

# CHAPTER 1

## BASIC COST MANAGEMENT CONCEPTS

### DISCUSSION QUESTIONS

1. An accounting information system is a system consisting of interrelated manual and computer parts, using processes such as collecting, recording, classifying, summarizing, analyzing, and managing data to provide output information to users.
2. The financial accounting information system is primarily concerned with producing outputs for external users using well-specified economic events as inputs and processes that meet certain rules. The cost management system, on the other hand, produces outputs for internal users, and the criteria that govern inputs and processes are directly related to management objectives. As a result, the cost management system is more flexible than the financial system.
3. The three broad objectives of a cost management information system are: (1) to cost out products, services, and other cost objects; (2) to provide information for planning and control; and (3) to provide information for decision making.
4. A cost object is anything for which costs are measured and assigned. Examples include activities, products, plants, and projects.
5. An activity is a basic unit of work performed within an organization. Examples include materials handling, inspection, purchasing, billing, and maintenance.
6. A direct cost is a cost that can be easily and accurately traced to a cost object. An indirect cost is a cost that cannot be easily and accurately traced to cost objects.
7. Traceability is the ability to assign a cost directly to a cost object in an economically feasible way using physical observation or a causal relationship.
8. Allocation is the assignment of indirect costs to cost objects based on convenience or assumed linkages.
9. Driver tracing uses drivers based on a causal relationship to trace costs to cost objects. Often, this means that costs are first traced to activities using resource drivers and then to cost objects using activity drivers.
10. Tangible products are goods that are made by converting raw materials into a final product through the use of labour and capital inputs.
11. A service is a task or activity performed for a customer or an activity performed by a customer using an organization's products or facilities. Services differ from tangible products on three important dimensions: intangibility, perishability, and inseparability. Intangibility means that buyers of services cannot see, feel, taste, or hear a service before it is bought. Perishability means that services cannot be stored. Inseparability means that producers of services and buyers of services must be in direct contact (not true for tangible products).
12. The three cost elements are direct materials, direct labour, and overhead.
13. The income statement for a service firm does not need a supporting cost of goods manufactured schedule. Since services cannot be stored, the cost of services produced equals the cost of services sold (not necessarily true for a manufacturing firm).

## CORNERSTONE EXERCISES

### Cornerstone Exercise 1–1

1. Unit prime cost
  - = (Direct materials + Direct labour)/Units
  - = (\$300,000 + \$90,000)/150,000
  - = \$2.60
2. Unit conversion cost
  - = (Direct labour + Variable overhead + Fixed overhead)/Units
  - = (\$90,000 + \$45,000 + \$420,000)/150,000
  - = \$3.70
3. Unit variable product cost
  - = (Direct materials + Direct labour + Variable overhead)/Units
  - = (\$300,000 + \$90,000 + \$45,000)/150,000
  - = \$2.90
4. Unit product cost
  - = (Direct materials + Direct labour + Variable overhead + Fixed overhead)/Units
  - = (\$300,000 + \$90,000 + \$45,000 + \$420,000)/150,000
  - = \$5.70
5. Total direct materials, total direct labour, and total variable overhead would all increase by 10 percent since the units increased by 10 percent and these are strictly variable costs. Total fixed overhead would remain the same. Unit prime cost would remain exactly the same  $(\$300,000 + \$90,000)(1.10)/165,000$  since both direct materials and direct labour are strictly variable, and 10 percent more units would require 10 percent more variable cost. However, unit conversion cost would decrease because of the presence of fixed costs.

New unit product cost

$$\begin{aligned} &= [(\$300,000 + \$90,000 + \$45,000)(1.10) + \$420,000]/165,000 \\ &= \$5.45 \text{ (rounded)} \end{aligned}$$

## Cornerstone Exercise 1–2

1. **Sodowsky Manufacturing Inc.**  
**Statement of Cost of Goods Manufactured**  
**For the Coming Year**

|   |                |                  |
|---|----------------|------------------|
| Direct materials                          |                |                  |
| Beginning inventory .....                 | \$ 22,400      |                  |
| Add: Purchases .....                      | <u>292,400</u> |                  |
| Materials available .....                 | \$314,800      |                  |
| Less: Ending inventory.....               | <u>14,800</u>  |                  |
| Direct materials used in production ..... |                | \$300,000        |
| Direct labour .....                       |                | 90,000           |
| Manufacturing (factory) overhead .....    |                | <u>465,000</u>   |
| Total manufacturing costs added .....     |                | 855,000          |
| Add: Beginning work in process .....      |                | 45,000           |
| Less: Ending work in process.....         |                | <u>(40,000)</u>  |
| Cost of goods manufactured .....          |                | <u>\$860,000</u> |

2. If the ending inventory of direct materials were \$2,000 higher, then the direct materials used in production would be \$2,000 smaller, the total manufacturing costs added would be \$2,000 lower, and the cost of goods manufactured would be \$2,000 lower. No other line items would be affected.

## Cornerstone Exercise 1–3

1. **Sodowsky Manufacturing Inc.**  
**Statement of Cost of Goods Sold**  
**For the Coming Year**

|  |                  |
|--|------------------|
| Cost of goods manufactured .....       | \$860,000        |
| Add: Beginning finished goods.....     | <u>25,000</u>    |
| Cost of goods available for sale ..... | 885,000          |
| Less: Ending finished goods .....      | <u>74,000</u>    |
| Cost of goods sold .....               | <u>\$811,000</u> |

2. If beginning finished goods were \$5,000 lower, then the cost of goods sold would be \$5,000 lower.

## Cornerstone Exercise 1–4

### Sodowsky Manufacturing Inc. Income Statement For the Coming Year

|                               |                  | Percent      |
|-------------------------------|------------------|--------------|
| Sales (\$7.50 × 140,000)..... | \$1,050,000      | 100.00       |
| Cost of goods sold .....      | <u>811,000</u>   | <u>77.24</u> |
| Gross margin.....             | 239,000          | 22.76        |
| Less operating expenses:      |                  |              |
| Selling expenses.....         | \$ 33,000        |              |
| Administrative expenses ..... | <u>145,000</u>   | <u>16.95</u> |
| Operating income.....         | <u>\$ 61,000</u> | <u>5.81</u>  |

2. If the cost of goods sold has been 80 percent of sales for the past few years, managers would probably be pleased. Clearly, the cost of goods sold has decreased by about 2.76 percent, and this would be reflected in higher profit. Managers should investigate to see why the decrease occurred, making sure that it was not on account of reduced quality, and take steps to lock in the improvement in the coming year.

## Cornerstone Exercise 1–5

1. Unit prime cost  
= (Direct materials + Direct labour)/Units  
= (\$27,000 + \$472,500)/15,000  
= \$33.30
2. Unit conversion cost  
= (Direct labour + Variable overhead + Fixed overhead)/Units  
= (\$472,500 + \$15,000 + \$18,000)/15,000  
= \$33.70
3. Unit variable services production cost  
= (Direct materials + Direct labour + Variable overhead)/Units  
= (\$27,000 + \$472,500 + \$15,000)/15,000  
= \$34.30
4. Unit services production cost  
= (Direct materials + Direct labour + Variable overhead + Fixed overhead)/Units  
= (\$27,000 + \$472,500 + \$15,000 + \$18,000)/15,000  
= \$35.50
5. Since office rent is a fixed cost, no variable cost would be affected, and prime cost and total variable cost stay the same. Since conversion cost includes the new higher fixed overhead, it would increase. Similarly, total unit service cost would increase as shown below.

Unit services production cost

$$= (\$27,000 + \$472,500 + \$15,000 + \$19,500)/15,000$$
$$= \$35.60$$

## Cornerstone Exercise 1–6

1.

