Add: Estimated ending inventory	7,000	7,400
Total merchandise needs	15,600	14,400
Less: Beginning inventory	8,000	7,000
Merchandise to be purchased	7,600	7,400

Alternative method:

Purchases are as follows:

February: BB + P = Sales + EB
8,000 + P = 8,600 + 7,000
= 15,600 – 8,000
= 7,600 = February purchases

March: 7,000 + P = 7,000 + 7,400
P = (7,000 – 7,000) + 7,400
P = 7,400 = March purchases = April sales

b. Payments for these purchases are made as follows:

		Month of Delivery		
Month of Payment	*Total*	*January*	*February*	*March*
February	$2,492,400	$1,160,000[a]	$1,322,400[b]	
March	2,169,200		881,600[c]	$1,287,600[d]

---

[a] $1,160,000 = 40% x $290 x 10,000 units.
[b] $1,322,400 = 60% x $290 x 7,600 units.
[c] $881,600 = 40% x $290 x 7,600 units.
[d] $1,287,600 = 60% x $290 x 7,400 units.

17–22. (15 min.) *Estimate cash disbursements: Walsh Company.*

Walsh Company
Schedule of Cash Disbursements
For the Period Ended May 31

	Month *May*
Beginning accounts receivable, April 1	$ 10,000
April sales	55,000
May purchases	154,000[a]
Total cash disbursements	$219,000

---

[a] $154,000 = $220,000 × 70%

17–23. (15 min.) *Estimate cash collections: 47th Street Company.*

The correct answer is (4): $342,000

47th Street Company
Schedule of Cash Collections
For the Month Ended July 31

	Month *July*
Beginning accounts receivable, June 1	$ 32,000
June sales	$210,000[a]
July sales	100,000[b]
Total cash collections	$342,000

---

[a] $210,000 = $300,000 x 70%
[b] $100,000 = $400,000 x 25%

17–24. (20 min.) *Estimate cash collections: Kingstons Products.*

The correct answer is (3): $89,650.

Kingstons Products
Schedule of Cash Collections
For the Month Ended September 30

	Month *September*
June sales	$ 2,850[a]
July sales	4,800[b]
August sales	54,000[c]
September sales	28,000[d]
Total cash collections	$89,650

---

[a] $2,850 = $95,000 x 3%
[b] $4,800 = $80,000 x 6%
[c] $54,000 = $90,000 x 60%
[d] $28,000 = $100,000 x 28%

17–25. (30 min.) *Estimate cash receipts: Bride To Be.*

a. Revenues are as follows:

January	$16,000	=	5 weddings	x	$3,200
February	$9,600	=	3 weddings	x	$3,200
March	$6,400	=	2 weddings	x	$3,200
April	$12,800	=	4 weddings	x	$3,200
May	$16,000	=	5 weddings	x	$3,200
June	$35,200	=	11 weddings	x	$3,200

b. Cash receipts are as follows:

Bride to Be
Multiperiod Schedule of Cash Receipts

	Cash Receipts in Month of:				*Total Cash Receipts for Period*
	January	*February*	*March*	*April*	
January sales	$ 4,800[a]				$ 4,800
February sales	4,800[b]	$2,880			7,680
March sales	1,280[c]	3,200	$ 1,920		6,400
April sales		2,560	6,400	$ 3,840	12,800
May sales			3,200	8,000	11,200
June sales				7,040	7,040
Total cash collections	$10,880	$8,640	$11,520	$18,880	$49,920

---

[a] $4,800 = 16,000 x 30%

[b] $4,800 = $9,600 x 50%

[c] $1,280 = $6,400 x 20%

This pattern is repeated for subsequent months.

17–26. (30 min.) *Estimate cash receipts: Water Works.*

a. Revenues are as follows:

March $2,500 = .5 calls x 100 subscribers x $50
April 6,000 = 1.0 call x 120 subscribers x $50
May 23,400 = 1.8 calls x 260 subscribers x $50
June 33,000 = 2.2 calls x 300 subscribers x $50
July 30,000 = 2.0 calls x 300 subscribers x $50
August 23,800 = 1.7 calls x 280 subscribers x $50

Collections of these revenues are expected according to the following schedule:

Water Works
Multiperiod Schedule of Cash Receipts

	Cash Receipts in Month of:				*Total Cash Receipts for Period*
	May	*June*	*July*	*August*	
March sales	$ 450[a]				$450
April sales	3,600[b]	$ 1,080			4,680
May sales	4,680[c]	14,040	$ 4,212		22,936
June sales		6,600	19,800	$ 5,940	32,340
July sales			6,000	18,000	24,000
August sales				4,760	4,760
Total cash collections.....	$8,730	$21,720	$30,012	$28,700	$89,162

---

[a] $450 = 18% x $2,500
[b] $3,600 = 60% x $6,000
[c] $4,680 = 20% x $23,400

This pattern is repeated for subsequent months.

17–27. *Prepare budgeted financial statements: Water Works.*

Water Works
Budgeted Income Statement
For the Month of September

		Calculations
Revenues	$17,136	(90% x 280) x (80% x 1.7) x $50
Less manufacturing costs:		
Variable costs	3,398	(.72[a] x $4,720)
Maintenance and repair	4,242	(1.01 x $4,200)
Depreciation	2,200	(no change)
Total manufacturing costs	9,840	
Marketing and administrative:		
Marketing (variable)	1,800	(.72[a] x $2,500)
Administrative (fixed)	2,416	(1.05 x $2,300)
Total marketing and administrative costs	4,216	
Total costs	$14,056	
Operating profit	$ 3,080	

---

[a] Ratio of September to August volume:

September: (90% x 280) x (80% x 1.7) = 342.72
August: 280 x 1.7 = 476
Ratio = .72 = 342.72/476
or
Ratio = .80 x .90 = .72

17–28. *Prepare budgeted financial statements: Hampton, Inc.*

Hampton, Inc.
Budgeted Income Statement
For the Year, Year 2

		Calculations
Revenues (120 units @ $225/unit)	$27,000	($25,000 x 1.20 x .90)
Less		
Manufacturing costs:		
Variable	4,499	($3,640 x 1.20 x 1.03)
Depreciation (fixed)	1,325	(unchanged)
Total manufacturing costs	5,824	
Gross profit margin	21,176	
Less:		
Marketing and Administrative		
Fixed costs (cash)	4,829	($4,390 x 1.10)
Depreciation (fixed)	675	(unchanged)
Total marketing and administrative costs	$5,504	
Operating profits	$15,672	

17–29. (20 min.) *Ethics and Budgeting: El Dorado Company.*

a. Their methods are a hedge against the uncertain, but more importantly it is a method of allowing employees to exceed expectations. By artificially reducing sales, and increasing costs, one can surely excel when compared to the budget. This can be personally rewarding if reviews, promotions, bonuses, etc. are based on actual versus budgeted performance.

b. The use of a budget to motivate employees to top performance is limited if sales figures are lower and costs are higher than expected. Barry and Maria will lose credibility in the eyes of upper management if they continuously present poor budgets. Furthermore, management may use these budgets for important decisions such as determining staffing levels or the profitability of products or product lines. Submitting a budget with lower sales and higher costs (reduced contribution margins) could have adverse effects on continued employment.

c. Maria and Barry have an ethical responsibility to prepare reports using relevant and reliable information. Clearly they are not doing this. The budgets they are submitting were not prepared objectively. There is also a question of integrity since Maria and Barry hope to benefit from the use of budgetary slack. By submitting erroneous budgets they are subverting the legitimate goals of the company.

Solutions to Problems

17–30. (30 min.) *Prepare budgeted financial statements: Parker Products.*

Parker Products
Budgeted Income Statement
For Year 2

		Calculations
Revenues	$812,725[a]	$725,000 x 1.18 x .95
Manufacturing costs:		
Materials	45,595	$42,000 x .92 x 1.18
Other variable costs	41,168	$35,600 x .98 x 1.18
Fixed cash costs	85,995	$81,900 x 1.05
Depreciation (fixed)	249,750	unchanged
Total manufacturing costs	422,508	
Marketing and administrative costs:		
Marketing (variable, cash)	124,608	$105,600 x 1.18
Marketing depreciation	37,400	unchanged
Administrative (fixed, cash)	140,030	$127,300 x 1.10
Administrative depreciation	18,700	unchanged
Total marketing and administrative costs	320,738	
Total costs	743,246	
Operating profits	$ 69,479	

---

[a] $812,725 = 118,000 units x (.95 x $7.25 per unit)

17–31. (10 min.) *Estimate cash receipts: Parker Products.*

Parker Products
Cash Basis Budgeted Income Statement
For Year 2

Revenues	$812,725
Manufacturing costs:	
Materials	45,595
Other variable costs	41,168
Fixed cash costs	85,995
Total manufacturing costs	172,758
Marketing and administrative costs:	
Marketing (variable, cash)	124,608
Administrative (fixed, cash)	140,030
Total marketing and administrative costs	264,638
Total costs	437,396
Operating profits	$375,329

Cash from operations would equal revenues less cash costs, which excludes depreciation.

17–32. (30 min.) *Prepare budgeted financial statements: Quinn Electronics.*

Quinn Electronics
Budgeted Income Statement
For Year Ended XXX

		Calculations
Revenues	$885,651	$746,000 x 1.12 x 1.06
Manufacturing costs:		
Materials	163,856	$133,000 x 1.12 x 1.10
Variable cash costs	194,504	$180,900 x 1.12 x .96
Fixed cash costs	66,960	$72,000 x .93
Depreciation (fixed)	93,300	$89,000 – $9,700 + $14,000
Total manufacturing costs	$518,620	
Marketing and administrative costs:		
Marketing (variable, cash)	106,400	$95,000 x 1.12
Marketing depreciation	22,600	unchanged
Administrative (fixed, cash)	97,319	$90,110 x 1.08
Administrative depreciation	8,400	unchanged
Total marketing and administrative costs	234,719	
Total costs	753,339	
Operating profits	$132,312	

17–33. (10 min.) *Estimate cash receipts: Quinn Electronics.*

Quinn Electronics
Cash Basis Budgeted Income Statement
For the Year Ended XXX

Revenues	$885,651
Manufacturing costs:	
Materials	163,856
Variable cash costs	194,504
Fixed cash costs	66,960
Total manufacturing costs	425,320
Marketing and administrative costs:	
Marketing (variable, cash)	106,400
Administrative (fixed, cash)	97,319
Total marketing and administrative costs	203,719
Total costs	629,039
Operating profits	$256,612

Cash from operations would equal revenues less cash costs, which excludes depreciation.

17–34. (25 min.) *Prepare a production budget: Sevi, Inc.*

Sevi, Inc.
Production Budget
For the Year Ended December 31
(in units)

Expected Sales	18,000	units
Add: Desired ending inventory of finished goods	7,000	
Total needs	25,000	
Less: Beginning inventory of finished goods	4,000	
Units to be produced	21,000	units

Alternative method:

First, compute the estimated production:

$$P = \text{Sales} + EB - BB$$

$$P = \text{Sales} + (7{,}000 - 4{,}000)$$

$$= 18{,}000 + 3{,}000$$

$$= \underline{\underline{21{,}000}} \text{ units}$$

Next estimate the costs:

Direct materials		
Z-A styrene 21,000 x 1 lb. x $.40		$8,400
Vasa finish 21,000 x 2 lbs. x $.80 x 1.10		36,960
Total direct materials		$45,360
Direct labor:		
21,000 x 1/4 hr. x $8.60		$45,150
Overhead:		
Indirect labor	21,000 x $.12	2,520
Indirect materials	21,000 x $.03	630
Power	21,000 x $.07	1,470
Equipment costs	20,000 x $.36	7,200
Building occupancy	20,000 x $.19	3,800
Total overhead		$15,620
Total budgeted manufacturing costs		$106,130

17–35. (25 min.) *Sales expense budget: Gemini Corporation.*

Item	*January*		*Adjustments*		*Budgeted Typical Month*
Sales commissions	$135,000	x	1.05 x 1.10	=	$155,925
Sales staff salaries	32,000	x	1.04	=	33,280
Telephone & mailing	16,200	x	1.08 x 1.05	=	18,371
Building lease payment	20,000		none	=	20,000
Heat, light & water	4,100	x	1.12	=	4,592
Packaging & delivery	27,400	x	1.05	=	28,770
Depreciation	12,500	+	($1,900 x 1/10)	=	12,690
Marketing consultants	–0–	x	$35,000	=	35,000
Total budgeted costs					$308,628

17–36. (30 min.) *Budgeted purchases and cash flows–multiple choice: Warner Corporation.*

a. The correct answer is (3) $225,000

$$\begin{aligned}
\text{BB} + \text{TI} &= \text{TO} + \text{EB} \\
(130\% \times 11{,}900) + \text{TI} &= 11{,}900 + (130\% \times 11{,}400) \\
15{,}470 + \text{TI} &= 11{,}900 + 14{,}820 \\
\text{TI} &= 11{,}900 + 14{,}820 - 15{,}470 \\
&= 11{,}250 \text{ units} \\
11{,}250 \times \$20 &= \underline{\underline{\$225{,}000}}
\end{aligned}$$

b. The correct answer is (2) $243,600

$$\begin{aligned}
\text{BB} + \text{TI} &= \text{TO} + \text{EB} \\
(130\% \times 11{,}400) + \text{TI} &= 11{,}400 + (130\% \times 12{,}000) \\
14{,}820 + \text{TI} &= 11{,}400 + 15{,}600 \\
\text{TI} &= 11{,}400 + 15{,}600 - 14{,}820 \\
&= 12{,}180 \text{ units} \\
12{,}180 \times \$20 &= \underline{\underline{\$243{,}600}}
\end{aligned}$$

c. The correct answer is (4) $333,876

$$\begin{aligned}
60\% \times \$363{,}000 \times 97\% &= \$211{,}266 \\
25\% \times \$363{,}000 &= 90{,}750 \\
9\% \times \$354{,}000 &= \underline{31{,}860} \\
&\ \underline{\underline{\$333{,}876}}
\end{aligned}$$

17–36. (continued)

d. The correct answer is (1) $285,379

May purchases paid in June:
$225,000* x 46% = $103,500

May selling general and administrative expenses paid in June:
[($357,000 x 15%) – $2,000] x 46% = $23,713

June purchases paid in June:
$243,600** x 54% = $131,544

June selling, general and administrative expenses paid in June:
[($342,000 x 15%) – $2,000] x 54% = $26,622
$103,500 + $23,713 + $131,544 + $26,622 = $285,379

---

*From part a. of this problem

**From part b. of this problem

e. The correct answer is (3) 12,260

$$\begin{aligned} BB + TI &= TO + EB \\ (130\% \times 12{,}000) + TI &= 12{,}000 + (130\% \times 12{,}200) \\ TI &= 12{,}000 + 15{,}860 - 15{,}600 \\ &= \underline{\underline{12{,}260}}\ \text{units} \end{aligned}$$

17–37. (40 min.) *Comprehensive budget plan: Tipless, Inc.**

a. (1)

Tipless, Inc.
Schedule Computing Production
Budget (Units)
For October, November, and December 19X0

	October	*November*	*December*
Budgeted Sales—Units	120,000	90,000	120,000
Inventory Required at End of Month[a]	18,000	24,000	24,000
Total to Be Accounted for	138,000	114,000	144,000
Less Inventory on Hand at Beginning of Month	24,000	18,000	24,000
Budgeted Production—Units	114,000	96,000	120,000

---

[a] October: 90,000 x .2 = 18,000
November: 120,000 x .2 = 24,000
December: 120,000 x .2 = 24,000

(2)

Schedule Computing Raw Materials Inventory
Purchase Budget (Pounds)
For October and November 19X0

	October	*November*
Budgeted Production—Pounds (1/2 lb. per Unit)[a]	57,000	48,000
Inventory Required at End of Month[b]	19,200	24,000
Total to Be Accounted for	76,200	72,000
Less Inventory on Hand at Beginning of Month	22,800	40,800[c]
Balance Required by Purchase	53,400	31,200
Budgeted Purchases—Pounds (Based on Minimum Shipments of 25,000 lbs. Each)	75,000	50,000

---

[a] October: 114,000 x .5 = 57,000
November: 96,000 x .5 = 48,000

[b] October: 96,000 x .4 x .5 = 19,200
November: 120,000 x .4 x .5 = 24,000

[c] 22,800 + 75,000 – 57,000 = 40,800

*CPA adapted.

17–37. (continued)

b.

Tipless, Inc.
Projected Income Statement
For the Month of November 19X0

Sales (90,000 Units at $2)		$180,000
Less: Cash discounts on Sales	$ 1,800	
Estimated Bad Debts (1/2 Percent of Gross Sales)	900	2,700
Net Sales		$177,300
Cost of Sales:		
Variable Cost per Unit (= $\frac{\$110,000}{100,000}$ x 90,000 Units)	$99,000	
Fixed Cost	10,000	109,000
Gross Profit on Sales		$ 68,300
Expenses:		
Selling (10 Percent of Gross Sales)	$18,000	
Administrative ($33,000 per Month)	33,000	
Interest Expense (.01 x $100,000)	1,000	52,000
Operating Profit		$ 16,300

17–38. (60 min.) *Comprehensive budget plan: Eagle Corporation.**

Eagle Corporation
Budgeted Income Statement
(in thousands)

	Actual For the Year Ended December 31, (Last Year)		*Budgeted For the Year Ended December 31, (This Year)*	
Revenue:				
Sales	$450,000		$600,000	
Other income	15,000		9,000	
Total Revenue		$465,000		$609,000
Expenses:				
Cost of Goods Manufactured and Sold:				
Materials	132,000		213,000	
Direct Labor	135,000		218,000	
Variable Overhead	81,000		130,000	
Fixed Overhead	12,000		12,750	
	360,000		573,750	
Beginning Inventory	48,000		48,000	
	408,000		621,750	
Ending Inventory	48,000	360,000	114,750	507,000
Marketing:				
Salaries	13,500		16,000	
Commissions	15,000		20,000	
Promotions and Advertising	31,500	60,000	45,000	81,000
Administrative:				
Salaries	14,000		16,000	
Travel	2,000		2,500	
Office Costs	8,000	24,000	9,000	27,500
Income Taxes (credit)		8,400		(2,600)
Total Expenses		452,400		612,900
Operating Profit (Loss)		$ 12,600		$ (3,900)

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*CMA adapted

Note: Actual for December 31, Last Year not required but included for comparison.

17–38. (continued)

Eagle Corporation
Budgeted Balance Sheet
(in thousands)

	Budgeted December 31, This Year	
Cash	$ 1,200	
Accounts Receivable	80,000	
Inventory	114,750[a]	
Income Tax Receivable	2,600[b]	
Total Current Assets		$198,550
Plant and Equipment	130,000	
Less: Accumulated Depreciation	41,000	89,000
Total Assets		$287,550
Current Liabilities		
Accounts Payable	$45,000	
Accrued Payable	23,250	
Notes Payable	50,000	
Total Current Liabilities		$118,250
Shareholders' Equity		
Common Stock	70,000	
Retained Earnings	99,300	
Total Shareholders' Equity		169,300
Total Liabilities and Shareholders' Equity		$287,550

Additional computations:

[a] Inventory

Units:

Beginning inventory \$48,000 ÷ $\frac{\$360,000,000}{300,000,000}$	=	40,000 units
Added to inventory 450,000 – 400,000	=	50,000 units
Ending inventory		90,000 units

Cost:

Manufacturing costs	$573,750
Units manufactured	450,000
Cost per unit ($573,750 ÷ 450,000)	$1.275
Ending units	90,000
Cost of ending inventory	$114,750

Note: Footnote b appears on the next page.

17–38. (continued)

[b]Income tax:

Sales & other income	$609,000
Cost of goods sold	$507,000
Selling expense	81,000
General & administrative expense	27,500
Total cost	$615,500
Tax loss	$ (6,500)
Tax rate	40%
Tax receivable	$ 2,600

Solutions to Integrative Cases

17–39. (40 min.) *Prepare cash budget for service organization: Triple-F Health Club.*

The income statement is on a cash basis, hence we start with a budgeted income statement.

a.

Triple-F Health Club
Budgeted Statement of Income (Cash Basis)
For the Year Ended October 31, 19X8

Cash revenue	
Annual membership fees $355,000 x 1.1 x 1.03	$402,215
Lesson and class fees $\left(\frac{234}{180} \times \$234,000\right)$	304,200
Miscellaneous $\left(\frac{2.0}{1.5} \times \$2,000\right)$	2,667
Total cash received	$709,082
Cash costs	
Manager's salary and benefits ($36,000 x 1.15)	$ 41,400
Regular employees' wages and benefits ($190,000 x 1.15)	218,500
Lesson and class employee wages and benefits	291,525
Towels and supplies ($16,000 x 1.25)	20,000
Utilities (heat and light) ($22,000 x 1.25)	27,500
Mortgage interest ($360,000 x .09)[a]	32,400
Miscellaneous ($2,000 x 1.25)	2,500
Total cash expenses	$633,825
Cash income	$ 75,257
Additional Cash Flows	
Cash payments:	
Mortgage payment	$ 30,000
Accounts payable balance at 10/31/19X7	2,500
Accounts payable on equipment at 10/31/19X7	15,000
Planned new equipment purchase	25,000
Total cash payments	72,500
Cash inflows from income statement	75,257
Beginning cash balance	7,300
Cash available for working capital and to acquire property	$ 10,057

---

[a] On November 1, 19X7, the unpaid balance after annual payment is $360,000, computed as follows: Balances after the $30,000 annual payment November 1, 19X4 = $450,000; November 1, 19X5 = $420,000; November 1, 19X6 = $390,000; November 1, 19X7 = $360,000.

17–39. (continued)

b. Operating problems which Triple-F Health Club could experience in 19X8 include:

- The lessons and classes contribution to cash decreased because the projected wage increase for lesson and class employees is not made up by the increased volume of lessons and classes.
- Operating costs are increasing faster than revenues from membership fees.
- Triple-F seems to have a cash management problem. Although there appears to be enough cash generated for the club to meet its obligations, there are past due amounts on equipment and regular accounts. Perhaps the cash balance may not be large enough for day to day operating purposes.

c. The manager's concern with regard to the Board's expansion goals are justified. The 19X8 budget projections show only a minimal increase in the cash balance. The total cash available is well short of the cash needed for the land purchase over and above the club's working capital needs. However, it appears that the new equipment purchases can be made on an annual basis. If the Board desires to purchase the adjoining property, it is going to have to consider significant increases in fees or other methods of financing such as membership bonds, or additional mortgage debt.

17–40. River Beverages Case.

Note: It is important to understand the regional structure of the organization (Illustration 17.40A) as well as the production plant structure for the company's NonCarbonated Drink plant in St. Louis (Illustration 17.40B). Instructors may want to present an overview of this case before assigning it to students.

a. Sales projections are made at three levels:

- Division managers submit a report to the vice president for the region that includes forecasts for capital, sales, and income. This report is used for strategic planning purposes.
- The strategic research team develops sales forecasts for each division while considering economic conditions and current market share for each region. The strategic research team reports directly to the vice president of each region (see Illustration 17.40A). This team is able to more accurately integrate division products and assess demand for complementary products than the individual division managers.
- Once the corporate forecast is completed (using the information from division managers and the strategic research team), district sales managers estimate sales for their district. The district sales managers report to the division sales managers for each division (see Illustration 17.40B). However, the district sales managers return their forecasts to the division managers rather than to the division sales manager. The strategic research team and division controller review the forecasts prior to sending the forecasts on to top management (probably to check for reasonableness—the strategic research team and controller likely know more about the division's market than top management).

After the sales budget is approved by top management, it is separated into a sales budget for each plant. Since the sales budget is already established, plant managers are responsible for establishing the budget for costs and profit given specific predetermined sales projections. The plant budgets are established as follows:

- Each department within the plant is required to develop cost standards and cost reduction targets. (The department personnel will likely know more about these costs than upper management. Thus, it is reasonable to have them be involved in the process.)
- A member of the strategy team and controller review the budget process with the plant manager to make sure the budget is reasonable.
- Final budgets are submitted by April 1.

17–40. (continued)

The final budgets are fine tuned by the vice presidents and CEO and submitted to the board of directors for approval in early June. (The vice presidents and CEO must be able to justify the budgets to the board, and thus, review it and make any necessary changes before submitting it.)

b. The question is “should the plants be treated as profit centers (responsible for sales and costs), or as cost centers (responsible only for costs)?”

The plant managers have very little control (if any) over sales projections. As shown in Illustration 17.40B, the division and district sales managers report separately to the division manager, and do not discuss the sales budget with the plant managers. It is very difficult to make a case that plant managers should be responsible for sales. However, plant managers are responsible for controlling costs and are directly involved in establishing budgeted costs. Thus, it is reasonable to treat the plant as a cost center and hold plant managers responsible for costs. If management wants to continue treating the plant as a profit center, plant managers should be involved in the sales budgeting process.

c. The primary question is “what behavior is top management trying to promote with the budgeting process?” In general, River Beverages’ management wants its employees to maximize production efficiency (thus minimizing production costs), and maximize profits.

Answers concerning the advantages and disadvantages of the budget process will vary. One example follows:

- Plant managers are held responsible for sales and costs even though they only have control over costs. Sales departments can cut prices or offer promotional campaigns that negatively affect a plant manager’s profit. In this example, it is not advantageous to assign responsibility for sales to plant managers without control over pricing and promotional decisions.

Chapter 18

Flexible Budgeting and Performance Evaluation

Solutions to Review Questions

18–1.
A responsibility center is a subunit of an organization that has control over certain costs and/or revenues. The accounting system is designed to relate controllable costs and revenues to the appropriate responsibility center.

18–2.
Some responsibility centers are responsible only for costs. The assembly unit of a manufacturing plant would be a good example. On the other hand, some responsibility centers, such as sales offices, are responsible for revenues. Other responsibility centers such as corporate divisions are responsible for both revenues and costs. Finally, some responsibility centers are responsible for revenues, costs, and investment in company assets. The chief executive officer is the prime example of this. The designation of responsibility centers depends on the specific organizational structure and management system in the organization.

18–3.
For performance evaluation purposes, the costing format should identify the actual costs for comparison with expected costs during the relevant period. Under absorption costing, the manufacturing fixed costs are allocated on a per unit basis. An increase in production results in a lower per unit cost. If all of the production is sold, all of the fixed cost will be charged against profit. However, if some of the costs are assigned to inventory, the result can be a deferral of costs that should be evaluated at this time. This problem is highlighted by the suggestion that one can increase production in times of declining sales in order to “help the bottom line by spreading fixed costs over more units.”

18–4.
Variable costs and revenues “flex” with changes in activity. Fixed costs are expected to remain the same when operations are in the relevant range.

18–5.
Standard costing establishes standard costs—anticipated costs of producing and/or selling a unit of output, typically based on historical data adjusted for current trends. Target costing is a systematic approach to establishing product cost goals based on market-driven factors. Target costing begins with the customer and “backs in” to the target cost based on the target sales price minus the target margin (set by management).

18–6.
Flexible budget—multiple choice question.

(d) Master budget is based on a predicted level of activity and a flexible budget is based on the actual level of activity.

18–7.

Flexible budget—multiple choice question.

(d) Appropriate for any level of activity.

Solutions to Critical Analysis and Discussion Questions

18–8.

Responsibility is usually expressed in terms of standards for units of output. That is, an assembly line worker is expected to assemble a given number of units per hour, day or week. A college instructor is expected to teach a given number of courses and students. Hence, these workers do not avoid responsibility, but their responsibility is measured differently.

18–9.

Government systems are usually not able to respond to changes in activity levels. For example, an unemployment commission is usually strapped for workers when the unemployment rate rises. By the time the needs are presented to legislators and the needs are met through increased funding, the unemployment rate may well have decreased leading to over-funding in a subsequent period. In part this problem is due to the elaborate controls that have been instituted over governmental units.

18–10.

Preparation of the *ex post* budget allows management to compare actual results with the budget that would have been instituted if certain ex ante unknowns were known. The most significant of these is, typically, volume of activity. By controlling for the difference between *ex ante* expectations and the *ex post* volumes, comparisons between actual results and plans can be more meaningful. The controllable factors (i.e., costs per unit, efficiency, sales prices) can be isolated and evaluated.

18–11.

The performance measurement system should not change with the differences in financial reporting methods. For performance evaluation and control, the important factor is costs *incurred*, not the accounting treatment of those costs.

18–12.

The management at MiniScribe was trying to create the illusion of more sales than there really were. Invoices dated in the next fiscal year would not be included in the current fiscal year. Back dating invoices allows the company to record sales in the current year that occurred in the following year. This would tend to overstate revenues and make the company look more profitable than it really is. Shipping disk drives to customers who had not ordered them was a very expensive way of continuing the illusion of increased sales when true sales were much smaller.

18–13.

A flexible budget indicates budgeted revenues, costs and profits for virtually all feasible levels of activity. So, managers can use the flexible budget to determine what costs should be assuming different levels of activity. Since changes in volume of production may not be within the particular manager’s control, the flexible budget allows supervisory managers to isolate the effect of changes in volume on the overall costs of a department in question. The flexible budget also separates fixed and variable costs. Generally, fixed costs are less controllable in the short run than variable costs.

Solutions to Exercises

18–14. (20 min.) *Flexible budgeting: Davidson, Inc.*

Calculations: Master budget dollar amount

Sales revenue:	18,000 units x $12 per unit =	$216,000
Variable costs:	18,000 units x $ 5 per unit =	$ 90,000
Fixed costs:		$ 54,000

Davidson, Inc.
Flexible Budget

Sales revenue	$220,800	(= $12 x 18,400)
Less:		
Variable manufacturing costs	92,000	(= $5 x 18,400)
Contribution margin	$128,800	
Less:		
Fixed manufacturing costs	54,000	
Operating profits	$ 74,800	

18–15. (30 min.) *Sales activity variance: Davidson, Inc.*

	Flexible Budget (based on actual of 18,400 units)	*Sales Activity Variance*	*Master Budget (based on budgeted 18,000 units)*
Sales revenue	$220,800	$4,800 F	$216,000
Less:			
Variable manufacturing costs	92,000	2,000 U	90,000
Contribution margin	128,800	2,800 F	126,000
Less:			
Fixed costs	54,000		54,000
Operating profits	$ 74,800	$2,800 F	$ 72,000

18–16. (30 min.) *Profit variance analysis: Davidson, Inc.*

	Actual (18,400 Units)	*Manufacturing Variances*	*Sales Price Variance*	*Flexible Budget (18,400 Units)*	*Activity Variance*	*Master Budget (18,000 Units)*
Sales revenue	$223,560[a]		$2,760 F	$220,800[b]	$4,800 F	$216,000[c]
Less:						
Variable manufacturing costs	108,560[d]	$16,560 U		92,000[e]	2,000 U	90,000[f]
Contribution margin	115,000	16,560 U	2,760 F	128,800	2,800 F	126,000
Less:						
Fixed manufacturing costs	54,000			54,000		54,000
Operating profits	$ 61,000	$16,560 U	$2,760 F	$ 74,800	$2,800 F	$ 72,000

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[a] 18,400 units x $12.15

[b] 18,400 units x $12

[c] 18,000 units x $12

[d] 18,400 units x $5.90

[e] 18,400 units x $5

[f] 18,000 units x $5

18–17. (20 min.) *Flexible budgeting—Service organization: Wright & Allen.*

	Actual	*Budget*
Billable Hours	23,000	20,000

Wright & Allen
Flexible Budget

		Calculations
Revenue	$1,725,000	$1,500,000 x 23,000 hrs./20,000 hrs.
Costs:		
Professional salaries	862,500	$750,000 x 23,000 hrs./20,000 hrs.
Other variable costs	230,000	$200,000 x 23,000 hrs./20,000 hrs.
Fixed costs	300,000	
Total costs	1,392,500	
Department profit	$ 332,500	

18–18. (45 min.) *Sales activity variance—Service organization: Wright & Allen.*

	Flexible Budget (based on actual of 23,000 hours)	*Sales Activity Variance*	*Master Budget (based on budgeted 20,000 hours)*
Revenue	$1,725,000	225,000 F	$1,500,000
Costs:			
Professional salaries	862,500	112,500 U	750,000
Other variable costs	230,000	30,000 U	200,000
Fixed costs	300,000		300,000
Total costs	1,392,500	142,500 U	1,250,000
Department profit	$ 332,500	82,500 F	$ 250,000

18–19. (30 min.) *Profit variance analysis: Wright & Allen.*

	(1) *Actual (23,000 hrs.)*	*(2)* *Cost Variances*	*(3)* *Price Variances*	*(4)* *Flexible Budget (23,000 hrs.)*	*(5)* *Sales Activity Variance*	*(6)* *Master Budget (20,000 hrs.)*
Revenue	$1,650,000		$75,000 U	$1,725,000[a]	$225,000 F	$1,500,000
Professional salaries	925,000	$62,500 U		862,500[b]	112,500 U	750,000
Other variable costs	212,500	17,500 F		230,000[c]	30,000 U	200,000
Fixed costs	290,000	10,000 F		300,000		300,000
Department profit	$ 222,500	$35,000 U	$75,000 U	$ 332,500	$ 82,500 F	$250,000

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[a] $\frac{23{,}000 \text{ hrs.}}{20{,}000 \text{ hrs.}} \times 1{,}500{,}000$

[b] $\frac{23{,}000 \text{ hrs.}}{20{,}000 \text{ hrs.}} \times \$750{,}000$

[c] $\frac{23{,}000 \text{ hrs.}}{20{,}000 \text{ hrs.}} \times \$200{,}000$

18–20. (20 min.) *Flexible budget.*

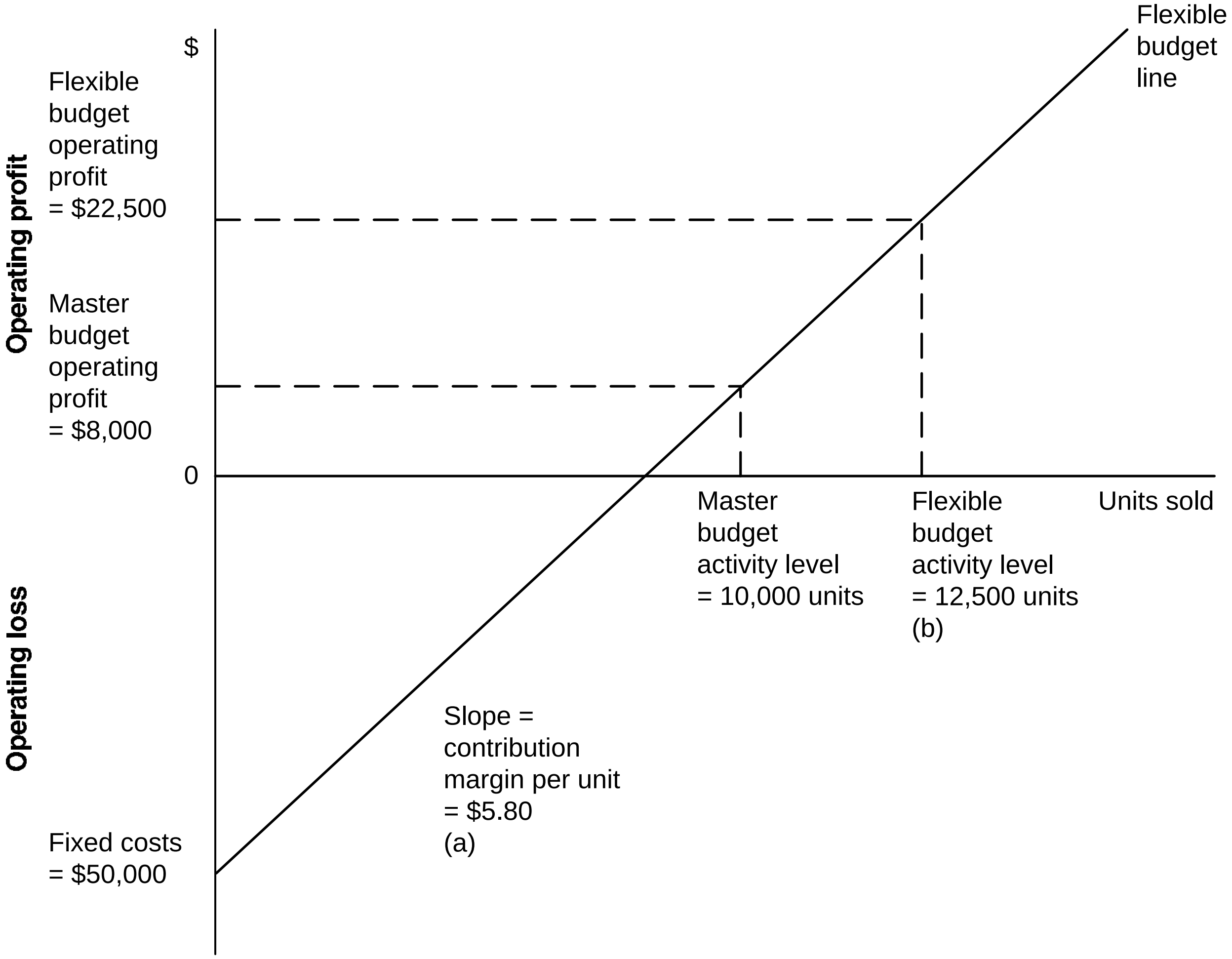
a. $2,000,000

b. $32 per unit VC = (TC – FC)/X
= ($6,000,000 – $2,000,000)/125,000 units

c. $5,200,000 TC = F + VX
= $2,000,000 + ($32 x 100,000 units)

d. $8,400,000 TC = F + VX
= $2,000,000 + ($32 x 200,000 units)

18–21. (25 min.) *Fill in amounts on flexible budget graph*.