### Happy Home Helpers Inc. Statement of Cost of Services Produced For the Coming Year

|   |               |                  |
|---|---------------|------------------|
| Direct materials                            |               |                  |
| Beginning inventory .....                   | \$ 4,000      |                  |
| Add: Purchases .....                        | <u>25,600</u> |                  |
| Materials available .....                   | 29,600        |                  |
| Less: Ending inventory.....                 | <u>2,600</u>  |                  |
| Direct materials used in production.....    |               | \$ 27,000        |
| Direct labour.....                          |               | 472,500          |
| Cleaning overhead .....                     |               | <u>33,000</u>    |
| Total services production costs added ..... |               | 532,500          |
| Add: Beginning work in process* .....       |               | 0                |
| Less: Ending work in process.....           |               | <u>(0)</u>       |
| Cost of services produced.....              |               | <u>\$532,500</u> |

\*The beginning and ending work-in-process amounts could clearly be eliminated. They are shown here to reinforce the concept that for this firm, with no work in process, total services production cost equals cost of services produced.

2. If purchases of direct materials increased to \$30,000, and materials inventories remained unchanged, then the direct materials used in production, the total services production costs added, and the cost of services produced would all increase by \$4,400 (\$30,000 – \$25,600).

## Cornerstone Exercise 1–7

1. **Happy Home Helpers Inc.**  
**Statement of Cost of Services Sold**  
**For the Coming Year**

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|                                      |                  |
|--------------------------------------|------------------|
| Cost of services produced.....       | \$532,500        |
| Add: Beginning finished goods* ..... | 0                |
| Less: Ending finished goods .....    | <u>(0)</u>       |
| Cost of services sold .....          | <u>\$532,500</u> |

\*The beginning and ending finished goods amounts could clearly be eliminated. They are shown here to reinforce the concept that for this firm, with no finished goods inventory, total cost of services produced equals the cost of services sold.

2. Unlike a service firm, we would expect a manufacturing firm to have beginning and ending finished goods inventory.

## Cornerstone Exercise 1–8

1. **Happy Home Helpers Inc.**  
**Income Statement**  
**For the Coming Year**

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|                               |               |                  |
|-------------------------------|---------------|------------------|
| Sales (\$45 × 15,000).....    |               | \$675,000        |
| Cost of services sold .....   |               | <u>532,500</u>   |
| Gross margin.....             |               | 142,500          |
| Less operating expenses:      |               |                  |
| Selling expenses.....         | \$22,000      |                  |
| Administrative expenses ..... | <u>53,000</u> | <u>75,000</u>    |
| Operating income.....         |               | <u>\$ 67,500</u> |

2. If the price increased to \$50, sales would be \$750,000, a \$75,000 increase. This would increase gross margin and operating income by \$75,000. The new operating income would be \$142,500.

## EXERCISES

### Exercise 1–9

1. The objective of the dishwashing system is to provide clean, germ-free dishes, glasses, and silverware. Processes include scraping uneaten food off dishes into disposal, loading the racks, washing the dishes, and unloading the racks.
2. The items are classified as follows:
  - a. Automatic dishwasher—interrelated part
  - b. Racks to hold the dirty glasses, silverware, and dishes—interrelated part
  - c. Electricity—input
  - d. Water—input
  - e. Waste disposal—interrelated part
  - f. Sinks and sprayers—interrelated parts
  - g. Dish detergent—input
  - h. Gas heater to heat water to 85 degrees Celsius—interrelated part
  - i. Conveyor belt—interrelated part
  - j. Persons 1, 2, 3, and 4—interrelated parts
  - k. Clean, germ-free dishes—outputs
  - l. Dirty dishes—inputs
  - m. Half-eaten dinner—inputs
  - n. Aprons—interrelated parts

### 3. Operational Model: Dishwashing System

| <i>Inputs:</i>    | <i>Processes:</i> | <i>Output:</i> |
|-------------------|-------------------|----------------|
| Dish detergent    | Scraping off food | Clean dishes   |
| Water             | Loading racks     |                |
| Electricity       | Washing           |                |
| Dirty dishes      | Unloading         |                |
| Half-eaten dinner |                   |                |

4. The cost management information system is similar in that it has interrelated parts: processes, objectives, inputs, and outputs. The differences are: inputs are economic events and there are users of information. The output of the cost management system produces user actions. Output can act as the basis for action or can confirm that actions already taken had the intended effects.



## Exercise 1–10

1.
  - a. Interrelated parts: Cost accounting personnel, computer, printer
  - b. Processes: Cost assignment: materials, labour, and overhead
  - c. Objectives: Costing out of products
  - d. Inputs: Direct materials, direct labour, depreciation, power, and materials handling
  - e. Outputs: Product cost report
  - f. User actions: Submission of a bid, make-or-buy decision
  
2. Operational Model: Cost Accounting System

|  |  |  |
|--|--|--|
| <i>Inputs:</i><br>Direct materials<br>Direct labour<br>Depreciation<br>Power<br>Materials handling | <i>Processes:</i><br>Cost assignment:<br>Direct materials<br>Direct labour<br>Overhead | <i>Output:</i><br>Product cost<br>Bidding decision<br>Make-or-buy decision |
|--|--|--|
  
3. The inputs consist of only production costs suggesting a traditional product cost definition.

## Exercise 1–11

- a. Direct tracing
- b. Allocation
- c. Direct tracing
- d. Direct tracing
- e. Driver tracing; potential driver—machine hours or maintenance hours
- f. Direct tracing
- g. Direct tracing
- h. Allocation
- i. Driver tracing; potential driver—number of orders
- j. Driver tracing; potential driver—number of engineering hours
- k. Allocation
- l. Driver tracing; potential driver—number of employees or direct labour hours
- m. Allocation
- n. Allocation

## Exercise 1–12

- a. *Value-chain*. This is a strategic decision and involves activities and costs throughout the entire value chain.
- b. *Operating*. At this point, the costs of design and development are sunk costs; the decision to produce should consider the costs of production, marketing, and servicing the product.
- c. *Value-chain*. The price needs to cover all product costs, including the costs of developing, selling, and servicing.
- d. *Product*. This approach is mandated for external reporting.
- e. *Value-chain*. Product mix decisions should consider all costs and the mix that is the most profitable in the long run should be selected.
- f. *Operating*. The designs should be driven by the effect they have on production, marketing, and servicing costs. Thus, the operating cost definition is the most relevant.
- g. *Product*. This approach is mandated for external reporting.
- h. *Operating*. Research and design costs are not relevant for a price decision involving an existing product. Production, marketing, and servicing costs are relevant, however.
- i. *Operating*. Any special order should cover its costs which potentially include production, marketing, and servicing costs.

### Exercise 1–13

1. Direct materials used =  $\$56,800 + \$160,200 - \$31,000 = \$186,000$

|                                  |                  |
|----------------------------------|------------------|
| 2. Direct materials.....         | \$186,000        |
| Direct labour .....              | 225,600          |
| Overhead.....                    | <u>308,400</u>   |
| Total manufacturing cost.....    | 720,000          |
| Add: Beginning WIP .....         | 34,700           |
| Less: Ending WIP.....            | <u>(29,700)</u>  |
| Cost of goods manufactured ..... | <u>\$725,000</u> |

Unit cost of goods manufactured =  $\$725,000/10,000 = \$72.50$

3. Direct labour = Product cost – Direct materials – Overhead  
=  $\$72.50 - \$18.60 - \$30.85 = \$23.05$

Prime cost = Direct materials + Direct labour  
=  $\$18.60 + \$23.05 = \$41.65$

Conversion cost = Direct labour + Overhead  
=  $\$23.05 + \$30.85 = \$53.90$

## Exercise 1–14

1. Beginning inventory + Purchases – Ending inventory = Direct materials used  
 $\$9,000 + \$143,000 - \text{Ending inventory} = \$110,000$   
Ending inventory = \$42,000

2. Units in beginning finished goods inventory =  $\$3,422 / \$11.80 = 290$

Since 8,000 units were manufactured and 290 were in beginning finished goods inventory, 8,290 units were available for sale. But 8,120 units were sold, so ending finished goods inventory is 170.