Computations:

(a)

$$\text{Profit} = (P - V)X - FC$$

$$\$8{,}000 = (a)(10{,}000 \text{ units}) - \$50{,}000$$

$$a = \frac{\$58{,}000}{10{,}000 \text{ units}} = \$5.80 \text{ per unit}$$

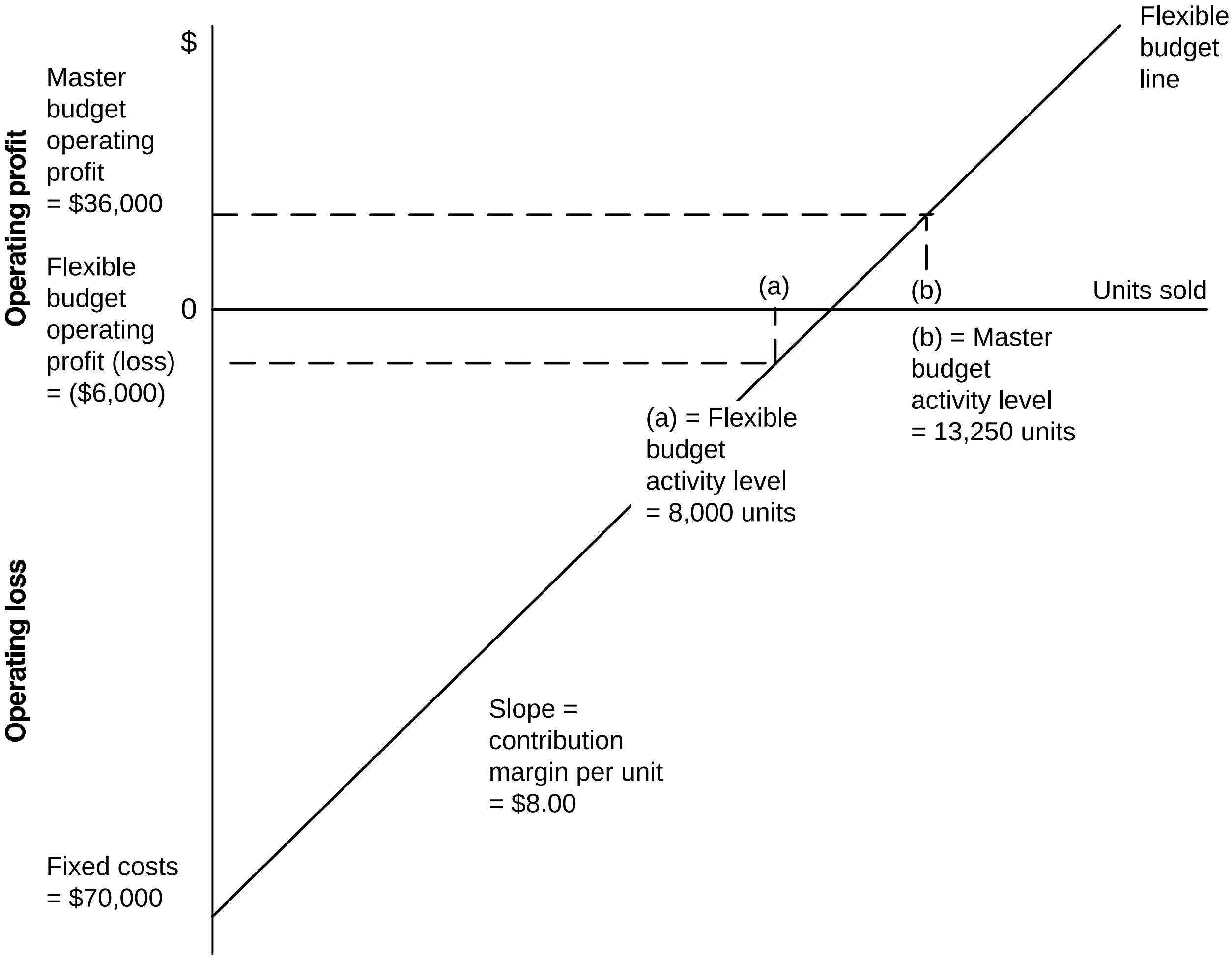
(b)

$$\$22{,}500 = \$5.80X - \$50{,}000$$

$$\$5.80X = \$22{,}500 + \$50{,}000$$

$$X = \frac{\$72{,}500}{\$5.80} = 12{,}500 \text{ units}$$

18–22. (25 min.) *Flexible budget.*



Computations:

(a)

$$\begin{aligned}\text{Profit} &= (P - V)X - FC\\ -\$6{,}000 &= \$8X - \$70{,}000\\ \$8X &= -\$6{,}000 + \$70{,}000\\ X &= \frac{\$64{,}000}{\$8} = 8{,}000 \text{ units}\end{aligned}$$

(b)

$$\begin{aligned}\$36{,}000 &= \$8X - \$70{,}000\\ \$8X &= \$36{,}000 + \$70{,}000\\ X &= \frac{\$106{,}000}{\$8} = 13{,}250 \text{ units}\end{aligned}$$

18–23. (35 min.) *Prepare flexible budget: Graphix, Inc.*

	Flexible Budget (based on actual of 850,000 units)	*Calculations (000 omitted for units)*
Sales revenue	$4,250,000	$4,000,000 x 850/800
Variable costs:		
Blank disks	1,275,000	1,200,000 x 850/800
Direct labor	297,500	280,000 x 850/800
Variable overhead	552,500	520,000 x 850/800
Variable marketing and administrative	425,000	400,000 x 850/800
Total variable costs	$2,550,000	
Contribution margin	$1,700,000	
Fixed costs:		
Manufacturing overhead	$ 800,000	
Marketing	240,000	
Administrative	150,000	
Total fixed costs	$1,190,000	
Operating profits	$ 510,000	

18–24. (45 min.) *Sales activity variance: Graphix, Inc.*

	Flexible Budget (based on actual of 850,000 units)	*Sales Activity Variance*	*Master Budget (based on budgeted 800,000 units)*
Sales revenue	$4,250,000	$250,000 F	$4,000,000
Variable costs:			
Blank disks	1,275,000	75,000 U	1,200,000
Direct labor	297,500	17,500 U	280,000
Variable overhead	552,500	32,500 U	520,000
Variable marketing and administrative	425,000	25,000 U	400,000
Total variable costs	$2,550,000	$150,000 U	$2,400,000
Contribution margin	$1,700,000	$100,000 F	$1,600,000
Fixed costs:			
Manufacturing overhead	$ 800,000	—	$ 800,000
Marketing	240,000	—	240,000
Administrative	150,000	—	150,000
Total fixed costs	$1,190,000		$1,190,000
Operating profits	$ 510,000	$100,000 F	$ 410,000

18–25. (30 min.) *Profit variance analysis: Graphix, Inc.*

	Actual (based on 850,000 units)	*Manufacturing Variances*	*Marketing and Administrative Variances*	*Sales Price Variance*	*Flexible Budget (based on 850,000 units)*	*Sales Activity Variance*	*Master Budget (based on 800,000 units)*
Sales revenue	$3,860,000			$390,000 U	$4,250,000	$250,000 F	$4,000,000
Blank disks	1,200,000	75,000 F			1,275,000	75,000 U	1,200,000
Direct labor	330,000	32,500 U			297,500	17,500 U	280,000
Variable Manufacturing	478,000	74,500 F			552,500	32,500 U	520,000
Variable Marketing and administrative	410,000		$15,000 F		425,000	25,000 U	400,000
Total variable costs	$2,418,000	$117,000 F	$15,000 F		$2,550,000	$150,000 U	$2,400,000
Contribution margin	$1,442,000	$117,000 F	$15,000 F	$390,000 U	$1,700,000	$100,000 F	$1,600,000
Fixed costs:							
Manufacturing Overhead	776,000	24,000 F			800,000		800,000
Marketing	240,000		-0-		240,000		240,000
Administrative	130,000		20,000 F		150,000		150,000
Total fixed costs	1,146,000	24,000 F	20,000 F	-0-	1,190,000	-0-	1,190,000
Operating profits	$ 296,000	$141,000 F	$35,000 F	$390,000 U	$ 510,000	$100,000 F	$ 410,000

18–26. (15 min.) *Assigning responsibility: Berg & Jordan.*

This situation is a normal part of a tax department's business and would probably be charged to the tax department. In future assignments it would be beneficial for the tax department to be able to rely on the audit department's work with reasonable assurance. The audit department should be charged for the error if the mistake was due to negligence on the part of the audit department to give them incentives to do the job right.

18–27. (15 min.) *Assigning responsibility.*

It appears that the start station manager acted against the best interests of the company by refusing to shut down production temporarily. This refusal cost the company $50,000 and much time and effort including the opportunity cost of lost profits due to stopped production. However, management is also to blame for giving the start station manager the wrong incentives. Hopefully this incident will not happen again and production managers will be given proper incentives to cooperate, so the $50,000 could be written off as an abnormal expense for the period.

Solutions to Problems

18–28. (30 min.) *Solve for master budget given actual results: Kentron Enterprises.*

a.

	Master Budget	*Computations*
Sales volume	108,000 units	
Sales revenue	$540,000	108,000 units x $5
Variable costs:		
Manufacturing	106,000	$540,000 – $54,000 – $380,000
Marketing and administrative	54,000	10% x $540,000
Contribution margin	380,000	(given)
Fixed costs:		
Manufacturing	216,000	$2 x 108,000 units
Marketing and administrative	56,000	$380,000 – $216,000 – $108,000
Operating profit	$108,000	$1 x 108,000 units

18–28. (continued)

b.

	Actual (120,000 Units)	*Manufacturing Variances*	*Marketing and Administrative Variances*	*Sales Price Variance*	*Flexible Budget (120,000 Units)*	*Sales Activity Variance*	*Master Budget (108,000 Units)*
Sales revenue	$672,000			$72,000 F	$600,000[a]	$60,000 F	$540,000
Variable costs:							
Manufacturing	147,200	$29,422 U			117,778[d]	11,778 U	106,000
Marketing and administrative	61,400		$ 1,400 U		60,000[c]	6,000 U	54,000
Contribution margin	463,400	29,422 U	1,400 U	72,000 F	422,222[b]	42,222 F	380,000
Fixed costs:							
Manufacturing	205,000	11,000 F			216,000	—	216,000
Marketing and administrative	113,200		57,200 U		56,000	—	56,000
Operating profit	$145,200	$18,422 U	$58,600 U	$72,000 F	$150,222	$42,222 F	$108,000

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[a] 120,000 units x $5

[b] $\frac{\$380{,}000}{108{,}000 \text{ units}}$ x 120,000 units

[c] 10% x $600,000

[d] Solved after determining flexible budget sales revenue, contribution margin, and variable marketing and administrative. Also, $117,778 = $106,000 x 120,000 units/108,000 units.

18–29. (30 min.) *Find missing data for profit variance analysis.*

	Actual (750 Units)	*Manu-facturing Variance*	*Marketing & Adminis-trative Variance*	*Sales Price Variance*	*Flexible Budget ((a) 750 Units)*	*Sales Activity Variance*	*Master Budget (800 Units)*
Sales revenue	$1,950			(b) $75 U	$2,025	(c) $135 U	(d) $2,160
Variable manufacturing costs	(e) 510	$60 F			(f) 570	38 F	(g) 608
Variable marketing and administrative	(h) 200		(i) $25 F		(j) 225	(k) 15 F	240
Contribution margin......................	$1,240	(l) $60 F	(m) $25 F	(n) $75 U	(o) $1,230	(p) $82 U	(q) $1,312

Note: See computations on next page.

18–29. (continued)

Additional computations for Problem 18-29:

(a) 750 units from actual column.

(b) $75 U = $2,025 – $1,950.

(c), (d) Budgeted sales price per unit = $2,025/750 units = $2.70.

Master budget = $2.70 x 800 units = $2,160 (d).

Activity variance = $2,160 – $2,025 = $135 U (c).

(e), (f), (g) Budgeted variable manufacturing cost per unit = $38/(800 – 750 units) = $.76.

Flexible budget variable manufacturing costs = $.76 x 750 units = $570 (f) (= $38/$135 x $2,025).

Master budget variable manufacturing costs = $.76 x 800 units = $608 (g) (= $38/$135 x $2,160).

Actual variable manufacturing costs = $570 – $60 = $510 (e).

(h) Variable marketing and administrative costs = $1,950 – $510 – $1,240 = $200.

(i), (j), (k) Budgeted variable marketing and administrative costs per unit = $240/800 units = $.30.

Flexible budget marketing and administrative costs = $.30 x 750 units = $225 (j).

Variable marketing and admin. costs that are part of the activity variance = $.30 x 50 units = $15 F (k) = $240 – $225.

Marketing and administrative cost variance = $225 – $200 = $25 F (i).

(l), (m), (n), (o), (p), and (q) are column totals.

18–30. (40 min.) *Find data for profit variance analysis.*

	Actual (based on actual sales volume)	*Manufacturing Variance*	*Marketing and Administrative Variance*	*Sales Price Variance*	*Flexible Budget (based on actual sales volume)*	*Sales Activity Variance*	*Master Budget (based on budgeted sales volume)*
Units	(a) 12,000				(b) 12,000	2,000 F	10,000
Sales revenue	(g) $198,000			$18,000 F	(h) $180,000	(i) $30,000 F	$150,000
Less:							
Variable manufacturing costs	(n) 105,000	(o) $9,000 U			96,000	(j) 16,000 U	80,000
Variable marketing and administrative costs	21,600		(p) $2,400 F		24,000	4,000 U	(c) 20,000
Contribution margin	(q) 71,400	9,000 U	(s) 2,400 F	(x) 18,000 F	60,000	(k) 10,000 F	50,000
Less:							
Fixed manufacturing costs	(r) 23,000	2,000 F			(m) 25,000		(d) 25,000
Fixed marketing and administrative costs	18,000		(v) 3,000 U		15,000		(e) 15,000
Operating profits	(t) $ 30,400	(u) $7,000 U	(w) $ 600 U	$18,000 F	$ 20,000	(l) $10,000 F	(f) $ 10,000

Note: See computations on next page.

18–30. (continued)

Calculations:

a.	12,000 units.	Same as b.
b.	12,000 units.	10,000 units + 2,000 units
c.	$20,000	$150,000 – $80,000 – $50,000
d.	$25,000	Same as m.
e.	$15,000	Fixed costs in flexible budget are the same as the fixed costs in the master budget.
f.	$10,000	$50,000 – $25,000 – $15,000
g.	$198,000	$180,000 (from h.) + $18,000
h.	$180,000	12,000 units x $150,000/10,000 units Alternative computation: $96,000 + $24,000 + $60,000
i.	$30,000 F	$180,000 – $150,000 Alternative computation: 2,000 units x $15
j.	$16,000 U	$96,000 – $80,000
k.	$10,000 F	$60,000 – $50,000 Alternative computation: $30,000 F – $16,000 U – $4,000 U
l.	$10,000 F	Same as k.
m.	$25,000	$60,000 – $15,000 – $20,000
n.	$105,000	$96,000 + $9,000 (from o.)
o.	$9,000 U	Total manufacturing variance on the contribution margin line
p.	$2,400 F	$24,000 – $21,600
q.	$71,400	$198,000 – $105,000 – $21,600
r.	$23,000	$25,000 – $2,000
s.	$2,400 F	Same as p.
t.	$30,400	$71,400 (q.) – $23,000 (r.) – $18,000
u.	$7,000 U	$9,000 U – $2,000 F
v.	$3,000 U	$18,000 – $15,000
w.	$600 U	$2,400 – $3,000 U
x.	$18,000 F	Sales price variance

18–31. (20 min.) *Ethical issues in managing reported profits: Herald Co.*

Mary is trying to improve the profit on next year's income statement. She knows that a revised budget to reflect changes in product lines might make it harder to get a bonus next year. Since she has reached a plateau on this year's bonus, anything she can do to increase next year's profit will help her get a bonus next year. This is an unethical practice. Mary must perform her professional duties with competence. She must prepare reports in accordance with technical standards and generally accepted accounting principles. Revenues and expenses must be matched to the correct period to which they belong.

Mary faces a conflict of interest between communicating information fairly and objectively and achieving high bonuses. She should meet with her superiors, point out the conflict, and try to change the incentive system. If this is not possible, she should communicate her performance truthfully.

18–32. (20 min.) *Prepare flexible budget: Ishima Corporation.*

	Flexible Budget[a]	*Calculations*
Sales revenue	$9,000	$10,000 x 90/100
Variable costs:		
Manufacturing direct labor	1,350	1,500 x 90/100
Manufacturing materials	1,260	1,400 x 90/100
Manufacturing overhead	900	1,000 x 90/100
Marketing	540	600 x 90/100
Administrative	450	500 x 90/100
Total variable costs	4,500	
Contribution margin	4,500	
Fixed costs:		
Manufacturing overhead	500	
Marketing	1,000	
Administrative	1,000	
Total fixed costs	2,500	
Operating profit	$2,000	

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[a] Sales revenue and the variable costs are 90 percent (90 units ÷ 100 units x 100%) of the master budget amounts.

18–33. (45 min.) *Sales activity variance: Ishima Corporation.*

	Flexible Budget (based on actual of 90 units)	*Sales Activity Variance*	*Master Budget (based on budgeted 100 units)*
Sales revenue	$9,000	$1,000 U	$10,000
Less variable costs:			
Manufacturing costs:			
Direct labor	1,350	150 F	1,500
Materials	1,260	140 F	1,400
Variable overhead	900	100 F	1,000
Marketing	540	60 F	600
Administrative	450	50 F	500
Total variable costs	$4,500		$ 5,000
Contribution margin	$4,500	500 U	$ 5,000
Less fixed costs:			
Manufacturing	500	-0-	500
Marketing	1,000	-0-	1,000
Administrative	1,000	-0-	1,000
Total fixed costs	$2,500	-0-	$ 2,500
Operating profits	$2,000	$ 500 U	$ 2,500

18–34. (30 min.) *Profit variance analysis: Ishima Corporation.*

	Actual (90 Units)	*Manufacturing Variance*	*Marketing & Administrative Variance*	*Sales Price Variance*	*Flexible Budget (90 Units)*	*Sales Activity Variance*	*Master Budget (100 Units)*
Sales revenue	$9,200			$200 F	$9,000	$1,000 U	$10,000
Variable costs:							
Manufacturing							
Direct labor..........	1,420	$70 F			1,350	150 F	1,500
Materials..............	1,200	60 F			1,260	140 F	1,400
Overhead	820	80 F			900	100 F	1,000
Marketing................	530		$10 F		540	60 F	600
Administrative	500		50 U		450	50 F	500
Contribution margin....	4,730	70 F	40 U	200 F	4,500	500 U	5,000
Fixed costs:							
Manufacturing.........	485	15 F			500	—	500
Marketing................	1,040		40 U		1,000	—	1,000
Administrative	995		5 F		1,000	—	1,000
Operating profit	$2,210	$85 F	$75 U	$200 F	$2,000	$ 500 U	$2,500

18–35. (20 min.) *Derive amounts for profit variance analysis: Checker Cab Co.*

Hint: Use last month's actual as master budget.

	Actual (based on actual activity of 16,100 trips)	*Variable Cost Variance*	*Sales Price Variance*	*Flexible Budget (based on actual activity of 16,100 trips)*	*Sales Activity Variance*	*Master Budget (based on a prediction of 14,000 trips)*
Sales revenue	$152,000		$21,650 U	$173,650[a]	$22,650 F	$151,000
Less:						
Variable costs	43,500	$430 F		43,930[b]	5,730 U	38,200
Contribution margin	$108,500	$430 F	$21,650 U	$129,720	$16,920 F	$112,800

[a] Last month price = $\frac{\$151{,}000}{14{,}000 \text{ trips}}$ = $10.7857

$173,650 = $10.7857 x 16,100 trips

[b] Last month unit variable cost = $38,200/14,000 trips = $2.7286

$43,930 = $2.7286 x 16,100 trips

Although the two months' contribution margins are similar, there are significant variances. This illustrates the need to consider variance analysis even if bottom-line dollar amounts are similar to budget. Activity levels, prices, and other factors may offset each other, but individually be significant.

The number of trips increased by 2,100, which increased profit by $22,650. However, the average price per trip decreased by $1.3447 ($10.7857 less $9.441), which decreased profit by $21,650.

18–36. (20 min.) *Flexible budget—multiple choice: The City of Dixon.*

Flexible budget is based on actual activity of 63,000 miles for costs that vary per mile.

a. (4) $3,780 $20 over
$3,000 x (63,000 mi./50,000 mi.) = $3,780

b. (3) $378 $2 over
$300 x (63,000 mi./50,000 mi.) = $378

c. (4) $2,500 equal to budget
The assumption is that, within the relevant range, this is a fixed cost.

d. (1) Decreased *unit* fixed costs.

Assuming that insurance, salaries and benefits, and depreciation are fixed costs, the budgeted amount is $0.104 per mile [($500 + $2,500 + $2,200)/50,000 miles]. The actual amount is $0.085 per mile for 63,000 actual miles, which is a drop of $0.019. This is 83.7% of the total decrease from $0.1745 to $0.1518.

18–37. (40 min.) *Analyze performance for a restaurant: Arbuckles.*

Hint for working the problem: Use sales revenue as the basis for measuring volume.

(in thousands)

	Actual	*Purchases Variances*	*Marketing & Administrative Variances*	*Flexible Budget*	*Activity Variance*	*Master Budget*
Sales revenue[a]	$1,200			$1,200	$200 F	$1,000
Variable costs:						
Purchases	780	$60 U		720[b]	120 U	600
Hourly wages	60			60[c]	10 U	50
Franchise fee	36			36[d]	6 U	30
Utilities	76		$8 F	84[e]	14 U	70
Total variable costs	952			900	150 U	750
Contribution margin	248	60 U	8 F	300	50 F	250
Fixed costs:						
Advertising	100			100		100
Depreciation	50			50		50
Lease	30			30		30
Salaries	30			30		30
Total fixed costs	210			210		210
Operating profit	$ 38	$60 U	$8 F	$ 90	$ 50 F	$ 40

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[a] Sales revenue is used as the basis of volume measurement because there are no price changes.

[b] $\frac{\$600}{\$1,000} \times \$1,200$

[c] $\frac{\$50}{\$1,000} \times \$1,200$

[d] $\frac{\$30}{\$1,000} \times \$1,200$

[e] $\frac{\$70}{\$1,000} \times \$1,200$

Solutions to Integrative Cases

18–38. (30 min.) *Analyze budget planning process–Behavioral issues: RV Industries.**

a. Division and plant personnel biases which may be included in the submission of budget estimates include:

- Budget sales estimates probably would tend to be lower than actually expected because of the high volatility in product demand and the current reward/penalty system for exceeding or missing the budget.
- Budget cost estimates will be higher than actually expected in order to protect the divisions against the effects of down-side risk of business slumps and the possibility of higher costs. The reward/penalty system encourages this action.
- Plant and division management can incorporate “slack and padding” into the budget without the likelihood that it will be removed because corporate headquarters does not appear to get actively involved in the actual budget preparation.

b. Sources of information that top management can use to monitor divisional budget estimates include:

- industry and trade association sales projections and performance data.
- prior year performance by reporting units as measured by their financial, production and sales reports.
- performances of similar divisions and plants.
- regional and national leading economic indicators and trends in consumer preference and demand.

*CMA adapted.

c. Services which could be offered by corporate management in the development of budget estimates are as follows:

- Provide national and regional industry sales forecasts for products as developed by corporate management or obtained by management from other sources.
- Sponsor training programs for plant and divisional personnel on budgeting techniques and procedures.
- Inform divisions of overall corporate goals in terms of sales, market share and net income.
- Provide economic forecasts with regard to expected inflationary trends and overall business cycles.

d. Top management should weigh the costs and benefits and the resulting behavioral effects of its actions before getting more involved in the budgeting process. The costs to be evaluated would include:

- increased costs at the corporate level because more time and perhaps additional staff will be required.
- lower profits due to an unfavorable change in division and plant management attitudes and motivation.

The benefits to be considered would include improved profits from:

- more accurate budget estimates which might reduce lost sales and/or reduce costs incurred.
- more effective management because of more realistic budgets.
- improved coordination and control of the budget process.

The behavioral variables to be considered would include:

- the effect on goal congruence.
- the effect on the communication channels between top management and divisional management.
- the effect of restricting authority over the budget process at the divisional level.
- the possible negative effect on motivation and morale due to loss of authority and autonomy.
- the effect on performance due to a potential reduction in bonuses.

18–39. (40 min.) *Adapt budget control concepts to research organization: Argo Co.*

The approved activity may be considered the equivalent of master budget activity. Activity achieved would be the equivalent of the flexible budget. Analysis can then be carried out as follows:

(in thousands)

	Actual[a]	*Cost Variances*	*Flexible Budget*	*Activity Variance*	*Master Budget*[a]
Direct costs:					
Project 4–1	$ 40	$ 20 U	$ 20	-0-	$ 20
5–3 (ph. 3)[b] ...	440	140 U	300	-0-	300
(ph. 4)	-0-		-0-	100 F [c]	100
8–1	300	-0-	300	-0-	300
8–2	220	20 U	200	-0-	200
8–3	-0-	-0-	-0-	80 F	80
Total direct costs	1,000	180 U	820	180 F	1,000
Indirect costs:					
Administration[d]	52	2 U	50	—	50
Facilities[d]	118	8 U	110	—	110
	$1,170	$190 U	$980	$180 F	$1,160

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[a] Each figure in the approved activity and actual cost columns in the problem include the pro rata share of the indirect costs. These costs must be removed in order to evaluate the individual projects. For the approved activity (master budget), each cost should be multiplied by $\frac{(\$1{,}160 - \$160)}{\$1{,}160}$. For the actual column, each cost should be multiplied by $\frac{(\$1{,}170 - \$170)}{\$1{,}170}$.

[b] Phase 4 was budgeted for $100,000, but no work was performed. Therefore, the remaining part of the budget, and all the actual costs must have been for an earlier phase.

[c] These costs are "favorable" only in the sense that they were not incurred. Since the work was also not done, they do not signal a favorable outcome for the year. It is important, nevertheless, to separate these variances caused by no activity from the other cost variances.

[d] These costs are likely to be fixed.

*CMA adapted

18–40. (30 min.) *Analyze activity variances—FIFO process costing: Fellite, Inc.*

a. Equivalent unit computations:

		Actual Units		*Master Budget Units*
To complete beginning inventory		200		500
Started and completed:				
Completed	2,500		3,200	
Less: beginning inventory................	(1,000)		(1,000)	
		1,500		2,200
To start ending inventory.....................		500		400
Equivalent units this period		2,200		3,100

b. Analysis of differences between actual and master budget:

	Actual	*Manufacturing Cost Variances*	*Flexible Budget*	*Activity Variance*	*Master Budget*
Equivalent units..........	2,200		2,200		3,100
Direct materials.......	$30,000	$6,935 U	$23,065[a]	$9,435 F	$32,500
Direct labor	24,600	5,439 U	19,161[b]	7,839 F	27,000
Variable overhead ..	16,200	5,910 U	10,290[c]	4,210 F	14,500
Fixed overhead.......	24,100	1,900 F	26,000	—	26,000
Total costs	$94,900	$16,384 U	$78,516	$21,484 F	$100,000

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[a] $\left(\frac{\$32{,}500}{3{,}100 \text{ units}}\right) \times 2{,}200$

[b] $\left(\frac{\$27{,}000}{3{,}100 \text{ units}}\right) \times 2{,}200$

[c] $\left(\frac{\$14{,}500}{3{,}100 \text{ units}}\right) \times 2{,}200$

Chapter 19

Performance Evaluation: Cost Variances

Solutions to Review Questions

19–1.
A standard is related to a cost per unit. Budgets focus on totals.

19–2.
Responsibility reporting systems identify variances or exceptions to budget plans and, further, relate those exceptions to the manager responsible for them. The reported variances (and the analysis thereof) further isolates and identifies the cause of exceptions to budget plans.

19–3.
The three primary sources of variances are:

a. price variances which arise because factor input prices differ from standards;

b. efficiency variances which occur when the relationship between the usage of input factors (labor, materials, variable overhead) differs from that which would be expected to produce a given level of output; and

c. activity variances which represent differences between planned (master budget) output levels and the output levels actually attained during the period.

19–4.
The fixed cost variances differ from variable cost variances because fixed costs do not vary with the level of production activity. Therefore, the fixed costs in the flexible budget will be the same as in the master budget (within the relevant range). Additionally, there are no efficiency variances for fixed costs because there is no input-output relationship that can be applied.

19–5.
Variances represent differences between plans and actual outcomes. Capturing these variances can provide useful information regardless of whether inventories exist. Knowledge about differences between plans and actual outcomes can help managers improve planning or take steps to improve operations.

19–6.
A standard cost is a cost that management expects to incur in producing a product or supplying a service. An actual cost is the transaction cost for an item.

19–7.
Variances are usually “expensed” as a period cost (e.g., charged to Cost of Goods Sold). Variances may also be prorated to accounts according to the standard cost balances in each of the accounts. Hence, a materials price variance recorded at the time of purchase would be prorated to Materials Inventory, Materials Efficiency Variance, Work in Process, Finished Goods and Cost of Goods Sold according to the current year standard cost balances in those accounts.

19–8.
By definition fixed costs do not change with changes in the level of outputs (in the relevant range). Hence, it is difficult to relate fixed costs to specific units of output.

Solutions to Critical Analysis and Discussion Questions

19–9.
The action that management can take in response to price variances is probably quite different than the action that can be taken in response to efficiency variances. The latter is generally more subject to management control. Also, different departments may be responsible for each variance. For example, purchasing may be responsible for the materials price variance and production for the materials efficiency variance.

19–10.
The flexible budget is generally based on output units. That is, the flexible budget contains the costs that would have been budgeted if the actual output level had been known beforehand. Inputs priced at standard are the costs that were expected to be incurred for the materials, labor and overhead used irrespective of the output attained from those inputs.

19–11.
This problem arises more frequently than one would hope. Since costs are accumulated in responsibility centers usually according to where the cost is incurred, it is quite likely that the production department will be charged with a cost that originated by the action of some other (e.g., sales) department. In accepting the rush order, the sales department would either have raised the selling price to compensate for the special delivery or undertaken the rush order to avoid losing a sale. The extra costs incurred in other departments as a direct result of the sales department's action should be chargeable back to the sales department.

19–12.
Typically, the labor price variances are relatively small since the rates are usually determined in advance through the union negotiation process. However, if a line manager uses workers that are more skilled (and thus higher paid) than the labor that was considered when preparing the budget, an unfavorable price variance would arise that would be the responsibility of the line manager. Presumably, the manager would do this only when the manager expected efficiency improvements at least equal to the unfavorable price variance. If overtime premiums are not accounted for separately, then unbudgeted overtime premiums could be the cause of price variances.

19–13.
The production volume variance represents the result of allocating a fixed sum of costs over a different level of activity than was used in computing the allocation rate. Since the sum is fixed, the cash outflows associated with the fixed costs will be unchanged regardless of the amount or direction of the production volume variance.

19–14.
By recognizing the materials price variance at the time of purchase, management captures any difference between actual materials cost and the standard costs as reflected in the budget as those costs are incurred. If the price variance is not reflected until the time of use, the effect of price changes may not be recognized until the materials are removed from the raw materials inventory and placed into work in process. This could be a substantial time delay. If decisions need to be made to compensate for the effect of materials price changes, it would seem that the sooner the information comes to management's attention, the better the opportunities to react to the information.

19–15.
Labor and material costs are entered into production as incurred. The variances are also recorded as incurred. Overhead costs are applied to production on the basis of units of output. The variances are computed at the end of the period when the applied costs are reconciled with actual costs.

19–16.
The production volume variance arises because fixed overhead is applied over a greater or lesser number of units than were used in deriving the fixed overhead application rate. Hence, the production volume variance does not tell us whether we spent more or less, but rather only that we produced more or less than expected.

Solutions to Exercises

19–17. (15 min.) *Variable cost variances: Eagle Air Charters.*

Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget (Standard Allowed)*
$44,500		$6.50 x 6,800 hours = $44,200		$6.50 x (72,000 units ÷ 10) = $46,800
	$300 U		$2,600 F	

19–18. (10 min.) *Variable cost variances.*

Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget (Standard Allowed)*
$18,800		$5 x 3,900 hours = $19,500		$5 x 2 hrs. x 1,900 units = $19,000
	$700 F		$500 U	

19–19. (20 min.) *Variable cost variances: Nugget, Inc.*

	Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget (Standard Allowed)*
Direct labor	$88,400		$88,400 – $1,600 = $86,800		$15,000 x $6.20[a] = $93,000
		$1,600 U		$6,200 F	
Variable Overhead	$44,200		$14,000 hours x $3.40 = $47,600		$15,000 x $3.40 = $51,000
		$3,400 F		$3,400 F	

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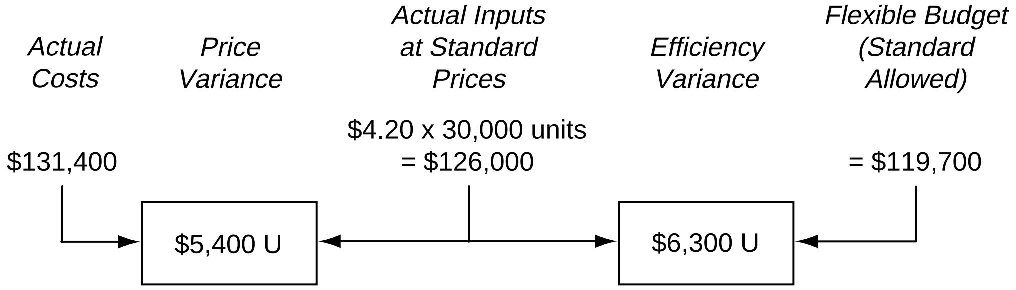
[a] Standard labor wage rate = (Actual Direct Labor – Direct Labor Price Variance)/ Actual hours worked ($88,400 – $1,600) / 14,000 hrs. = $6.20

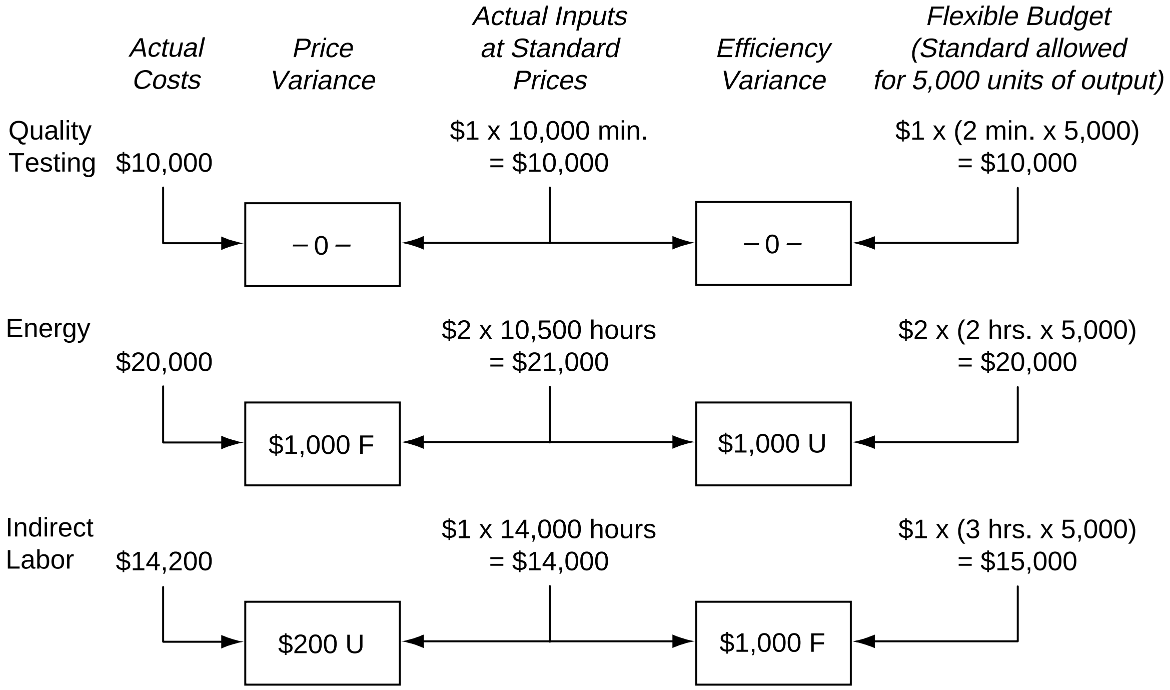
19–20. (15 min.) *Variable cost variances: Almay Corporation.*


Actual Costs
Price Variance
Actual Inputs at Standard Prices
Efficiency Variance
Flexible Budget (Standard Allowed)
$131,400
$4.20 x 30,000 units = $126,000
= $119,700
$5,400 U
$6,300 U

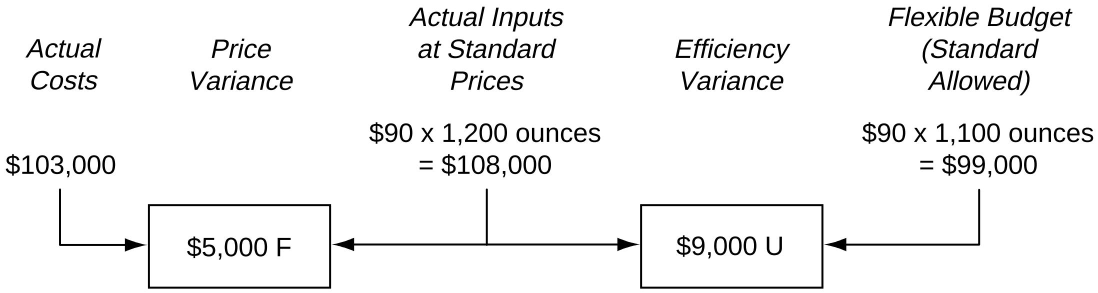
Report to management:

The total variance from the flexible budget is $11,700 unfavorable. This variance was caused by higher than expected prices ($5,400) and the use of more units than expected ($6,300).

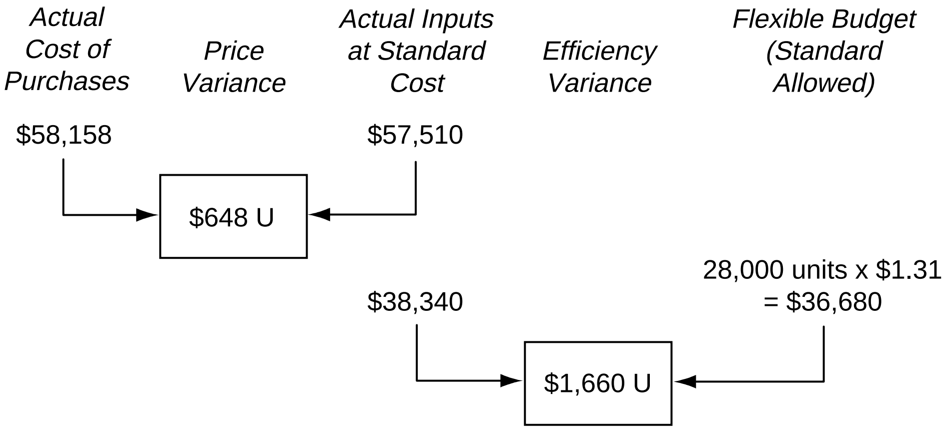
19–21. (30 min.) *Variances from activity based costs: Crucible Company.*


Actual Costs
Price Variance
Actual Inputs at Standard Prices
Efficiency Variance
Flexible Budget (Standard allowed for 5,000 units of output)
Quality Testing
$10,000
$1 x 10,000 min. = $10,000
$1 x (2 min. x 5,000) = $10,000
– 0 –
– 0 –
Energy
$20,000
$2 x 10,500 hours = $21,000
$2 x (2 hrs. x 5,000) = $20,000
$1,000 F
$1,000 U
Indirect Labor
$14,200
$1 x 14,000 hours = $14,000
$1 x (3 hrs. x 5,000) = $15,000
$200 U
$1,000 F

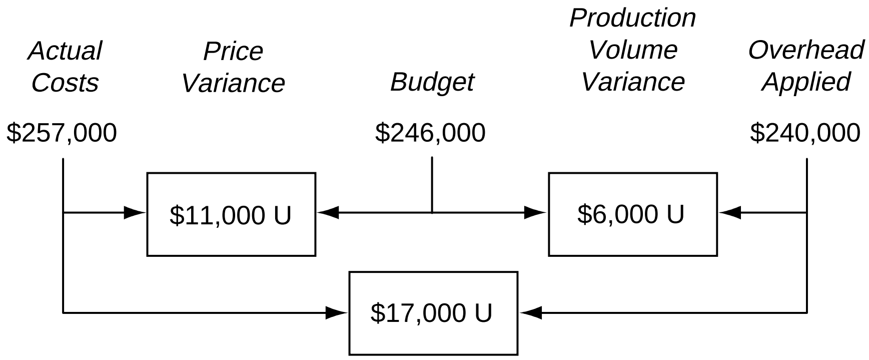
19–22. (20 min.) *Variable cost variances: Blarney Chemicals.*


Actual Costs
Price Variance
Actual Inputs at Standard Prices
Efficiency Variance
Flexible Budget (Standard Allowed)
$103,000
$90 x 1,200 ounces = $108,000
$90 x 1,100 ounces = $99,000
$5,000 F
$9,000 U

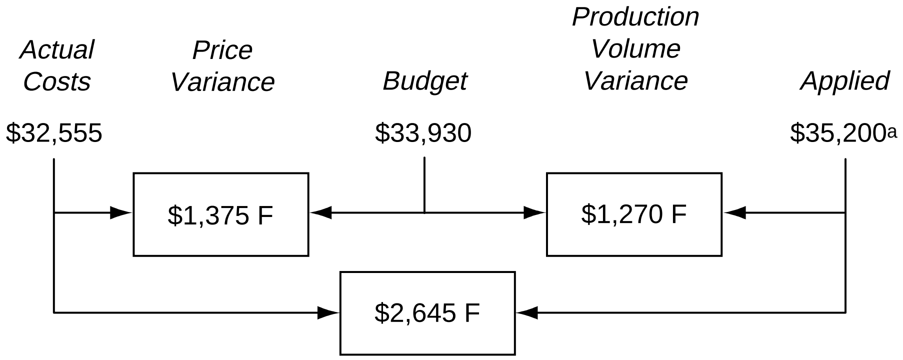
19–23. (15 min.) *Variable cost variances where materials purchased and used are not equal: Durango Company.*


Actual Cost of Purchases
Price Variance
Actual Inputs at Standard Cost
Efficiency Variance
Flexible Budget (Standard Allowed)
$58,158
$57,510
$648 U
$38,340
28,000 units x $1.31 = $36,680
$1,660 U

19–24. (20 min.) *Fixed cost variances: Cramden Co.*



19–25. (20 min.) *Fixed cost variances: Mahalo Corporation.*



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[a] $35,200 = 16,000 units x $2.20

19–26. (45 min.) *Comprehensive cost variance analysis: Miller, Inc.*

a. Variable cost:

	Actual (AP x AQ)	*Price Variance*	*Actual Inputs at Standard (SP x AQ)*	*Efficiency Variance*	*Flexible Production Budget (SP x SQ)*
Direct Materials	$1.80 x 240,000 pounds = $432,000	$48,000 F	$2 x 240,000 pounds = $480,000	$20,000 U	$2 x 230,000 pounds = $460,000
Direct Labor	$9.20 x 44,000 hours = $404,800	$8,800 U	$9 x 44,000 hours = $396,000	$18,000 F	$9 x 46,000 hours = $414,000
Variable Overhead	$110,160	$2,160 U	$10 x 10,800 hours = $108,000	$4,500 U	$10 x 10,350 hours = $103,500
Total variable manufacturing cost variances	$946,960	$37,040 F	$984,000	$6,500 U	$977,500
			$30,540 F		

b. Fixed overhead variances:

	Actual	*Price Variance*	*Budget*	*Production Volume Variance*	*Applied**
Fixed Overhead	$1,000,000	$50,000 U	$950,000	$76,000 U	= $380 x 2,300 tires = $874,000

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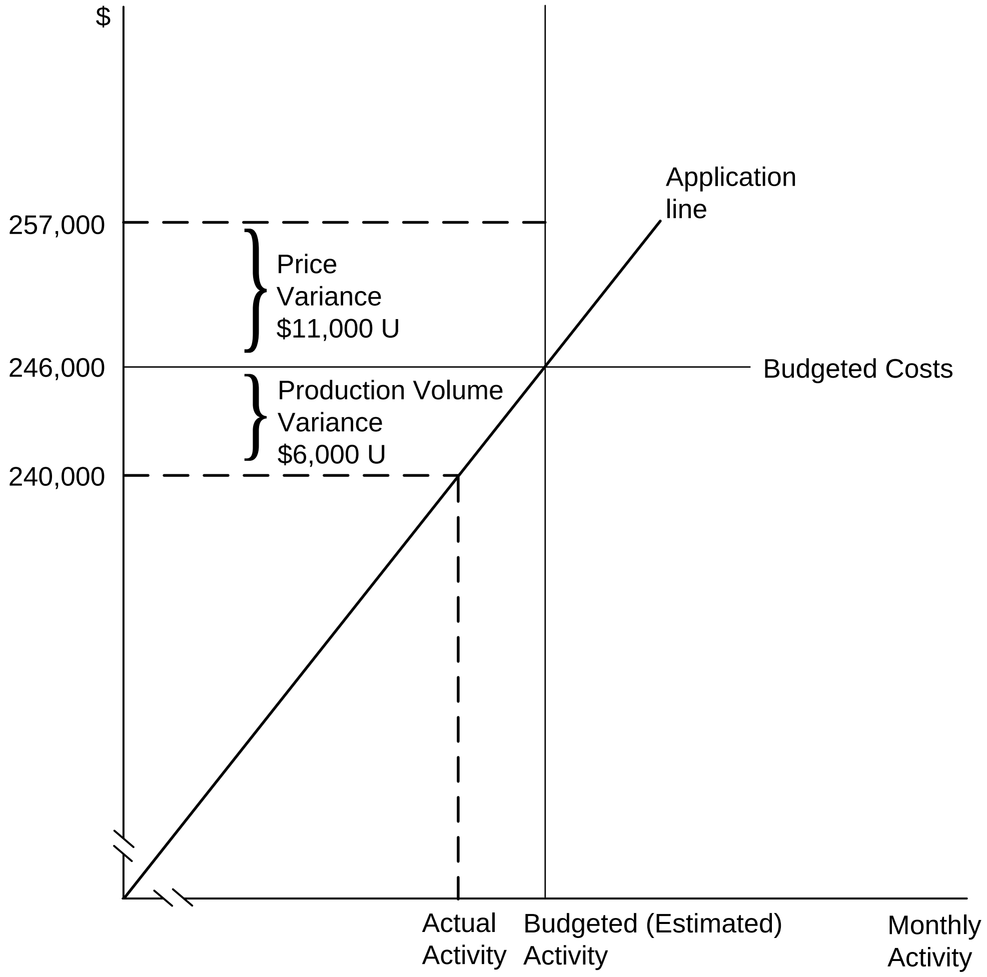
*Fixed overhead rate = $\dfrac{\$950{,}000}{2{,}500 \text{ tires}}$ = $380 per tire

19–27. (15 min.) *Fixed cost variances: Cramden Co.*



19–28. (30 min.) *Comprehensive cost variance analysis: Bryce, Inc.*

a. Variable cost variances:

	Actual (AP x AQ)	*Price Variance*	*Actual Inputs at Standard (SP x AQ)*	*Efficiency Variance*	*Flexible Production Budget (based on 50,000 exams) (SP x SQ)*
Direct optometrist services	$39 x 75,000 hours[b] = $2,925,000	$225,000 U	$36 x 75,000 hours[b] = $2,700,000	$300,000 U	$36 x 66,667 hours[a] = $2,400,000
Variable overhead and support	$14 x 120,000 hours = $1,680,000	$120,000 F	$15 x 120,000 hours = $1,800,000	$150,000 U	$15 x 110,000 hours = $1,650,000
Total variable cost variances	$4,605,000	$105,000 U	$4,500,000	$450,000 U	$4,050,000
			$555,000 U		

---

[a] 66,667 (rounded) = 4/6 hours x 100,000 exams

[b] 75,000 (rounded) = 45/60 hours x 100,000 exams

b. Fixed overhead variances:

Actual		*Budget*		*Applied[a]*
$374,000	$14,000 U	$360,000	$40,000 F	$4 x 100,000 exams = $400,000

---

[a] Fixed overhead rate = $360,000/90,000 exams = $4 per exam

19–29. (30 min.) *Variances from activity based costs: Klien's.*

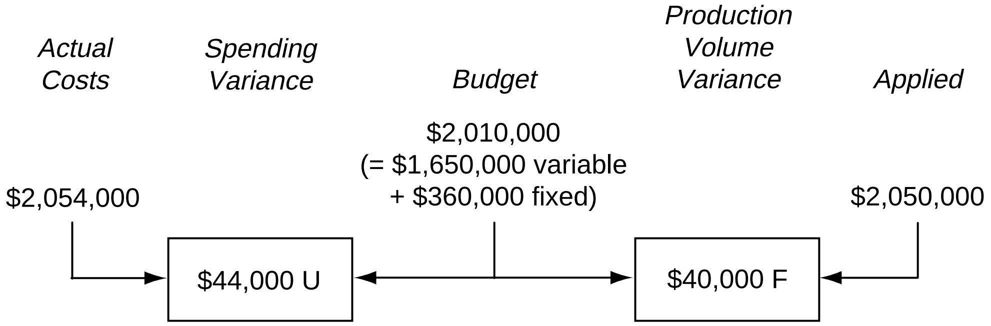
	Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget (Standard allowed for 50,000 exams)*
Purchasing	$100,000	$8,000 U	$2.00 x 46,000 purchases = $92,000	$8,000 F	$2.00 x 50,000 purchases = $100,000
Support Staff Labor	$550,000	$30,000 U	$10.00 x 52,000 fittings = $520,000	$80,000 F	$10.00 x (1.2 x 50,000) = $600,000
Special Contact Lenses	$145,000	$10,000 F	$5.00 x 31,000 pairs of lenses = $155,000	$5,000 U	$5.00 x (0.6 x 50,000) = $150,000

19–30. (20 min.) *Two-way and three-way overhead variances (Appendix B):Bryce, Inc.*

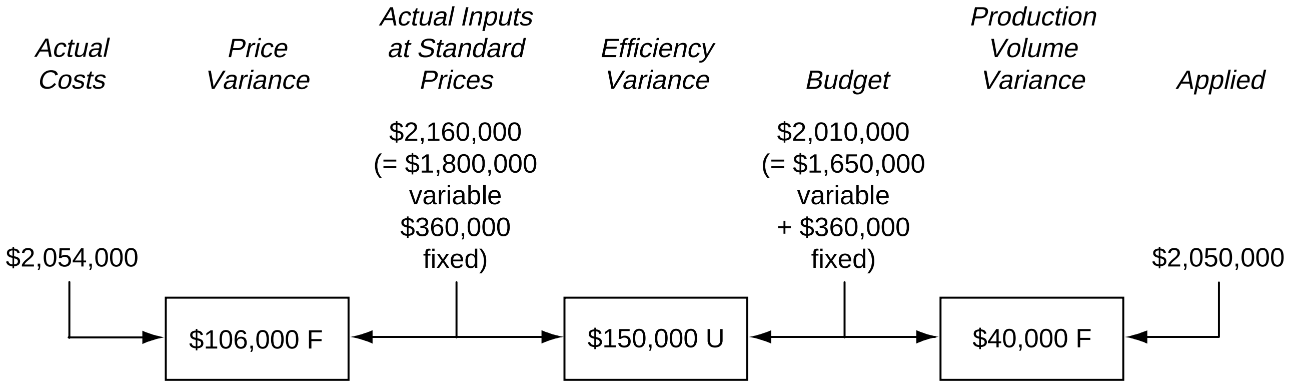
a.

Actual overhead	$2,054,000	
Overhead applied:		
Variable	1,650,000	($16.50 x 100,000 exams)
Fixed	400,000	($4.00 x 100,000 exams)
Total overhead applied	$2,050,000	
Underapplied	$4,000	

b.



c.



19–31. (20 min.) *Overhead variances: Jasper Corporation.*

	Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget (Standard Allowed)*
Variable Overhead	$19,000		$6 x 3,300 hours = $19,800		$6 x 3,500 hours = $21,000
		$800 F		$1,200 F	

	Actual Costs	*Price Variance*	*Budget*
Fixed Overhead	$7,600		$7,800
		$200 F	

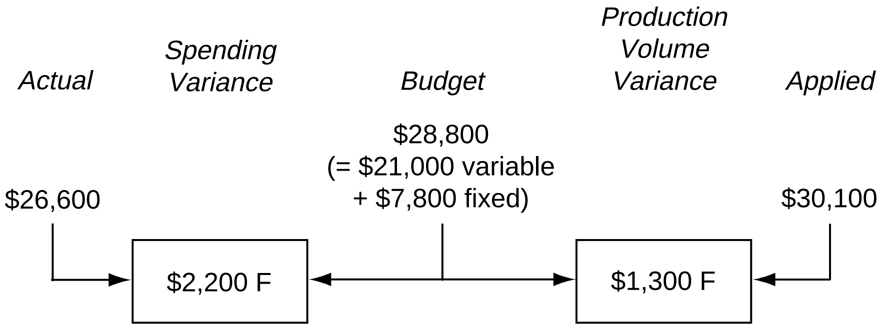
19–32. (30 min.) *Two-way and three-way overhead variances (Appendix B): Jasper Corporation.*

a.

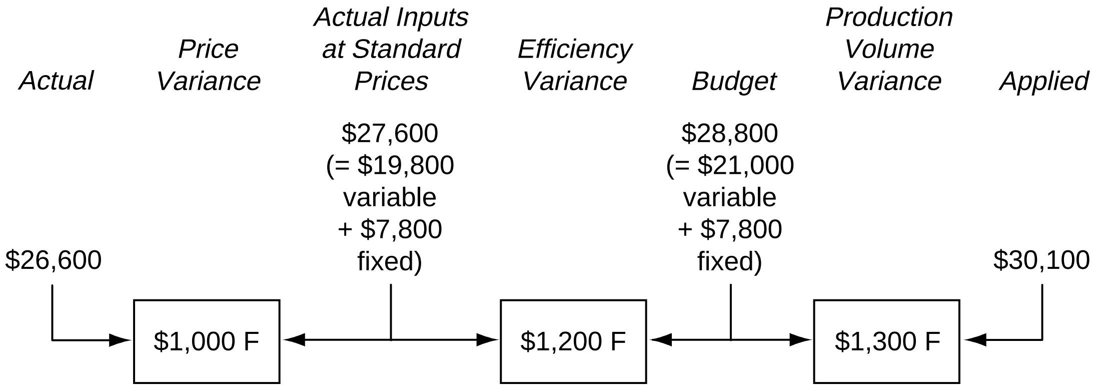
Actual overhead	$26,600	
Overhead applied:		
Variable	21,000	($6 x 3,500)
Fixed	9,100	($2.60[a] x 3,500 hours)
Total applied	$30,100	
Overapplied	$3,500	

[a]$2.60 = $\frac{\$7{,}800 \text{ budgeted cost}}{3{,}000 \text{ budgeted hours}}$

b.


Actual
Spending Variance
Budget
Production Volume Variance
Applied
$26,600
$28,800 (= $21,000 variable + $7,800 fixed)
$30,100
$2,200 F
$1,300 F

c.

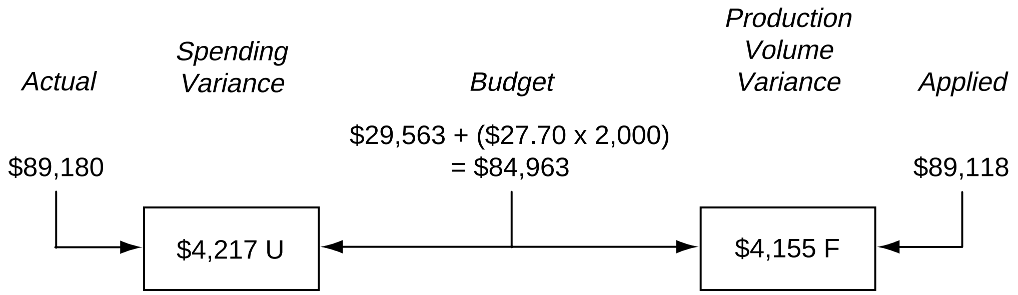

Actual
Price Variance
Actual Inputs at Standard Prices
Efficiency Variance
Budget
Production Volume Variance
Applied
$26,600
$27,600 (= $19,800 variable + $7,800 fixed)
$28,800 (= $21,000 variable + $7,800 fixed)
$30,100
$1,000 F
$1,200 F
$1,300 F

19–33. (30 min.) *Two-way and three-way overhead variances (Appendix B): Indio Company.*

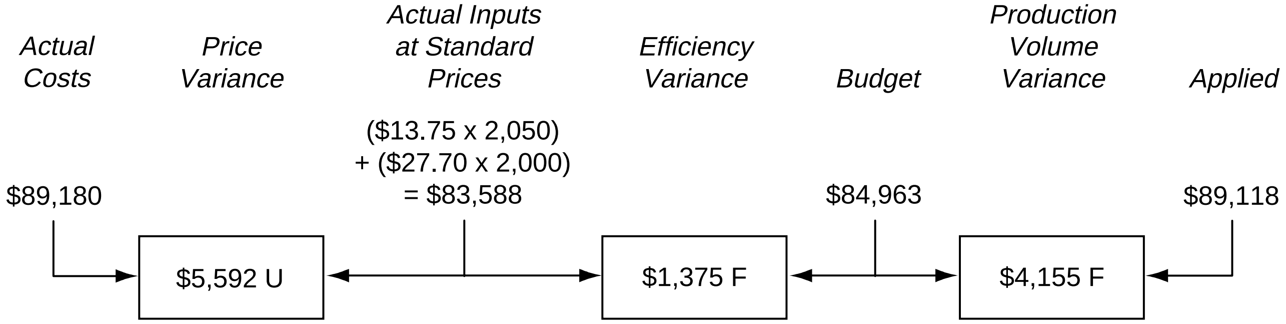
a.

Actual overhead	$89,180	
Overhead applied:		
Variable	29,563	(= $13.75 x 2,150)
Fixed	59,555	(= $27.70 x 2,150)
Total applied	$89,118	
Underapplied	$62	

b. Two-way analysis
Budgeted hours = 2,000 = "normal workload."



c.



19–34. (35 min.) *Standard materials costs: Armadillo Corporation.*

1.	Materials Inventory	65,000	
	Materials Price Variance	5,000	
	Accounts Payable		70,000
	To record the purchase of direct materials at an actual cost of $70,000 and to record the transfer to Materials Inventory at the standard cost of $1.30 per unit.		
2.	Work in Process Inventory	62,400	
	Materials Inventory		58,500
	Materials Efficiency Variance		3,900
	To record the requisition of 45,000 units of material from Materials Inventory and to charge Work in Process Inventory with the standard usage of 48,000 units.		
3.	Finished Goods Inventory	49,920	
	Work in Process Inventory		49,920
	To record the materials component of the transfer of 80% of the finished units from Work in Process to Finished Goods Inventory.		
4.	Cost of Goods Sold	29,952	
	Finished Goods Inventory		29,952
	To record the materials component of the sale of 60% of the finished units.		

Accounts Payable	
	70,000

Materials Inventory	
–0–	58,500
65,000	
6,500	

Work in Process Inventory	
–0–	49,920
62,400	
12,480	

Finished Goods Inv.	
–0–	29,952
49,920	
19,968	

Mat. Price Variance	
5,000	

Mat. Eff. Variance	
	3,900

Cost of Goods Sold	
29,952	

19–35. *Prorate variances: Armadillo Corporation*

Refer to 19–34.
Prorate variances to Ending Inventory and Cost of Goods Sold:

Variances:

Materials price variance	$5,000 U
Materials efficiency variance	3,900 F

Prorate variances:
Materials price variance:

Account	*(1) Cost in Account before Proration*	*(2) Percent of Total Cost*	*(3) Variance to be Prorated (Column 2 x $5,000)*
Materials Inventory	$ 6,500	10	$ 500 U
Materials Efficiency Variance	(3,900)[a]	(6)	(300) F
Work in Process	12,480	19.2	960 U
Finished Goods Inventory	19,968	30.72	1,536 U
Cost of Goods Sold	29,952	46.08	2,304 U
	$65,000[b]	100	$5,000 U

---

[a] $3,900 is a favorable variance.

[b] $65,000 = 50,000 units x $1.30 standard price.

Materials efficiency variance:

Account	*(1) Cost in Account before Proration*	*(2) Percent of Total Cost*	*(3) Variance to be Prorated (Column 2 x $4,200[a])*
Work in Process	$13,440[b]	20	$ 840 F
Finished Goods Inventory	21,504[c]	32	1,344 F
Cost of Goods Sold	32,256[d]	48	2,016 F
	$67,200	100	$4,200 F

---

[a] $4,200 = $3,900 favorable variance before proration plus $300 materials price variance prorated to materials efficiency variance. (The $300 increases the favorable variance).

[b] $13,440 = $12,480 + $960

[c] $21,504 = $19,968 + $1,536

[d] $32,256 = $29,952 + $2,304

19–36. (30 min.) *Standard costing in a just-in-time environment: Otter Co.*

a. See following T-accounts and computations.

b. See credit to Standard Cost of Goods Sold for $5,202.

Standard Cost of Goods Sold

Materials	39,960[a]	5,202[e]
Variable OH	68,672[b]	
Fixed OH	148,000[c]	

Finished Goods

5,202[e]	

Various Accounts

	38,000	Mat.
	69,341	V.O.H.
	143,200	F.O.H.

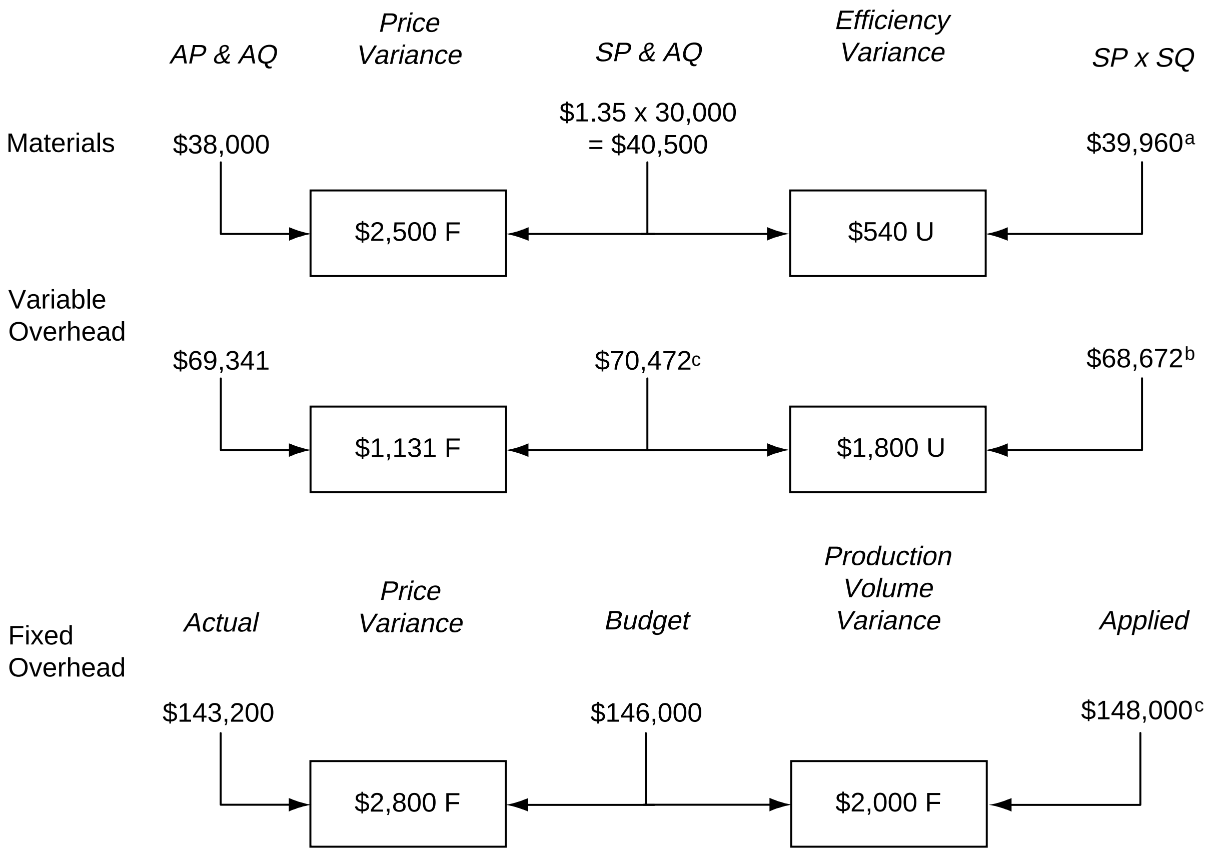
Standard Cost Variances

Mat efficiency	540	2,500	Mat. price
Var. OH efficiency	1,800	1,131	Var. OH price
		2,800	Fixed OH price
		2,000	Production volume

Note: Variances and footnotes showing computations are on the next page.

19–36. (continued)

Variance Calculations:



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[a] $39,960 = 14,800 units x 2 units of material x $1.35

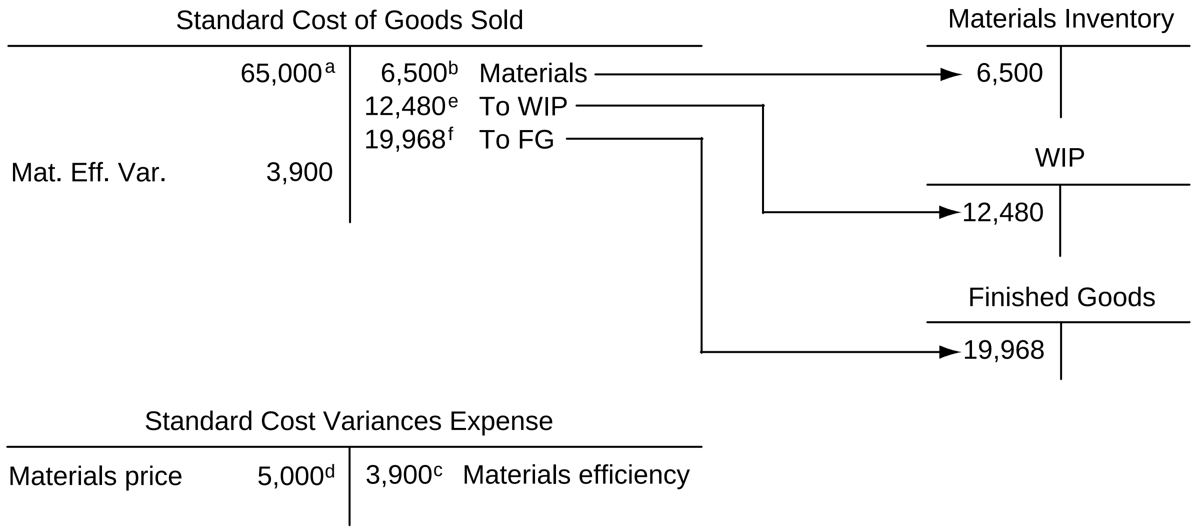
[b] $68,672 = $69,600 x 14,800 actual units/15,000 budgeted units

[c] $148,000 = $10 x 14,800 actual units

[d] $70,472 = $68,672 x $1,800

[e] Adjustment from Cost of Goods Sold to Finished Goods Inventory for remaining 300 units: $5,202 = (300 units/14,800 units) x ($39,960 + $68,672 + $148,000)

19–37. (30 min.) *Standard costing in a just-in-time environment: Armadillo Co.*



Standard Cost of Goods Sold

	65,000[a]	6,500[b]	Materials
		12,480[e]	To WIP
		19,968[f]	To FG
Mat. Eff. Var.	3,900		

Materials Inventory

6,500	

WIP

12,480	

Finished Goods

19,968	

Standard Cost Variances Expense

Materials price	5,000[d]	3,900[c]	Materials efficiency

---

[a] $65,000 = $1.30 x 50,000 united purchased.

(Note: The materials price variance is already out of the materials debit to Cost of Goods Sold.)

[b] $6,500 = $1.30 x (50,000 – 45,000)

[c] $3,900 = (48,000 – 45,000) x $1.30

[d] $5,000 = $70,000 – $65,000

[e] $12,480 = 20% x (48,000 x $1.30)

[f] $19,968 = 40% x ($62,400 – $12,480)

Solutions to Problems

19–38. (30 min.) *Nonmanufacturing cost variances: Seattle Financial.*

Incidental office costs comprise the variable costs. Salaries and the fixed office costs are all fixed. Variance analysis for the two classes of overhead is as follows:

Variable costs:

Actual Costs		*Flexible Budget (Standard Allowed)*
\$3,555 x 1.08 = \$3,839		\$3,555[a]
	Combined Price and Efficiency Variances \$284 U	

Actual		*Budget*
\$23,800 + \$28,100 = \$51,900		0.5[b] x (\$27,000 + \$20,000 + \$58,000) = \$52,500
	Price (Spending) Variance \$600 F	

Optional:
If computed, the production volume variance would be

Budget		*Applied*
\$52,500		\$52,500 x (79/75) = \$55,300
	Production Volume Variance \$2,800 F	

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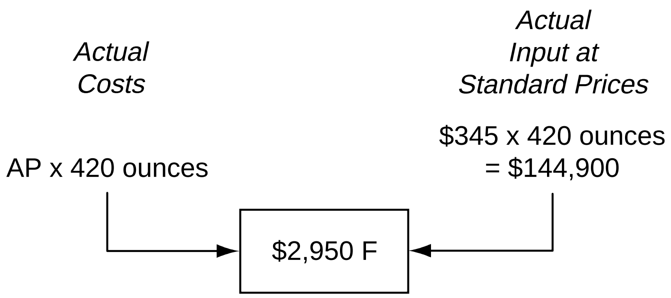
[a] \$3,555 = 79 loans x \$45 per loan.

[b] 0.5 represents one-half year.

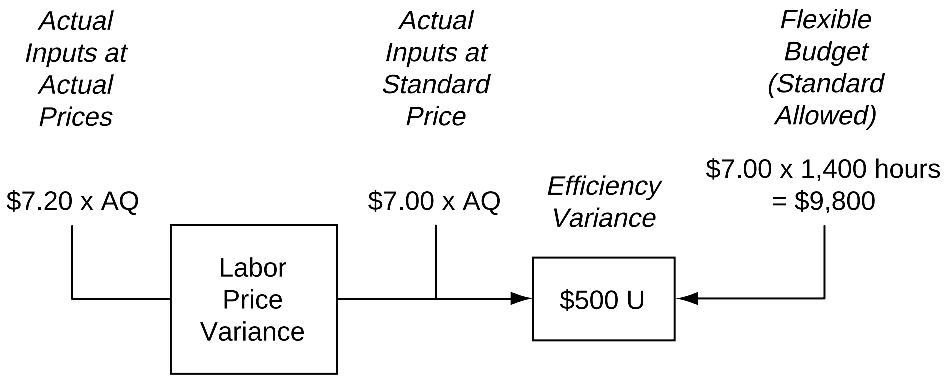
19–39. (20 min.) *Direct materials: Stanley Company.*



420 x AP = $144,900 – $2,950 = $141,950
AP = $337.98

19–40. (20 min.) *Solve for direct labor hours: Harrison Co.*

Set up variance model:



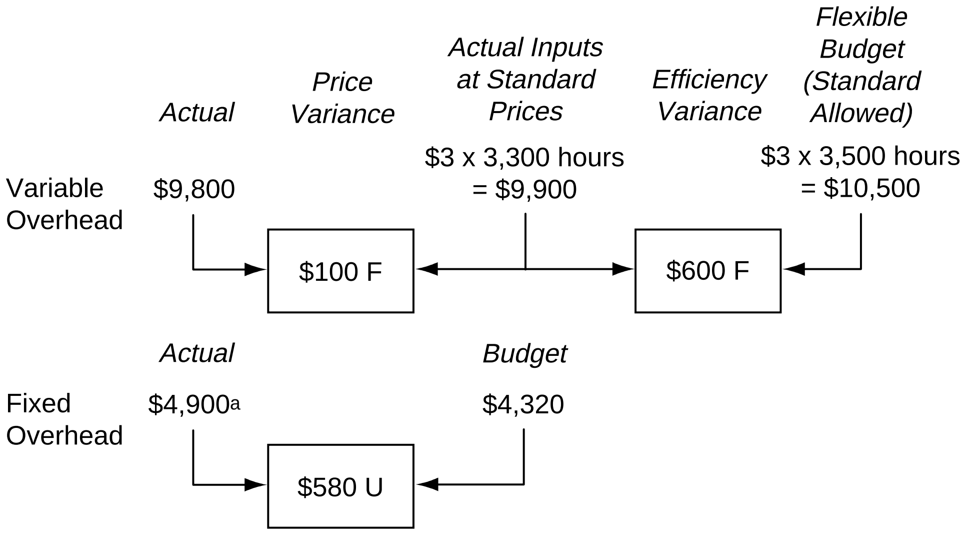
Solve for actual input at standard prices:
$9,800 + $500 unfavorable efficiency variance = $10,300.

Solve for AQ:
$7.00 x AQ = $10,300
AQ = $10,300/$7.00
AQ = 1471.4 hours

Solve for labor price variance:

Labor price variance = ($7.20 x 1471.4 hours) – $10,300
= $10,594 – $10,300
Labor price variance = $294 U

19–41. (20 min.) *Overhead variances: Cyclaris, Inc.*



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[a] $4,900 = $14,700 – $9,800

19–42. (40 min.) *Manufacturing variances: Adiamo Co.*

	Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget (Standard Allowed)*
Direct Materials	$.90 x 3,000 kilograms = $2,700	$300 F	$1 x 3,000 kilograms = $3,000		
			$1 x 2,100 kilograms = $2,100	$200 U	$1 x 1,900 kilograms = $1,900
Direct Labor	$5 x 3,200 hours = $16,000	$3,200 U	$4 x 3,200 hours = $12,800	$2,400 F	$4 x 2 hours x 1,900 units = $15,200
Variable Overhead	$4,500	$1,300 U	$1 x 3,200 hours = $3,200	$600 F	$1 x 2 hours x 1,900 units = $3,800

19–43. (30 min.) *Alternative variance calculations (Appendix C): Adiamo Co.*

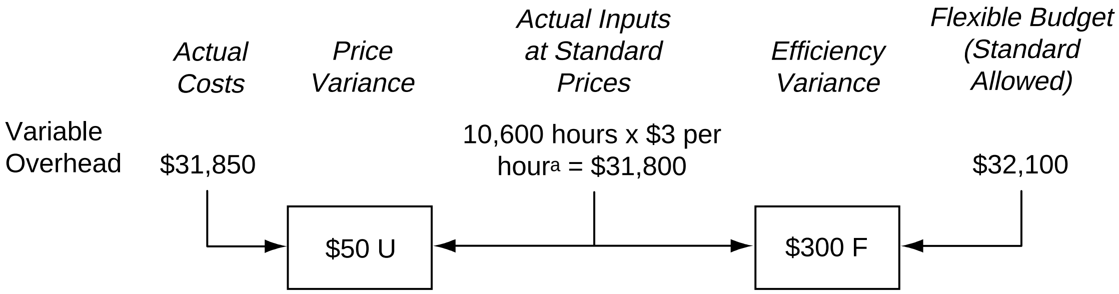
	Actual Costs	*Efficiency Variance*	*Actual Prices at Standard Input Quantities*	*Price Variance*	*Flexible Budget (Standard Allowed)*
Direct Labor	\$5 x 3,200 hours = \$16,000	\$3,000 F	\$5 x 2 hours x 1,900 units = \$19,000	\$3,800 U	\$4 x 2 hours x 1,900 units = \$15,200
Variable Overhead	\$1.40625[a] x 3,200 hours = \$4,500	\$844 F	\$1.40625[a] x 3,800 hours = \$5,344	\$1,544 U	\$1 x 3,800 hours = \$3,800

---

[a] $\frac{\text{Actual variable overhead}}{\text{Actual direct hours}} = \frac{\$4{,}500}{3{,}200 \text{ hours}} = \underline{\underline{\$1.40625}}$

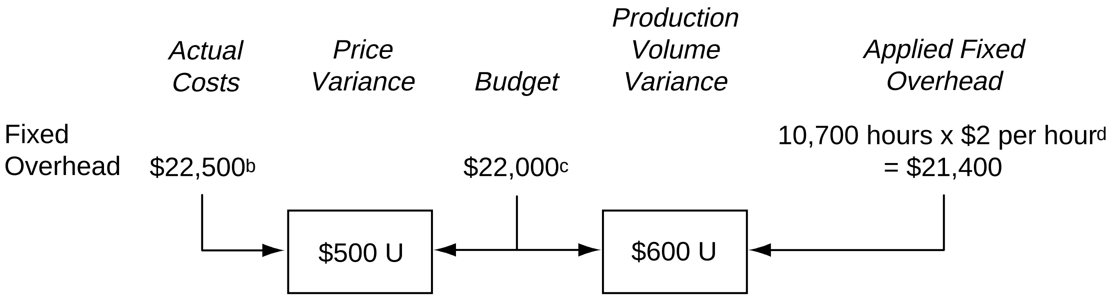
19–44. (40 min.) *Overhead cost and variance relationships: Sparkle Company.*

a.



	Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget (Standard Allowed)*
Variable Overhead	$31,850		10,600 hours x $3 per hour[a] = $31,800		$32,100
		$50 U		$300 F	

b.