3. Cost of goods manufactured =  $\$40,000 + \$20,000 - \$18,750 = \$41,250$

4. Prime cost = \$70 = Direct materials + Direct labour  
Direct materials = \$70 – Direct labour

Conversion cost = \$84 = Direct labour + Overhead

Overhead = \$84 – Direct labour

$(\$70 - \text{Direct labour}) + \text{Direct labour} + (\$84 - \text{Direct labour}) = \$120$

Direct labour = \$34

Direct materials + Direct labour = \$70

Direct materials + \$34 = \$70

Direct materials = \$36

5. Total manufacturing costs + BWIP – EWIP = COGM

$\$446,900 + \$160,000 - \text{EWIP} = \$512,000$

EWIP = \$94,900

Prime cost + Overhead = Total manufacturing costs

$\$290,000 + \text{Overhead} = \$446,900$

Overhead = \$156,900

## Exercise 1–15

1.

### Favourite Brands Company Statement of Cost of Goods Manufactured For the Month of June

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|   |                |                  |
|---|----------------|------------------|
| Direct materials:                         |                |                  |
| Beginning inventory .....                 | \$ 34,000      |                  |
| Add: Purchases .....                      | <u>346,000</u> |                  |
| Materials available .....                 | 380,000        |                  |
| Less: Ending inventory.....               | <u>56,000</u>  |                  |
| Direct materials used in production ..... |                | \$324,000        |
| Direct labour .....                       |                | 78,000           |
| Manufacturing overhead .....              |                | <u>380,600</u>   |
| Total manufacturing costs added .....     |                | 782,600          |
| Add: Beginning work in process .....      |                | 24,500           |
| Less: Ending work in process.....         |                | <u>(37,500)</u>  |
| Cost of goods manufactured .....          |                | <u>\$769,600</u> |

2.

### Favourite Brands Company Statement of Cost of Goods Sold For the Month of June

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|   |                  |
|---|------------------|
| Cost of goods manufactured .....              | \$769,600        |
| Add: Beginning finished goods inventory ..... | <u>46,000</u>    |
| Cost of goods available for sale .....        | 815,600          |
| Less: Ending finished goods inventory.....    | <u>56,000</u>    |
| Cost of goods sold .....                      | <u>\$759,600</u> |

## Exercise 1–16

1. Units ending finished goods = 6,000 + 90,000 – 89,000  
= 7,000

Finished goods ending inventory = 7,000 × \$39.25\* = \$274,750

\*Since the unit cost of beginning finished goods and the unit cost of current production both equal \$39.25, the unit cost of ending finished goods must also equal \$39.25.

2. **Roundabout Shoe Company**  
**Statement of Cost of Goods Sold**  
**For the Year Ended December 31**

|  |                    |
|--|--------------------|
| Cost of goods manufactured (\$39.25 × 90,000)..... | \$3,532,500        |
| Add: Beginning finished goods inventory .....      | <u>235,500</u>     |
| Cost of goods available for sale .....             | 3,768,000          |
| Less: Ending finished goods inventory .....        | <u>274,750</u>     |
| Cost of goods sold .....                           | <u>\$3,493,250</u> |

3. **Roundabout Shoe Company**  
**Income Statement: Absorption Costing**  
**For the Year Ended December 31**

|                                    |                |                   |
|------------------------------------|----------------|-------------------|
| Sales (89,000 × \$54).....         |                | \$4,806,000       |
| Cost of goods sold .....           |                | <u>3,493,250</u>  |
| Gross margin.....                  |                | 1,312,750         |
| Less operating expenses:           |                |                   |
| Commissions (89,000 × \$2.70)..... | \$240,300      |                   |
| Advertising co-pays.....           | 236,000        |                   |
| Administrative expenses .....      | <u>183,000</u> | <u>659,300</u>    |
| Operating income.....              |                | <u>\$ 653,450</u> |

## Exercise 1–17

1.

### Lucero Company Statement of Cost of Goods Manufactured For the Year Ended December 31

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|   |                |                  |
|---|----------------|------------------|
| Direct materials:                             |                |                  |
| Beginning inventory .....                     | \$ 47,000      |                  |
| Add: Purchases .....                          | 160,400        |                  |
| Freight-in on materials .....                 | <u>830</u>     |                  |
| Materials available .....                     | 208,230        |                  |
| Less: Ending inventory.....                   | <u>17,000</u>  |                  |
| Direct materials used in production.....      |                | \$191,230        |
| Direct labour.....                            |                | 206,780          |
| Manufacturing overhead:                       |                |                  |
| Materials handling.....                       | 26,750         |                  |
| Factory supplies.....                         | 37,800         |                  |
| Factory utilities.....                        | 46,000         |                  |
| Factory supervision and indirect labour ..... | <u>190,000</u> |                  |
| Total overhead costs .....                    |                | <u>300,550</u>   |
| Total manufacturing costs added .....         |                | 698,560          |
| Add: Beginning work in process .....          |                | 201,000          |
| Less: Ending work in process.....             |                | <u>(98,000)</u>  |
| Cost of goods manufactured .....              |                | <u>\$801,560</u> |

2.

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

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|   |                  |
|---|------------------|
| Cost of goods manufactured .....              | \$801,560        |
| Add: Beginning finished goods inventory ..... | <u>18,000</u>    |
| Cost of goods available for sale .....        | 819,560          |
| Less: Ending finished goods inventory.....    | <u>62,700</u>    |
| Cost of goods sold .....                      | <u>\$756,860</u> |

## Exercise 1–18

|   |                 |
|---|-----------------|
| 1. Beginning inventory, materials .....   | \$ 1,050        |
| + Purchases .....                         | 11,450          |
| – Ending inventory, materials .....       | <u>(950)</u>    |
| Materials used in service provision ..... | <u>\$11,550</u> |

2. Prime cost = \$11,550 + \$5,570 = \$17,120

3. Conversion cost = \$5,570 + \$8,130 = \$13,700

|                          |                 |
|--------------------------|-----------------|
| 4. Direct materials..... | \$11,550        |
| Direct labour .....      | 5,570           |
| Overhead.....            | <u>8,130</u>    |
| Cost of services .....   | <u>\$25,250</u> |

5. **Send ‘n’ Deliver  
Income Statement  
For the Month Ended May 31**

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|                                      |                 |
|--------------------------------------|-----------------|
| Sales revenues .....                 | \$36,100        |
| Cost of services sold .....          | <u>25,250</u>   |
| Gross margin.....                    | 10,850          |
| Operating expenses:                  |                 |
| Advertising .....                    | (750)           |
| Franchise fee (0.05 × \$36,100)..... | (1,805)         |
| Other administrative expenses .....  | <u>(3,650)</u>  |
| Operating income.....                | <u>\$ 4,645</u> |

6. Clearly, the rent, insurance, and utilities are indirect costs. No matter how many packages Janine and her workers package and send off for delivery, the rent, utilities, and insurance will be the same. The amount paid to UPS and FedEx, however, for the package delivery is a direct cost. This amount, which is collected by Send ‘n’ Deliver, is a direct cost of each package. It will change from month to month according to the number and type of packages that customers drop off.