	Actual Costs	*Price Variance*	*Budget*	*Production Volume Variance*	*Applied Fixed Overhead*
Fixed Overhead	$22,500[b]		$22,000[c]		10,700 hours x $2 per hour[d] = $21,400
		$500 U		$600 U	

---

[a] $\$3 = \frac{\$32,100 \text{ flexible budget}}{10,700 \text{ hours}}$

[b] $22,500 = $54,350 – $31,850

[c] $22,000 = $22,500 – $500 U price variance.

[d] $\$2 = \frac{\$22,000}{11,000 \text{ hours}}$

19–45. (20 min.) *Analysis of cost reports: Cifloxo Plant.*

Three possible changes that could make the cost information more meaningful are:

a. Use a flexible budget rather than a static master budget for measuring performance so that changed conditions, volume changes, and fixed versus variable costs are recognized in the reporting process.

b. Use standard costs.

c. Identify those elements of the report for which the production manager is directly responsible.

19–46. (25 min.) *Change of policy to improve productivity: Bichlor Bike Co.*

Currently the assembly personnel rarely complete the operations in less time than the standard allows. Assuming that the assembly department is working efficiently, it is not likely that the tightening of the standards (reducing the allowed time per operation) will result in increased productivity. More likely the assembly personnel will resent having the standards tightened without their input into the decision making process. They currently view the standards as achievable since they do, although rarely, complete the operations in less than the standard time. Tightening the standards will result in decreased motivation and morale as they strive for what they will view as an unrealistic standard.

Improved profit margins will not be achieved. The production manager fails to understand that by tightening the standards (all other things being equal) he will simply increase the negative variances. Simply lowering the standard time allowed per operation does not reduce the cost of manufacturing the product, unless an actual reduction in processing time occurs on the shop floor. As stated above the tightening of the standards will probably decrease morale and motivation resulting in an increased processing time. This will decrease productivity and increase the costs of production.

19–47. (20 min.) *Behavioral impact of implementing standard cost system: Lavoy, Inc.*

a. Standard costing allows for management by exception. Timely reporting of variances allows management to take corrective action before costs get out of hand. The breakdown of variances into various components helps management trace the source of potential cost problems. Standard costing may also motivate employees to operate more efficiently if they are allowed to participate in setting the standards.

b. The standard cost system can have a negative impact on the motivation of employees if the standards are too easily attainable or too difficult to reach. If the standards are too easy then employees tend to reduce productivity. If they are too difficult then production workers become frustrated and ignore the standards. Also, standards that are set without production employee input may not be accepted as realistic by those employees.

19–48. (20 min.) *Ethics and standard costs: Jamestown Joe’s.*

Larry's behavior is unethical. Larry has an obligation to communicate information fairly and objectively. He must prepare complete and clear reports and recommendations. By misrepresenting the costs of the strawberries he is hoping to benefit his friend's strawberry farm at the expense of Jamestown Joe’s. Larry should avoid such conflicts of interest, and advise all parties of any potential conflicts. He should not be setting the standards and mandating from whom Joe’s should purchase the goods.

19–49. (40 min.) *Comprehensive variance problem: Soundex Manufacturing Company.*

	Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget*
Direct Materials	18,000 meters x $.92 = $16,560	$360 U	18,000 meters x $.90 = $16,200		
			9,500 meters x $.90 = $8,550	$450 F	500 units x 20 meters/unit x $.90/meter = $9,000
Direct Labor	2,100 hours x $6.10 = $12,810	$210 U	2,100 hours x $6/hour = $12,600	$600 U	500 units x 4 hours x $6/hour = $12,000
Variable Overhead	?		2,100 hours x $3.75[a] = $7,875	$375 U	500 units x $15 = $7,500
Fixed Overhead	?		*Budget*	*Production Volume Variance*	*Applied Fixed Overhead*
			600 units x $5[b] = $3.000	$500 U	500 units x $5 = $2,500

The variable overhead price and fixed overhead price variances cannot be computed.
The total overhead price variance = $225 U
= $11,100 actual − ($7,875 + $3,000)

---

[a] $3.75/hour = $20 standard overhead per unit divided by 4 direct labor hours per unit multiplied by 3/4 (ratio of variable to fixed costs)

[b] $5.00/unit = $20 times 1/4 (ratio of fixed costs to total overhead)

19–49. (continued)

Note: If Appendix B has been assigned, then the three-way overhead variance (price, efficiency, and production volume variances) can be computed.

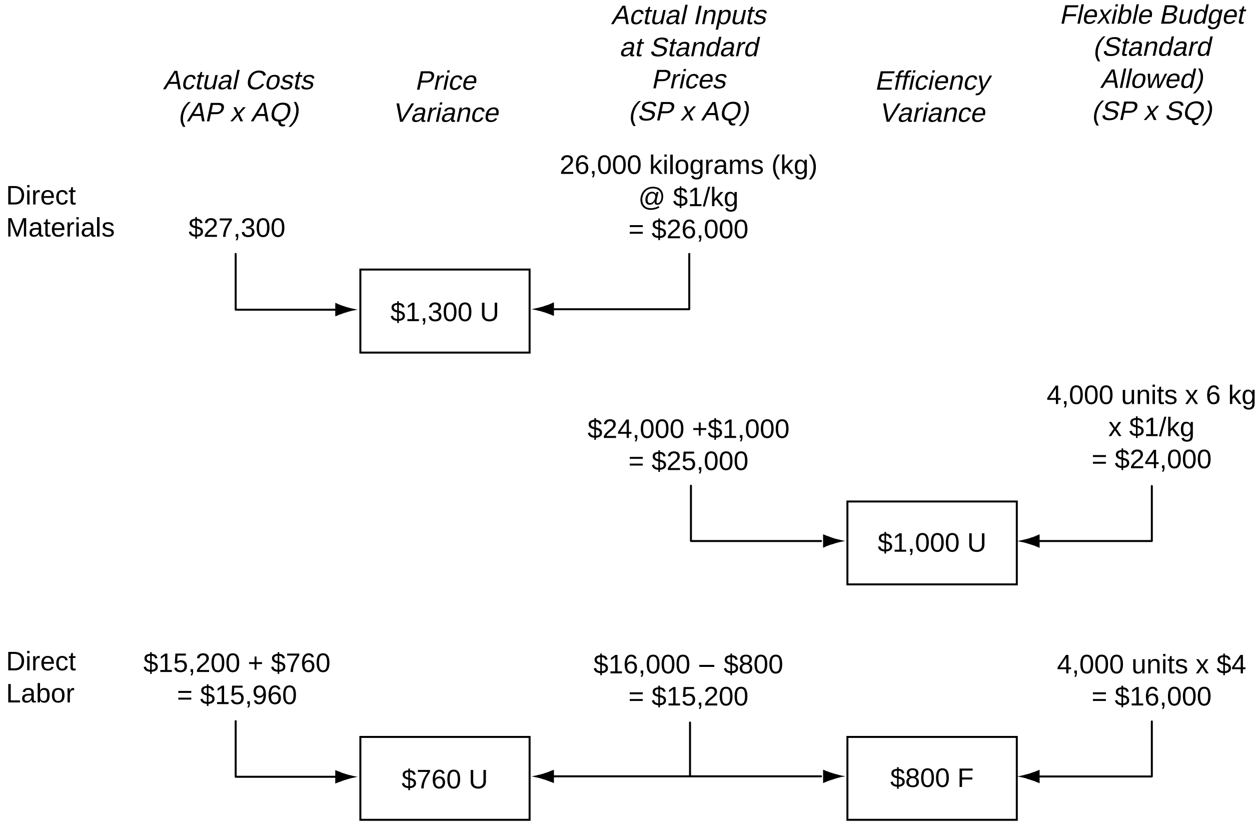
Three-way variance for overhead:

Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget*	*Production Volume Variance*	*Applied*
$11,100		$7,875 variable + $3,000 fixed = $10,875		$7,500 variable + $3,000 fixed = $10,500		$20 x 500 = $10,000
	$225 U		$375 U		$500 U	

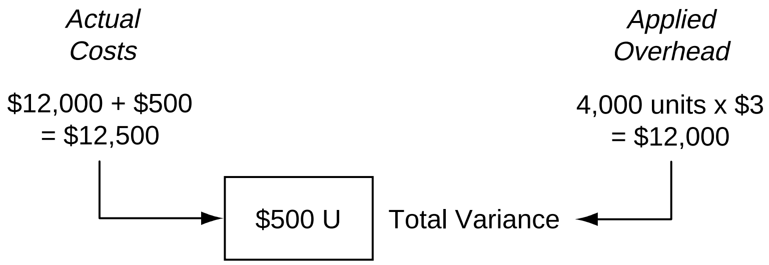
A good additional question to this problem is: "What additional information would you need to compute *all* overhead variances?" (Answer: A breakdown of actual overhead into fixed and variable components.)

19–50. (25 min.) *Find actual and budget amounts from variances: Nintendo.*

a.



b.
Overhead:



19–51. (40 min.) *Variance computations with missing data: Paramount Company.*

Note: The calculation of the fixed overhead budget amount makes this a challenging problem.

	Actual Costs (AP x AQ)	*Price Variance*	*Actual Inputs at Standard Prices (SP x AQ)*	*Efficiency Variance*	*Flexible Budget (Standard Allowed) (SP x SQ)*
Direct Materials	$1.85[a] x 102,000 pounds = $188,700	$20,400 U	$1.65 x 102,000 pounds = $168,300	$4,950 F	$1.65 x 5 pounds x 21,000 units = $173,250
Direct Labor	$13.084[b] x 10,700 hours = $140,000	$9,800 F	$14 x 10,700 hours = $149,800	$2,800 U	$14 x .5 hours x 21,000 units = $147,000
Variable Overhead	61% x $204,000 = $124,440	$2,890 F	$11.90 x 10,700 hours = $127,330	$2,380 U	$11.90 x .5 hours x 21,000 units = $124,950

	Actual	*Price Variance*	*Budget*	*Production Volume Variance*	*Applied*
Fixed Overhead	39% x $204,000 = $79,560	$440 F	$80,000[c]	$4,000 F	$4[d] x 21,000 units =$84,000

(Footnotes on next page)

19–51. (continued)

[a] $\$1.85 = \dfrac{\$188{,}700}{102{,}000 \text{ pounds}}$

[b] $\$13.084 = \dfrac{\$140{,}000}{10{,}700 \text{ hours}}$

[c] There are 20,000 units in the master production budget, computed by dividing total master budget costs by standard unit cost as follows:

Materials: $165,000 ÷ ($1.65 x 5 pounds)
= $165,000 ÷ $8.25 = 20,000 units.
Labor: $140,000 ÷ ($14.00 x .5 hours)
= $140,000 ÷ $7 = 20,000 units.

This means the master budget variable overhead amount is $119,000 = $11.90 x .5 hours x 20,000 units. So the fixed overhead budget is $80,000 = $199,000 – $119,000.

[d] $\$4 = \dfrac{\$80{,}000 \text{ budget}}{20{,}000 \text{ units}}$

19–52. (50 min.) *Comprehensive variance problem: Flintco Company.*

Florimene

a.

	Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget*
Direct Materials	3,100 x $.90 = $2,790	$310 F	3,100 x $1 = $3,100	$100 U	1,000 x 3 x $1 = $3,000
Direct Labor	4,900 x $4.05 = $19,845	$245 U	4,900 x $4 = $19,600	$400 F	1,000 x 5 x $4 = $20,000
Variable Overhead	$16,170	$490 U	4,900 x $3.20 = $15,680	$320 F	1,000 x 5 x $3.20 = $16,000

b.

	Actual	*Price Variance*	*Budget*	*Production Volume Variance*	*Applied*
Fixed Overhead	$20,930	$1,426 F	$22,356	$2,916 U	($22,356/1,150) x 1,000 = $19,440

19–52. (continued)

Glyoxide

a.

	Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget*
Direct Materials	4,700 x $1.15 = $5,405	$235 U	4,700 x $1.10 = $5,170	$110 F	1,200 x 4 x $1.10 = $5,280
Direct Labor	7,400 x $5.10 = $37,740	$740 U	7,400 x $5 = $37,000	$1,000 U	1,200 x 6 x $5 = $36,000
Variable	$25,234	$666 F	7,400 x $3.50 = $25,900	$700 U	1,200 x 6 x $3.50 = $25,200

b.

	Actual	*Price Variance*	*Budget*	*Production Volume Variance*	*Applied*
Fixed Overhead	$26,400	$120 F	$26,520	$2,040 U	($26,520/1,300) x 1,200 = $24,480

19–53. (50 min.) *Two-way, three-way and four-way overhead variances (Appendix B): Flintco Co.*

Note: Refer to Problem 19-52 for calculations.

Florimene

Two-way variance:

Actual	*Spending Variance*	*Budget*	*Production Volume Variance*	*Applied*
$16,170 variable + $20,930 fixed = $37,100		$16,000 variable + $22,356 fixed = $38,356		1,000 x 5 x ($3.20 + $3.888) = $35,440
	$1,256 F		$2,916 U	

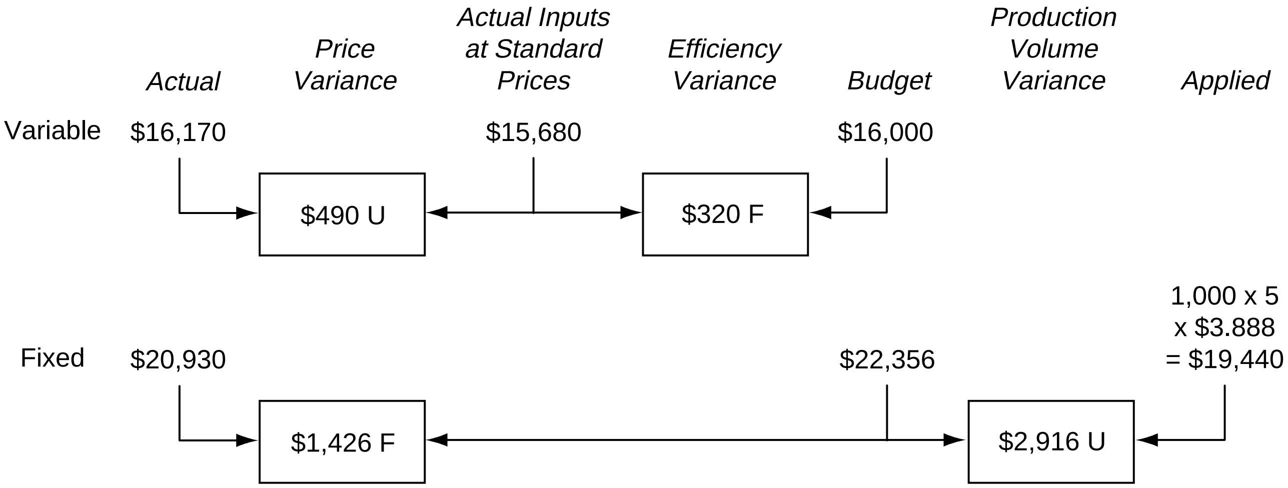
Three-way variance:

Actual	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Budget*	*Production Volume Variance*	*Applied*
$16,170 variable + $20,930 fixed = $37,100		$15,680 variable + $22,356 fixed = $38,036		$16,000 variable + $22,356 fixed = $38,356		$1,000 x 5 x ($3.20 + $3.888) = $35,440
	$936 F		$320 F		$2,916 U	

19–53. (continued)

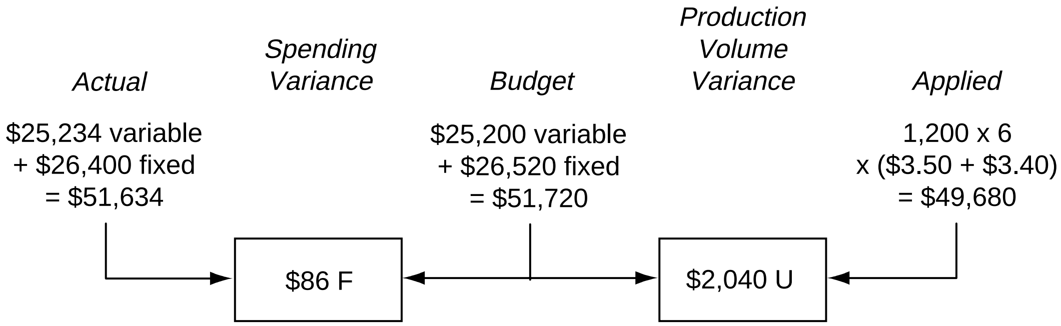
Florimene

Four-way variance:



Glyoxide

Two-way variance:


Actual
Spending Variance
Budget
Production Volume Variance
Applied
$25,234 variable + $26,400 fixed = $51,634
$25,200 variable + $26,520 fixed = $51,720
1,200 x 6 x ($3.50 + $3.40) = $49,680
$86 F
$2,040 U

Three-way variance:

Price variance = $51,634 – ($25,900 + $26,520) = $786 F.

Efficiency variance = $700 U (see problem 19–52).

Production volume variance = $2,040 U.

Four-way variance:

Same as three-way except price variance is divided into $666 F for variable overhead and $120 F for fixed overhead.

19–54. (30 min.) *Performance evaluation in service industries: Safe-City Insurance Co.*

Item	*Actual Costs*	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget*	*Activity Variance*	*Master Production Budget*
New Policies	$358,400	$12,800 U	(ignored)		4,800 x $72 = $345,600	$14,400 F	5,000 x $72 = $360,000
Policy Maintenance	$23,200	$300 U	$22,900	$1,300 F	$12,100,000 x .002[a] = $24,200	$2,600 U	$10,800,000 x .002[a] = $21,600

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[a] .002 = $2 per $1,000 face amount of insurance

Solutions to Integrative Cases

19–55. (35 min.) *Process costing variances: Cornwell, Inc.*

Note: Equivalent unit computations can be handed out in advance if students have not covered equivalent units.

	Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget (Standard Allowed)*
Direct Materials	11,000 kilograms x $11.25 = $123,750	$13,750 U	11,000 kilograms x $10 = $110,000	$10,000 U	10,000[a] kilograms x $10 = $100,000
Direct Labor	$105,575	$5,575 U	$4 per hour x 25,000 hours = $100,000	$17,600 U	$4 per hour x 2 hours x 10,300[b] units = $82,400
Variable Overhead	$30,350	$900 F	$1.25[c] per hour x 25,000 hours = $31,250	$5,500 U	$25,750

Footnotes on next page.

19–55. (continued)

[a]Equivalent units of work during the period with respect to materials:

To complete beginning inventory		0	EU
Units started	10,000		
Ending inventory	(2,000)		
Started and completed		8,000	
Ending inventory 2,000 x 100 %		2,000	
Equivalent units of material		10,000	EU

[b]Equivalent units of direct labor and overhead:

To complete beginning inventory 2,500 units x 60%	1,500	EU
Started and completed (from footnote a)	8,000	
Ending inventory 2,000 units x 40%	800	
Equivalent production	10,300	EU

[c]Assumes variable overhead is applied on the basis of direct labor hours (or dollars) because both are part of conversion costs.

$$\text{Standard variable overhead per direct labor hour is \$1.25} = \frac{\$25{,}750}{2 \text{ hours} \times 10{,}300 \text{ units}} = \frac{\$25{,}750}{20{,}600 \text{ hours}}$$

19–56. *Racketeer, Inc. (Comprehensive overview of budgets and variances).*

The following solution is based on a report by Tom Terpstra.

Elmo's problem is that he thinks that the graph and the income statement measure the same thing. Otto should have told him that they do not. The income statement presents actual costs in a full-absorption costing format, while the profit graph is based on standard costs in a variable costing format. These differences account for the difference in the profit measurement.

Because the profit graph is based on standard costs, the profit it shows will be the actual profit only in those very rare cases when the variances net out to zero. Racketeer has some significant variances listed on the income statement, so Elmo should expect that the actual profit would differ from the profit on the graph. These variances are:

Material	$490 U
Labor	392 U
Overhead	190 U
Selling and administrative	300 F
Total	$772 U

The overhead amount differs from the figure on the income statement, because the income statement overhead variance includes a production volume variance of $470 (= $.47 x 1,000). But that variance does not reflect a difference between actual and budget or standard costs when fixed manufacturing costs are not unitized.

The other part of the difference between the two profit figures is explained by the difference in accounting methods. Variable costing expenses fixed costs when they are incurred. With full-absorption, the fixed costs are assigned to the units produced, and then expensed in the period in which the units are sold. Racketeer treats each racket as having a fixed cost of $.47. For the 10,000 rackets sold, the fixed cost expense is $4,700 under full-absorption costing. Additionally, the production volume variance of $470 is also expensed during this period. Thus, $5,170 in fixed costs (aside from price variances) was deducted from income on the income statement. Under variable costing, the only fixed cost to be expensed is the standard cost for the period of $3,760 (also aside from price variances). So, the use of different accounting methods results in a profit difference of $1,410.

(Before Elmo starts to complain about the accountants' use of full-absorption, one should remind him that, in those months when production exceeds sales, the full-absorption method would expense less fixed costs than variable costing, so it evens out in the long run.)

19–56. (continued)

Now the two results can be reconciled:

Profit per chart	$20,940
Less:	
Cost variances	772
Additional fixed costs in full-absorption	1,410
Profit per Income Statement	$18,758

Besides failing to explain the profit graph, Otto also failed to set up a format to take advantage of the standards he developed. The company should set up a chart showing the actual results, the flexible budget, and the master budget. This would provide information concerning the profit changes in relation to the change in sales volume. Additionally, the manufacturing variances could be analyzed in greater detail, as shown in Exhibits A and B on the following pages.

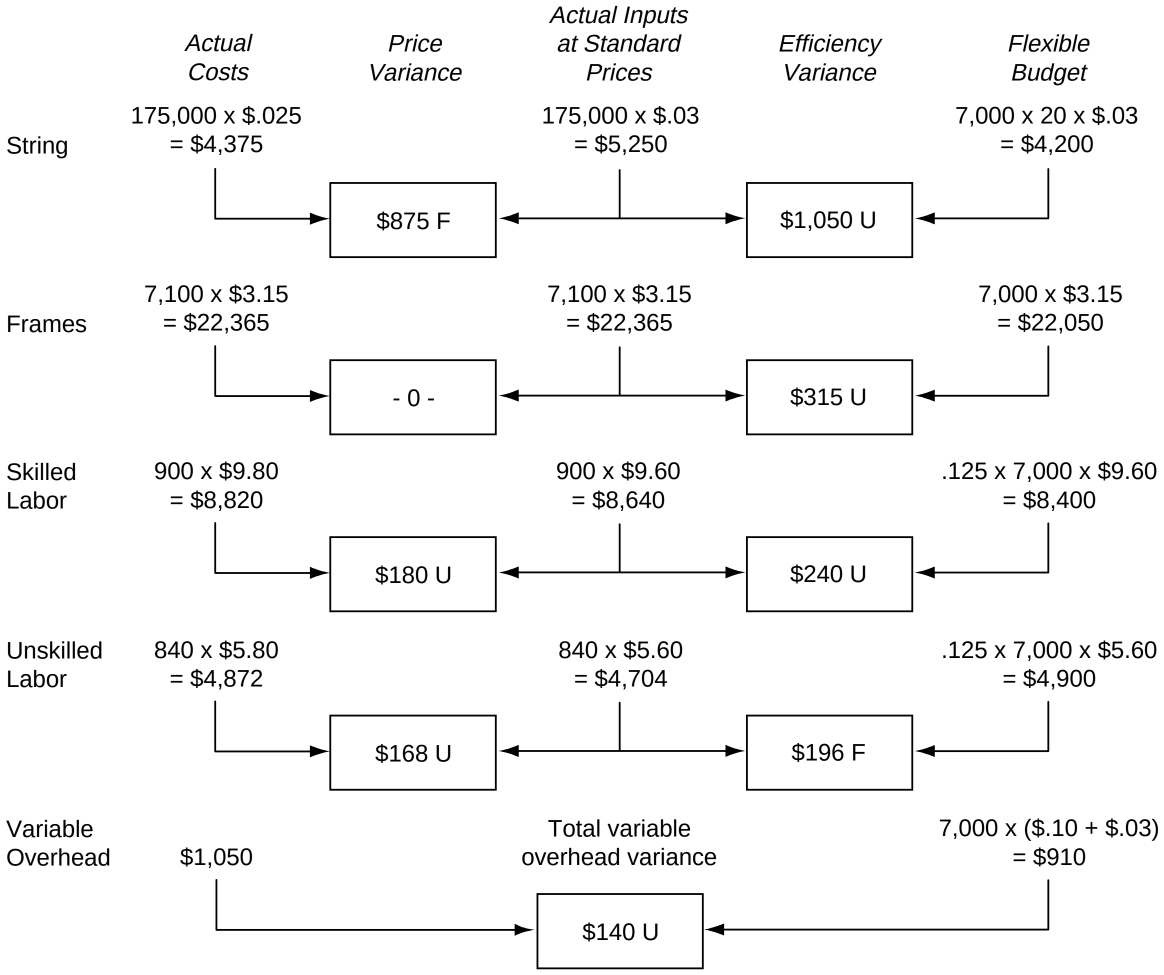
19–56. (continued)

Exhibit A Comparison of Master Budget to Actual Results.

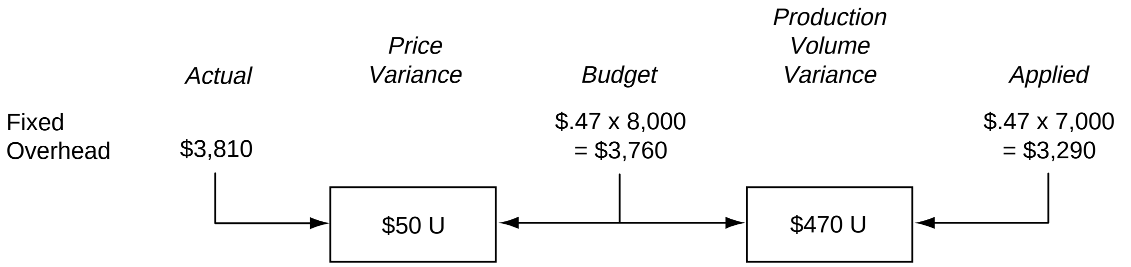
	Actual	*Manufacturing Variance*	*Selling and Administrative Variance*	*Sales Price Variance*	*Flexible Budget*	*Activity Variance*	*Master Budget*
Sales	$90,000		–0–	–0–	$90,000	$18,000 F	$72,000
Less Variable Costs:							
Materials	37,990	$ 490 U			37,500	7,500 U	30,000
Labor	19,392	392 U			19,000	3,800 U	15,200
Overhead	1,440	140 U			1,300	260 U	1,040
Contribution Margin	31,178	1,022 U	–0–	–0–	32,200	6,440 F	25,760
Less Fixed Costs:							
Manufacturing	3,810	50 U			3,760		3,760
Selling and Administrative	7,200		$300 F		7,500		7,500
Operating Profit	$20,168	$1,072 U	$300 F	–0–	$20,940	$ 6,440 F	$14,500

19–56. (continued)

Exhibit B Manufacturing Cost Variances.



	Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget*
String	175,000 x $.025 = $4,375	$875 F	175,000 x $.03 = $5,250	$1,050 U	7,000 x 20 x $.03 = $4,200
Frames	7,100 x $3.15 = $22,365	- 0 -	7,100 x $3.15 = $22,365	$315 U	7,000 x $3.15 = $22,050
Skilled Labor	900 x $9.80 = $8,820	$180 U	900 x $9.60 = $8,640	$240 U	.125 x 7,000 x $9.60 = $8,400
Unskilled Labor	840 x $5.80 = $4,872	$168 U	840 x $5.60 = $4,704	$196 F	.125 x 7,000 x $5.60 = $4,900
Variable Overhead	$1,050		Total variable overhead variance $140 U		7,000 x ($.10 + $.03) = $910



	Actual	*Price Variance*	*Budget*	*Production Volume Variance*	*Applied*
Fixed Overhead	$3,810	$50 U	$.47 x 8,000 = $3,760	$470 U	$.47 x 7,000 = $3,290

19–56. (continued)

The variance breakdown in Exhibits A and B highlights the areas that Elmo and Otto should research. One area involves the strings. Is the combination of a favorable price variance and unfavorable efficiency variance an indicator that low quality string was purchased? Another point for investigation is the apparent waste of 100 racket frames. Is there something in the production process which causes frames to break? Or are the standards unrealistic? A third area is the labor efficiency variances. Why are the skilled workers spending more time than budgeted, while the unskilled are spending less? Finally, the relationship between labor efficiency and materials efficiency variances is worth investigating, because use of substandard materials may result in an unfavorable labor efficiency variance. These are the types of questions that should be raised as a result of this variance analysis.

Chapter 20
Decentralization and Performance Evaluation

Solutions to Review Questions

20–1.
There exists a number of accounting alternatives that can be chosen by management. Moreover, financing decisions (e.g., lease vs. buy) may also be selected by management. The alternative chosen can have an impact on the reported accounting numbers and the reported investment base. If management compensation is dependent upon the income measure (and, possibly, in conjunction with the investment base), management may have a pecuniary incentive to choose a specific alternative even though such a choice may not be in the optimal long-run interest of the company. By choosing both the measurement system and the operating decisions, there may be a conflict of interest for the agent-manager.

20–2.
Top managers are viewed as agents of the Board of Directors. The Board of Directors is considered the agent of the shareholders.

20–3.
Middle managers are principals to their subordinates (e.g., line managers, supervisors).

20–4.
ROI measures scale the division accounting profit by the investment required. Managers would have incentives to maximize accounting measures of profit without regard to the investment required if only profits are evaluated. (Use of economic profits would not have this problem, of course.)

20–5.
If the return on a specific project is greater than the company's cost of capital, but this return is lower than the division's average ROI, a division manager would have an incentive to avoid that project even though it would benefit the company as a whole.

20–6.
Use of net book value will result in the ROI rising as the net asset is reduced through depreciation. This may be mitigated if ROI is based on gross book value. The problem is most acute if all depreciable assets in the investment base are the same age.

20–7.
In many cases managers are content to take a stated salary and perform optimally. However, in other organizations managers appear to perform better when given profit targets and other incentive devices. Lower level managers are also closer to their respective markets. With an incentive system these managers are more likely to take actions to respond to changes in their respective markets. However, an executive manager elects the performance evaluation and incentive system that is best for the specific organization. Hence, the executive's comments would make sense in the right organization setting.

Solutions to Critical Analysis and Discussion Questions

20–8.
Here the managers are encouraged to include slack in the budget by underestimating revenues and overestimating costs. The greater the slack, the greater the division manager's bonus.

20–9.
Sales people might be encouraged to cut prices or to incur marketing costs in excess of that required for maximum profit. Indeed, with the described system sales people could sell at prices less than the company's variable cost and still be paid a bonus. The problem with the system is that it depends on volume only and does not hold the sales managers responsible for any costs.

20–10.
Two problems usually arise here:

(a) The division might be encouraged to produce in volumes in excess of sales. In this way, the fixed production costs would be "deferred in inventory." See Chapter 11 on variable costing for an elaboration on this phenomenon.

(b) There could be a great deal of game-playing over how costs are allocated since a manager's performance will depend in part on how few costs get charged to the division.

20–11.
Residual income measures depend upon the rate chosen for charging a division for its investments. Different rates can yield different residual income rankings. In addition, residual income measures will tend to favor large divisions over smaller ones since the measures are based on an absolute dollar value.

20–12.
Large divisions are, all other things being equal, more likely to rank in the upper half. Hence, a large division manager would tend to receive a bonus with performance that is just barely above the cost of capital whereas a smaller division might need to earn a return far in excess of the cost of capital in order to earn a bonus. The approach used also does not take into account differences in capital charges that might be appropriate for different divisions.

20–13.

- Residual Income (RI) is defined as follows:

  Investment center operating profits—(Capital charge × Investment center assets)

  The capital charge is the minimum acceptable rate of return which will likely be greater than the company's cost of capital.

- Economic value added (EVA) is defined as follows:

  After-tax operating profits—(Cost of capital × Capital employed)

- Comparison:

  Investment center operating profits (in the RI formula) can be equated to after-tax operating profits (in the EVA formula). Investment center assets can be equated to capital employed. However, the capital charge is not the same as the cost of capital. The capital charge is the company's minimum acceptable rate of return, and the cost of capital is the weighted average cost of the company's debt and equity. While it is possible that these percentages might be the same for a given company, the terms clearly have different meanings. Therefore, although the two methods—RI and EVA—have many similarities, they are not typically identical.

20–14.

In both (a) and (b) there is a need to consider what role accounting is supposed to play in the settling of contracts–whether they be loan contracts or management incentive contracts. It would seem reasonable that the influence of an outside party (e.g., the FASB) should be limited in these situations. The parties to the contract apparently decided on a measurement system based on accounting rules in effect at the time the contract was entered into. Subsequent changes brought about by outsiders (or unilaterally by one party to the contract) are probably beyond the intent of the parties at the time the contracts were signed and, hence, properly ignored. In practice, it seems that lenders tend to ignore such changes while Boards of Directors tend to pay incentive bonuses based on revised income numbers. However, the “jury” is out on the issue. There are a number of cases which can be used to illustrate both approaches in both types of situations.

20–15.

If the division can rent and the rent does not have to be capitalized for inclusion in the investment base, the residual income will increase so long as the income from the asset exceeds the lease payment.

20–16.

ROI does not take the time value of money into account; while the cost of capital is a measure which does consider the time value of money. Differences between ROI and the cost of capital are likely when assets have different lives or are purchased at different times. Since the two measures are not comparable, trying to relate the two will not be meaningful.

20–17.

Using ROI as the sole performance measurement index will tend to discourage new investment and innovation. Managers will tend to focus on short-run performance. Quality tends to be sacrificed for quantity. Bleak Prospects could improve its situation by adopting a performance system that includes nonfinancial measures of performance such as requiring that a certain level of sales come from new products and that defective goods and rework rates be below a certain level.

Solutions to Exercises

20–18. (10 min.) *Compute residual income and ROI: PlainsfieldDivision.*

a. $\frac{\$600,000}{\$2,400,000} = 25\%$

b. $\$600,000 - .14(\$2,400,000) = \underline{\underline{\$264,000}}$

20–19. (25 min.) *ROI versus residual income.*

$$\text{Annual income} = \$140,000 - \frac{\$360,000}{5} = \$68,000$$

Year	*Investment Base*	*(a) ROI $68,000/Base*	*(b) Residual Income $68,000 – (25% x Base)*
1	$360,000*	18.9%	($22,000)
2	288,000	23.6%	(4,000)
3	216,000	31.5%	14,000
4	144,000	47.2%	32,000
5	72,000	94.4%	50,000

*Base decreases by annual depreciation of $72,000

20–20. (10 min.) *Compare alternative measures of division performance.*

a. Using return on investment measures:

*East: $\dfrac{\$35{,}000}{\$100{,}000} = 35\%$

West: $\dfrac{\$195{,}000}{\$750{,}000} = 26\%$

Using residual income:

East: $35,000 – (20% x $100,000) = $15,000

*West: $195,000 – (20% x $750,000) = $45,000

b. Yes. *East: $35,000 – (25% x $100,000) = $10,000

West: $195,000 – (25% x $750,000) = $7,500

*Indicates division with “better” performance.

20–21. (10 min.) *Impact of new project on performance measures.*

a. ROI before:

$$\frac{\$390{,}000}{\$1{,}300{,}000} = \underline{\underline{30\%}}$$

b. ROI after:

$$\frac{\$390{,}000 + \$46{,}500^{a}}{\$1{,}300{,}000 + \$225{,}000} = \underline{\underline{28.6\%}}$$

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[a] $46,500 = $84,000 – $\left[\dfrac{\$225{,}000}{6}\right]$

20–22. (10 min.) *Impact of leasing on performance measures.*

With the lease, the incremental income is the operating cash flow minus the lease payment or $10,000 = $84,000 – $74,000.

The new ROI is:

$$\frac{\$390{,}000 + \$10{,}000}{\$1{,}300{,}000} = \underline{\underline{30.8\%}}$$

20–23. (15 min.) *Residual income measures and new project consideration.*

a. $\$390{,}000 - .2(\$1{,}300{,}000) = \underline{\underline{\$130{,}000}}$

b. $\$130{,}000 + \$84{,}000 - \dfrac{\$225{,}000}{6} - .2(\$225{,}000) = \underline{\underline{\$131{,}500}}$

or

$$\left(\$390{,}000 + \$84{,}000 - \frac{\$225{,}000}{6}\right) - .2(\$1{,}300{,}000 + \$225{,}000)$$

$= \underline{\underline{\$131{,}500}}$

c. $\$130{,}000 + \$84{,}000 - \$74{,}000 = \underline{\underline{\$140{,}000}}$

or

$(\$390{,}000 + \$84{,}000 - \$74{,}000) - .2(\$1{,}300{,}000) = \underline{\underline{\$140{,}000}}$

20–24. (25 min.) *Compare historical cost, net book value to gross book value: Oracle Division.*

	a *Net Book Value*	*b* *Gross Book Value*
Year 1	$\frac{(\$1,000,000 - \$400,000)}{(\$4,000,000 - \$400,000)}$ $= \frac{\$600,000}{\$3,600,000} = 16.7\%$	$\frac{(\$1,000,000 - \$400,000)}{\$4,000,000}$ $= \frac{\$600,000}{\$4,000,000} = 15\%$
Year 2	$\frac{(\$1,000,000 - \$400,000)}{[\$4,000,000 - (2 \times \$400,000)]}$ $= \frac{\$600,000}{\$3,200,000} = 18.8\%$	$\frac{(\$1,000,000 - \$400,000)}{\$4,000,000}$ $= \frac{\$600,000}{\$4,000,000} = 15\%$
Year 3	$\frac{(\$1,000,000 - \$400,000)}{[\$4,000,000 - (3 \times \$400,000)]}$ $= \frac{\$600,000}{\$2,800,000} = 21.4\%$	$\frac{(\$1,000,000 - \$400,000)}{\$4,000,000}$ $= \frac{\$600,000}{\$4,000,000} = 15\%$
Year 4	$\frac{(\$1,000,000 - \$400,000)}{[\$4,000,000 - (4 \times \$400,000)]}$ $= \frac{\$600,000}{\$2,400,000} = 25\%$	$\frac{(\$1,000,000 - \$400,000)}{\$4,000,000}$ $= \frac{\$600,000}{\$4,000,000} = 15\%$

20–25. (25 min.) *Compare ROI using net book and gross book values: Oracle Division.*

	a *Net Book Value*	*b* *Gross Book Value*
Year 1	$\frac{(\$1{,}000{,}000 - \$400{,}000)}{\$4{,}000{,}000} = \frac{\$600{,}000}{\$4{,}000{,}000} = 15\%$	$\frac{(\$1{,}000{,}000 - \$400{,}000)}{\$4{,}000{,}000} = \frac{\$600{,}000}{\$4{,}000{,}000} = 15\%$
Year 2	$\frac{(\$1{,}000{,}000 - \$400{,}000)}{(\$4{,}000{,}000 - \$400{,}000)} = \frac{\$600{,}000}{\$3{,}600{,}000} = 16.7\%$	$\frac{(\$1{,}000{,}000 - \$400{,}000)}{\$4{,}000{,}000} = \frac{\$600{,}000}{\$4{,}000{,}000} = 15\%$
Year 3	$\frac{(\$1{,}000{,}000 - \$400{,}000)}{[\$4{,}000{,}000 - (2 \times \$400{,}000)]} = \frac{\$600{,}000}{\$3{,}200{,}000} = 18.8\%$	$\frac{(\$1{,}000{,}000 - \$400{,}000)}{\$4{,}000{,}000} = \frac{\$600{,}000}{\$4{,}000{,}000} = 15\%$
Year 4	$\frac{(\$1{,}000{,}000 - \$400{,}000)}{[\$4{,}000{,}000 - (3 \times \$400{,}000)]} = \frac{\$600{,}000}{\$2{,}800{,}000} = 21.4\%$	$\frac{(\$1{,}000{,}000 - \$400{,}000)}{\$4{,}000{,}000} = \frac{\$600{,}000}{\$4{,}000{,}000} = 15\%$

c. Of course, there is no change under the gross book value method. With the net method, both alternatives (using end-of-year asset values versus beginning-of-year values) show the same trend of rising ROIs as the assets depreciate. This is to be expected. The end-of-year value is the next year’s beginning-of-year value.

20–26. (30 min.) *Compare current cost to historical cost: Oracle Division.*

Parts c and d can be solved easier if one first sets up a table showing the change in value of the depreciable assets.

	(1) *Gross Depreciable Asset Value*[a]	*(2)* *Yearly Depreciation* *(1) x 25%*	*(3)* *Total Depreciation* (1) times $\frac{\textit{Years of life}}{\textit{4 years}}$
Year 1	\$1,600,000 x 1.1 = \$1,760,000	\$440,000	\$1,760,000 x 1/4 = \$440,000
Year 2	\$1,760,000 x 1.1 = \$1,936,000	\$484,000	\$1,936,000 x 2/4 = \$968,000
Year 3	\$1,936,000 x 1.1 = \$2,129,600	\$532,400	\$2,129,600 x 3/4 = \$1,597,200
Year 4	\$2,129,600 x 1.1 = \$2,342,560	\$585,640	\$2,342,560 x 4/4 = \$2,342,560

[a] Start with gross assets = \$4,000,000 – \$2,400,000 salvage value = \$1,600,000.

20–26. (continued)

	a *Historical Cost* *Gross Book Value*	*b.* *Historical Cost* *Net Book Value*
Year 1	$\frac{(\$1,100,000 - \$400,000)}{\$4,000,000} = \frac{\$700,000}{\$4,000,000} = 17.5\%$	$\frac{(\$1,100,000 - \$400,000)}{(\$4,000,000 - \$400,000)} = \frac{\$700,000}{\$3,600,000} = 19.4\%$
Year 2	$\frac{(\$1,210,000 - \$400,000)}{\$4,000,000} = \frac{\$810,000}{\$4,000,000} = 20.3\%$	$\frac{(\$1,210,000 - \$400,000)}{[\$4,000,000 - (2 \times \$400,000)} = \frac{\$810,000}{\$3,200,000} = 25.3\%$
Year 3	$\frac{(\$1,331,000 - \$400,000)}{\$4,000,000} = \frac{\$931,000}{\$4,000,000} = 23.3\%$	$\frac{(\$1,331,000 - \$400,000)}{[\$4,000,000 - (3 \times \$400,000)]} = \frac{\$931,000}{\$2,800,000} = 33.3\%$
Year 4	$\frac{(\$1,464,100 - \$400,000)}{\$4,000,000} = \frac{\$1,064,100}{\$4,000,000} = 26.6\%$	$\frac{(\$1,464,100 - \$400,000)}{[\$4,000,000 - (4 \times \$400,000)]} = \frac{\$1,064,100}{\$2,400,000} = 44.3\%$

20–26. (continued)

	c *Current Cost Gross Book Value*	*d.* *Current Cost Net Book Value*
Year 1	$\frac{(\$1{,}100{,}000 - \$440{,}000)}{\$4{,}400{,}000}$ $= \frac{\$660{,}000}{\$4{,}400{,}000} = 15\%$	$\frac{(\$1{,}100{,}000 - \$440{,}000}{(\$4{,}400{,}000 - \$440{,}000)}$ $= \frac{\$660{,}000}{\$3{,}960{,}000} = \$16.7\%$
Year 2	$\frac{(\$1{,}210{,}000 - \$484{,}000)}{\$4{,}840{,}000}$ $= \frac{\$726{,}000}{\$4{,}840{,}000} = 15\%$	$\frac{(\$1{,}210{,}000 - \$484{,}000)}{(\$4{,}840{,}000 - \$968{,}000)}$ $= \frac{\$726{,}000}{\$3{,}872{,}000} = 18.8\%$
Year 3	$\frac{(\$1{,}331{,}000 - \$532{,}400)}{\$5{,}324{,}000}$ $= \frac{\$798{,}600}{\$5{,}324{,}000} = 15\%$	$\frac{(\$1{,}331{,}000 - \$532{,}400)}{(\$5{,}324{,}000 - \$1{,}597{,}200)}$ $= \frac{\$798{,}600}{\$3{,}726{,}800} = 21.4\%$
Year 4	$\frac{(\$1{,}464{,}100 - \$585{,}640)}{\$5{,}856{,}400}$ $= \frac{\$878{,}460}{\$5{,}856{,}400} = 15\%$	$\frac{(\$1{,}464{,}100 - \$585{,}640)}{(\$5{,}856{,}400 - \$2{,}342{,}560)}$ $= \frac{\$878{,}460}{\$3{,}513{,}840} = 25\%$

20–27. (25 min.) *Effects of current cost on performance measures: Otter Division.*

a. *ROI*

Year 1 $$\frac{\$30{,}000 - (.25 \times \$100{,}000)}{\$100{,}000} = \frac{\$5{,}000}{\$100{,}000} = 5.0\%$$

Year 2 $$\frac{\$34{,}000 - (.25 \times \$100{,}000)}{\$100{,}000} = \frac{\$9{,}000}{\$100{,}000} = 9.0\%$$

Year 3 $$\frac{\$38{,}000 - (.25 \times \$100{,}000)}{\$100{,}000} = \frac{\$13{,}000}{\$100{,}000} = 13.0\%$$

Year 4 $$\frac{\$40{,}000 - (.25 \times \$100{,}000)}{\$100{,}000} = \frac{\$15{,}000}{\$100{,}000} = 15.0\%$$

b. *ROI*

Year 1 $$\frac{\$30{,}000 - (.25 \times \$100{,}000)}{\$100{,}000} = \frac{\$5{,}000}{\$100{,}000} = 5.0\%$$

Year 2 $$\frac{\$34{,}000 - (.25 \times \$110{,}000)}{\$110{,}000} = \frac{\$6{,}500}{\$110{,}000} = 5.9\%$$

Year 3 $$\frac{\$38{,}000 - (.25 \times \$121{,}000)}{\$121{,}000} = \frac{\$7{,}750}{\$121{,}000} = 6.4\%$$

Year 4 $$\frac{\$40{,}000 - (.25 \times \$133{,}100)}{\$133{,}100} = \frac{\$6{,}725}{\$133{,}100} = 5.1\%$$

Solutions to Problems

20–28. (30 min.) *Equipment replacement and performance measures: Juneau, Inc.*

a. $$\frac{\$750{,}000}{\$800{,}000 + \$1{,}000{,}000 - \$300{,}000 - \$250{,}000} = 60\%$$

b. $$\frac{\$750{,}000 - \$700{,}000^{*}}{\$800{,}000 - \$250{,}000 + \$1{,}300{,}000} = 2.7\%$$

*Loss on old equipment equal to its $1 million cost less $300,000 depreciation.

c. $$\frac{\$1{,}005{,}000^{**}}{\$800{,}000 - (2 \times \$250{,}000) + \$1{,}300{,}000 - \$400{,}000^{***}} = 83.8\%$$

**Net income:

	Revenues	$3,520,000	(up 10%)
	Costs:		
	Variable	440,000	(up 10%)
	Fixed	1,425,000	(down 5%)
	Depreciation:		
	Equipment	400,000***	
	Other	250,000	
		$1,005,000	

$$^{***}\$400{,}000 = \left(\frac{\$1{,}300{,}000 - \$100{,}000}{3 \text{ years}}\right)$$

20–29. (20 min.) *Evaluate trade-offs in return measurement: Juneau, Inc.*

a. The machine is going to result in a positive net benefit so you would want to acquire it as early in the year as possible so you could obtain a full year's benefits.

b. For the manager, the relevant cost is the lost bonus this year if the machine is purchased this year versus the effect on the manager's bonus that would arise from the increased depreciation charge. If the manager waits until next year, then the return on investment for this year would be the 60% as indicated in Problem 20–28, part a. For the coming year, the ROI would be:

$$\frac{\$940{,}000 - \$700{,}000}{\$800{,}000 - (2 \times \$250{,}000) + \$1{,}495{,}000 - \$465{,}000} = \frac{\$240{,}000}{\$1{,}330{,}000} = \underline{\underline{18.0\%}}$$

assuming that the new equipment is bought at the beginning of the year.

Where:
$$\$1{,}495{,}000 = \$1{,}300{,}000 \times 1.15$$
$$\$465{,}000 = \frac{\$1{,}495{,}000 - \$100{,}000}{3 \text{ years}}$$
$\$700{,}000$ = loss on disposal of the old equipment
$$\$940{,}000 = \$1{,}005{,}000 + \$400{,}000 - \$465{,}000$$

For the company, the relevant costs would be the 15% price increase versus any savings the company might realize on its capital costs if it waits until next year.

However, it is difficult to see how the division or company would be better off by waiting a few weeks and incurring an added 15% cost.

20-30. (40 min.) *Analyze performance report for decentralized organization: Ashwood.**

a. An evaluation of the performance of Patric Anderson for the nine months ending September, Year 3 would appear favorable if only the divisional residual income figure were considered. The actual residual income is well above the nine month budgeted figure. However, closer examination of the report reveals that overall performance cannot be considered satisfactory for the following reasons:

   - Variable cost of sales (direct materials and labor) have increased significantly as a percentage of sales.
   - The maintenance and repair costs implied in the budget and probably needed have not been incurred.
   - Allocated corporate fixed costs are below budget. While these costs should have no effect on the performance of this division, its inclusion in the report does affect the residual income figure.

   Corporate policy dictates that division managers minimize their investment in inventories and maintain control over plant fixed assets. In this respect, Patric Anderson has not performed as well as expected for reasons described as follows:

   - Inventories have increased significantly relative to sales volume and to divisional investment.
   - Budgeted additions to plant fixed assets have not been made. The decision to postpone obtaining these fixed assets at the division level could have been made for the purpose of reducing the investment base and the imputed interest charge, or to reduce the investment base.

b. A performance evaluation system should reflect the division manager's (D.M.) responsibilities (i.e., those things that are specifically controllable by the D.M. and for which the D.M. is held accountable). A good division performance measurement should present the performance of the manager unobscured by extraneous items that are not subject to the D.M.'s control. In this instance. Ashwood's divisional management is solely responsible for the production and distribution of corporate products.

   Specific features of the performance measurement reporting and evaluation system which should be revised are as follows:

   - A flexible budget based upon production as well as sales should be used so that divisions can better reflect the actual level of activity achieved.
   - Fixed divisional costs should be so identified and subtracted from a divisional contribution margin.

*CMA adapted.

20–30. (continued)

- Allocated corporate fixed costs obscure the division's performance since such costs are not subject to division management control. Ideally, corporate level fixed costs should not be allocated. However, if corporate management feels it necessary to allocate corporate level fixed costs, they should be relegated to a position as a final subtract item from divisional residual income.
- The investment base used to compute residual income uses year-end values for receivables and inventories as opposed to some average-value method. An average value would more accurately reflect the activities in these accounts over the time period being analyzed.
- Plant assets are under the joint authority of the division and the corporation, thereby limiting the control at the divisional level.

20–31. (40 min.) *ROI and management behavior: Thain Corporation.**

a. Most of the specific actions that division managers can take which would result in increasing division ROI and decreasing corporate ROI relate to investment proposals. The division managers have the responsibility to recommend investment opportunities for their divisions. The facts in the problem would suggest that they have been recommending only investments which are a "sure thing" to increase division ROI and screening out investments which would lower division ROI even though improving corporate ROI. In addition, the postponement of capital investments makes the divisional asset base smaller for the calculation of division ROI. Further, the managers are not likely to recommend projects which would improve division ROI in the long-run but would depress it in the short-run (start-up periods).

b. Thain's corporate goals and goals for its divisions are not congruent. Improving the division ROI does not automatically lead to improved corporate ROI. Certain actions could be taken by a division which would improve its ROI, such as rejecting an investment below its ROI but above the corporation ROI, but would not necessarily improve corporate ROI. The emphasis on division ROI as the most important appraisal factor for salary changes does not provide the proper motivation because divisional executives are motivated to maximize division ROI without regard to the corporate ROI.

   Additionally, division managers are indifferent as to the amount and timing of cash flows because cash is not part of the division's investment base. However, the corporation is not indifferent to cash flow because it has to invest the cash.

c. The changes should be two-fold in character. The emphasis on a single measure for performance evaluation should be eliminated. Additional factors important to division and corporate goals should be included.

   One approach would be to establish a target ROI which would include allowances for start-up costs of long-term projects. The company could consider the residual profits concept of divisional performance measurement. The divisions would be charged "interest" cost of assets employed and performance would be measured on the basis of the division profits above the "interest" charges.

   Factors other than ROI also should be included in the policy. The long-run success of the company requires attention to such items as:

   - new products and/or new markets.
   - new manufacturing technology.
   - improvement in sales volume and/or market share.
   - cost efficiency.

*CMA adapted

20–32. (30 min.) *Impact of decisions to capitalize or expense on performance measurement: Lewison Drilling Company.*

a.

	ROI *Base Year*	*This Year*
Successful efforts (used in base year)	$\frac{\$900,000}{\$6,900,000} = 13.0\%$	$\frac{(\$1,720,000 - \$900,000)}{(\$8,100,000 - \$900,000)} = 11.4\%$
Full-cost (used by new management)		$\frac{\$1,720,000}{\$8,100,000} = 21.2\%$

b. 10% x $820,000 = $82,000

c. The board should reject the request for a bonus. The purpose of the bonus is to provide an incentive to management to improve actual performance. However, management has just manipulated the figures by which performance is measured. If the accounting method had not been changed, both income and ROI would have shown decreases in the present year.

20–33. (30 min.) *Evaluate performance evaluation system–Behavioral issues: Drawem Co.**

a. An answer that assumed that managers should only be held responsible for what they control would make the following arguments:

The financial reporting and performance evaluation program of Drawem Company is inappropriate as a measure of the responsibilities of the Bildem Division. Bildem is being evaluated as a profit or investment center when it has no control over pricing, production and investment decisions. In actuality, Bildem Division is a cost center and the performance report should only consider costs under the control of Bildem management.

Additionally, the corporate general service costs should not be included on the performance report because these costs are not under the control of the division management. Moreover, the allocation basis is artificial in that corporate management determines Bildem Division sales volume.

Bildem's managers currently share some of the organization-wide risk because they are held responsible for things they do not control. Presumably, they must be compensated for sharing this risk if they are risk-averse. On the other hand, they may attain nonpecuniary rewards from being an "investment center" instead of a cost center. Despite the fact that Bildem's managers are held responsible for things outside of their control, it is not clear that Bildem's managers or the company would be better off by making Bildem a cost center, although it is a cost center, *de facto.*

*CMA adapted.

20–33. (continued)

b. Following the notion that managers should be held responsible only for what they control, the answer to requirement *b* would be:

The following revisions should be made to Drawem Company’s financial reporting and performance evaluation system.

- Evaluate Bildem Division as a cost center and include in the analysis only those costs under the control of division management.
- Introduce a budget system possibly including a flexible budget format which would be used with costs classified as fixed and variable.
- The allocated corporate general services costs should not be included in the report. However, if management wants to include the corporate services, it should be identified separately and treated as the final addition to division costs.
- Corporate computer costs should be included on the report. The amount charged should be based upon actual usage and a predetermined standard rate.
- Provided a flexible budget is used for the actual level of production activity, a variance analysis can be included in the evaluation. The variances should be identified as price or efficiency related.
- The report could be expected to analyze noneconomic aspects of production other than costs. Performance measures to consider might include manpower levels, inventory levels, order backlogs, training programs, and new products or developments.

20–34. (40 min.) *Divisional performance measurement—Behavioral issues: Lenco Incorporated.*

a. The proposed Achievement of Objectives System (AOS) would be an improvement over the current measure of divisional performance for the following reasons:

- There appears to be greater participation in the establishment of objectives by divisional managers.
- The use of multiple criteria for performance measures should be a more equitable standard of evaluation. This performance measure tends to reduce over-emphasis on single measurement criteria and may also balance extremes in performance in one area versus another.
- Realistic planning encourages accurate budget estimations and promotes intermediate and long-range objectives, which enhances goal congruence.
- Static budgets established six months before the start of the year would be replaced by flexible budgets which would be subject to change as needed.
- The emphasis on performance is based upon factors controllable by and upon efforts actually directed by divisional managers.

b. Specific performance measures for the criterion “doing better than last year” could include total sales, contribution margin, controllable costs, net income, net income as a function of sales, return on investment, market share, and productivity. Measurement of these items should be compared in absolute terms or by percentages to the prior year.

Specific performance measures for the criterion “planning realistically” could include an analysis of variance between actual and budget and the use of a flexible budget to determine sales, net income, net income as a function of sales, and return on investment.

Specific performance measures for the criteria “managing current assets” could include accounts receivable turnover, inventory turnover, return on current assets, and year-to-year comparisons of current assets in total and by account classification.

*CMA adapted

20–34. (continued)

c. The motivational and behavioral aspects of the achievement-of-objectives-system depend upon the level of acceptance of the system by top management and the divisional managers.

- Divisional managers could have a sense of participation in the role of goal setting and budget development which could encourage goal congruence.
- Multiple criteria enhance a sense of equity or fairness, and remove pressures to pursue measured goals, the achievement of which may conflict with corporate long-run objectives (i.e., promotes goal congruence).
- Divisional managers should have an increased sense of responsibility and control over activities within their divisions once they are not held responsible for uncontrollable factors.
- Top management support along with timely and regular reviews of performance will promote division managers' feelings of self-worth.

Programs which may be instituted to promote morale and give incentives to divisional managers in conjunction with the achievement-of-objectives system include the following.

- Intrinsic motivators can be provided by allowing the manager to assess his/her own achievements and his/her own worth.
- Extrinsic motivators can be developed through a manager's competition against him/herself or with other divisions with recognition given to the successful participants in the form of awards or monetary incentives.
- Increased morale can result from participation in budget setting and management level decisions as well as having positive feedback.

20–35. (35 min.) *ROI, residual income, different asset bases: Woodside Products Store.*

a. and b.

Income statements to summarize the alternatives are as follows: ($ in thousands)

	Regular Merchandise	*Furniture*	*Total*
Revenue	$260,000	$75,000	$335,000
Cost of Sales	163,000	57,000	220,000
Gross Margin	$ 97,000	$18,000	$115,000
Operating Expense	26,000	8,500	34,500
Operating Profit	$ 71,000	$ 9,500	$ 80,500
Investment	$187,500	$55,000	$242,500
ROI	37.87%	17.27%	33.20%
	a.		b.

Although the furniture provides a return greater than the cost of capital, it lowers the status quo ROI.

c. If the floor plan is used, the investment base will be $187,500. Operating profits will equal $80,500 minus the floor plan charge of $6,750 for a net profit of $73,750. The ROI will be 39.33% which is $73,750 ÷ $187,500.

d. The manager would prefer the floor plan because it would raise the store’s ROI above the current ROI of 37.87%.

Chapter 21
Transfer Pricing

Solutions to Review Questions

21–1.
A transfer price may be based on costs, market prices, a negotiated amount or some combination of the three.

21–2.
Transfer prices exist in centralized organizations to record the transfer of goods and services from one unit to another for the same reasons such organizations allocate costs (e.g., inventory valuation, cross-department monitoring).

21–3.
Market-based transfer pricing is considered optimal under many circumstances because it preserves divisional autonomy, yet encourages division managers to make economically optimal decisions for the company if divisions operate at capacity and there are no market transaction costs.

21–4.
The key limitation is that market prices are often not readily available. The limitations of market-based transfer prices exist when the market price does not reflect the opportunity cost of the goods and services, for example when idle capacity is present. Also, temporary short-run fluctuations in market prices could lead to suboptimal long-run decisions.

21–5.
The advantage of direct intervention is it promotes short-run profits by ensuring proper action. The disadvantages of such a practice are that top management will become too involved in pricing disputes, and division managers will lose flexibility and autonomy in their decision making. The company also loses the other advantages of decentralization.

21–6.
Companies often use prices other than market prices for interdivisional transfers because (1) market prices may not be available, (2) market prices can lead to suboptimal behavior when the supplier division has idle capacity, or (3) the company is not otherwise indifferent between internal and external buying.

21–7.
When actual costs are used as a basis for the transfer, any variances or inefficiencies in the selling division are passed along to the buying division. To promote responsibility in the selling division and to isolate variances within divisions, standard costs are usually used as a basis for transfer pricing in cost based systems. (Note: Standard cost transfer pricing is only appropriate if standard costs are up to date and reflect reasonable estimates of cost.)

21–8.
The disadvantages of a negotiated transfer price system are that a great deal of management effort may be wasted on the negotiating process and that the negotiated price may be based more upon the managers' ability to negotiate rather than economic factors.

21–9.
The two general transfer pricing rules are as follows:

1) If the selling division is operating at capacity, the transfer price should be the market price.
2) If the selling division has idle capacity that cannot be used for other purposes, the transfer price should be at least the variable costs incurred to produce the goods.

Solutions to Critical Analysis and Discussion Questions

21–10.
Three goals of transfer pricing in a decentralized organization are (1) to coordinate the activities of various responsibility centers, (2) to motivate managers to perform in the company's best interest and (3) to serve as a performance measure for responsibility centers.

21–11.
A cost-based or negotiated cost-based transfer pricing method would be necessary. We recommend using differential standard costs to the supplier plus supplier's opportunity costs of the internal transfer, if any. If a dual transfer pricing system is used, the supplier could be given a mark-up without charging it to the buyer.

21–12.
The transfer price becomes revenue for the selling segment and a cost to the buying segment. An increase (decrease) in the transfer price increases (decreases) the selling segment's operating profit and decreases (increases) the buying segment's operating profit.

21–13.
The IRS claimed the U.S. subsidiary's low profits and losses were caused by a transfer price set below an arms-length market-based price. Also, the IRS claimed the Japanese parent company should bear some of the costs of the U.S. subsidiary's high inventory levels.

21–14.
Because transfer prices can affect the assignment of income from one jurisdiction to another, there is a tendency to set a cross-jurisdictional transfer price in such a manner that income is shifted to the jurisdiction with a lower tax burden. Of course, management may need to be aware of differences in tax laws, currency controls and other factors when establishing a transfer price. Moreover, taxing authorities may challenge a transfer price that is deemed unreasonable.

Solutions to Exercises

21–15. (20 min.) *Apply economic transfer pricing rule: Beamer & Associates.*

a. The minimum transfer price that the maintenance division should obtain is $70 per hour.

b. The maximum transfer price that the leasing division should pay is $40 per hour.

c. Answer (a) would be $36 per labor hour. Answer (b) would not be affected.

21–16. (15 min.) *Evaluate transfer pricing system: Paradym, Inc.*

If Division X buys from outsiders because the transfer price is greater than $150, this would cost the company $10,000. The difference between the price paid for the units from an outside supplier ($150) and the differential costs of producing in Division Y ($140) times the 1,000 units in the order = $10,000.

21–17. (15 min.) *Evaluate transfer pricing system.*

With the possibility of increased production Division X has an opportunity cost of transferring to Division Y of $4.50 per square foot which is the appropriate transfer price. However, the opportunity cost of acquiring the warehouse space is $3.00 per square foot for Division Y. Therefore, it would be in the company’s best interest if Division Y rented the space from the outside company. [This assumes no additional costs such as moving expenses to Division Y in using outside facilities.]

21–18. (20 min.) *Evaluate transfer pricing system.*

a.

	Buyer		*Seller*		*Company*	
Transfer internally	Pays	$160.00	Receives	$150	Pays	$10
			Pays	$55	Pays	55
					Pays	$65
Transfer externally	Pays	$157.50	Receives	$150	Pays	$ 7.50
			Pays	55	Pays	55
					Pays	$62.50

Optimal to transfer externally.

b.

	Buyer		*Seller*		*Company*	
Transfer internally	Pays	$160.00	Receives	$150	Pays	$ 10
			Pays	55	Pays	55
					Pays	$ 65
Transfer externally	Pays	$157.50	Receives and pays	–0–	Pays	$157.50

Optimal to transfer internally.

21–19. (25 min.) *Evaluate transfer pricing system: Seattle Transit Ltd.*

a. Different prices:

(1) The opportunity cost might be considered the regular fare of $.80 less the $.10 fee collected.

(2) The full cost is $2.00 less the $.10 fee collected.

(3) One might suggest that if the transit vehicles are not running at capacity, the opportunity cost is zero because the senior citizens are riding in seats that would otherwise be empty.

b. Seattle Transit would prefer to be reimbursed at the full cost of $2.00 because it would receive more revenue.

c. The provisional government would prefer a rate of zero so it would pay no money to the transit authority.

d. The difference is $380,000 per month, which equals 200,000 rides at $1.90 per ride. The $1.90 is the difference between the full cost less the $.10 fare collected.

21–20. (25 min.) *Evaluate pricing system: Oracle Greenery.*

	Total	*Mr. Peterson's Share*	*Ms. Jefferies Share*
Decrease in profits at Oracle Greenery.........	($1,500)[a]	($900)	($600)
Increase in profits at Lively Landscape Co. ..	1,500[a]	300	900
Net change in profits	$ 0	($600)	$300

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[a] $1,500 = $15 per plant x 10% x 1,000 plants.

21–21. (25 min.) *International transfer prices: Pyramid Corporation.*

Analyze the tax liabilities in each jurisdiction using the alternative transfer prices. If the transfer price is $3 million, the tax liabilities are:

	Canada	*U.S.*	
Revenues....................................	$3,000,000	$15,000,000	
Third-party costs	2,000,000	6,000,000	
Transferred goods costs		3,000,000	
Total costs	2,000,000	9,000,000	
Taxable income	1,000,000	6,000,000	
Tax rate.......................................	60%	40%	
Tax liability	$ 600,000	$ 2,400,000	
Total tax liability			$3,000,000

If the transfer price is $4 million, the tax liabilities are computed as follows:

	Canada	*U.S.*	
Revenues....................................	$4,000,000	$15,000,000	
Third-party costs	2,000,000	6,000,000	
Transferred goods costs		4,000,000	
Total costs	2,000,000	10,000,000	
Taxable income	2,000,000	5,000,000	
Tax rate.......................................	60%	40%	
Tax liability	$1,200,000	$ 2,000,000	
Total tax liability			$3,200,000

The total tax liability is higher if profits are shifted to the country with the higher tax rate.

21–22. (30 min.) *Segment reporting: Lincoln Homes, Inc.*

($ in millions)

a. Using an $8 million transfer price:

Item	*Building Company*	*Finance Company*
Outside revenue	$68	$16
Transfer price		8
Total revenue	68	24
Less:		
Outside costs	52	14
Transfer	8	
Total costs	60	14
Operating profit before tax	$ 8	$10

b. Using a $4 million transfer price:

Item	*Building Company*	*Finance Company*
Outside revenue	$68	$16
Transfer price		4
Total revenue	68	20
Less:		
Outside costs	52	14
Transfer	4	
Total costs	56	14
Operating profit before tax	$12	$ 6

21–23. (30 min.) *Segment reporting: Sidney Corporation.*

($ in thousands)

Item	*Amusement Park*	*Hotel*
Revenue:		
Outside revenue	$11,200	$7,400
Transfer price	1,600	600
Total revenue	$12,800	$8,000
Less:		
Outside costs	$6,200	$5,000
Transfer	600	1,600
Total costs	$6,800	$6,600
Operating profit before tax	$6,000	$1,400

Solutions to Problems

21–24. (30 min.) *Transfer pricing with imperfect markets—ROI evaluation, normal costing: LaZareth, Inc.*

a. ROI for Division S.

$$[90{,}000 \times (\$10 - \$3)] - [\$5 \times 100{,}000] = \$130{,}000$$

$$\text{ROI} = \frac{\$130{,}000}{\$600{,}000} = \underline{\underline{21.67\%}}$$

b. Note: Capacity is 100,000 units, so regular sales would be reduced to 80,000 units (100,000 units capacity – 20,000 units to Division T).

(80,000 x $7) + [20,000 x ($6.20 – $3.00)] – $500,000 =
$560,000 + $64,000 – $500,000 = $124,000.

$$\text{ROI} = \frac{\$124{,}000}{\$600{,}000} = \underline{\underline{20.67\%}}$$

c. (80,000 x $7) + [20,000 x (TP – $3)] – $500,000 = $130,000

$$\$560{,}000 + 20{,}000\ \text{TP} - \$60{,}000 - \$500{,}000 = \$130{,}000$$
$$20{,}000\ \text{TP} = \$130{,}000$$

$$\text{TP} = \frac{\$130{,}000}{20{,}000 \text{ units}} = \underline{\underline{\$6.50,}}$$

where TP = transfer price per unit.

Proof

$$\begin{aligned} &\$560{,}000 + [20{,}000 \times (\$6.50 - \$3.00)] - \$500{,}000 \\ &= \$560{,}000 + \$70{,}000 - \$500{,}000 \\ &= \$130{,}000 \end{aligned}$$

$$\text{ROI} = \frac{\$130{,}000}{\$600{,}000} = \underline{\underline{21.67\%}}$$

21–25. (50 min.) *Evaluate profit impact of alternative transfer decisions: Stickney Products Co.**

(000 omitted in all calculations)

a. 1. The bottle division profits

Revenue	$10,000	
Cost	7,200	
Profit	$ 2,800	

2. The cologne division profits

Revenue	$63,900	
Cost	58,400	(= $48,400 + $10,000)
Profit	$ 5,500	

3. The corporation profits

Revenue	$63,900	
Cost	55,600	(= $48,400 + $7,200)
	$ 8,300	

b. 1. Yes

	Bottle Division Volumes		
Cases	2,000	4,000	6,000
Revenue	$ 4,000	$ 7,000	$10,000
Cost	3,200	5,200	7,200
Profit	$ 800	$ 1,800	$ 2,800

2. No

	Cologne Division Volumes		
Cases	2,000	4,000	6,000
Revenue	$25,000	$45,600	$63,900
Cost[a]	20,400	39,400	58,400
Profit	$ 4,600	$ 6,200	$ 5,500

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[*] CMA adapted.

[a] Production costs plus market price for the bottles.

21–25. (continued)

b. (continued)

3. Yes

	Corporation Volumes		
Cases	2,000	4,000	6,000
Revenue	$25,000	$45,600	$63,900
Cost	19,600	37,600	55,600
Profit	$ 5,400	$ 8,000	$ 8,300

The bottle division and the corporation are the most profitable at the 6,000,000 volume and the cologne division is most profitable at the 4,000,000 volume. Based on a market-based transfer price, the divisions achieve maximum profit for themselves at different levels of sales based on the market price at the various levels relative to the division costs at these various levels. The corporation achieves maximum profit based on the selling price to outsiders relative to the total cost of making the product.

21–26. (40 min.) *International transfer prices: Tilden Merchant, Co-op (TMC).*

All $ in millions.

a. Malaysian basis for transfer price:

Item	*Shipping Company*		*Dock Service Co.*
Revenue:			
Outside revenue	$26		$4
Transfer price			3
Total revenue	26		7
Less:			
Outside costs	17		5
Transfer	3		
Total costs	20		5
Operating profit before tax (Revenue-costs)	$ 6		$2
Tax rate	x .75		x .20
Income taxes	$ 4.5		$ .4
Total taxes		$4.9	

b. Great Britain basis for transfer price:

Item	*Shipping Company*		*Dock Service Co.*
Outside revenue	$26		$ 4
Transfer price			8
Total revenue	26		12
Less:			
Outside costs	17		5
Transfer	8		
Total costs	$25		$ 5
Operating profit before tax (Revenues-costs)	$ 1		$ 7
Tax rate	x .75		x .20
Income taxes	$ .75		$ 1.4
Total taxes		$2.15	

The difference in taxes is $2,750,000 which is $4,900,000 minus $2,150,000.

21–27. (60 min.) *Analyze transfer pricing data: Notewon, Inc.*

a. If L sells to outside

Contributions to L	
Outside sales 140,000 @ $16.00	$2,240,000
Leftover DLH [400,000 – (140,000 x 2)] ÷ 2.5 = 48,000. 48,000 units transferred @ $18.00	864,000
	$3,104,000
Labor costs 400,000 hrs. @ $6	2,400,000
Contribution margin	$ 704,000

b.

Units transferred 120,000 @ $18.	$2,160,000
Leftover DLH 400,000 – (120,000 x 2.5) = 100,000; (100,000 hrs ÷ 2) x 16	800,000
	$2,960,000
Labor costs	2,400,000
Contribution margin	$ 560,000

c. and d.[a]

	Division L	*Division N*	*Company*
Sales by L to outside	$2,240,000		$2,240,000
Sales by L to N	864,000		864,000
Sales by N to outside (120,000 x $45)		$5,400,000	5,400,000
Total sales			$8,504,000
Cost of labor in L	2,400,000		2,400,000
Cost of units transferred to N		864,000	864,000
Cost of units purchased from outside by N (120,000 – 48,000) x $18.50		1,332,000	1,332,000
Conversion cost in N $8 x 120,000		960,000	960,000
Contribution	$ 704,000	$2,244,000	$2,948,000

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[a] This is based on the optimal company policy. If L sold 120,000 units to N, L's total contribution would be $560,000. N's contribution if 120,000 units were transferred to it would be $2,280,000 (= $5,400,000 – $2,160,000 – $960,000). Company contributions would be only $2,840,000.

21–28. (40 min.) *Transfer pricing—performance evaluation issues: Lillard Corporation**

a. Delaware should not supply Jaydee with fitting 1726 for the $5.00 per unit price. Delaware is operating at capacity and would lose $2.50 ($7.50 – $5.00) for each fitting sold to Jaydee. The management performance of Delaware is measured by return on investment and dollar profits; selling to Jaydee at $5.00 per unit would adversely affect those performance measures.

b. Lillard would be $5.50 better off, in the short run, if Delaware supplied Jaydee the fitting for $5.00 and the brake unit was sold for $49.50. Assuming the $8.00 per unit for fixed overhead and administration represents an allocation of cost Jaydee incurs regardless of the brake unit order, Lillard would lose $2.50 in cash flow for each fitting sold to Jaydee but gain $8.00 plus mark-up from each brake unit sold by Jaydee.

c. In the short run there is an advantage to Lillard of transferring the fitting at the $5.00 price and thus selling the brake unit for $49.50 plus mark-up. In order to make this happen, Lillard will have to overrule the decision of the Delaware management.

   This action would be counter to the purposes of decentralized decision making. If such action were necessary on a regular basis the decentralized decision making inherent in the divisionalized organization would be a sham. Then the organization structure is inappropriate for the situation.

   On the other hand if this is an occurrence of relative infrequency, the intervention of corporate management will not indicate inadequate organization structure. It may, however, create problems with division managements. In the case at hand, if Lillard management requires that the fitting be transferred at $5.00, the result will be to enhance Jaydee's operating results at the expense of Delaware. This certainly is not in keeping with the concept that a manager's performance should be measured on the results achieved by the decisions he controls.

   In this case, it appears that Delaware and Jaydee serve different markets and do not represent closely related operating units. Delaware operates at capacity, Jaydee does not; no mention is made of any other interdivisional business. Therefore, the Lillard controller should recommend that each division should be free to act in accordance with its best interests. The company is better served in the long run if Delaware is permitted to continue dealing with its regular customers at the market price. If Jaydee is having difficulties, the solution does not lie with temporary help at the expense of another division but with a more substantive course of action.

Note that Jaydee can still make the sale if it changes its allocation of fixed overhead and administration to $5.50 per unit. In that case, it can pay Delaware (or a competitor) $7.50 for the part and still arrive at a total cost of $49.50. Because it is not operating at capacity, it should be willing to try this.

---

*CMA adapted.

21–29. (40 min.) *Evaluate transfer price system: Tri-City, Inc.**

a. Raleigh division management's attitude at the present time should be positive to each of these prices in decreasing order because Raleigh apparently has unused capacity. Raleigh division management performance is evaluated based on return on investment (ROI) and each of these prices exceed variable costs which will increase Raleigh's ROI.

At the time when all existing capacity is being used, Raleigh division management would want the inter-company transfer price to generate the same amount of profit as outside business in order to maximize division ROI.

b. Negotiation between the two divisions is the best method to settle on a transfer price. Tri-City, Inc. is organized on a highly decentralized basis and each of the four conditions necessary for negotiated transfer prices exist. These conditions are:

- An outside market exists that provides both parties with an alternative.
- Both parties have access to market price information.
- Both parties are free to buy and sell outside the corporation.
- Top management supports the continuation of the decentralized management concept.

c. No, the management of Tri-City should not become involved in this controversy. The company is organized on a highly decentralized basis which top management must believe will maximize long-term profits. Imposing corporate restrictions will adversely affect the current management evaluation system because division management would no longer have complete control of profits. In addition, the addition of corporate restrictions could have a negative impact on division management who are accustomed to an autonomous working environment.

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*CMA adapted.

21–30. (25 min.) *Transfer prices and tax regulations: Hellena, Inc.*

The transfer price economically optimal for Hellena Inc. is $60 per unit. As illustrated below this is due to the difference in tax rates between the U.S. and France. It would thus be advantageous to Hellena to charge as high a transfer price as possible so as to generate income in the U.S. and avoid the higher-tax rate of 70% in France.