### Exercise 1–19

1. Shelly is interested in the manufacturing costs of Glaxane. In particular, the costs of direct materials, direct labour, and overhead will be calculated to budget for Glaxane production.
2. Leslie will be concerned with all costs along the value chain. Clearly, the after-sale costs will be an important factor in pricing since the potential for fatal side effects will lead to both lawsuits and the withdrawal of Glaxane from the market. However, Leslie must also be concerned with the costs of research, development, and production since pharmaceutical companies attempt to link all of these costs to a drug to justify their pricing strategies.
3. Dante will be primarily concerned with the overall research and development costs and the eventual revenue from the successful drugs. Any individual potential drug can turn out to have no value as long as some drug projects are successful and can justify the total efforts.

### Exercise 1–20

1. Direct materials used =  $\$59,000 + \$125,000 - \$27,500 = \$156,500$

|                                      |                  |
|--------------------------------------|------------------|
| 2. Direct materials.....             | \$156,500        |
| Direct labour .....                  | 320,000          |
| Overhead.....                        | <u>490,000</u>   |
| Total manufacturing cost.....        | 966,500          |
| Add: Beginning work in process ..... | 13,000           |
| Less: Ending work in process.....    | <u>(14,500)</u>  |
| Cost of goods manufactured .....     | <u>\$965,000</u> |

Unit cost of goods manufactured =  $\$965,000/50,000 = \$19.30$

3. Direct labour per unit =  $\$19.30 - \$3.20 - \$9.80 = \$6.30$   
Prime cost =  $\$3.20 + \$6.30 = \$9.50$   
Conversion cost =  $\$6.30 + \$9.80 = \$16.10$

### Exercise 1–21

|   |                  |
|---|------------------|
| 1. Cost of goods manufactured .....           | \$965,000        |
| Add: Beginning finished goods inventory ..... | 34,000           |
| Less: Ending finished goods inventory .....   | <u>(70,100)</u>  |
| Cost of goods sold.....                       | <u>\$928,900</u> |

2.

**Tremblay Company**  
**Income Statement**  
**For the Year Ended December 31**

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|   |                   |
|---|-------------------|
| Sales .....                                     | \$1,320,000       |
| Cost of goods sold .....                        | <u>928,900</u>    |
| Gross margin.....                               | 391,100           |
| Less: Selling and administrative expenses ..... | <u>204,600</u>    |
| Operating income.....                           | <u>\$ 186,500</u> |

## PROBLEMS

### Problem 1–22

1. Direct materials = \$124,000 + \$250,000 – \$102,000 = \$272,000

2. Prime cost = \$272,000 + \$140,000 = \$412,000

3. First, calculate total overhead cost:

|  |                         |
|--|-------------------------|
| Depreciation on factory equipment..... | \$ 45,000               |
| Depreciation on factory building ..... | 30,000                  |
| Factory insurance.....                 | 15,000                  |
| Factory property taxes.....            | 20,000                  |
| Factory utilities.....                 | 34,000                  |
| Indirect labour salaries .....         | <u>156,000</u>          |
| Total overhead .....                   | <u><u>\$300,000</u></u> |

Conversion cost = \$140,000 + \$300,000 = \$440,000

4. **Brody Company**  
**Statement of Cost of Goods Manufactured**  
**For Last Year**

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|                                      |                          |
|--------------------------------------|--------------------------|
| Direct materials.....                | \$ 272,000               |
| Direct labour .....                  | 140,000                  |
| Overhead.....                        | <u>300,000</u>           |
| Total manufacturing cost.....        | 712,000                  |
| Add: Beginning work in process ..... | 124,000                  |
| Less: Ending work in process.....    | <u>(130,000)</u>         |
| Cost of goods manufactured .....     | <u><u>\$ 706,000</u></u> |

Unit product cost = \$706,000/100,000 units = \$7.06

5. **Brody Company**  
**Statement of Cost of Goods Sold**  
**For Last Year**

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|  |                         |
|--|-------------------------|
| Cost of goods manufactured .....               | \$706,000               |
| Add: Beginning inventory, Finished goods ..... | 84,000                  |
| Less: Ending inventory, Finished goods.....    | <u>(82,000)</u>         |
| Cost of goods sold.....                        | <u><u>\$708,000</u></u> |

**Problem 1–22 (Concluded)**

6. First, compute selling expense and administrative expense:

|  |                  |
|--|------------------|
| Utilities, sales office .....                | \$ 1,800         |
| Sales office salaries .....                  | 90,000           |
| Sales commissions (\$1,200,000 × 0.05) ..... | <u>60,000</u>    |
| Selling expense .....                        | <u>\$151,800</u> |
|  |                  |
| Depreciation on headquarters building.....   | \$ 50,000        |
| Property taxes, headquarters .....           | 18,000           |
| Administrative salaries.....                 | <u>150,000</u>   |
| Administrative expense .....                 | <u>\$218,000</u> |

**Brody Company  
Income Statement  
For Last Year**

|                               |                   | Percent      |
|-------------------------------|-------------------|--------------|
| Sales .....                   | \$1,200,000       | 100.00       |
| Cost of goods sold .....      | <u>708,000</u>    | <u>59.00</u> |
| Gross margin.....             | 492,000           | 41.00        |
| Less: Operating expenses      |                   |              |
| Selling expenses.....         | \$151,800         | 12.65        |
| Administrative expenses ..... | <u>218,000</u>    | <u>18.17</u> |
| Operating income.....         | <u>\$ 122,200</u> | <u>10.18</u> |

**Problem 1–23**

**Spencer Company**  
**Statement of Cost of Goods Manufactured**  
**For the Year Ended December 31**

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|  |                  |                    |
|--|------------------|--------------------|
| 1. Direct materials:                     |                  |                    |
| Beginning inventory .....                | \$ 290,000       |                    |
| Add: Purchases .....                     | <u>2,350,000</u> |                    |
| Materials available .....                | 2,640,000        |                    |
| Less: Ending inventory .....             | <u>112,000</u>   |                    |
| Direct materials used in production..... |                  | \$2,528,000        |
| Direct labour .....                      |                  | 1,100,000          |
| Manufacturing overhead:                  |                  |                    |
| Indirect labour .....                    | 334,000          |                    |
| Depreciation, factory building .....     | 525,000          |                    |
| Depreciation, factory equipment.....     | 416,000          |                    |
| Property taxes on factory.....           | 65,000           |                    |
| Utilities, factory .....                 | 150,000          |                    |
| Insurance on factory .....               | <u>200,000</u>   | <u>1,690,000</u>   |
| Total manufacturing costs added.....     |                  | 5,318,000          |
| Add: Beginning work in process.....      |                  | 450,000            |
| Less: Ending work in process .....       |                  | <u>(750,000)</u>   |
| Cost of goods manufactured.....          |                  | <u>\$5,018,000</u> |

2. Unit cost = \$5,018,000/200,000 = \$25.09

**Problem 1–23 (Concluded)**

3.

**Spencer Company  
Income Statement: Absorption Costing  
For the Year Ended December 31**

|   |                    | Percent      |
|---|--------------------|--------------|
| Sales (191,000* × \$36) .....             | \$6,876,000        | 100.00       |
| Cost of goods sold:                       |                    |              |
| Cost of goods manufactured .....          | \$5,018,000        |              |
| Add: Beg. finished goods inventory .....  | <u>107,500</u>     |              |
| Goods available for sale .....            | 5,125,500          |              |
| Less: End. finished goods inventory ..... | <u>488,750</u>     | <u>67.43</u> |
| Gross margin.....                         | 2,239,250          | 32.57        |
| Less: Salary, sales supervisor .....      | 85,000             | 1.24         |
| Commissions, salespersons.....            | 216,000            | 3.14         |
| Advertising.....                          | 500,000            | 7.27         |
| Administrative expenses.....              | <u>390,000</u>     | <u>5.67</u>  |
| Operating income.....                     | <u>\$1,048,250</u> | <u>15.25</u> |

\*2,500 + 200,000 – 11,500 = 191,000 units sold

## Problem 1–24

1.