Profit after tax at the transfer price of $25/unit

Div.X, U.S.		*Div. Y, France*		
		Selling Price		$115
Transfer Price	$25	Transfers from U.S.	$25	
Variable Cost	25	Shipping costs	15	
Profit	$ 0	Processing costs	10	50
				65
		Tax @ 70%		45.5
		Profit after tax		$ 19.5

Total Profit after tax for Hellena Inc. = $19.50/unit

Profit after tax at the transfer price of $60/unit

Div. X, U.S.		*Div. Y, France*		
Transfer Price	$60	Selling Price		$115
Variable Cost	25	Transfers from U.S.	$60	
Profit	35	Shipping costs	15	
Tax @ 40%	14	Processing costs	10	85
Profit after tax	$21			30
		Tax @ 70%		21
		Profit after tax		$ 9

Total profit after tax for Hellena Inc. = $21 + $9 = $30/unit

21–31. (40 min.) *Segment reporting: Tyejon Corp.*

a. ($ millions)

	Airline	*Hotel*	*Auto Rental*	*Travel Services*
Outside revenue	$245	$106	$89	$32
Frequent stayer coupons	26			
Auto discounts (airline)			7	
Auto discounts (hotel)			3	
Crew lodging		13		
Travel commissions:				
Airline				4
Hotel				2
Auto				1
Total revenues	$271	$119	$99	$39
Outside costs	$157	$ 71	$66	$30
Frequent stayer coupons		26		
Auto discounts (airline)	7			
Auto discounts (hotel)		3		
Crew lodging	13			
Travel commissions:				
Airline	4			
Hotel		2		
Auto			1	
Total costs	$181	$102	$67	$30
Operating profits	$ 90	$ 17	$32	$ 9

b. Adjust the operating profits in part (a.) for the changed transfer prices.

	Airline	*Hotel*	*Auto Rental*	*Travel Services*
Operating profits (a)	$90	$17	$32	$9
Frequent stayer	(21)	21		
Auto coupons	6		(6)	
Operating profits (b)	$75	$38	$26	$9

21–31. (continued)

c. Divide the operating profits in (a.) and (b.) by division assets:

For (a):			
Travel services	13.85%	=	$9/$65
Auto rental	9.97	=	$32/$321
Airline	9.42	=	$90/$955
Hotel	4.42	=	$17/$385
For (b):			
Travel services	13.85%	=	$9/$65
Hotel	9.87	=	$38/$385
Auto rental	8.10	=	$26/$321
Airline	7.85	=	$75/$955

The hotel moves from last place in the rankings to second, while the airline and auto rentals each drop in ranking. The transfer pricing method chosen does have an effect on the ROI-based rankings.

21–32. (60 min.) *Custom Freight Systems (A): Transfer Pricing.*

a. The Logistics Division should accept the bid from Forwarders Division. Custom Freight Systems is $72 (= $185 – $113) better off if the Logistics division uses the Forwarders division for this contract. See detail calculations below.

Option I: Pruchase Internally

	Air Cargo Division	*Forwarders Division*	*Logistics Division*
Sales	$155	$ 210	–0–
Variable Costs			
($155 x 60%)	93		
($175 – $155)		20	
(From Forwarders Div.)		155	
(Given)			$210
Operating Profit (Cost)	$ 62	$ 35	($210)
Total Company Cost		($113)	

Option II: Purchase externally (United Systems)

Total Company Cost = ($185)

b. If we assume it is optimal for the transfer to be made internally, then the question arises as to the appropriate transfer price. The economic transfer pricing rule for making transfers to maximize a company's profits is to transfer at the differential outlay cost to the selling division plus the opportunity cost to the company of making the internal transfers.

	Differential Outlay Cost	*+*	*Opportunity Cost of Transferring Internally*	*=*	*Transfer Price*
If the seller (the division supplying the goods or services) has idle capacity	$175	+	$ 0	=	$175
If the seller has no idle capacity	$175	+	$35 ($210 selling price – $175 variable cost)	=	$210

21–32. (continued)

c. Espinosa has many alternatives to intervention or to forcing the manager of the Forwarders division to lower his price below $210. Each has advantages and disadvantages.

  - Espinosa must trade-off the benefits of intervention on this particular transaction against the impact of intervention on decentralization as a policy. Too much intervention by Espinosa will eliminate the benefits of decentralization.
  - Tell the Logistics and Forwarder divisions that the transfer price will be between differential cost ($113) and the lowest outside market price ($185) and allow them to negotiate the profit.
  - Espinosa could reorganize the company combining the divisions into one operating company. However, Custom Freight Systems would lose all of the benefits of decentralization.
  - Espinosa could simply do nothing and let the managers maintain their autonomy. This would not be in the best interests of Custom Freight Systems. However, it might be better to sub-optimize for this transaction and obtain more general benefits from decentralizing.

d. The reward system at Custom Freight Systems creates an environment that encourages managers to act in the best interests of their division rather than for the corporation. Managers are rewarded on their return on assets and profits which discourages discounting to other divisions of Custom Freight Systems and ultimately costs the corporation more.

21–33. (30 min.) Custom Freight Systems (B): Transfer Pricing.

Similar to Case A, the Logistics Division should accept the bid from the Forwarders Division. However, if we eliminate the Forwarders Division from the bidding process, the bid from World should be accepted. Emphasize that even though World's bid is $10 per hundred pounds higher than United's, the overall cost to Custom Freight Systems is lower because other divisions of Customer Freight Systems are included in the bid. See detailed calculations below.

Option I: (from **21–32**) Purchase internally

	Air Cargo Division	*Forwarders Division*	*Logistics Division*
Sales	$155	$210	–0–
Variable Costs			
($155 x 60%)	93		
($175 – $155)		20	
(From Forwarders Div.)		155	
(Given)			$210
Operating Profit/(Cost)	$ 62	$ 35	($210)
Total Company Cost		($113)	

Option II: (from **21–32**) Purchase externally (United Systems)

Total Company Cost = ($185)

Option III: Purchase Externally (World Systems)

	Air Cargo Division	*Forwarders Division*	*Logistics Division*
Sales	$155	–0–	–0–
Variable Costs	93		$195
Operating Profit (Cost)	$ 62	–0–	($195)
Total Company Cost		($133)	

Chapter 22
Nonfinancial Performance Measures

Solutions to Review Questions

22–1.

The balanced scorecard is a set of performance targets and results that show an organization's performance in meeting its objectives relating to competing stockholder wants.

22–2.

Stakeholders are groups or individuals who have a stake in what an organization does, such as employees, suppliers, customers, shareholders, and the community.

22–3.

Nonfinancial performance measures direct employees' attention to the organization's objectives and focus on the measures that are controllable by each employee.

22–4.

Critical success factors are the factors that are important to the organization's success. For example, proprietary technology or established distribution channels.

22–5.

People at different levels in the organization have different responsibilities. Performance measures are most effective when they relate to what people at different levels control.

22–6.

Benchmarking identifies an activity that needs to be improved, finds an organization that is the most efficient at the activity, studies its process, and then utlizes that process.

22–7.

Competitive benchmarking involves the search for, and implementation of, the best way to do something as practiced in other organizations.

22–8.

An organization's mission statement should communicate the organization's values, its responsibilities to stakeholders, and the major strategies the organization plans to use to meet its commitments.

22–9.

Customer satisfaction measures reflect the performance of the organization on several factors, including quality control and delivery performance.

22–10.

Manufacturing cycle efficiency measures the efficiency of the total manufacturing cycle (the most efficient companies have a measure of 1). This measure is important to most companies because gains in efficiency generally improve company profitability.

22–11.

Delivery performance measures indicate how proficient the organization is at delivering goods or services when promised to the customer. Poor delivery performance will likely negatively impact an organization's profitability as repeat business declines.

22–12.

Worker involvement is important for three reasons:

1) Increased worker involvement often translates to an increased commitment to the organization.
2) Workers are able to be responsive at all levels if empowered with decision-making responsibilities.
3) Workers are able to use their skills and knowledge to further develop and to improve the organization's performance.

22–13.

See Illustration 22.4.

Solutions to Critical Analysis and Discussion Questions

22–14.

Answers will vary, but should include:

Stakeholders—students, professors, employees, publishers, authors, and regents.

Critical success factors—sufficient inventory and accurate class/text information.

22–15.

Answers will vary.

Quality control:

1) Number of customer complaints
2) Number of service calls
3) Number of returns

Delivery performance:

1) Percentage of on-time deliveries
2) Percentage of deliveries damaged
3) Delivery service surveys

22–16.

Critics contend that traditional financial performance measures are obstacles to effective implementation of innovative management methods because many performance measures do not use financial data.

22–17.

The number of positions filled from within the company may indicate whether or not employees are committed enough to the company to want to advance and employee perception of advancement possibilities. It may also indicate employee commitment by the quality of employee performance. For instance, if positions are not filled internally it may be because the employees are not performing well enough to be promoted.

22–18.

If awards are based on effective worker involvement and commitment (i.e., this is the criteria for the awards), then this percentage measures the proportion of company employees who meet the criteria.

Solutions to Exercises

22–19. (20 min.) *Balanced scorecard.*

Answers will vary, but should include the following:

The balanced scorecard focuses on company-wide objectives, many of which are not under the control of production level employees. They would not be able to relate the competing objectives to what they are doing on a daily basis. The balanced scorecard should be used by upper mnagement to make trade-offs between competing wants, then establish objectives for production which are related to the production level employees and on which they can focus.

22–20. (20 min.) *Benchmarks.*

a. On-time delivery of materials.	3. Supplier performance.
b. Percentage defective units.	2. Product performance.
c. Employee turnover.	1. Employee performance.
d. Time to generate reports.	4. Support performance.

22–21. (20 min.) *Benchmarks.*

a. On-time delivery to customer.	2. Product performance.
b. Percentage defective raw materials.	3. Supplier performance.
c. Number of employee sick days.	1. Employee performance.
d. Maintenance response time.	4. Support performance.

22–22. (45 min.) *Performance measures.*

Answers will vary, but may include any of the performance measures listed in the illustrations.

22–23. (20 min.) *Manufacturing Cycle Time and Efficiency.*

$$\text{Manufacturing Cycle Efficiency} = \frac{6 \text{ hrs.}}{2 \text{ hrs.} + 6 \text{ hrs.} + 1 \text{ hr.} + 24 \text{ hrs.}}$$

$$= \frac{6 \text{ hrs.}}{33 \text{ hrs.}}$$

$$= \underline{\underline{18\%.}}$$

22–24. (20 min.) *Functional measures.*

Answers will vary. Some possible examples are:

- Accounting quality—Percent error in budget
- Clerical quality—Number of misfiled papers
- Forecasting quality—Number of forecasting assumption errors
- Procurement/purchasing quality—Percentage of incorrectly ordered materials
- Production control quality—Time that line is down due to untrained employee error

22–25. (30 min.) *Worker involvement.*

Answers will vary. Examples are as follows:

Percentage of managers active in continuing education—used to measure worker development.

Percentage of workers acting as mentors—used to measure worker empowerment.

Percentage of workers applying for promotions—used to measure worker recruitment.

22–26. (20 min) *Manufacturing Cycle Time and Efficiency.*

$$\text{Manufacturing Cycle Efficiency} = \frac{2 \text{ days}}{.5 \text{ days} + 2 \text{ days} + .25 \text{ days} + 5 \text{ days}}$$

$$= \frac{2 \text{ days}}{7.75 \text{ days}}$$

$$= \underline{\underline{26\%}}$$

Solutions to Problems

22–27. (20 min.) *Benchmarks.*

Answers will vary, but may include the following:

- Number of customer complaints for every 100 cars sold.
- Number of defects for every car sold.
- Dollar amount of warranty repairs for every car sold.
- Customer satisfaction on a scale of 1 to 10.

Although this information may be difficult to obtain from competitors, likely candidates for comparison might be Honda or Toyota. It would be easier to get this information from other General Motors divisions, such as Chevrolet, but this information is only useful if the other GM divisions are doing better than the Saturn Division.

22–28. (45 min) *Mission statement.*

Answers will vary, but should identify the stakeholders (patients, doctors, staff, and community) and state how the company intends to add value to each group.

22–29. (45 min.) *Performance measures.*

Answers will vary.

22–30. (20 min.) *Functional measures.*

Answers will vary, but may include any of the functional measures shown in Illustration 22.3. The following is one example. An important critical success factor for many banks is the efficiency in which the bank can process loans. This can be measured by the average number of days it takes to process a loan. By using this measure, the bank would be sending a signal to its employees that this is important not only to the bank, but also to its customers. If employees are evaluated based on this measure, they would have a clear incentive to shorten the loan processing time.

22–31. (45 min.) *Performance measures.*

Answers will vary.

22–32. (40 min.) *Operational performance measures.*

a. Answers will vary, but should address the following points:

- Percentage of manufacturing cycle efficiency has improved steadily from 85% in week 1 to 90% in week 6.
- Percentage of on-time deliveries has improved steadily from 94% in week 1 to 99% in week 6.
- Number of customer complaints has decreased significantly from 40 in week 1 to 11 in week 6.

b. As a manager of the company, you may want to know what caused the improvements shown by all three measures. Did employees have incentives to make these improvements? Were additional costs incurred to improve on all three measures?, etc.

22–33. (40 min.) *Operational performance measures: Kenston Corporation.*

a. Answers may include:

Production almost doubled from January to June. However, as production increased, the number of defective units produced and delivered increased in greater proportion than production. There are several probable causes for this including:

- Employees may be rushing to keep up with orders and unable to take the time to do a good job, in which case hiring more employees may alleviate the problem.
- The equipment being used is not designed to handle this level of production or may be out of adjustment. Recalibrating the machines may solve the problem.
- Employees may be so pushed that they have a bad attitude about work so they get sloppy.

b. The number of late deliveries does not appear to be related to the increase in production. However, the month of May should be investigated to determine the cause of the high number of late deliveries.

Chapter 23
Capital Investment Decisions

Solutions to Review Questions

23–1.

The *timing* is important because cash received earlier has a greater economic value than cash received later. There is an opportunity cost and risk involved by having funds tied up in capital investment projects. Determining the *amount* is important in estimating the future cash flows. The timing and amount together are used to determine the economic value of the project.

23–2.

The time value of money merely states that cash received earlier has a greater value than cash received later because the dollar received today can be earning interest between now and later.

23–3.

Tax policies provide additional incentive for capital investment by various accelerated depreciation methods (or investment tax credits when in effect) which result in a faster return of the company's capital through quicker reductions in tax liabilities. As a result, the net present value of the capital investment is increased.

23–4.

The relationship between the real return (r) and the inflation rate (i) that is used to discount nominal cash flows under conditions of inflation is:

$$(1 + r)(1 + i) - 1$$

The equation serves to reduce the inflated future dollars to their value in terms of today's dollars through the (1 + i) term. The term (1 + r) operates to discount the dollars for the time value of money effects.

23–5.

The net present value of the project will usually be lower after adjusting for inflation, unless future cash flows from the project are expected to increase more rapidly than the rate of inflation. This problem arises because the tax shield is based on the original cost of the assets. The cash flows from the depreciation tax deduction are discounted more because they are received in the future and are worth less than the dollars that were paid for the asset. This effect may be reflected in lower asset prices, and the tax deductibility of nominal interest rates may offset some of the tax disadvantages of historical cost depreciation.

Solutions to Critical Analysis and Discussion Questions

23–6.

To determine which, if either, project should be approved, the net present value of each project should be determined. Once the timing and amount of cash flows has been determined, they should be discounted to the present by determining and applying appropriate discount rates. Any project with a positive net present value could be justified and the project with the greater net present value should be approved under normal circumstances.

23–7.

The four types of cash flows are:

(1) investment cash flows,

(2) periodic operating flows,

(3) depreciation tax shield, and

(4) disinvestment flows.

We consider them separately because each type of flow results from different activities and gives rise to different tax consequences.

23–8.

Audits identify what estimates were wrong and can create an environment in which planners will not be tempted to inflate their estimates of profits to get a project improved. Audits often lead to more accurate cash flow analyses.

23–9.

The $160,000 reduction in the operating loss is a cost savings. In addition, the company will receive the tax shield from depreciation of the new equipment. If the equipment lasts for more than a few years, it appears to be a good investment. A better investment might be to liquidate the division.

23–10.

No. Depreciation is not a cash flow item. However, the tax shield which arises from depreciation deductions for tax purposes is a cash flow item and is included.

23–11.

The relevant costs for any decision are the differential costs. Allocated costs should not be used for decision making. If some portion of fixed costs are allocated to new projects then the new projects are subsidizing the existing operations.

23–12.

The primary concern is not the amount of the deduction but the timing of the deduction. Deductions that can be taken sooner have a greater net present value in the presence of constant tax rates. Therefore, an accelerated depreciation method will result in greater net present value simply because the deductions are taken sooner.

23–13.

Working capital requirements increase with the increased volume of nominal dollars because more dollars are required to support the same level of activity under inflation. Inventory values will not change if a given quantity was initially procured and the inventory level remains the same. Replacement costs of inventory are included as period cash outflows.

Solutions to Exercises

For purposes of presentation all PV factors have been rounded to three places.

23–14. (20 min.) *Present value of cash flows.*

	Year		
	0	*1*	*2*
Engineering studies	$(100,000)		
Initiation costs		$(400,000)	
Construction costs			$(1,800,000)
Net cash flow	$(100,000)	$(400,000)	$(1,800,000)
PV factor for 10%	1.000	.909	.826
Present values	$(100,000)	$(363,600)	$(1,486,800)

Project net present value: $(1,950,400)

23–15. (20 min.) *Present value of cash flows: Tribure City.*

a. At 20%

	Time	*Year*				
	0	*1*	*2*	*3*	*4*	*5*
Net cash flow	($200,000)	$20,000	$50,000	$80,000	$80,000	$100,000
PV factor (20%)......	1.000	.833	.694	.579	.482	.402
Present values	($200,000)	$16,660	$34,700	$46,320	$38,560	$ 40,200
Net PV of project....	($ 23,560)					

b. At 12%

	Time	*Year*				
	0	*1*	*2*	*3*	*4*	*5*
Net cash flow	($200,000)	$20,000	$50,000	$80,000	$80,000	$100,000
PV factor (12%)......	1.000	.893	.797	.712	.636	.567
Present values	($200,000)	$17,860	$39,850	$56,960	$50,880	$ 56,700
Net PV of project....	$ 22,250					

23–16. (15 min.) *Effects of inflation: Tribure City.*

a. Inflation adjusted discount rate:

$(1 + r)(1 + i) - 1 = d$

$(1 + .12)(1 + .10) - 1 = \underline{\underline{23.2\%}}$

	Year					
	0	*1*	*2*	*3*	*4*	*5*
Net cash flow[a]..........	($200,000)	$22,000	$60,500	$106,480	$117,128	$161,052
PV factor (23.2%)	1.000	.812	.659	.535	.434	.352
Present values.........	($200,000)	$17,864	$39,870	$ 56,967	$ 50,834	$ 56,690
Net PV of project......	$ 22,225					

[a]Assumes inflation affects cash flows at the rate of 10% per year.

b. The NPV of the project using the inflation adjusted discount rate is the same ($25 difference due to rounding the PV factor) as when inflation was not considered because inflation increases the value of cash flows in the future by the same amount as inflation reduces the PV factor.

23–17. (30 min.) *Present value of cash flows: Titantic Entertainment.*

a.

	Time	*($000 omitted)* *Year*				
	0	*1*	*2*	*3*	*4*	*5*
Investment flows:						
Investment	$(2,500)					
Operating flows:						
Net cash flows		$750	$850	$1,200	$1,000	$600
Total cash flows	$(2,500)	$750	$850	$1,200	$1,000	$600
PV factor (20%)	1.000	.833	.694	.579	.482	.402
Present values	$(2,500)	$625	$590	$ 695	$ 482	$241
Net PV of project	$ 133					

b.

	Time	*($000 omitted)* *Year*				
	0	*1*	*2*	*3*	*4*	*5*
Investment flows:						
Investment	$(2,500)					
Operating flows:						
Net cash flows		$750	$850	$1,200	$1,000	$600
Total cash flows	$(2,500)	$750	$850	$1,200	$1,000	$600
PV factor (15%)	1.000	.870	.756	.658	.572	.497
Present values	$(2,500)	$653	$643	$ 790	$ 572	$298
Net PV of project	$ 456					

23–18. (30 min.) *Effects of inflation on cash flows: Titantic Entertainment.*

	Time	*Year*				
	0	*1*	*2*	*3*	*4*	*5*
Investment flows:						
Investment	$(2,500)					
Operating flows:						
Net cash flows		$795	$955	$1,429	$1,263	$803
Total cash flows	$(2,500)	$795	$955	$1,429	$1,263	$803
PV factor (21.9%)	1.000	.820	.673	.552	.453	.372
Present values	$(2,500)	$652	$643	$ 789	$ 572	$299
Net PV of project	$ 455					

Calculations:

$795 = $750 x 1.06

$955 = $850 x $(1.06)^2$

etc.

Nominal rate = (1 + .15) x (1 + .06) – 1 = .219 = 21.9%

23–19. *Effects of inflation on cash flows: Titantic Entertainment.*

The net present value of the project, using the inflation adjusted discount rate, is the same as when inflation is not considered if inflation increases the value of cash flows in the future at the same rate as inflation increases the discount rate. That would be the case here. (Compare NPV in part b of 23–17 to NPV in 23-18 [$1 difference is due to rounding].)

23–20. (25 min.) *Compute present value of tax shield: Limbo Corporation.*

a.

Year	*Depreciation*	*Tax Shield at 40%*	*PV Factor (18%)*	*Present Value*
1	$120,000	$ 48,000	.847	$ 40,656
2	210,000	84,000	.718	60,312
3	90,000	36,000	.609	21,924
4	90,000	36,000	.516	18,576
5	90,000	36,000	.437	15,732
	$600,000	$240,000		$157,200

The present value of the tax shield is $157,200

b.

Year	*Depreciation*	*Tax Shield at 40%*	*PV Factor (18%)*	*Present Value*
1	$120,000	$ 48,000	.847	$ 40,656
2	120,000	48,000	.718	34,464
3	120,000	48,000	.609	29,232
4	120,000	48,000	.516	24,768
5	120,000	48,000	.437	20,976
	$600,000	$240,000		$150,096

The present value of the tax shield is $150,096. Note the total depreciation taken is the same under straight-line and accelerated, but the timing under accelerated methods increase the present value of the tax shield over the straight-line method.

23–21. (25 min.) *Present value of depreciation tax shield under inflation: Limbo Corp.*

a. At 8% inflation: Nominal Interest Rate = (1.08)(1.22) – 1 = 31.76%

Year	*Depreciation*	*Tax Shield at 40%*	*PV Factor (31.76%)*	*Present Value*
1	$120,000	$ 48,000	.759	$ 36,432
2	210,000	84,000	.576	48,384
3	90,000	36,000	.437	15,732
4	90,000	36,000	.332	11,952
5	90,000	36,000	.252	9,072
	$600,000	$240,000		$121,572

b. At 14% inflation: Nominal Interest Rate = (1.14)(1.22) – 1 = 39.08%

Year	*Depreciation*	*Tax Shield at 40%*	*PV Factor*	*Present Value*
1	$120,000	$ 48,000	.719	$ 34,512
2	210,000	84,000	.517	43,428
3	90,000	36,000	.372	13,392
4	90,000	36,000	.267	9,612
5	90,000	36,000	.192	6,912
	$600,000	$240,000		$107,856

c. The net present value of the tax shield decreases as the inflation rate increases.

23–22. (30 min.) *Present value of tax shield: C. L. Corporation.*

Year	*Depreciation*	*Tax Shield at 35%*	*PV Factor (15%)*	*Present Value*
1	$115,000	$ 40,250	0.870	$ 35,018
2	150,000	52,500	0.756	39,690
3	45,000	15,750	0.658	10,364
4	45,000	15,750	0.572	9,009
5	45,000	15,750	0.497	7,828
	$400,000	$140,000		$101,909

23–23. (30 min.) *Present value of tax shield: C. L. Corporation.*

Year	*Depreciation*	*Tax Shield at 35%*	*PV Factor (15%)*	*Present Value*
1	$ 80,000	$28,000	0.870	$24,360
2	80,000	28,000	0.756	21,168
3	80,000	28,000	0.658	18,424
4	80,000	28,000	0.572	16,016
5	80,000	28,000	0.497	13,916
	$400,000	$140,000		$93,884

23–24. (20 min.) *Present value of tax shield under inflation: C. L. Corporation.*

Nominal Interest Rate = (1.06)(1.15) – 1 = 21.9%

a. At 6% inflation:

Year	*Depreciation*	*Tax Shield at 35%*	*PV Factor (21.9%)*	*Present Value*
1	$115,000	$ 40,250	0.820	$33,005
2	150,000	52,500	0.673	35,333
3	45,000	15,750	0.552	8,694
4	45,000	15,750	0.453	7,135
5	45,000	15,750	0.372	5,859
	$400,000	$140,000		$90,026

23–25. (30 min.) *Present value of cash flows under inflation: Kentron Products.*

a.

	Time	*Year*				
	0	*1*	*2*	*3*	*4*	*5*
Investment flows:						
New equipment	$(240,000)					
Operating flows:						
Cash flows[a]		$43,200	$43,200	$43,200	$43,200	$43,200
Tax shield:						
Depreciation[b]..........		14,400	21,120	20,160	20,160	20,160
Total cash flows	$(240,000)	$57,600	$64,320	$63,360	$63,360	$63,360
PV factor (8%)	1.000	.926	.857	.794	.735	.681
Present values	$(240,000)	$53,338	$55,122	$50,308	$46,570	$43,148
Net PV of project........	$ 8,486					

---

[a] $43,200 = (1 – 40%) x $72,000

[b] $14,400 = $240,000 x 15% x 40%
$21,120 = $240,000 x 22% x 40%
$20,160 = $240,000 x 21% x 40%

b. At 12% inflation

Nominal Rate = (1 + .08) x (1 + .12) – 1 = .2096 = 20.96%

	Time	*Year*				
	0	*1*	*2*	*3*	*4*	*5*
Investment flows:						
New equipment	$(240,000)					
Operating flows:						
Cash flows[a]		$48,384	$54,190	$60,692	$67,976	$76,134
Tax shield:						
Depreciation		14,400	21,120	20,160	20,160	20,160
Total cash flows	$(240,000)	$62,784	$75,310	$80,852	$88,136	$96,294
PV factor (20.96%)	1.000	.827	.683	.565	.467	.386
Present values	$(240,000)	$51,922	$51,437	$45,681	$41,160	$37,169
Net PV of project	$ (12,631)					

---

[a] $43,384 = $43,200 x 1.12
$54,190 = $48,384 x 1.12 or $43,200 x $(1.12)^2$
etc.

23–26. (30 min.) *Present value analysis in nonprofit organizations: Goldberg Research Organization.*

	Year 0	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Investment flows	$(4,000,000)							
Periodic operating flows:								
Annual cash savings.......		$1,400,000	$1,400,000	$1,400,000	$1,400,000	$1,400,000	$1,400,000	$1,400,000
Additional cash outflow ...		(200,000)	(200,000)	(200,000)	(200,000)	(200,000)	(200,000)	(200,000)
Disinvestment flows........								400,000
Net annual cash flow	$(4,000,000)	$1,200,000	$1,200,000	$1,200,000	$1,200,000	$1,200,000	$1,200,000	$1,600,000
PV factor 12%	1.000	.893	.797	.712	.636	.567	.507	.452
Present value	$(4,000,000)	$1,071,600	$ 956,400	$ 854,400	$ 763,200	$ 680,400	$ 608,400	$ 723,200
Net present value	$1,657,600							

Yes, the hospital should buy the equipment.

23–27. (20 min.) *Impact of inflation on net present value in nonprofit organizations: Goldberg Research Organization.*

	Year							
	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Net annual cash flow[a]	$(4,000,000)	$1,296,000	$1,399,680	$1,511,654	$1,632,586	$1,763,194	$1,904,250	$2,742,118
PV factor 20.96%[b]	1.000	.827	.683	.565	.467	.386	.319	.264
Present value	$(4,000,000)	$1,071,792	$ 955,981	$ 854,085	$ 762,418	$ 680,593	$ 607,456	$ 723,919
Net present value	$1,656,244							

If inflation is considered, then the equipment should still be bought.

---

[a] Cash flows from Exercise 23–26 times $(1.08)^n$, where n is the year of the cash flow.

[b] 20.96% = (1.08)(1.12) – 1.

23–28. (35 min.) *Sensitivity analysis in capital investment decisions: Hearld Manufacturing.*

The schedule of cash flows is ($000 omitted):

Year	*Best Case*	*Expected*	*Worst Case*
0	($3,000)	($3,000)	($3,000)
1	0	0	0
2	0	0	0
3	0	0	0
4	2,000	1,400	600
5	2,000	1,400	600
6	2,000	1,400	600
7	2,000	1,400	600
Net Present Value @ 16%	$ 586[a]	($ 490)[b]	($1,924)[c]
Internal Rate of Return	20%	12%	(4%)

---

[a] \$586 = (\$3,000) + \$2,000 x $(1.16^{-4} + 1.16^{-5} + 1.16^{-6} + 1.16^{-7})$

[b] (\$490) = (\$3,000) + \$1,400 x $(1.16^{-4} + 1.16^{-5} + 1.16^{-6} + 1.16^{-7})$

[c] (\$1,924) = (\$3,000) + \$600 x $(1.16^{-4} + 1.16^{-5} + 1.16^{-6} + 1.16^{-7})$

Under the expected scenario, the project does not meet the company's hurdle rate. Therefore, it would probably be rejected. However, under the best case, the project's internal rate of return is 20%, which may be suitable if there are additional reasons to believe this scenario is more likely or if the company is willing to take the risk on the project for other reasons.

23–29. (20 min.) *Net present value index.*

Item	*Year (in thousands)* 0	1	2	3	4
Project A Cash Flows	$ (200)	$ 50	$ 90	$100	$100
20% PV Factors	—	.833	.694	.579	.481
Present Value	$ (200)	$ 42	$ 62	$ 58	$ 48
Net Present Value	$ 10				

Net Present Value Index 5.0% (= $10/$200)

Project B Cash Flows	$ (350)	$ 80	$190	$250	$120
Present Values @ 20%	$ (350)	$ 67	$132	$145	$ 58
Net Present Value	$ 52				

Net Present Value Index 15% (= $52/$350)

Project C Cash Flows	$ (300)	$ 70	$125	$170	$200
Present Values @ 20%	$ (300)	$ 58	$ 87	$ 98	$ 96
Net Present Value	$ 39				

Net Present Value Index 13% (= $39/$300)

Rank	*Project*	*Amount to Invest*	*Net Present Value*	
1	B	$350	$52	
2	C	250	33	(i.e., 250/300 x $39)
3	A	0	0	
		$600	$85	

23–30. (40 min.) *Net present value: Morris and Associates.*

a. Calculate net present value index. (Answers may differ somewhat due to rounding.)

($000 omitted)

Year	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
A. Software Designs	$(900)	$0	$0	$0	$0	$1,000	$1,000	$1,000
PV factor (15%)		0.870	0.756	0.658	0.572	0.497	0.432	0.376
Present values	(900)	$0	$0	$0	$0	$ 497	$ 432	$ 376
Net present value	$405							

Net present value index 45% = $405/$900

Year	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
B. Sunset Mall	$(550)	$65	$65	$65	$250	$250	$250	$250
PV factor (15%)		0.870	0.756	0.658	0.572	0.497	0.432	0.376
Present values	(550)	$57	$49	$43	$143	$124	$108	$94
Net present value	$ 68							

Net present value index 12% = $68/$550

23–30. (continued)

Year	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
C. Nutri-care	($650)	$260	$260	$260	$60	$60	$60	$60
PV factor (15%)		0.870	0.756	0.658	0.572	0.497	0.432	0.376
Present values	($650)	$226	$197	$171	$34	$30	$26	$23
Net present value	$57							

Net present value index 9% = $57/$650

Year	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
D. Marvin Gardens	($850)	$250	$250	$250	$250	$250	$250	$250
PV factor (15%)		0.870	0.756	0.658	0.572	0.497	0.432	0.376
Present values	($850)	$217	$189	$164	$143	$124	$108	$94
Net present value	$189							

Net present value index 22% = $189/$850

b. With no constraints, Morris and Associates would invest $900,000 in Software Designs and would purchase 70.6% (= $600,000 remaining ÷ $850,000 project investment) interest in Marvin Gardens. These are the first and second ranked in terms of net present value index. The net present value from this investment plan would be $538,000 = $405,000 + (.706 x 189,000).

23–31. (15 min.) *Alternative project evaluation measures: Farm Fresh Corporation.*

$$\frac{\text{Investment}}{\text{Annual cash flow}} = \frac{\$300{,}000}{\$80{,}000} = 3.75 \text{ years}$$

23–32. (20 min.) *Alternative project evaluation measures: No discounting: Quintana Co.*

a. $$\frac{\text{Investment cost}}{\text{Annual cash returns (after tax) + Depreciation tax shield}}$$

$$= \frac{\$20{,}000}{\Big[\$8{,}000 \text{ x } (1 - .40)]\Big] + \Big[\frac{\$20{,}000}{5}(.4)\Big]}$$

$$= \frac{\$20{,}000}{\$4{,}800 + \$1{,}600} = \underline{\underline{3.125 \text{ years}}}$$

b. $$\frac{1}{3.125}$$
$= 32\%$

c.

$$\frac{\text{(Cash flow – Depreciation)(1 – Tax rate)}}{\text{Average investment}} = \frac{(\$8{,}000 - \$4{,}000)(1 - .40)}{1/2 \text{ x } \$20{,}000}$$

$$= \frac{\$2{,}400}{\$10{,}000} = 24\%$$

Solutions to Problems

23–33. (45 min.) *Assess capital investment project with alternative measures: Baxter Co.*

a.

	Year			
	0	*1*	*2*	*3*
Investment flows:				
Equipment	$(900,000)			
Annual operating flows (see schedule below)		$330,000	$480,000	$240,000
Tax shield ($900,000/3) x .40		120,000	120,000	120,000
Disinvestment:				
Salvage				180,000
Tax on gain				(72,000)
Net cash flows	$(900,000)	$450,000	$600,000	$468,000

	Year		
	1	*2*	*3*
Sales	$1,000,000	$1,600,000	$800,000
Material, labor & variable overhead	400,000	750,000	350,000
Incremental rent (12,500 @ $4)	50,000	50,000	50,000
Net before taxes	$ 550,000	$ 800,000	$400,000
After tax operating flows	$ 330,000	$ 480,000	$240,000

b. Yes. Payback period is less than two years.

Year	*Cash Flow*	*Balance*
0	0	(900,000)
1	450,000	(450,000)
2	600,000	150,000

$$\frac{\$450,000}{\$600,000} = .75$$

Payback = 1.75 years.

23-33. (continued)

c. $$\frac{\text{Average accounting income}}{\text{Average investment}} = \frac{1/3(\$103{,}500 + \$232{,}500 + \$16{,}500)}{1/2(\$900{,}000 + \$180{,}000)}$$

$$= \frac{\$117{,}500}{\$540{,}000} = \underline{\underline{21.8\%}}$$

(If the calculation is based on initial investment instead of average investment, the result is $117,500 / $900,000 = 13.1%). The calculation assumes rent and assigned overhead are allocated to this product according to the problem.

d. Yes.

	Year			
	0	*1*	*2*	*3*
Net cash flows (see part a.)	$(900,000)	$450,000	$600,000	$468,000
PV factors @ 20%		.833	.694	.579
Present values	$(900,000)	$374,850	$416,400	$270,972
Net present value.........................	$ 162,222			

23–34. (40 min.) *New machine decision: TCY, Inc.*

Do not purchase the new machine, based on the negative NPV.

	Time	*Year*		
	0	*1*	*2*	*3*
Investment:				
New machine	(2,000,000)			
Sale of old machine	400,000			
Tax on gain on sale of old machine	(32,000)[a]			
Operating cash flows:				
Variable cost savings		120,000	120,000	120,000
Fixed cost savings		240,000	240,000	240,000
Tax effects of cost savings[b]		(144,000)	(144,000)	(144,000)
Depreciation tax shield on new machine[c]		120,000	200,000	160,000
Forgone depreciation tax shield on old machine[d]		(128,000)		
Disinvestment cash flows:				
Salvage of new machine				1,000,000
Tax on gain[e]				(80,000)
Forgone salvage of old machine				(200,000)
Tax on gain[f]				80,000
Net cash flows	$(1,632,000)	$208,000	$416,000	$1,176,000
Present value factors	1.0	.909	.826	.751
Present values	$(1,632,000)	$189,072	$343,616	$ 833,176
Net present value	$ (216,136)			

---

[a] Old machine has been depreciated to 20% of its original cost, 20% x $1,600,000 = $320,000. Tax on gain = 40% x ($400,000 – $320,000) = $32,000.

[b] Cost savings times 40% tax rate.

[c] 15% x $2,000,000 x 40% = $120,000 in Year 1; 25% x $2,000,000 x 40% = $200,000 in Years 2; 20% x $2,000,000 x 40% = $160,000 in Year 3.

[d] Old machine is being depreciated $320,000 (= 20% x $1,600,000) in Year 1 (its 5th year). Tax shield = 40% x $320,000 = $128,000.

[e] ($80,000) = 40% x ($1,000,000 – $300,000 – $500,000 – 400,000).

[f] $80,000 = 40% x $200,000.

23–35. (25 min.) *Ethical Issues: Ishima Company.*

a. Helen Dodge’s first revision of the proposal was unethical if she did not also disclose that estimates were remote possibilities. She should communicate information fairly and objectively, and disclose fully all relevant information that would influence an intended user’s understanding. She needs to avoid conflicts of interest, and to refrain from subverting the attainment of the organization’s legitimate and ethical objectives.

b. His conduct was definitely unethical. Watson has the responsibility to perform his professional duties in accordance with relevant standards, such as using realistic estimates in his net present value analysis. He has a duty to communicate both favorable and unfavorable information, as well as professional judgements and opinions. He must avoid conflicts of interest, and advise all parties of such potential conflicts.

c. Always investigate to see if there is an existing policy within the company for resolving ethical conflicts. Follow this policy if it does exist. Otherwise, since George Watson, Dodge’s superior, is involved, it is not necessary to discuss this issue with him any further. She should take her problem to the next higher level of authority, that is to the vice president of finance. If she fails to get a satisfactory solution she should take her problem to the Audit Committee or to the Board of Directors. Perhaps seeking the advice of a confidential objective advisor, for example a peer, will help to clarify the concepts of the issues at hand. If the situation still remains unresolved after exhausting all levels of internal review. Helen should resign and submit an informative memorandum to the appropriate official in the organization. Unless there is a legal obligation, which is not the case here, Helen should refrain from discussing this with authorities or individuals not employed or engaged by the organization. (Note: The IMA has an 800 hotline for discussing ethical dilemmas.)