### Skilz-Accountants Company Statement of Cost of Goods Manufactured For the Previous Year

|   |                            |
|---|----------------------------|
| Direct materials .....                  | \$ 45,000                  |
| Direct labour .....                     | 35,000 <sup>a</sup>        |
| Manufacturing overhead .....            | <u>205,000<sup>a</sup></u> |
| Total current manufacturing costs ..... | 285,000                    |
| Add: Beginning work in process .....    | 12,500 <sup>b</sup>        |
| Less: Ending work in process .....      | <u>(2,500)<sup>b</sup></u> |
| Cost of goods manufactured .....        | <u><u>\$295,000</u></u>    |

<sup>a</sup> Conversion cost = 3 × Prime cost

$$\$240,000 = 3(\text{Direct materials} + \text{Direct labour})$$

$$\$240,000 = 3(\$45,000 + \text{Direct labour})$$

$$\text{Direct labour} = \$35,000$$

$$\text{Overhead} = \text{Conversion cost} - \text{Direct labour}$$

$$\text{Overhead} = \$240,000 - \$35,000$$

$$\text{Overhead} = \$205,000$$

<sup>b</sup> Ending WIP = 0.2 × Beginning WIP

$$\$285,000 + \text{Beginning WIP} - (0.2 \times \text{Beg. WIP}) = \$295,000$$

$$\text{Beginning WIP} = \$12,500; \text{Ending WIP} = 0.2 \times \$12,500 = \$2,500$$

2.

### Skilz-Accountants Company Statement of Cost of Goods Sold For the Previous Year

|  |                                     |
|--|-------------------------------------|
| Cost of goods manufactured .....       | \$295,000                           |
| Add: Beginning finished goods .....    | <u>14,400</u>                       |
| Cost of goods available for sale ..... | 309,400                             |
| Less: Ending finished goods .....      | <u>73,400<sup>a</sup></u>           |
| Cost of goods sold .....               | <u><u>\$236,000<sup>b</sup></u></u> |

<sup>a</sup> Ending finished goods = \$309,400 – \$236,000 = \$73,400

<sup>b</sup> Cost of goods sold = 0.80 × \$295,000 = \$236,000

## Problem 1–25

1.

### Mason, Singh, and Westbrook Statement of Cost of Services Sold For the Year Ended June 30

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|                                      |                    |
|--------------------------------------|--------------------|
| Direct materials used* .....         | \$ 46,500*         |
| Direct labour .....                  | 1,400,000          |
| Overhead .....                       | <u>100,000</u>     |
| Total service costs added .....      | 1,546,500          |
| Add: Beginning work in process ..... | 44,000             |
| Less: Ending work in process .....   | <u>(13,000)</u>    |
| Cost of services sold .....          | <u>\$1,577,500</u> |

\*Because all other data for the statement are given, you can work backward from the cost of services sold to get the direct materials used. In this type of firm, direct materials probably includes supplies such as paper, toner, file folders, and envelopes.

2. The dominant cost is direct labour (for the 15 professionals). Although labour is the major cost of providing many services, it is not always the case. For example, the dominant cost for some medical services may be overhead (e.g., CAT scans). In some services, the dominant cost may be materials (e.g., funeral services).

3.

### Mason, Singh, and Westbrook Income Statement For the Year Ended June 30

---

|                               |                |                   |
|-------------------------------|----------------|-------------------|
| Sales (3,000 × \$850).....    |                | \$2,550,000       |
| Cost of services sold .....   |                | <u>1,577,500</u>  |
| Gross margin.....             |                | 972,500           |
| Less operating expenses:      |                |                   |
| Selling expenses.....         | \$ 65,000      |                   |
| Administrative expenses ..... | <u>257,000</u> | <u>322,000</u>    |
| Operating income.....         |                | <u>\$ 650,500</u> |



## **Problem 1–25 (Concluded)**

4. Services have three attributes that are not possessed by tangible products: (1) intangibility, (2) perishability, and (3) inseparability. Intangibility means that the buyers of services cannot see, feel, hear, or taste a service before it is bought. Perishability means that services cannot be stored. Therefore, there will never be any finished goods inventories, making the cost of services produced equal to cost of services sold. Inseparability means that providers and buyers of services must be in direct contact for an exchange to take place.

The average cost of preparing one tax return last year was \$526 ( $\$1,577,500/3,000$  returns). However, it will be difficult for MSW to use this figure in budgeting. Some of its accountants are no doubt more experienced than others, capable of completing a return in less time and with less research. The returns themselves differ in complexity. In addition, the seemingly continual changes in the tax law may affect certain of its clients more than others, making those clients' returns more difficult to prepare.

## Problem 1–26

1.

### Paulisse Company Statement of Cost of Goods Manufactured For Last Year

|  |                 |                  |
|--|-----------------|------------------|
| Direct materials:                        |                 |                  |
| Beginning inventory .....                | \$ 16,200       |                  |
| Add: Purchases .....                     | 164,700*        |                  |
| Less: Ending inventory.....              | <u>(10,700)</u> |                  |
| Direct materials used in production..... |                 | \$170,200        |
| Direct labour.....                       |                 | 72,000           |
| Manufacturing overhead:                  |                 |                  |
| Plant depreciation .....                 | 9,500           |                  |
| Salary, production supervisor .....      | 45,000          |                  |
| Indirect labour .....                    | 40,600          |                  |
| Utilities, factory .....                 | 5,700           |                  |
| Depreciation, factory equipment.....     | 25,000          |                  |
| Supplies (0.4 × \$8,000).....            | <u>3,200</u>    | <u>129,000</u>   |
| Total manufacturing costs added .....    |                 | 371,200          |
| Add: Beginning work in process .....     |                 | 13,250           |
| Less: Ending work in process.....        |                 | <u>(28,250)</u>  |
| Cost of goods manufactured .....         |                 | <u>\$356,200</u> |

\*\$16,200 + Purchases – \$10,700 = \$170,200; Purchases = \$164,700

2.

### Paulisse Company Income Statement: Absorption Costing For Last Year

|   |                |                   |
|---|----------------|-------------------|
| Sales (250,000 × \$4).....                  |                | \$1,000,000       |
| Cost of goods sold:                         |                |                   |
| Beginning finished goods inventory .....    | \$113,000      |                   |
| Add: Cost of goods manufactured .....       | <u>356,200</u> |                   |
| Goods available for sale .....              | 469,200        |                   |
| Less: Ending finished goods inventory ..... | <u>85,000</u>  | <u>384,200</u>    |
| Gross margin.....                           |                | 615,800           |
| Less operating expenses:                    |                |                   |
| Administrative expenses .....               | 162,000        |                   |
| Selling expenses* .....                     | <u>119,800</u> | <u>281,800</u>    |
| Operating income.....                       |                | <u>\$ 334,000</u> |

\*\$40,000 + (0.6 × \$8,000) + \$75,000 = \$119,800

### **Problem 1–27**

At first glance, this seems simple. Couldn't John simply mention that Patty had already accepted a position as controller in another company? Since the decision was a close one between the two, this information would likely tip the balance in favour of John. However, some ethical issues should be considered. First, the information that Patty gave was likely given in confidence, and John should not disclose this confidential information without her permission. Second, disclosing the confidential information may provide a personal benefit to John. Third, it may be that Patty will change her mind about the position she has accepted (assuming she can withdraw honourably from the acceptance) once she is officially aware of the promotion. This decision and its consequences should be Patty's and not John's. If I were John, I would leave the response to the promotion entirely in Patty's hands. Once offered the position, she may simply indicate that she cannot accept it because she is committed to another job. This may then cleanly open up the position for John.