23–36. (1 hour) *Compute net present value: Wright Corporation.*

a. Equipment removal net of tax effects = $2,750 = $5,000 x (1 – 45%).

b. Depreciation schedule:

Year	*Depreciation*	*Tax Shield at 45%*	*Present Value Factor (15%)*	*Present Value*
1	$ 40,000	$18,000	.870	$15,660
2	70,000	31,500	.756	23,814
3	30,000	13,500	.658	8,883
4	30,000	13,500	.572	7,722
5	30,000	13,500	.497	6,710
Totals	$200,000	$90,000		$62,789

c. Forgone tax benefits:

$$\$4{,}500 = \frac{\$100{,}000}{10 \text{ years}} \times 45\%$$

d. Gain from salvage of new equipment:

$33,000 = $60,000 x (1 – 45%)

e. Tax benefit arising from loss on old equipment:

$27,000 = ($100,000 book value – $40,000 salvage value) x .45 tax rate

f. Differential cash flows (years 1 – 10):

$18,150 = [($30,000 + $48,000) – ($25,000 + $20,000)] x (1 – 45%)

23–36. (continued)

g.

	Year										
	0	1	2	3	4	5	6	7	8	9	10
Investment flows:											
Equipment cost	$(200,000)										
Removal	(2,750)										
Salvage of old equipment	40,000										
Tax benefit—sale of old equipment	27,000										
Periodic operating flows		$18,150	$18,150	$18,150	$18,150	$18,150	$18,150	$18,150	$18,150	$18,150	$18,150
Tax shield from depreciation:											
New equipment:											
Year 1		18,000									
Year 2			31,500								
Years 3–5				13,500	13,500	13,500					
Old equipment (forgone)		(4,500)	(4,500)	(4,500)	(4,500)	(4,500)	(4,500)	(4,500)	(4,500)	(4,500)	(4,500)
Disinvestment:											
Proceeds of disposal											60,000
Tax on gain											(27,000)
Total cash flows	$(135,750)	$31,650	$45,150	$27,150	$27,150	$27,150	$13,650	$13,650	$13,650	$13,650	$46,650
PV factor at 15%		.870	.756	.658	.572	.497	.432	.376	.327	.284	.247
Present values	$(135,750)	$27,536	$34,133	$17,865	$15,530	$13,494	$ 5,897	$ 5,132	$4,464	$ 3,877	$11,523
Net present value	$ 3,701										

Note: Your answer may vary slightly due to rounding of PV factor.

23–37. (45 min.) *Impact of inflation on net present values: Wright Corporation.*

a. Nominal interest rate = (1.15 x 1.06) – 1 = .219 = $\underline{\underline{21.9\%}}$

b. Annual operating flows under inflation

Year	*Operating flow x inflation factor*	=	
1	$18,150 x 1.06^1	=	$19,239
2	$18,150 x 1.06^2	=	$20,393
3	$18,150 x 1.06^3	=	$21,617

etc. (see schedule in part c)

23–37. (continued)

c.

	Time	*Year*									
	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Investment flows:											
Equipment	$(200,000)										
Removal	(2,750)										
Salvage of old equipment	40,000										
Tax benefit—sale of old equipment	27,000										
Periodic operating flows		$19,239	$20,393	$21,617	$22,914	$24,289	$25,746	$27,291	$28,928	$30,664	$32,504
Tax shield–new:											
Year 1		18,000									
Year 2			31,500								
Years 3–5				13,500	13,500	13,500					
Taxshield—old equipment (forgone)		(4,500)	(4,500)	(4,500)	(4,500)	(4,500)	(4,500)	(4,500)	(4,500)	(4,500)	(4,500)
Disinvestment:											
Proceeds of disposal											100,000
Tax on gain											(45,000)
Total cash flows	$(135,750)	$32,739	$47,393	$30,617	$31,914	$33,289	$21,246	$22,791	$24,428	$26,164	$83,004
Discount factor (21.9%)	1.000	0.820	0.673	0.552	0.453	0.372	0.305	0.250	0.205	0.168	0.138
Present value	$(135,750)	$26,846	$31,895	$16,901	$14,457	$12,384	$ 6,480	$ 5,698	$ 5,007	$ 4,396	$11,455
Net present value	$ (231)										

Note: Your answer may vary slightly due to rounding of PV factor.

23–38. (25 min.) *Assess net present value of training costs: Zigfield, Inc.*

The new training should be purchased. The support calculations follow:

(000's omitted)

Cost savings due to training:

Reduction in direct labor	$ 770
Reduction in other expenses	275
Gross savings	$1,045
After tax of 40%	$ 627

Present value of $627 per year for 10 years at 12%:

	5.650 x $627 =	$3,543
After tax training costs [$5,000 x (1 – .40)]		(3,000)
Net present value of training		$ 543

Thus, the new training should be purchased.

23–39. (40 min.) *Sensitivity analysis in capital investment decisions: Octagon, Corp.*

The cash flows are scheduled as follows ($000 omitted):

Year	*Best Case*	*Expected*	*Worst Case*
0	($3,500)	($3,500)	($3,500)
1	500	0	(500)
2	500	0	(500)
3	1,500	1,000	1,000
4	1,500	1,000	1,000
5	3,000	2,000	1,000
6	3,000	3,000	1,000
7	3,000	3,000	1,000
Net Present Value @ 20%	$1,903[a]	$207[b]	($2,187)[c]
Internal Rate of Return	33%	21%	2%

---

[a] $1,903 = ($3,500) + [$500 x ($1.20^{-1}$ + 1.20^{-2})] + [$1,500 x ($1.20^{-3}$ + 1.20^{-4})] + [$3,000 x ($1.20^{-5}$ + 1.20^{-6} + 1.20^{-7})]

[b] $207 = ($3,500) + [$1,000 x ($1.20^{-3}$ + 1.20^{-4})] + [$2,000 x 1.20^{-5}] + [$3,000 x (1.20^{-6} + 1.20^{-7})]

[c] ($2,187) = ($3,500) – [$500 x ($1.20^{-1}$ + 1.20^{-2})] + [$1,000 x ($1.20^{-3}$ + 1.20^{-4} + 1.20^{-5} + 1.20^{-6} + 1.20^{-7})]

Since the expected net present value is greater than zero, the company would be likely to invest in this project. However, the alternative scenarios need to be considered when making the decision.

23–40. (40 min.) *Capital investment analysis under inflation with investment tax credit: Norton Company.*

	Year								
	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Investment flows:									
Machine	$(80,000)								
Investment tax credit		$ 8,000							
Annual operating flows[a]		23,976	$25,894	$27,966	$30,203	$32,619	$35,229	$38,047	$41,091
Depreciation tax shield[b]		6,400	11,200	4,800	4,800	4,800			
Total cash flows....................	$(80,000)	$38,376	$37,094	$32,766	$35,003	$37,419	$35,229	$38,047	$41,091
PV factor at 20.96%[c]		.827	.683	.565	.467	.386	.319	.264	.218
Present values......................	$(80,000)	$31,737	$25,335	$18,513	$16,346	$14,444	$11,238	$10,044	$ 8,958
Net present value	$ 56,615								

Note: Your answer may vary slightly due to rounding of NPV factor.

---

[a] Annual operating flows = (1 – 40%) x ($50,000 – $3,000 – $10,000) x $(1 + i)^n$ = $22,200 x $(1.08)^n$

[b] *Year*	*Depreciation tax shield*	*Tax shield*
1	40% x $16,000 =	$ 6,400
2	40% x $28,000 =	11,200
3	40% x $12,000 =	4,800
4	40% x $12,000 =	4,800
5	40% x $12,000 =	4,800

[c] Nominal rate = [(1.12)(1.08) – 1] = 20.96%

Chapter 24
Inventory Management

Solutions to Review Questions

24–1.
Although the inventory models are developed by operations researchers, statisticians and computer specialists, their areas of expertise do not extend to the evaluation of the differential costs for the inventory models. Generally, discussions of inventory models take the costs as given. It is the role of the accountant to determine which costs are appropriate for inclusion in an inventory model.

24–2.
As with other investments, there is an opportunity cost involved in having resources invested in a specific asset. Funds that are invested in inventory could, at least, be earning short-term interest rates if invested in market securities. It is more likely that these funds would be invested in more profitable assets, however. Therefore, so long as the funds are tied up in inventory, the opportunity to obtain earnings on other investments must be forgone.

24–3.
The economic order quantity model seeks to minimize the sum of carrying costs plus order costs for the working inventory. Since the working inventory is assumed to behave in a sawtooth pattern (see Illustration 24.5), the inventory carrying cost would be the costs associated with the average quantity of inventory on hand. At the start of the cycle there are Q units on hand, while at the end there are zero units on hand. The average of these two numbers (Q + 0) is equal to Q/2; hence, the division.

There is an assumption of steady usage rates in the EOQ model. If this assumption is seriously violated, some other cost function may be required.

24–4.

a. Hourly fee for inventory audit	(C)
b. Salary of purchasing supervisor	(N)
c. Costs to audit purchase orders and invoices	(P)
d. Taxes on inventory	(C)
e. Stockout costs	(P)
f. Storage costs charged per unit in inventory	(C)
g. Fire insurance on inventory	(C)
h. Fire insurance on warehouse	(N)
i. Obsolescence costs on inventory	(C)
j. Shipping costs per shipment	(P)

24–5.
Q* is, by definition, the optimal solution in the absence of constraints. With constraints, we can never obtain a lower cost solution than Q*. If the constraint is irrelevant (that is, Q* is still feasible) then Q* is the least cost solution. If Q* is not feasible, then the next best solution will be at an adjacent constraint either greater than or lower than Q*. This occurs because the total cost function is decreasing until it reaches Q* and then increasing after. Any restriction other than those adjacent to Q* will necessarily be at a higher cost than the adjacent restrictions. Inspection of Illustration 24.2 with the imposition of constraints at various values of Q will confirm this visually.

24–6.

a. Order quantity

b. Reorder point

c. Safety stock

d. Stockout

Solutions to Critical Analysis and Discussion Questions

24–7.
Since the carrying costs exceed the order cost, and in the absence of constraints, it would appear that the actual Q is in excess of Q*. Recall that at Q* the two costs are equal (in simple cases) or generally close to equal. An inspection of illustration 24.1 shows that the carrying cost function is greater than the order cost function when the actual Q is greater than Q*.

24–8.
Differential relevant costs are defined as those that change with a change in the decision variable. In the case of inventory policy, the decision variables are either order quantities or safety-stock levels. In the case of order quantities, the differential costs may be those associated with the quantities of inventory that are maintained as a result of a given order quantity or with the number of orders placed in a given year. Any cost which varies with either of these factors would be relevant to the economic lot size decision.

For safety-stock determination, the relevant costs are the carrying cost of the safety stock plus the expected annual stockout costs. The expected stockout costs are affected by the probability of a stockout, the costs of a given stockout, and the exposure to stockout. The latter term is determined by the frequency of ordering. The stockout must usually be determined with data outside the accounting records and may range from rather low costs of special orders to extensive costs of a shutdown of company operations.

24–9.
A symmetrical distribution implies equal probabilities on either side of the expected value. A stockout would occur any time the demand over lead time exceeded the expected value. That is likely to happen equally as often as a demand over lead time of less than the expected value, so one would expect a stockout 50% of the time.

24–10.
In the first place, large order sizes will not eliminate the exposure to a stockout. Safety stock will. Thus, ordering 5,000 units with 75 in stock and a demand over the lead time of 800 units will result in a stockout. However, reducing the number of orders per year will reduce the expected frequency of a stockout.

For example, if a company has concluded that a .5 probability of a stockout is acceptable, and it places two orders a year, it can expect one stockout (i.e., 2 x .5). However, if it places fifty orders a year then 25 stockouts can be expected.

The appropriate criterion for inventory policy is not avoidance of a stockout, as implied in the comment, but rather the minimization of the costs associated with maintaining inventories.

24–11.
The method of accounting for financial reporting or tax purposes will not directly affect the optimal inventory policy. Optimal inventory policy is related to expected future costs, not the past costs on which LIFO or FIFO data are based. However, since LIFO can result in a significant tax penalty if LIFO inventories are reduced in quantity, there can be an additional cost to consider in management of LIFO inventories, namely, the costs of avoiding the tax liability on LIFO inventory liquidation. However, that problem is different from the material discussed here and usually relates to an aggregate inventory rather than to a specific item in inventory.

24–12.
Just-in-time eliminates inventory where spoiled goods and defects can be stored. If a department is making defective products, with JIT it must correct the problem before the products are transferred to the next department.

24–13.
Flexible manufacturing enables companies to change from production of product A to product B quickly, with minimal setup time. This reduces the need for inventories.

24–14.
Companies that use just-in-time production might have a shortage of product if demand increases unexpectedly. Also, supplier disruptions (for example, worker strikes) may cause an interruption in the receipt of materials and parts necessary to complete production.

Solutions to Exercises

24–15. (15 min.) *Compute EOQ.*

$$A = 40{,}000$$

$$S = \$9.60 + (18\% \text{ x } \$80.00) = \$9.60 + \$14.40 = \$24.00$$

$$P = \$480.00$$

$$Q^* = \sqrt{\frac{2 \text{ x } 40{,}000 \text{ x } \$480.00}{\$24.00}}$$

$$= \sqrt{1{,}600{,}000}$$

$$= \underline{\underline{1{,}265 \text{ units}}}$$

24–16. (15 min.) *Compute EOQ: Sonoma Technology Inc.*

$$\text{EOQ} = \sqrt{\frac{2 \text{ x } 310{,}000 \text{ x } \$620}{\$125}}$$

$$= \sqrt{3{,}075{,}200}$$

$$= \underline{\underline{1{,}754 \text{ units}}}$$

24-17. (35 min.) *Find missing data for EOQ: Errantos Corporation.*

This problem requires solving for an unknown in the EOQ equation. Given the equation,

$$Q^* = \sqrt{\frac{2AP}{S}}$$

substituting in the knowns from the exercise, and letting the unknown inventory cost be denoted “I” we obtain:

$$3{,}500 = \sqrt{\frac{2 \text{ x } 3{,}500 \text{ x } 20 \text{ x } \$306.25}{\$0.80 + .2I}}$$

Squaring both sides:

$$12{,}250{,}000 = \sqrt{\frac{2 \text{ x } 3{,}500 \text{ x } 20 \text{ x } \$306.25}{\$0.80 + .2I}}$$

Collecting terms:

$$12{,}250{,}000 = \frac{42{,}875{,}000}{\$0.80 + .2I}$$

and:

$$12{,}250{,}000 \text{ x } (\$0.80 + .2I) = \$42{,}875{,}000$$

then

$$\begin{aligned} \$0.80 + .2I &= \$42{,}875{,}000 / 12{,}250{,}000 \\ \$0.80 + .2I &= \$3.50 \\ .2I &= \$3.50 - \$0.80 \\ .2I &= \$2.70 \\ I &= \$13.50 \end{aligned}$$

24–18. (15 min.) *EOQ-multiple choice.*

a. The answer is 2.

$$600 = \sqrt{\frac{2 \text{ x } 240{,}000 \text{ x } \$300}{\$400}}$$

b. The answer is 1. There are 4,000 units in the optimal production run:

$$4{,}000 = \sqrt{\frac{2 \text{ x } 48{,}000 \text{ x } \$100}{\$.60}}$$

Therefore, Fong should make 12 production runs per year:

$$12 \quad = \frac{48{,}000 \text{ units per year}}{4{,}000 \text{ units per run}}$$

c. The answer is 3.

$$1{,}200 = \sqrt{\frac{2 \text{ x } 160{,}000 \text{ x } \$54}{\$12}}$$

24–19. (35 min.) Orders in round lots: Loggins Corporation.

The optimal order quantity without regard to the order restrictions is:

$$Q^* = \sqrt{\frac{2 \text{ x } A \text{ x } P}{S}}$$

$$Q^* = \sqrt{\frac{2 \text{ x } 172{,}000 \text{ x } \$325}{\$25}}$$

$$= \sqrt{4{,}472{,}000}$$

$$= \underline{\underline{2{,}115 \text{ units}}}$$

Given the restrictions, it is necessary to evaluate the costs at the adjacent order quantities of 2,000 units and 3,000 units.

At 2,000 units:

Carrying costs:

$$\frac{QS}{2} = \frac{2{,}000 \text{ x } \$25}{2} = \$25{,}000$$

Order costs:

$$\frac{AP}{Q} = \frac{172{,}000 \text{ x } \$325}{2{,}000} = \underline{\$27{,}950}$$

$$\text{Total costs} \quad \underline{\underline{\$52{,}950}}$$

At 3,000 units:

Carrying costs:

$$\frac{QS}{2} = \frac{3{,}000 \text{ x } \$25}{2} = \$37{,}500$$

Order costs:

$$\frac{AP}{Q} = \frac{172{,}000 \text{ x } \$325}{3{,}000} = \underline{\$18{,}633}$$

$$\text{Total costs} \quad \underline{\underline{\$56{,}133}}$$

It is optimal to order 2,000 units.

24–20. (35 min.) *Impact of quantity discounts on order quantity: Folsom Company.*

First compute the EOQ without regard to the discount schedule:

$$Q^* = \sqrt{\frac{2AP}{S}} = \sqrt{\frac{2 \times 810 \times \$500}{\$450}}$$

$$= 42$$

Then compute the total costs under the initial Q* and for the minimum quantity required to earn each of the next price breaks.

Order Quantity	*Carrying Cost*	*Order Cost*	*Foregone Discount*	*Total Costs*
42	$\frac{42 \times \$450}{2}$	$\frac{810 \times \$500}{42}$	810 x $1,500 x (6% – 2%)	
	= $9,450	= $9,643	= $48,600	$67,693
80	$\frac{80 \times \$450}{2}$	$\frac{810 \times \$500}{80}$	810 x $1,500 x (6% – 5%)	
	= $18,000	= $5,063	= $12,150	$35,213 Optimal
150	$\frac{150 \times \$450}{2}$	$\frac{810 \times \$500}{150}$	zero	
	= $33,750	= $2,700	-0-	$36,450

24–21. (20 min.) *Impact of constraints on optimal order: Folsom Company.*

If there were a restriction on the storage capacity, then the optimal order size would be 42 units, not the 50 unit restriction. This may be found by comparing the total cost at 42 units given in exercise 24-20 as $67,693 with the following costs at 50 units.

Carrying Cost	*Order Cost*	*Foregone Discount*	*Total Costs*
$\frac{50 \times \$450}{2}$	$\frac{810 \times \$500}{50}$	810 x $1,500 x (6% x 2%)	
= $11,250	= $8,100	= $48,600	$67,950

24–22. (25 min.) *Evaluate safety-stock policy: Rollins Corporation*

It is necessary to evaluate the total annual carrying costs and expected stockout costs at each safety-stock level. The carrying cost will be $32.00 for each unit in safety stock. With the given order size, there are 15 orders placed a year (i.e., 39,000/2,600 = 15). Based on these computations, we prepare the following schedule:

Safety Stock	*Carrying Costs of Safety Stock*	*Expected Stockout Costs*	*Total Costs*	
0	0	.6 x 15[a] x $3,300 = $29,700	$29,700	
100	100 x $32.00 = $3,200	.2 x 15[a] x $3,300 = $ 9,900	13,100	
175	175 x $32.00 = $5,600	.08 x 15[a] x $3,300 = $ 3,960	9,560	(optimal)
250	250 x $32.00 = $8,000[b]	.04 x 15[a] x $3,300 = $ 1,980	9,980	

Additional computations:

[a] 15 is the number of orders per year.

[b] It should be evident that at this level the carrying costs alone exceed the total costs at a safety stock of 175 units. Therefore, it is not possible for this or any safety-stock level larger than 250 to be less costly than 175 units.

24–23. (20 min.) *Safety stock–multiple choice.*

a. The answer is 4.

Safety Stock	*Carrying Cost*	*Expected Stockout Cost*	*Total Cost*	
10	10 x $1 = $10	40% x 5 x $300 = $600	$610	
20	20 x $1 = $20	20% x 5 x $300 = $300	$320	
40	40 x $1 = $40	10% x 5 x $300 = $150	$190	
80	80 x $1 = $80	5% x 5 x $300 = $ 75	$155	Optimal

b. The answer is 1.

Safety Stock	*Carrying Cost*	*Expected Stockout Cost*	*Total Cost*	
10	$8 x 10 = $ 80	50% x 5 x $120 = $300	$380	Optimal
20	$8 x 20 = $160	40% x 5 x $120 = $240	$400	
30	$8 x 30 = $240	30% x 5 x $120 = $180	$420	
40	$8 x 40 = $320	20% x 5 x $120 = $120	$440	
50	$8 x 50 = $400	10% x 5 x $120 = $ 60	$460	
55	$8 x 55 = $440	5% x 5 x $120 = $ 30	$470	

24–24. (30 min.) *Differential costs of inventory policy: Souds, Inc.*

Costs that vary with the number of units purchased:

Purchase price	$195
Insurance on shipment	3
Total	$198

Costs that vary with the average number of units in inventory:

Inventory insurance	$5.60	
Inventory tax	3.90	(= $195 x 2%)
Total	$9.50	per unit

Total carrying cost = (25% x $198) cost of capital + $9.50 = $49.50 + $9.50 = $59.

Order costs:

Shipping permit	$403.30
Costs to arrange for the shipment	55.20
Unloading	160.40
Stockout costs	244.00
Total	$862.90

24–25. (30 min.) *Differential costs of inventory policy.*

$$\text{Order costs} = \text{Insurance} + \text{Other order costs}$$

$$P = \$860 + \$18 = \$878$$

$$\text{Carrying costs} = \text{Out-of-pocket costs} + \text{Cost of capital on inventory}$$

$$S = \$75 + 20\% \times \$317 = \$138.40$$

a. Carrying costs:

$$\frac{QS}{2} = \frac{500 \times \$138.40}{2} = \$34{,}600.00$$

Order costs:

$$\frac{AP}{Q} = \frac{5{,}400 \times \$878}{250} = \underline{\$18{,}964.80}$$

$$\text{Total} \quad \underline{\underline{\$53{,}564.80}}$$

b. Economic order quantity:

$$Q^* = \sqrt{\frac{2 \times 5{,}400 \times \$878}{\$138.40}} = \sqrt{68{,}514} = 262 \text{ units}$$

Carrying costs:

$$\frac{QS}{2} = \frac{262 \times \$138.40}{2} = \$18{,}130.40$$

Order costs:

$$\frac{AP}{Q} = \frac{5{,}400 \times \$878}{262} = \underline{\$18{,}096.18}$$

$$\text{Total} \quad \underline{\underline{\$36{,}226.58}}$$

The company could save money by changing its order size to the optimal quantity.

Solutions to Problems

24–26. (40 min.) *Determine optimal safety-stock levels: Estatic, Inc.*

The key to this problem is computing the expected stockout costs in terms of dollars per day of stockout rather than in specific dollar amount. A stockout will occur when the actual lead time exceeds the sum of the planned lead time (5 days) plus the number of days' safety stock on hand. This latter amount is simply the safety stock divided by the usage rate (50 units per day).

Exposure to a stockout is based on the nine orders per year. That is, 270 working days times 50 units per day all divided by the 1,500 units ordered at one time.

The expected annual costs of alternate safety-stock policies may be illustrated in the following schedule:

Safety Stock	*Carrying Costs (@ $22/Unit)*	*Expected Annual Stockout Costs*	*Total Costs*
0	zero	9 x {[.05 x (9 – 5)] + [.15 x (8 – 5)] + [.20 x (6 – 5)]} x $4,200 = 9 x (.2 + .45 + .2) x $4,200 = $32,130	$32,130
50	50 x $22 = $1,100	9 x {[.05 x (9 – 5 – 1)] + [.15 x (8 – 5 – 1)]} x $4,200 = $17,010	$18,110
100	100 x $22 = $2,200	9 x {[.05 x (9 – 5 – 1)] + [.15 x (8 – 5 – 2)]} x $4,200 = $11,340	$13,540
150	150 x $22 = $3,300	9 x [.05 x (9 – 5 – 3)] + $4,200 = $ 1,890	$ 5,190
200	200 x $22 = $4,400	none -0-	$ 4,400 Optimal

24–27. (60 min.) *Inventory policy cost evaluation: Wilson, Inc.*

First it is necessary to compute the cost of each unit, the carrying cost, and the order cost from the data supplied in the problem.

a.

	Investment Cost		*Carrying Cost*		*Order Cost*
Invoice price	$32.92				$ 640.00
Shipping charges	1.05				
	.60	($.40 x 1.5 kg)			
Tax on each unit	1.80				
Special packaging	2.65	(net of refund)			
Casualty insurance	1.76				
Liability insurance					415.00
Processing order documents					183.00
Unloading operations	.82				
Inspect and count for annual inventory			$ 2.63		
Rental of unloading equipment					222.00
Estimated obsolescence costs			1.35		
Inventory record maintenance			.92		
Inventory tax			.99	($32.92 x 3%)	
Inventory insurance			4.94	($32.92 x 15%)	
Expected stockout costs					108.00[a]
Sub-totals	$41.60		$10.83		$1,568.00
Cost of capital			9.15	($41.6 x 22%)	
Totals	$41.60		$19.98		$1,568.00

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[a] $5,400 x 2%

With these data, it is possible to answer the questions in the problem.

24–27. (continued)

b. The costs of the current inventory policy include the carrying costs of the working inventory and safety stock, the order costs and the expected annual stockout costs. These are as follow:

Carrying costs:

Safety stock

= {25,000 units – [9 x (350,000/300)]} x $19.98

= [(reorder point) – (demand over lead time)] x carrying cost per unit

= 14,500 units x $19.98 = $289,710

Working inventory

$$\frac{QS}{2} = \frac{(350{,}000/4 \text{ orders per year})\$19.98}{2} = \underline{\$874{,}125}$$

Total carrying costs $1,163,835

Order costs:

4 orders per year x $1, 568.00 = $6,272

Expected annual stockout costs
(included in the order costs)

Total costs $1,170,107

c. Costs of optimal order policy:

(1) Determine Q* ignoring restrictions on order size:

$$Q^* = \sqrt{\frac{2\,AP}{S}}$$

$$Q^* = \sqrt{\frac{2 \times 350{,}000 \times \$1{,}568}{\$19.98}}$$

$$= \sqrt{54{,}934{,}935}$$

$$= \underline{\underline{7{,}412}}$$

24–27. (continued)

(2) Determine the lowest cost from the adjacent feasible order sizes:

At 5,000 units:

Carrying costs:

$$\frac{QS}{2} = \frac{5{,}000 \text{ x } \$19.98}{2} = \$\ 49{,}950$$

Order costs:

$$\frac{AP}{Q} = \frac{350{,}000 \text{ x } \$1{,}568}{5{,}000} = \$109{,}760$$

Total costs $159,710

At 10,000 units:

Carrying costs: (double that for 5,000 units) = $ 99,900

Order costs: (half that for 5,000 units) = $ 54,880

Total cost $154,780 Optimal

Optimal safety stock level is found by evaluating the annual costs at each different safety stock amount.

Safety Stock	*Carrying Cost*	*Expected Annual Stockout Cost*	*Total Costs*	
0	zero	35[a] x .5 x $5,400 = $94,500	$ 94,500	Optimal
7,000	$139,860[b]	35[a] x .1 x $5,400 = $18,900	$158,760	
14,000	279,720	35[a] x .02 x $5,400 = $ 3,780	$283,500	
21,000	419,580	35[a] x .01 x $5,400 = $ 1,890	$421,470	

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[a] 35 = number of orders per year = 350,000/10,000 determined in (2) above.

[b] It should be evident that the cost of carrying 7,000 or more units of safety stock is greater than the stockout costs at no units of safety stock. To carry 4,729 units would cost $94,500 (i.e., 4,729 x $19.98), thus the maximum cost-effective safety stock would be 4,729 units and this would only be economic if the expected stockout costs were reduced to zero.

d. Reorder point:

$$\text{Usage over lead time + safety stock} = \frac{350{,}000}{300} \text{ x } 9 + 0 = \underline{\underline{10{,}500}} \text{ units}$$

24-28. (40 min.) *Sensitivity of EOQ computations to changes in cost estimates: Wildridge, Inc.*

a.

$$Q^* = \sqrt{\frac{2\ AP}{S}} = \sqrt{\frac{2 \text{ x } 80{,}000 \text{ x } \$808}{\$7 + (.3 \text{ x } \$275)}}$$

$$= \sqrt{1{,}444{,}469}$$

$$= 1{,}202$$

b. Carrying costs:

$$\frac{QS}{2} = \frac{1{,}202 \text{ x } [\$7 + (.15 \text{ x } \$275)]}{2} = \$28{,}998$$

Order costs:

$$\frac{AP}{Q} = \frac{80{,}000 \text{ x } \$808}{1{,}202} = \$53{,}777$$

Total costs	$82,775

c. The new Q* is computed:

$$Q^* = \sqrt{\frac{2\ AP}{S}} = \sqrt{\frac{2 \text{ x } 80{,}000 \text{ x } \$808}{\$7 + (.2 \text{ x } \$275)}}$$

$$= \sqrt{2{,}085{,}161}$$

$$= \underline{\underline{1{,}444}}$$

And the total costs under this policy:

Carrying costs:

$$\frac{QS}{2} = \frac{\$1{,}444 \text{ x } \$62.00}{2} = \$44{,}764$$

Order costs:

$$\frac{AP}{Q} = \frac{80{,}000 \text{ x } \$808}{1{,}444} = \$44{,}765$$

Total costs	$89,529

24–29 (20 min.) *Inventory cycle analysis–multiple choice: Retem & Company.*

a. The answer is 2.

(280 x .2) + (180 x .8) = 200 units

b. The answer is 4.

420 = 200 x [(3 weeks x .1) + (2 weeks x .9)]

24–30. (60 min.) *Alternative order policy costs: Save the Whales.*

This problem is likely to result in a significant amount of discussion. There is no single solution to the problem and, hence, alternative thoughts are likely to arise. The focus of the discussion should be on the alternative costs of each order policy as suggested by the problem. It may help to narrow the choice of alternative order quantities to those at the price breaks or those suggested by the Committee (500 units and 2,500 units). Otherwise, as in the real world, the possibilities become unmanageable.

It is important to look at the costs of different order sizes with the idea that information might be gathered after the first set of shirts go on sale. That is, if one decides to order 500 shirts at a time and finds they are selling at a much greater rate, the next order could be larger. However, if one orders 2,500 shirts and finds they are not selling well, there is no opportunity to avoid the loss that might arise from unsold shirts.

To study the problem, the Committee will have to make a decision based on very sketchy evidence. Knowing the cost of a 500 shirt order policy vs. a 2,500 shirt order policy would at least provide the Committee with some economic basis for a trade-off between the returns and risks.

The two relevant costs are order costs (the $100.00 set-up charge) and the forgone discount. Since 2,500 units is the maximum order, the maximum discount would be based on the $3.80 price for ordering 2,500 units.

24–30. (continued)

Quantity	*Differential Costs with Sales of*		
Ordered	*500 Shirts*	*2,500 Shirts*	
500	Set-up costs:		
	$ 100.00	$ 500.00	(5 orders @ $100)
	Forgone discount:		
	-0-[a]	3,000.00	[2,500 x ($5.00 – $3.80)]
	Unsold shirt costs:		
	-0-	-0-	
Costs of 500 unit order policy	$ 100.00	$3,500.00	
2,500	Set-up costs:		
	$ 100.00	$ 100.00	
	Forgone discount:		
	-0-	-0-	
	Unsold shirt costs:		
	7,600.00[b]	-0-	
Costs of 2,500 unit order policy	$7,700.00	$ 100.00	

The committee must, therefore, consider the tradeoff between the lost discounts and higher ordering costs of ordering 500 at a time versus the potential loss from unsold shirts. It may be best to order 500 units, incurring an incremental set-up cost of $100.00 to gain information on the rate of sales. Based on the sales level for the 500 units, the next order (if there is one) could be for 500, 750, 1,000 or 2,000 units as indicated by the new information.

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[a] If only 500 were sold, even though full price was paid for the shirts, there is no discount forgone. There was no opportunity to gain from ordering more shirts.

[b] 2,000 shirts at $3.80 each.

Solution to Integrative Case

24–31. (60 min.) *Overhead application and inventory management costs: Commercial Furniture Inc.**

a. An estimate of Commercial Furniture's set-up is as follows:

Maintenance department costs:		
Salaries (2 x 5 x $10.80)		$108.00
Production department costs:		
Salaries (5 x 5 x $7.50)	187.50	
Variable overhead—labor base (5 x 5 x $2.75)	68.75	
Variable overhead—machine hour base (1 x $5)	5.00	261.25
Direct materials ($200 x $50)		150.00
Total		$519.25

Explanation of costs:

- The full cost of the maintenance men's salary and employee benefits is included because the $10.80 incurred per man hour is incurred solely for the purpose of affecting the changeover.
- The other costs of the maintenance department are not included in the estimate because they are fixed costs of the maintenance department and will be incurred regardless of the maintenance workers' activities.
- The salaries of the five production workers for the full five hours are included in the set-up cost because they must be in attendance all the time though they are needed only part of the time. If the workers could have been assigned to other jobs during the changeover, then the full amount would not be charged to set-up.
- The variable overhead costs of the production department applied on the direct labor base are incurred as a function of the direct labor hours; therefore, a full five hours of cost are assigned to the set-up cost.
- The variable overhead costs of the production department applied on the machine-hour base are incurred as a function of the operation of the machinery; therefore, one hour is assigned to set-up cost for the one hour the machinery is used in testing.
- All fixed overhead costs of the production department (those applied on the basis of direct labor and those applied on the basis of machine hours) are not included in the set-up cost because they are fixed costs and would be incurred regardless of the activity in the department. They are not relevant costs of this cost assignment.
- The net material cost of $150 is included because it represents the unsalvageable portion of the materials used for the set-up and not for the production of a saleable desk.

*CMA adapted

24–31. (continued)

b. The cost items which would be included in an estimate of Commercial Furniture's cost of carrying desks in inventory include:

- all costs related to warehousing and handling the desks in inventory (i.e., warehouse wages, insurance and other costs which vary in amount by the number of items stored).
- the opportunity cost for the funds committed to the investment in inventory.

Chapter 25

Management Ethics and Financial Fraud

Solutions to Review Questions

25–1.
Fraudulent financial reporting is intentional conduct that results in materially misleading financial statements. The two key concepts in the definition of fraudulent financial reporting are (1) the conduct must be intentional or reckless, and (2) the misstatement must be material to the financial statements.

25–2.
Materiality, in our setting, refers to the magnitude of the misstatement. To be material, the magnitude of the misstatement must be large enough that it would likely affect the judgment of a reasonable person relying on the information. Simply stated, the misstatement must be important. Materiality is difficult to define in practice because it is hard to know what amount is important to a decision maker.

25–3.
Common examples of fraudulent financial reporting are failure to write down obsolete inventory, and recognizing revenue before the sale has been made.

25–4.
"Tone at the top" refers to the tone that top management sets in dealing with ethical issues. The tone is critical because top management's actions have a great impact on ethics at lower levels of management.

25–5
Without internal control regulations, top management is able to use the excuse that they did not know about bribes made by lower level managers. The internal controls requirement forces top management to be aware of the bribery or face charges that the controls were insufficient.

25–6.
Separation of duties helps prevent financial fraud because it limits the opportunity to commit the fraud. When a separation of duties exists, two or more individuals must engage in collusion to commit fraud. While collusion can and does occur, it increases the risk that someone will "blow the whistle" on the fraud. The increased risk of revealing fraud makes it less likely that fraud will occur.

25–7.
Internal auditors deter fraud by reviewing and testing controls and by assuring that controls are in place and working well. Often, the physical presence of a watchful internal auditor can deter fraud. Internal auditors detect fraud by employing special fraud examiners or investigators whose job is to identify fraud.

25–8.
Public accounting firms are increasingly held accountable for their client's fraudulent financial reporting because the users of the financial reports see the public accounting firms as the independent entity most likely to find fraud. Also accounting firms are a source of funds where investors can collect for damages, particularly if the auditee went bankrupt.

Solutions to Critical Analysis and Discussion Questions

25–9.
No. Fraudulent financial reporting is not embezzlement or theft. See question 25-10.

25–10.
Generally, accounting for the stolen items as spoilage would be financial fraud if the item is material and the cover-up is intentional.

25–11.
The error in recording is not intentional; it is not financial fraud. Unintentional errors in preparing financial statements are not fraudulent financial reporting.

25–12.
The clerk's actions could easily be unintentional if the clerk thought the inventory was not obsolete; for example, if someone in operations told the clerk the inventory was not obsolete. Accounting people have the responsibility to record assets and transactions properly, though, so someone in accounting will eventually be held responsible if the inventory is not written off.

25–13.
Financial fraud was not proved in these cases. None of these cases went to trial. Generally, the individuals involved sign consent decrees in which they neither admit nor deny guilt, but they agree not to commit certain acts or do certain things in the future.

25–14.
For Year 1, sales, cost of goods sold, gross margin, and profit amounts are overstated, assuming the revenue exceeded the cost of goods sold. At December 31, Year 1, accounts receivable is overstated and inventory is understated. For Year 2, the income statement shows the opposite effects of Year 1—sales, cost of goods sold, gross margin and profit amounts are understated.

25–15.
What about people who rely on the financial statements during the period of the fraud? Suppose someone buys stock in a company that shows a good, but fictitious, performance in Year 1, only to have the bottom fall out in Year 2. In addition, early sales sometimes are fictitious when customers change their mind before the sale has been finalized. Early revenue recognition is an example of unethical behavior that sends a message that unethical behavior is normal practice. Early revenue recognition in Year 1 often leads to early revenue recognition in Year 2 and so on.

25–16.
Answering this question requires some speculation, but we suspect plant management at Ronson and the division manager at Doughtie's Foods wanted to know the correct numbers for their own decision making, planning, and control. These managers probably expected the false numbers and the correct numbers to converge someday.

25–17.

The situation in this question is based on an actual case. In the actual case, the fraudulent activities were discovered by people who worked in the accounting department who discovered the invoices and shipping documents tucked away in the desk drawer of the accountant who colluded to commit the fraud. The “friend” was among those charged with the fraud because she knew about it and was suspected to be involved. She was eventually cleared of wrongdoing, but not until after several years of defending herself against the charges. She lost her job, and she spent a lot of time defending herself.