### **Problem 1–28**

1. Emily should not implement the suggested accounting procedures because they conflict with generally accepted accounting principles and violate the CMA Code of Professional Ethics. It raises serious ethical questions in the areas of competence and integrity. Emily "must act at all times with competence through devotion to high ideals of personal honour and professional integrity." She must "disclose all material facts" when preparing financial reports.
2. Emily should discuss the problem with the next highest management level (if the divisional manager's mind cannot be changed). This could be, for example, the corporate controller or the CEO. She could also discuss the matter with an objective advisor to assess possible courses of action. In some firms, ethical hotlines exist that will allow the dilemma to be analyzed. If no resolution is obtained, then resignation may be called for.

## CMA PROBLEMS

### CMA Problem 1–1

The proposed changes violate several ethical standards.

Top management's request for Larry Stewart to account for the company's information in a manner that is not in accordance with generally accepted accounting principles violates the standard to "disclose all material facts known to" Larry and "report all material misstatements or departures from generally accepted accounting principles."

Top management has violated the ethical standard of not using "any confidential information concerning the affairs of" Larry's firm "unless acting in the course of his duties."

Top management has violated the standard to "act at all times with competence through devotion to high ideals of personal honour and professional integrity." Management must "not commit an act discreditable to the profession."

To resolve the ethical dilemma, Larry should first determine if the company has an established policy. If so, he should follow the prescribed policies in resolving the ethical conflict. If there is no policy, then the specific steps are as follows:

- a. To confront top management about the unethical behaviour unless Larry feels that they are involved, in which case the problem should be presented to the next higher level, the chairman of the board of directors. If this fails, then the issue can be taken to the audit committee and the board of directors.
- b. To clarify relevant concepts by confidential discussion with an objective advisor to obtain possible courses of action.
- c. To resign and submit an informative memorandum to the chairman of the board of directors, if all levels of internal review have been exhausted and the conflict still exists.

## **CMA Problem 1–2**

By discussing the possible sale of Emery’s common stock with members of the trouble-shooting team, Gus Swanson has violated certain standards of ethical conduct.

Gus has disclosed “confidential information concerning the affairs” of the firm.

By discussing this information, Gus has engaged in a “way which may adversely reflect on the public reputation” of the firm.

Gus has violated the requirement to “not commit an act discreditable to the profession.”

## CMA Problem 1–3

1. Assuming the controller did not inform the CEO and CFO of the situation, the ethical considerations of the controller's apparent lack of action, as covered in the CMA Code of Professional Ethics, are as follows.

Management accountants have a responsibility to “disclose all material facts known” to them. The controller must “report all material misstatements or departures from generally accepted accounting principles.”

Management accountants have a responsibility to “act at all times with competence through devotion to high ideals of personal honour and professional integrity.” They should refrain from engaging in any activity that would prejudice their ability to carry out their duties ethically and refrain from engaging in any activity that would discredit their profession.

Management accountants have a responsibility to “not commit an act discreditable to the profession.”

2. The recommended course of action that Marian Nevins should take is as follows.

Consult company policies and procedures regarding ethical conflict. If the company does not have adequate procedures in place to resolve the conflict, then Marian should discuss the problem with her immediate superior, the controller. However, as the controller is apparently involved in the matter and she has already spoken to him, it would not be necessary to inform him that she is taking the situation to the CFO.

Since the issue is still not resolved, she should consult the next higher level of management, the CFO, particularly since he or she will be one of the signers of the representation letter.

During this process, Marian could clarify relevant concepts by confidential discussion with an objective advisor to obtain an understanding of possible courses of action.

If the issue remains unresolved, Marian should continue to take the problem to the next higher levels of authority, which may include the audit committee, executive committee, and/or the board of directors.

If the ethical conflict still exists, after exhausting all levels of internal review, Marian should resign and submit an informative memorandum to an appropriate representative of the organization.

Except where legally prescribed, communication of these issues to outsiders (the media, regulatory bodies, etc.) by Marian is not considered appropriate.

### **CMA Problem 1-3 (Concluded)**

3. The actions that Heart Health Procedures can take to improve the ethical situation within the company include:
  - Setting the tone at the top for control consciousness of the people in the organization.
  - Establishing an audit committee within the board of directors and providing an avenue for communication free of reprisals within the company.
  - Adopting performance-based, long-term financial incentive plans.

## **CHAPTER 2**

### **COST BEHAVIOUR**

Chapter 2 provides the basics of cost behaviour, focusing on expanded definitions of fixed and variable costs and introducing the concept of mixed costs. Methods of separating mixed costs into fixed and variable elements are presented and discussed. In addition, the resource usage model is presented. This chapter is an important foundation for Chapter 3, Cost-Volume-Profit Analysis.

#### **LEARNING OBJECTIVES**

After studying Chapter 2, students should be able to:

1. Define and describe fixed, variable, and mixed costs.
2. Explain the use of resources and activities and their relationship to cost behaviour.
3. Separate mixed costs into their fixed and variable components using the high-low method, the scatterplot method, and the method of least squares.
4. Evaluate the reliability of the cost formula.
5. Discuss the use of managerial judgment in determining cost behaviour.
6. Explain how multiple regression can be used to assess cost behaviour.
7. Define the learning curve, and discuss its impact on cost behaviour.

#### **KEY TOPICS**

The following major topics are covered in this chapter (related learning objectives are listed for each Topic):

1. Basics of Cost Behaviour (LO 1)
2. Resources, Capacity, and Cost Behaviour (LO 2)
3. Quantitative Methods for Separating Mixed Costs (LO 3)
4. Reliability of Cost Formulas (LO 4)
5. Methods of Determining Cost Behaviour and Managerial Judgment (LO 5)



6. Multiple Regression (LO 6)

7. The Learning Curve and Nonlinear Cost Behaviour (LO 7)

## I. BASICS OF COST BEHAVIOUR

*Cost behaviour* refers to whether a cost changes when the level of output changes. Usually costs are placed into one of four categories: fixed costs, variable costs, mixed costs, and step costs. These categories are reasonably accurate within a relevant range of activity.

*Relevant range:* The range of activity over which the assumed cost relationship is valid for the normal operations of a firm is called the relevant range. While the cost function may not be linear, we will often assume linearity because the function will appear to be linear within the relevant range.

*Fixed costs:* Fixed costs are costs that do not change in total as the activity level changes. All costs are considered to be fixed in the short run. The term “fixed cost” does not mean that the cost cannot change over time, but that a change in the activity level will not cause a change in the total cost. The duration of the short run can change depending on the cost under consideration. Total fixed costs can be described in equation format to be:

$$F = \text{Total fixed costs}$$

*Teaching hint:* Some students have a hard time with the concept of fixed cost because they equate it to “never changing.” However, their experience living in an inflationary economy is that costs do change (typically upward). Thus, they think that no cost can ever be fixed. The key point is that a fixed cost does not change because activity level changes; a fixed cost can change for other reasons. For example, a salaried supervisor could be given a raise during the year because of excellent performance or in an effort to keep him from taking a job with another firm. The increase in his salary would be a change in a fixed cost. The change was not, however, due to an increase in the level of activity.

*Variable costs:* Variable costs are costs that, in total, will vary in direct proportion to changes in activity level, which is commonly defined as some measure of production or sales activity (e.g., direct labour hours, units produced, or units sold). Activity level can refer to the level of any cost driver (e.g., setup time, number of material moves, etc.) in an activity-based costing system. Total variable costs can be described in equation format to be:

$$Y_v = VX$$

where

$Y_v$  = Total variable costs  
 $V$  = Variable cost per unit  
 $X$  = Number of units of the driver

Exhibits 2-1 and 2-2 (pp. 48–49) present the graphical presentations of a fixed cost and a variable cost.

*Teaching hint:* You might emphasize that the total variable costs increases (decreases) as activity level increases (decreases). However, variable cost per unit stays constant as activity level changes. Students often have difficulty and confuse the two.

*Mixed costs:* Costs that have both a fixed and a variable component are classified as mixed costs. A salesperson paid a salary of \$20,000 plus a commission equal to 5 percent of sales is an example of a mixed cost.

Total mixed costs can be described as:

$$Y = F + VX$$

where

$Y$  = Total cost

$F$ ,  $V$ , and  $X$  are defined previously in the chapter.

Cornerstone 2-1 (p. 51) shows how the linear equation can be used to describe a mixed cost. Exhibit 2-5 (p. 52) presents a graph of a mixed cost.

## II. RESOURCES, CAPACITY, AND COST BEHAVIOUR

Resources are economic elements that permit one to perform activities. Common resources include direct materials, direct labour, equipment, etc. Resources can be categorized as either flexible or committed.

*Flexible resources* are supplied as used and needed (e.g., direct materials).

*Committed resources* are supplied in advance of usage. These resources are acquired by the use of either an explicit or implicit contract to obtain a given quantity of resource, regardless of whether the amount of the resource available is fully used or not. Committed resources may have unused capacity (e.g., buying or leasing a building or equipment).

Activities are tasks such as setting up equipment, purchasing materials, and assembling materials. *Activity capacity* is the ability to perform activities. When a company acquires resources necessary to perform an activity, it is obtaining activity capacity. *Practical capacity* is the efficient level of activity performance.

A *step-cost function* has the property of displaying a constant level of cost for a range of activity and then jumping to a higher level of cost at some point, where it remains for a similar range of activity. A step-cost function is illustrated in Exhibit 2-6 (p. 55).

A *step-variable cost* is simply a step-cost that changes for relatively narrow ranges of activity. This type of cost is usually treated as if it were a pure variable cost because of the narrow ranges of activity.

Step-costs that have relatively wide levels of activity are known as *step-fixed costs*. The difference between step-variable and step-fixed costs is the range of activity included at each step. For example, a step-variable cost may increase for every 100 units produced, while a step-fixed cost may increase for every 10,000 units produced. A step-fixed cost is usually treated as a fixed cost. Exhibit 2-7 (p. 55) displays a step-fixed cost.

A traditional cost management system typically provides information only about the cost of the resources supplied. A contemporary cost management system provides information about how much of the activity is used and the cost of its usage.

The relationship between resources supplied and resources used is expressed by either of the following equations:

$$\text{Activity availability} = \text{Activity used (output)} + \text{Unused capacity}$$

$$\text{Cost of available activity} = \text{Cost of activity used (output)} + \text{Cost of unused activity}$$

Cornerstone 2-2 (p. 56) illustrates the way a company may determine the cost of capacity used and unused capacity.

### III. QUANTITATIVE METHODS FOR SEPARATING MIXED COSTS

To facilitate planning and decision making, managers need to know the fixed and variable components of mixed costs. The text presents three methods used to separate a mixed cost into its fixed and variable components: the high-low method, the scatterplot method, and the method of least squares.

#### A. The High-Low Method

When using the *high-low method*, the highest point and the lowest point are used for creating the cost formula. The high point is defined as the point with the *highest activity level* and the low point as the point with the *lowest activity level*. The *independent variable* should be used when selecting the highest and lowest activity levels. Always make sure that the high and low activity points are representative of the rest of the points. A scatterplot would be helpful to see whether the two points are representative of the others.

Letting  $(X_1, Y_1)$  be the low point and  $(X_2, Y_2)$  be the high point, the equations for determining the *slope parameter* and *intercept parameter* are, respectively:

$$\begin{aligned} V &= \text{Change in cost/Change in activity} \\ &= (Y_2 - Y_1)/(X_2 - X_1) \end{aligned}$$

$$\begin{aligned} F &= \text{Total mixed cost} - \text{Variable cost} \\ &= Y_2 - VX_2 \end{aligned}$$

or

$$F = Y_1 - VX_1$$

Cornerstone 2-3 (p. 59) shows how the high-low method can be used to determine the fixed cost and variable rate.

*Teaching hint:* Tell the students that the high-low method is nothing more than finding the equation of a line through two points.

### **B. Scatterplot Method**

Using the *scatterplot method*, the manager plots the observations of cost and activity level on a graph. The manager selects two points by visual inspection of the *scattergraph* and fits a line to these two points. This is accomplished by using the slope-intercept method from basic algebra. The slope is the change in cost divided by the change in activity. Once the slope is known, simply substitute the slope and the values of one of the two points into the linear cost formula ( $Y = F + VX$ ) and solve for the fixed component,  $F$  ( $F = Y - VX$ ).

Exhibit 2-8 (p. 61) presents a plot of data points, along with the graph of a line for the high-low method and a possible scattergraph line.

### **C. The Method of Least Squares**

The *method of least squares* identifies the line that best fits the data points (the sum of the squared *deviations* is minimized). This method is the most sophisticated and provides the user with a measure of the goodness of fit, which can be used to assess the usefulness of the cost formula. If the fit is not very good, then a search for additional activity variables may be needed.

### **D. Using Regression Programs**

Computing the regression formula manually is tedious and best left to a statistics course. The same program can be used for multiple regression as well. Cornerstone 2-4 (p. 64) displays how to take the results of the regression program and to use them to construct a cost formula. That cost formula can then be used to determine the predicted cost given an estimate of the independent variable.

## **IV. RELIABILITY OF COST FORMULAS**

There are two basic measures for determining the reliability of cost formulas: coefficient of determination and coefficient of correlation.

The *coefficient of determination* ( $R^2$ ) is a measure of the *goodness of fit*. It shows the percent of the variation in the dependent variable that is explained by the independent variable (or variables). The higher the percentage of variability explained, the better the fit.

The *coefficient of correlation* ( $r$ ) is the square root of the coefficient of determination. If the coefficient of correlation is positive, the independent variable and the dependent variable move together in the same direction. If it is negative, the independent variable and the dependent variable move in a predictable fashion in opposite directions.

## V. METHODS OF DETERMINING COST BEHAVIOUR AND MANAGERIAL JUDGMENT

Activities may use a mix of resources acquired in advance and resources that are acquired as needed. As a result they display mixed cost behaviour. In practice, companies use a variety of methods of estimating cost, and a variety of quantitative and statistical methods.

The *industrial engineering method* is a forward-looking method of determining, through physical observation and analysis, just what activities, in what amounts, are needed to complete a process.

The *account analysis method* is used to estimate costs by classifying accounts in the general ledger as fixed, variable, or mixed. To use the account analysis method, the accountant uses judgment and experience to separate the accounts into two categories—fixed and variable. Once the fixed categories are known, the average monthly cost can be computed, and this is the fixed amount. The variable categories need to be further separated into categories according to the driver the accountant wishes to associate with the account. Cornerstone 2-5 (p. 68) shows how the account analysis method can be used to separate fixed and variable costs, determine a cost function, and use that cost function in budgeting.

### Managerial Judgment

Managerial judgment is a simple approach to classifying costs as variable or fixed. When managers have a thorough understanding of the firm and its cost patterns, this method can give good results. If the manager has poor judgment, errors will occur. With regard to using judgment, the manager may want to: (1) consider past experience, (2) confirm results with operating personnel, and (3) use common sense to confirm statistical studies.