If she were faced with similar circumstances again, she says she would immediately inform the head of the accounting department, and at least two other people in the organization who were higher than her boss. Her initial contact would not accuse the alleged perpetrators of committing fraud, but would inquire as to the propriety of their actions in view of the company’s accounting and sales policies. In this way, she would avoid accusing someone of misbehavior before she had proof of wrongdoing. If her inquiries were ignored, she would begin looking for a new job.

25–18.

Small “earnings management” often results in major fraud after a time because of the need to adjust each year to make up for prior year “adjustments.” Overstating revenue by early revenue recognition in Year 1 automatically understates revenue in Year 2. Therefore, Year 2 revenue “must” be overstated just to bring Year 2 back to actual, and Year 2 would be overstated even more to improve apparent earnings above the actual level. The problem gets larger and larger each year if managers or accountants continue the illusion.

25–19.

This incentive approach minimizes incentives to commit financial fraud, however, it also minimizes incentives for superior performance. The approach does not encourage or reward innovation and superior performance.

25–20.

The Treadway Commission listed the pressures to achieve unrealistically high, short-term financial results and incentive systems that focus on short-term financial results as examples of factors that may produce financial fraud. Combined, the two factors produce an environment that is highly conducive to fraud.

25–21.

Two explanations for the existence of unrealistic profit objectives for division managers are that upper management may be uninformed about the division, and that they may be too zealous regarding the company’s profit potential. In decentralized and widely dispersed companies, top management is usually not involved with the details of local operations. Unwittingly, top management may expect more from a division than operating and market conditions allow. On the other hand, top management may choose to knowingly expect unrealistic results, thinking that attempts to achieve the results will produce better results than if expectations were lower.

25–22.

Committing financial fraud in the current period may seem to outweigh future problems that the fraud may cause. The perpetrator of the fraud may be promoted before the negative consequences of the fraud are revealed. Alternatively, the perpetrator of fraud may believe he or she will be fired if the short-run targets are not met; so he or she has little to lose by committing fraud to meet the targets.

25–23.
Four compensating factors may be of assistance:

1) The internal audit department should assume a “watch-dog” role, thus reducing the opportunity to commit fraud.
2) Provide an ombudsman with whom employees can discuss questionable activities in confidence.
3) Top management should convey a “tone at the top” regarding ethics that encourages excellence in ethics.
4) Hire people who have good reputations. Promote people with integrity to top management positions.

25–24.
Miniscribe’s management may have placed too much emphasis on the short run. Both rewards and punishments were based on the achievement of unrealistically high profit objectives.

25–25.
People with big egos often want to make a big splash without concern for the consequences. Fraudsters who end up in prison relish the opportunity to share their many illegal experiences. They appear to enjoy getting away with something in the short-run, even if they eventually get caught. Also, people with big egos may believe *they* would never get caught!

Solutions to Problems

25–26. (25 min.) *Explain early revenue recognition.*

a. *Example*

	Year 1 (actual)	*Year 1 (fraud)*
Revenue	$100	$120
CGS	50	60
Gross Profit	$ 50	$ 60

	Year 2 (actual)	*Year 2 (assuming no additional fraud)*
Revenue	$100	$ 80
CGS	50	40
Gross Profit	$ 50	$ 40

b. Accounts Receivable and Revenue would be overstated. Inventory would be understated because goods that are still in inventory would be reported to be sold. Cost of Goods Sold would be overstated. To find the errors, try the following:

- Confirm accounts receivable with customers. If customers say they did not owe the money or purchase the goods as of the end of the year, then the company's records may be wrong.
- Count the inventory, physically. The physical count should reveal inventory on hand that has been reported to be sold as of the end of the year.
- Analyze the accounts to see if Accounts Receivable are old, which may indicate customers do not owe the money. Determine whether year-end Accounts Receivable are unusually high.

25–27. (25 min.) *Explain inventory overstatement.*

a. See Illustration 25.1.

b. Inventory is often overstated by not writing off obsolete inventory, thus leaving on the books an asset that should be expensed. In the PepsiCo case, for example, obsolete and broken bottles were not written off, thus overstating inventory and overstating profits. Inventory may also be overstated by reporting inflated ending inventory values as at Doughties' Foods.

Inventory overstatements can be found as follows:

- Count the inventory accurately (not like Doughties' Foods), and make sure the inventory that is reported is actually on hand.
- Have people who have technical expertise (e.g., engineers) check both the physical inventory and the records to find obsolete inventory (particularly important in high-tech fields).
- Analyze the inventory levels and the relation of inventory to cost of goods sold. If the inventory turnover ratio (inventory turnover = cost of goods sold/inventory) goes down over time, or is low compared to other similar divisions, inventory may be overstated.

25–28. (30 min.) *Causes of fraudulent financial reporting: Doughties' Foods.*

a. By committing financial fraud, Hanley was apparently trying to avoid the criticism of top management. Presumably, he would also be helping his employment and promotion prospects if he could show better financial results.

b. The tone at the top appears to be one that neither encouraged nor discouraged fraudulent activities. Top management had poor internal controls to monitor potential fraudulent activities and other division managers seemed to engage in financial fraud. It is possible that while top management demanded high performance, they did not want to know how it was achieved.

c. Doughties' Foods did not have proper internal controls, such as separation of duties. There appeared to be no internal audit presence to monitor controls. Hanley was responsible for both counting and reporting inventory levels. Further, his reports were not sufficiently verified for accuracy.

d. The independent auditors contributed to the fraud when they took inadequate steps to audit the level of inventory as an asset and did not recognize the weak internal controls. The auditors did not question or explore the irregular actions that Hanley committed during the audit. A thorough examination of the inventories and irregularities may have identified the fraud earlier.

25–29. (30 min.) *Causes of fraudulent financial reporting: Ronson Corp.*

a. Problems with the rest of the company caused top management at Ronson to focus on the success of the aerospace division. Pressure was continually applied in order to make the division perform even better. The company was relying on the division to provide the financial performance needed for corporate debt restructuring.

b. Perhaps, but the fraud involved collusion of a variety of individuals. The false sales and invoice documentation involved the help of individuals in sales and accounting. The movement of the unfinished jobs that were recorded as sales involved the help of workers on the floor of the plant.

c. In this case, internal controls may have been fairly good, but the collusion occurred such that the internal controls were inadequate to prevent financial fraud.

d. The SEC did not file a complaint against the independent auditors, presumably because the auditors' work complied with Generally Accepted Auditing Standards, and they too were misled by division managers.

25–30. (30 min.) *Causes of fraudulent financial reporting: PepsiCo.*

a. PepsiCo rewarded aggressive, highly motivated managers who achieved superior levels of performance, which provided an incentive for division managers to commit financial fraud.

b. Top management focused on short-term performance, provided a lot of autonomy and trusted the division managers. Top managers were distressed to learn about the fraud, suggesting they thought they had set an ethical tone in the company.

c. While we do not know which specific controls were lacking, we know from the autonomy given to division managers, the distance from headquarters, the language difference, and the role of internal audit as "consultants" instead of watchdogs, there was opportunity for division managers to design the control system to their own ends.

d. Internal auditors monitor internal controls and check to see if they are working. If they operate as consultants, they lose the skepticism and element of surprise that helps find situations in which internal controls are not working.

25-31. (25 min.) *Effect of bonus plan on financial fraud: Leslie Fay.*

a. Revenues, Accounts Receivable, and Cost of Goods Sold would be overstated; Inventory would be understated. Profits would be overstated for the period to which the invoices were backdated. The profits would be understated in the following period unless the fraud was continued.

b. The bonus plan provided a strong incentive for the CFO and COO to commit financial fraud. The plan was an all or nothing plan. If profits would fall just shy of $16 million, there would be a strong temptation for the CFO and COO to commit fraud or to apply a great deal of pressure to the divisional managers. Given that these two individuals have a major role concerning the tone at the top, and are central to the internal control process, the bonus plan adds fuel to a highly flammable mixture of factors that encourage fraud.

c. The geographical distance between headquarters and the center of financial operations made it easier for someone to commit fraud for a variety of reasons. First, the tone at the top was strongly influenced by the CFO, who had a strong motive to achieve specific short-run results. Second, internal controls were weakened because the CFO was apparently not being supervised. Third, access by lower level financial employees to the CFO’s superior was reduced. This made “whistle blowing” far more difficult.

25–32. (25 min.) *Top management awareness of fraud: Leslie Fay.*

It could be argued that the CEO is responsible because he helped to create an environment that was conducive to financial fraud. The CEO apparently supported a compensation plan that was heavily weighted towards short-run performance. The CFO and the CFO’s staff were given considerable autonomy, providing the opportunity for fraud. The CEO ignored financial results that were not consistent with the price markdowns which may have been interpreted as a sign that the CEO was willing to ignore the fraud.

On the other hand, the CEO apparently did not commit the fraud. It could be argued that the CEO neither intentionally, nor through reckless actions, encouraged unethical behavior.

25–33. (20 min.) *Top management's responsibility for fraud: NBC News.*

Two tones were set by the actions of the NBC News chief executive and the President of NBC. The NBC News chief executive's resignation suggested that NBC intended to uphold the highest of ethical standards. The chief executive was willing to resign not because he participated in the fraud, but because he had failed to prevent the fraud.

His action, however, was followed by an opposite action by his superior, the president of NBC. The president of NBC set a tone that accepted unethical behavior. His statement implies that unethical behavior is acceptable as long as it cannot be detected. Given that the President of NBC remained at NBC while the news chief executive did not, the President's tone is more likely to be conveyed to the rest of the organization.

25–34. (25 min.) *Taking action in the face of fraud.*

A student responds as follows:

The previous participation should not influence how my friend should act in the future. As such, the previous participation in the fraud is similar to a sunk cost. As a result, I recommend he/she report the fraud. If a superior was involved, proceed to a higher level. Additionally, his/her concerns should be put in writing. If no action is taken, I would recommend that my friend resign rather than continue to participate in the fraud. I understand that such an action would be difficult, consequently I would be willing to help my friend through the transition.

Solution to Integrative Case

25–35. (30 min.) *Motives and opportunities for fraud: H. J. Heinz Co.*

a. The example should be similar to the following:

	Year 1 (actual)	*Year 1 (fraud)*
Revenue	$100	$100
CGS	50	50
Optg. Expenses	20	30
Optg. Profit	$ 30	$ 20

	Year 2 (actual)	*Year 2 (fraud)*
Revenue	$100	$100
CGS	50	50
Optg. Expenses	20	10
Optg. Profit	$ 30	$ 40

b. By transferring income from period to period, the divisions were able to gain greater control over achieving the profit objectives sent down by corporate headquarters. As in many decentralized companies, the profit objectives were not developed with an in-depth understanding of the divisions' operations. Without an understanding of divisional operations, top management generally finds it difficult to determine whether income is being shifted or not. Further, as long as the divisional profit objectives are met, top management may not believe it should audit the results.

c. The communications gap and the us-versus-them attitude created an atmosphere in which the accuracy of reported financial data was not emphasized. Profit objectives originated at corporate headquarters with inadequate regard to the division's ability to achieve them. The divisions developed operating procedures which allowed them to report the numbers that headquarters wanted to see and, at the same time, the divisions created an income cushion that would allow for future manipulation of profits. This kept both headquarters and the divisions content. In a sense, financial fraud made life easier for everybody.

d. Examples will vary. For most examples a solution will include a recommendation for top management to gain a better understanding of the department or division while developing profit objectives. In effect, it should be indicated that participatory budgeting can help to mitigate the us-versus-them problem.

Chapter 26
Revenue, Mix, and Yield Variances

Solutions to Review Questions

26–1.
We want to isolate the cause of the variance separately for price changes and cost changes. By holding the costs at standard when analyzing revenue variances, we can isolate the effect of price changes. The costs are then analyzed separately.

26–2.
Efficiencies can be realized for *costs* only.

26–3.
The industry volume variance measures the impact of differences between actual and expected industry sales volume on the company's sales activity variance. Use of industry-wide data helps explain changes in volume in terms of what is happening to the industry.

26–4.
If a company has two or more products, a mix variance can arise even if the net effect of all variances is zero. It may be very useful to learn about the mix variance because if the mix is changing, the company may need to change production and/or marketing strategies to meet the change in mix. The U.S. automobile industry was facing rising revenues and rising volumes but, unfortunately, there were falling profits because buyers were purchasing smaller cars that had lower profit margins for the manufacturers.

26–5.
Examples include:

- Steel mills which can process both new steel and recycled scrap
- Oil refineries which can process different grades of crude oil
- Distilleries producing blended whiskeys
- Chemical companies

Solutions to Critical Analysis and Discussion Questions

26–6.
It could be that the variance the marketing manager refers to is a revenue variance alone and not a contribution margin variance. If so, the signal that the marketing manager has received is misleading–variable costs must be incurred to achieve the higher revenue levels. It would be better to show the activity variance in terms of contribution margins.

26–7.
In this situation it is necessary to investigate the reasons why volume fell short of expectations. If, indeed, marketing was unable to sell the production then the production manager's assertions have merit. However, if production were operating inefficiently and, hence, not producing at the level which marketing could handle then the matter could be turned around and production should be held responsible for the shortfall. The point of the question is that variances in one department (e.g., production) may arise due to activities in other departments. While this occurs infrequently, it is worthy of investigation when allegations arise such as those stated by the production manager.

26–8.
In a CPA firm, as in other professional firms, billing rates vary with the level of the professional person performing services. Hence, a staff accountant's time is billed at a lower rate than a partner's time. Even though the volume of hours billed may be the same, if the mix of staff to partner time is different there will be differences in revenues (and, most likely in profits as well).

26–9.
Salary rates vary according to the classification of the professionals in the firm (e.g., partners make more than junior accountants), and, on each engagement, a firm will budget a certain amount of time for each classification. Thus, a labor mix variance can be calculated to show if the appropriate personnel were used on that engagement. An unfavorable mix variance would suggest that partners were doing work that juniors should have done.

26–10.
In this situation the company is really selling just one product so a mix variance would not be meaningful.

Solutions to Exercises

26–11. (10 min.) *Sales price and activity variances: Creative Towels, Inc.*

Actual

190,000 x (8.50 – $3.65)
= $921,500

Flexible Budget

190,000 x ($9 – $3.65)
= $1,016,500

Master Budget

200,000 x ($9 – $3.65)
= $1,070,000

$95,000 U
Price variance

$53,500 U
Activity variance

26–12. (10 min.) *Sales price and activity variances: Creative Towels, Inc.*

Alternative 1

220,000 units
x ($8.00 – $3.95)
= $891,000

"Flexible Budget"

220,000 units
x ($9.00 – $3.95)
= $1,111,000

Alternative 2

185,000 units
x ($9.00 – $3.95)
= $934,250

$220,000 U
Price variance

$176,750 F
Activity variance

26–13. (15 min.) *Industry volume and market share variances: Placer Hills Products.*

Flexible Budget	*Standard contribution margin times budgeted market share percentage times actual industry volume*	*Master Budget*
(SP – SV) x AQ		(SP – SV) x SQ
$3 x 18,000 = $54,000	$3 x 20% x 120,000 = $72,000	$3 x 20,000 = $60,000

$18,000 U
Market share variance

$12,000 F
Industry volume variance

$6,000 U
Activity variance

26–14. (20 min.) *Sales price and activity variances: Sakata, Inc.*

Actual	*Flexible Budget*	*Master Budget*
125,000 x ($47 – $10) = 125,000 x $37 = $4,625,000	125,000 x $38 = $4,750,000	150,000 drums x ($48 – $10) = 150,000 x $38 = $5,700,000

$125,000 U
Price variance

$950,000 U
Activity variance

26–15. (15 min.) *Industry volume and market share variances: Sakata, Inc.*

Flexible Budget	*Standard contribution margin times budgeted market share percentage times actual industry volume*	*Master Budget*
(SP – SV) x AQ		(SP – SV) x SQ
12.5% x 1,000,000 x $38 = $4,750,000	10% x 1,000,000 x $38 = $3,800,000	10% x 1,500,000 x $38 = $5,700,000

$950,000 F
Market share variance

$1,900,000 U
Industry volume variance

$950,000 U
Activity variance

26–16. (20 min.) *Industry volume and market share variances–missing data.*

a. 2,400 units = 1,400 + 1,000

b. 60,000 units. [70,000 – (b)] x 10% = 1,000 units

c. 10%

d. 12%. [(d) – 10%] x 70,000 = 1,400 units

e. 70,000 units

26–17. (20 min.) *Sales mix and quantity variances: Fit-Right Gloves.*

a. Activity variance

Flexible Budget	*Activity Variance*	*Master Budget*
300,000 x ($10.95 – $5.00) + 200,000 x ($24.95 – $10.00)		400,000 x ($10.95 – $5.00) + 180,000 x ($24.95 – $10.00)
= 4,775,000		= $5,071,000
	$296,000 U	

26–17. (continued)

b. Mix and quantity variances

Flexible Budget	*Mix Variance*		*Quantity Variance*	*Master Budget*
(SP – SV) x AQ		(SP – SV) x ASQ		(SP – SV) x SQ
300,000 x ($10.95 – $5.00) + 200,000 x ($24.95 – $10.00)		$500{,}000 \times \frac{400{,}000}{580{,}000} \times (\$10.95 - \$5.00)$ $+\ 500{,}000 \times \frac{180{,}000}{580{,}000} \times (\$24.95 - \$10.00)$		400,000 x ($10.95 – $5.00) + 180,000 x ($24.95 – $10.00)
= $4,775,000	$403,448 F	= $4,371,552	$699,448 U	= $5,071,000

$296,000 U

Activity Variance

26–18. (35 min) *Materials mix and yield variances: Rosette Industries.*

a.

	Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget (Standard Allowed)*
Material A:	22,000 units x $94 = $2,068,000	$132,000 F	22,000 units x $100 = $2,200,000	$200,000 U	10 x 2,000 units x $100 = $2,000,000
Material B:	38,000 units x $152 = $5,776,000	$76,000 U	38,000 units x $150 = $5,700,000	$300,000 F	20 x 2,000 units x $150 = $6,000,000
Total variances		$56,000 F		$100,000 F	

26–18. (continued)

b.

	Actual Inputs at Standard Prices	*Mix Variance*	*SP x ASQ*	*Yield Variance*	*Flexible Budget*
Material A	22,000 units x $100 = $2,200,000	$200,000 U	1/3[a] x 60,000[b] units x $100 = $2,000,000	$ –0–	10 x 2,000 x $100 = $2,000,000
Material B	38,000 units x $150 = $5,700,000	$300,000 F	2/3[a] x 60,000[b] units x $150 = $6,000,000	$ –0–	20 x 2,000 x $150 = $6,000,000
		$100,000 F		$ –0–	
			$100,000 F		

[a] Proportions: Material A: 10/(10 + 20) = 1/3 Material B: 20/(10 + 20) = 2/3

[b] Total units used: 22,000 + 38,000 = 60,000 units

26–19. (20 min.) *Sales price and activity variances: Chapman, Krueger, and Pollock.*

Actual (AP – SV) x AQ	*Price Variance*	*Flexible Budget* (SP – SV) x AQ	*Activity Variance*	*Master Budget*
$2,150,000 – ($130 x 8,000)[a] + $2,225,000 – ($35 x 34,000) = $1,110,000 + $1,035,000 = $2,145,000		($275 – $130) x 8,000 + ($65 – $35) x 34,000 = $1,160,000 + $1,020,000 = $2,180,000		($275 – $130) x 8,500 + ($65 – $35) x 34,650 = $1,232,500 + $1,039,500 = $2,272,000
	$35,000 U		$92,000 U	

[a] (AP – SV) x AQ equals (AP x AQ) – (SV x AQ), which equals $2,150,000 – ($130 x 8,000).

26–20. (25 min.) *Sales mix and quantity variances: Chapman, Krueger, and Pollock.*

Flexible Budget (SP – SV) x AQ	(SP – SV) x ASQ	*Master Budget* (SP – SV) x SQ
	(\$145 x $\frac{8,500}{43,150}$ x 42,000)	
(8,000 x 145) + (34,000 x \$30)	+ (\$30 x $\frac{34,650}{43,150}$ x 42,000)	(8,500 x \$145) + (34,650 x \$30)
= \$2,180,000	= \$2,211,448*	= \$2,272,000

$31,448 U

Mix Variance

$60,552U

Quantity Variance

$92,000 U

Activity Variance

*Alternative calculation:

Weighted-average contribution:

$$\frac{\$2,272,000}{8,500 \text{ hrs.} + 34,650 \text{ hrs.}} = \$52.653534$$

42,000 x \$52.6535 = \$2,211,448

26–21. (35 min.) *Labor mix and yield variances: Speedy Burrito.*

a.

	Actual Costs	*Price Variance*	*Actual Inputs at Standard Prices*	*Efficiency Variance*	*Flexible Budget (Standard Allowed)*
Skilled Labor	$17,500	$1,040 F	$10.30 x 1,800 hours = $18,540	$2,060 F	$10.30 x 2,000 hours[a] = $20,600
Unskilled Labor	$33,000	$3,100 U	$6.50 x 4,600 hours = $29,900	$2,600 F	$6.50 x 5,000 hours[b] = $32,500
		$2,060 U		$4,660 F	

Note: See footnotes on page after part (b).

26–21. (continued)

b.

	Actual Inputs at Standard Prices	*Mix Variance*	*SP x ASQ*	*Yield Variance*	*Flexible Budget (Standard Allowed)*
Skilled Labor	$10.30 x 1,800 hours = $18,540	$294 F	$10.30 x 4/14 x 6,400 hours[c] = $18,834	$1,766 F	$10.30 x 2,000 hours = $20,600
Unskilled Labor	$6.50 x 4,600 hours = $29,900	$186 U	$6.50 x 10/14 x 6,400 hours[c] = $29,714	$2,786 F	$6.50 x 5,000 hours = $32,500
		$108 F		$4,552 F	
			$4,660 F		

Note: See footnotes on next page.

26–21. (continued)

[a] The flexible budget hours are calculated as follows:

4 minutes per equivalent meal x 30,000 equivalent meals = 120,000 minutes or 2,000 hours

An alternative method of calculation is to determine the cost per equivalent meal:

$$\left(\frac{\text{4 minutes per meal}}{\text{60 minutes per hour}}\right) \text{ x \$10.30 per hour = \$.6867 per equivalent meal}$$

$$\text{\$.6867 x 30,000 meals} = \underline{\underline{\text{\$20,600}}}$$

[b] 10 minutes per equivalent meal x 30,000 equivalent meals = 300,000 minutes = 5,000 hours

The alternative method:

$$\left(\frac{\text{10 minutes}}{\text{60 minutes}}\right) \text{ x \$6.50 = \$1.0833 per equivalent meal}$$

$$\text{\$1.0833 x 30,000 equivalent meals} = \underline{\underline{\text{\$32,500}}}$$

[c] Total hours: 1,800 + 4,600 = 6,400 hours.

Proportions:

Skilled: $\frac{\text{4 min.}}{\text{4 min. + 10 min.}} = \frac{4}{14}$

Unskilled: $\frac{\text{10 min.}}{\text{4 min. + 10 min.}} = \frac{10}{14}$

Solutions to Problems

26–22. (30 min.) *Revenue analysis using industry data and multiple product lines: In-n-Out Carpet Co.*

a. Sales price and activity variances.

(AP – SV) x AQ		*Flexible budget* (SP – SV) x AQ		*Master budget* (SP – SV) x SQ
$5,810 – $4,575[b] = $1,235		(800 x $.30[a]) + (1,000 x $.40) + (2,100 x $.35) = $1,375		$6,000 – $4,600 = $1,400
	$140 U Sales price variance		$25 U Sales activity variance	

---

[a] Unit contribution margins calculated from master budget panel as follows:

Unit margin = Contribution margin/Sales units.

[b] $$\left[800 \text{ x } \frac{\$700}{1{,}000}\right] + \left[1{,}000 \text{ x } \frac{\$1{,}600}{1{,}000}\right] + \left[2{,}100 \text{ x } \frac{\$2{,}300}{2{,}000}\right]$$

b. Two solutions are possible when calculating the market share variance, depending upon the figure used for the left column. The examples in the text use the flexible budget amount. However, those examples involve only one product, whereas this problem has two products, and therefore a mix issue is present. In this situation, another way to solve the problem would be to use the standard price times the actual quantities at the standard mix. Both alternatives are given on the following page.

26–22. (continued)

b. (continued)
Contribution margin variance

Actual Quantities at Standard Mix and Standard Prices
$1,365[a]

Industry Effect
$\frac{38,000}{40,000} \times \$1,400 = \$1,330$

Master Budget
$1,400

$35 F
Market Share Variance

$70 U
Industry Variance

$35 U
Quantity Variance

Flexible Budget
$1,375

Industry Effect
$1,330

Master Budget
$1,400

$45 F

$70 U

$25 U
Activity Variance

The $10 difference in the market share variance is explained by the difference in the mix.

$$^{a}\left(3,900 \times \frac{1,000}{4,000} \times \frac{\$300}{1,000}\right) + \left(3,900 \times \frac{1,000}{4,000} \times \frac{\$400}{1,000}\right) + \left(3,900 \times \frac{2,000}{4,000} \times \frac{\$700}{2,000}\right) = \underline{\underline{\$1,365}}$$

A shortcut is to multiply the actual number of rolls times the average contribution margin per roll in the master budget. 3,900 rolls x ($1,400/4,000 rolls) = $1,365.

26–23. (20 min.) *Sales mix and quantity variances: In-n-Out Carpet Co.*

Flexible Budget *(SP – SV) x AQ*	*Mix Variance*	*(SP – SV) x ASQ*	*Quantity Variance*	*Master Budget* *(SP – SV) x SQ*
(800 x $.30)		$\left(3{,}900 \text{ x } \frac{1{,}000}{4{,}000} \text{ x } \$.30\right)$		(1,000 x $.30)
+ (1,000 x $.40)		+ $\left(3{,}900 \text{ x } \frac{1{,}000}{4{,}000} \text{ x } \$.40\right)$		+ (1,000 x $.40)
+ (2,100 x $.35)		+ $\left(3{,}900 \text{ x } \frac{2{,}000}{4{,}000} \text{ x } \$.35\right)$		+ (2,000 x $.35)
= $1,375		= $1,365		= $1,400
	$10 F		$35 U	
		$25 U Activity Variance		

26–24. (20 min.) *Sales price, industry volume, and mix variances: Sea Air Airlines.*

Actual Price, Standard Variable Cost, Actual Quantity (AP – SV) x AQ	*Flexible Budget*	*Industry Adjusted Budget*	*Master Budget*
43 million x (30.3¢ – 10¢) = $8.729 million	43 million x 20¢ = $8.6 million	(40 million x 20¢) x 1.07 = $8.56 million	40 million x 20¢ = $8 million

$.129 million F
Price variance

$.04 million F
Market share variance

$.560 million F
Industry variance[a]

$.600 million F
Activity variance

[a] From another perspective, the seven percent industry improvement translates into $.560 million favorable variances (7% x $8 million master budget = $.560 million).

26–25. (30 min.) *Sales price, mix and quantity variances: Eccentric Inc.*

	(AP – SV) x AQ	*Price Variance*	*Flexible Budget*	*Mix Variance*	*SP x ASQ*	*Quantity Variance*	*Master Budget*
Product AR-10:	$ 7,560 – $3,360[a]		2,800 x $1.80[b]		8,400 x .25[c] x $1.80		$1.80 x 2,000
Product ZR-7:	+ $11,760 – $5,600[a]		+ 5,600 x $1.00[b]		+ 8,400 x .75[c] x $1.00		+ $1 x 6,000
Total:	= $10,360		= $10,640		= $10,080		= $9,600
		$280 U		$560 F		$480F	
					$1,040 F Activity Variance		

---

[a] Standard variable cost per unit times actual volume:

AR-10: $\frac{\$2,400}{2,000}$ x 2,800 = $3,360.

ZR-7: $\frac{\$6,000}{6,000}$ x 5,600 = $5,600.

[b] Contribution margins:

AR-10: $1.80 = $\frac{\$6,000 – 2,400}{2,000}$.

ZR-7: $1.00 = $\frac{\$12,000 – 6,000}{6,000}$.

[c] Budgeted mix:

AR-10: .25 = $\frac{2,000}{8,000}$.

ZR-7: .75 = $\frac{6,000}{8,000}$.

26–26. (30 min.) *Materials mix and yield variances: Duo Co.*

	Actual Cost (AP x AQ)	*Price Variance*	*Actual Inputs at Standard Prices (SP x AQ)*	*Mix Variance*	*SP x ASQ*	*Yield Variance*	*Flexible Budget (SP x SQ)*
Maxan	$17,384	$424 U	$2 x 8,480 gallons = $16,960	$249.60 U	$2 x 52,220[d] gallons x $\frac{100}{625}$ = $16,710.40	$710.40 U	$2 x 8,000[a] gallons = $16,000
Salex	$17,640	$1,260 F	$.75 x 25,200 gallons = $18,900	$100.80 U	$.75 x 52,220 gallons x $\frac{300}{625}$ = $18,799.20	$799.20 U	$.75 x 24,000[b] gallons = $18,000
Cralyn	$16,686	$1,854 F	$1 x 18,540 gallons = $18,540	$259.20 F	$1 x 52,220 gallons x $\frac{225}{625}$ = $18,799.20	$799.20 U	$1 x 18,000[c] gallons = $18,000
Total Variances		$2,690 F		$91.20 U		$2,308.80 U	
				$2,400 U Efficiency Variance			

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[a] (40,000 gal. ÷÷ 500 gal.) x 100 gal. = 8,000 gal.

[b] (40,000 gal. ÷÷ 500 gal.) x 300 gal. = 24,000 gal.

[c] (40,000 gal. ÷÷ 500 gal.) x 225 gal. = 18,000 gal.

[d] 52,220 gal. = 8,480 + 25,200 + 18,540

26–27. (30 min.) *Labor mix and yield variances: Rock Solid Engineering.*

Actual	*Price*	*Actual Inputs at Standard Prices*	*Mix*	*SP x ASQ*	*Yield*	*Flexible Budget*
(550 x $8.50) + (650 x $7.50) + (375 x $5.40) = $11,575		(550 x $8) + (650 x $7) + (375 x $5) = $10,825		1,575 x 1/3 x $8 + 1,575 x 1/3 x $7 + 1,575 x 1/3 x $5 = $10,500		500 x $8 + 500 x $7 + 500 x $5 = $10,000
	$750 U		$325 U		$500 U	
				$825 U		

26–28. (30 min.) *Contribution margin variances: Paulette Division.*

Revenue minus standard variable manufacturing costs by product:

	(AP – SV) x AQ	*Price*	*Flexible Budget*	*Mix*	*(SP – SV) x ASQ*	*Quantity*	*Master Budget*
Plastic	$150,000[a]		$120,000[c]				$100,000
Metal	100,000[b]		100,000[d]		$240,000[e]		125,000
Variable Marketing Costs:[f]	(55,800)		(54,000)		(64,000)		(52,500)
Contribution Margin	$194,200		$166,000		$176,000		$172,500
		$28,200 F[g] Price Variance		$10,000 U Mix Variance		$3,500 F Quantity Variance	
					$6,500 U Activity Variance		

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[a] $630,000 – $480,000.

[b] $300,000 – $200,000.

[c] 60,000 units x $\left(\text{budgeted contribution margin of \$2} \left(= \frac{\$500{,}000 - 400{,}000}{50{,}000 \text{ budgeted units}}\right)\right)$

[d] 20,000 units x $\left(\text{budgeted contribution margin of \$5} \left(= \frac{\$375{,}000 - 250{,}000}{25{,}000 \text{ budgeted units}}\right)\right)$

[e] $240,000 = ($2 x 50,000/75,000 x 80,000) + ($5 x 25,000/75,000 x 80,000)

[f] Based on six percent of sales dollars. $55,800 = .06 ($630,000 + $300,000). $54,000 = .06 [($10 x 60,000) + ($15 x 20,00)]. $64,000 = .06 [($10 x 25,000/75,000 x 80,000) + ($15 x 50,000/75,000 x 80,000)], etc.

[g] $30,000 revenue price variance for the Plastic Model minus six percent variable marketing costs.

26–29. (20 min.) *Analyze industry effects on contribution margins: Paulette Division.*

Flexible Budget		*Budget adjusted for 10% industry increase*		*Master Budget*
$166,000[a]		$172,500 x 1.1 = $189,750		$172,500[a]
	$23,750 U Market Share Variance		$17,250 F Industry Variance	
		$6,500 U Activity variance		

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[a] From Problem 26-28.

Solutions to Integrative Case

26–30. (60 min.) *Comprehensive review of variances, mix variances, analysis of differences between budget and actual: Sip-Fizz Bottling Co.*

a.

	Actual		Budget	
Revenues:				
48 oz	(80,000 x $5.40)	$432,000	(70,000 x $5.40)	$378,000
12 oz	(50,000 x $4.35)	217,500	(60,000 x $4.35)	261,000
10 oz	(120,000 x $2.80)	336,000	(110,000 x $2.80)	308,000
Total		$985,500		$947,000
Variable Manufacturing Costs:				
48 oz	(80,000 x $3.125)	$250,000	(70,000 x $2.98)	$208,600
12 oz	(50,000 x $2.75)	137,500	(60,000 x $2.65)	159,000
10 oz	(120,000 x $1.23)	147,600	(110,000 x $1.15)	126,500
Total		$535,100		$494,100
Variable Marketing Costs:				
48 oz	(80,000 x $0.16)	$ 12,800	(70,000 x $0.16)	$ 11,200
12 oz	(50,000 x $0.22)	11,000	(60,000 x $0.22)	13,200
10 oz	(120,000 x $0.17)	20,400	(110,000 x $0.17)	18,700
Total		44,200		43,100
Fixed Costs		182,000		175,000
Total Costs		761,300		712,200
Operating Profit		$224,200		$234,800

26–30. (continued)

b. Variance computations (analysis runs across this page and the next page)

	Actual	*Price Variance*	*Flexible Budget*
Revenues	80,000 x $5.40 + 50,000 x $4.35 + 120,000 x $2.80 = $985,500	-0-	$985,500
Variable Costs	80,000 x ($3.125 + .16) + 50,000 x ($2.75 + .22) + 120,000 x ($1.23 + .17) = $579,300	$26,200 U	80,000 x $3.14 + 50,000 x $2.87 + 120,000 x $1.32 = $553,100
Fixed Costs	$182,000	$7,000 U	$175,000

Reconciliation

Actual operating profit	$224,200
Plus:	
Unfavorable revenue mix variance	958
Unfavorable price variance (variable costs)	26,200
Unfavorable quantity variance (variable costs)	22,383
Unfavorable price variance (fixed costs)	7,000
Less:	
Favorable revenue quantity variance	(39,458)
Favorable mix variance (variable costs)	(6,483)
Budgeted operating profit	$234,800

26–30. (continued)

b. (continued)

Mix Variance	SP x ASQ	Quantity Variance	Master Budget
	$250{,}000 \times \frac{70{,}000}{240{,}000} \times \$5.40$ $+\ 250{,}000 \times \frac{60{,}000}{240{,}000} \times \$4.35$ $+\ 250{,}000 \times \frac{110{,}000}{240{,}000} \times \$2.80$ $= \$986{,}458$		$70{,}000 \times \$5.40$ $+\ 60{,}000 \times \$4.35$ $+110{,}000 \times \$2.80$ $= \$947{,}000$
$958 U		$39,458 F	
	$250{,}000 \times \frac{70{,}000}{240{,}000} \times \$3.14$ $+\ 250{,}000 \times \frac{60{,}000}{240{,}000} \times \$2.87$ $+\ 250{,}000 \times \frac{110{,}000}{240{,}000} \times \$1.32$ $= \$559{,}583$		$70{,}000 \times \$3.14$ $+\ 60{,}000 \times \$2.87$ $+110{,}000 \times \$1.32$ $= \$537{,}200$
$6,483 F[a]		$22,383 U	
		$175,000	

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[a] Do not confuse this mix variance with the mix variance calculated for manufacturing costs. That variance measured the changes in costs incurred because of a change in the mix of inputs, such as substituting one labor class for another. This mix variance measures changes in costs incurred because of a change in the mix of outputs, such as increasing the number of 10 ounce bottles sold.

26–30. (continued)

b. (continued)

Alternative Solution

	Actual	*Sales Price Variance*	*Manufacturing Cost Variance*	*Marketing and Administrative Variance*	*Flexible Budget*	*Mix Variance*	*Actual Quantities at Standard Mix and Standard Price*	*Quantity Variance*	*Master Budget*
Revenue[a]	$985,500	-0-			$985,500	$ 958 U	$986,458	$39,458 F	$947,000
Variable Costs:									
Manufacturing	535,100[b]		$26,200 U		508,900[c]	5,787 F	514,687[d]	20,587 U	494,100[e]
Marketing and Administrative	44,200[f]			-0-	44,200[f]	696 F	44,896[g]	1,796 U	43,100[h]
Total Variable Costs	579,300		26,200 U		553,100	6,483 F	559,583	22,383 U	537,200
Contribution Margin	406,200	-0-	26,200 U	-0-	432,400	5,525 F	426,875	17,075 F	409,800
Fixed Costs	182,000		7,000 U[i]		175,000	—	175,000	—	175,000
Operating Profit	$224,200	-0-	$33,200 U	-0-	$257,400	$5,525 F	$251,875	$17,075 F	$234,800

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[a] calculated the same way as in the primary solution to requirement b.

[b] (80,000 x $3.125) + (50,000 x $2.75) + (120,000 x $1.23)

[c] (80,000 x $2.98) + (50,000 x $2.65) + (120,000 x $1.15)

[d] $250{,}000 \times \left[\left(\frac{70{,}000}{240{,}000} \times \$2.98\right) + \left(\frac{60{,}000}{240{,}000} \times \$2.65\right) + \left(\frac{110{,}000}{240{,}000} \times \$1.15\right)\right]$

[e] (70,000 x $2.98) + (60,000 x $2.65) + (110,000 x $1.15)

[f] (80,000 x $.16) + (50,000 x $.22) + (120,000 x $.17)

[g] $250{,}000 \times \left[\left(\frac{70{,}000}{240{,}000} \times \$.16\right) + \left(\frac{60{,}000}{240{,}000} \times \$.22\right) + \left(\frac{110{,}000}{240{,}000} \times \$.17\right)\right]$

[h] (70,000 x $.16) + (60,000 x $.22) + (110,000 x $.17)

[i] insufficient information is given to classify this as a manufacturing cost variance or a marketing and administrative variance.