## VI. MULTIPLE REGRESSION

*Multiple regression* can be used to predict a cost function when there is more than one independent variable. When using a spreadsheet to perform regression analysis, multiple regression is no more difficult than simple regression that assists us to construct a cost equation.

## VII. THE LEARNING CURVE AND NONLINEAR COST BEHAVIOUR

The *learning curve* shows how the labour hours worked per unit decrease as the volume produced increases. The use of the learning curve enables management to be more accurate in budgeting and in performance evaluations for processes in which learning occurs. In order to use a learning curve model, management must estimate a learning rate for a process, usually on the basis of past experience. The learning curve model takes two common forms: (1) the cumulative average-time learning curve model, and (2) the incremental unit-time learning curve model.

The *cumulative average-time learning curve model* assumes that the cumulative average time per unit decreases by a constant percentage, or *learning rate*, each time the cumulative quantity of units produced doubles. Cornerstone 2-6 (p. 72) shows how to calculate the amount of time needed for producing successive units given the learning rate and direct labour hours for the first unit. Then, Exhibit 2-10 (p. 74) displays an Excel screenshot of the results for the cumulative average-time learning model. Exhibit 2-11 (p. 74) shows the graph of both the cumulative average time per unit (the bottom line) and the cumulative total hour's required (top line).

The *incremental unit-time learning curve model* assumes that the time necessary for production decreases by a constant percentage each time the cumulative quantity of units produced doubles.

### INFORMATION ABOUT EXERCISES, PROBLEMS, AND CASES

Exercises and problems are described on the following two pages according to coverage of content, learning objective(s), and level of difficulty. The time required to solve the problems is roughly proportional to the level of difficulty.

In general, *basic* exercises/problems are fairly simple and straightforward. The text material is relatively brief; only one or two concepts are covered. Basic exercises and problems should take about 15 to 20 minutes each.

*Moderate* exercises/problems may take longer and involve more concepts. These problems may have a “twist” and require more thought. Moderate exercises and problems may take 20 to 40 minutes each.

*Challenging* problems are more comprehensive and may cover more concepts. The text material is relatively longer and may include some ambiguity. Challenging problems may take 60 to 90 minutes each.

**Cornerstone****Exercise****(CS)/****Exercise/  
Problem****Topic****Learning  
Objective****Degree of  
Difficulty**

| <b>Exercise/<br/>Problem</b> | <b>Topic</b>  | <b>Learning<br/>Objective</b> | <b>Degree of<br/>Difficulty</b> |
|------------------------------|---|-------------------------------|---------------------------------|
| CS 2-1                       | Mixed Costs and Cost Formula  | LO 1                          | Basic                           |
| CS 2-2                       | Activity Availability, Capacity Used, Unused Capacity                           | LO 2                          | Basic                           |
| CS 2-3                       | High-Low Method to Determine Fixed Cost and Variable Rate                       | LO 3                          | Basic                           |
| CS 2-4                       | Using Regression Results to Construct and Apply a Cost Formula                  | LO 3                          | Basic                           |
| CS 2-5                       | Account Analysis to Determine Cost Behaviour                                    | LO 5                          | Basic                           |
| CS 2-6                       | Using Multiple Regression Results to Construct and Apply a Cost Formula         | LO 6                          | Basic                           |
| CS 2-7                       | Cumulative Average-Time Learning Curve  | LO 7                          | Basic                           |
| 2-8                          | Variable, Fixed, and Mixed Costs  | LO 1                          | Basic                           |
| 2-9                          | Cost Behaviour  | LO 1                          | Basic                           |
| 2-10                         | Types of Costs  | LO 1                          | Basic                           |
| 2-11                         | Resource Usage Model and Cost Behaviour   | LO 2                          | Basic                           |
| 2-12                         | Resource Usage and Supply, Activity Rates, Service Organization                 | LO 2                          | Basic                           |
| 2-13                         | Step Costs, Relevant Range  | LO 1, 2                       | Basic                           |
| 2-14                         | Account Analysis Method   | LO 5                          | Basic                           |
| 2-15                         | Account Analysis Method   | LO 5                          | Basic                           |
| 2-16                         | Scattergraph Method, High-Low Method  | LO 3                          | Basic                           |
| 2-17                         | Method of Least Squares, Goodness of Fit  | LO 3, 4                       | Moderate                        |
| 2-18                         | High-Low Method, Cost Formulas  | LO 3                          | Moderate                        |
| 2-19                         | Method of Least Squares, Evaluation of Cost Equation                            | LO 3, 4                       | Moderate                        |
| 2-20                         | Multiple Regression   | LO 6                          | Moderate                        |
| 2-21                         | Multiple Regression   | LO 6                          | Moderate                        |
| 2-22                         | Learning Curve  | LO 7                          | Moderate                        |
| 2-23                         | Learning Curve  | LO 7                          | Moderate                        |
| 2-24                         | Cost Behaviour Patterns   | LO 1, 2                       | Moderate                        |
| 2-25                         | Cost Behaviour, Resource Usage, Excess Capacity                                 | LO 1, 2                       | Moderate                        |
| 2-26                         | Cost Behaviour, High-Low Method, Pricing Decision                               | LO 1, 3                       | Moderate                        |
| 2-27                         | High-Low Method, Method of Least Squares, Correlation                           | LO 2, 3, 4                    | Moderate                        |
| 2-28                         | Cost Formulas, Single and Multiple Activity Drivers, Coefficient of Correlation | LO 1, 3, 4, 6                 | Moderate                        |
| 2-29                         | Scatterplot, High-Low Method, Regression  | LO 3, 4, 6                    | Moderate                        |
| 2-30                         | Method of Least Squares   | LO 1, 3, 4, 6                 | Moderate                        |
| 2-31                         | High-Low Method, Scatterplot, Regression  | LO 2, 3, 4, 6                 | Moderate                        |
| 2-32                         | Comparison of Regression Equations  | LO 1, 3, 4, 6                 | Challenging                     |

| <b>Cornerstone<br/>Exercise<br/>(CS)/<br/>Exercise/<br/>Problem</b> | <b>Topic</b>   | <b>Learning<br/>Objective</b> | <b>Degree of<br/>Difficulty</b> |
|---|--|-------------------------------|---------------------------------|
| 2-33  | Multiple Regression, Confidence Intervals,<br>Reliability of Cost Formulas | LO 2, 4, 6                    | Challenging                     |
| 2-34  | Learning Curve   | LO 7                          | Moderate                        |
| 2-35  | Learning Curve   | LO 7                          | Moderate                        |
| CMA 2-1   | Simple and Multiple Regression, Evaluating<br>Reliability of an Equation   | LO 2, 3, 4                    | Challenging                     |

### LIST OF ILLUSTRATIONS

| <b>Illustration</b> | <b>Topic</b>  |
|---------------------|---|
| Exhibit 2-1         | Fixed Cost Behaviour  |
| Exhibit 2-2         | Variable Cost Behaviour   |
| Exhibit 2-3         | Nonlinearity of Variable Costs  |
| Exhibit 2-4         | Relevant Range for Variable Costs   |
| Exhibit 2-5         | Mixed Cost Behaviour  |
| Exhibit 2-6         | Step-Cost Function  |
| Exhibit 2-7         | Step-Fixed Costs  |
| Exhibit 2-8         | Scattergraph for Anderson Company's Materials Handling Costs                      |
| Exhibit 2-9         | Deviations of Data from a Line  |
| Exhibit 2-10        | Spreadsheet for Cumulative Average-Time Learning Model                            |
| Exhibit 2-11        | Graph of Cumulative Total Hours Required and the Cumulative Average Time per Unit |