SECTION

2

COSTING

Chapters 3 to 8

Chapters 3 to 8 provide a comprehensive description of how costs are associated with manufacturing and other activities. In addition, these costing systems can be applied to service organizations and not-for-profit organizations. To permit costing for such specialized situations, two costing systems, job costing and process costing, can be mixed and matched.

Chapter 3 begins with the most basic and widely used costing system, *job costing*. Job costing permits costs to be assigned to specific outcomes, termed *jobs*, so that costs can be accumulated for what a company produces. In addition, manufacturing overhead, or a term often shortened to just *overhead*, is assigned by a process of averaging to determine its amount before actual overhead costs are known.

Chapter 4 introduces an averaging calculation used for costing like units, termed *process costing*. The ordering of costs learned in financial accounting, namely average and FIFO, can be applied. The idea of equivalent units is explained so partially finished work in progress can be counted in production. Chapter 4 also presents an elaboration of overhead methods so overhead can be disaggregated to cost objects, departments in this case, to permit more management control of overhead and more accurate costing.

Chapter 5 introduces another disaggregation of overhead and non-manufacturing costs according to the definition of a cost object as an activity and the use of a cost driver. By doing this, overhead costing can be improved and management can focus on managing activities rather than outcomes. Given the increasing importance of overhead to some types of organizations, methods to improve the management of overhead costs are important contributions.

Chapter 6 describes the details of cost behaviour and how costs that contain a mixture of behaviours can be analyzed.

Chapter 7 takes the idea of cost behaviour and incorporates revenues to provide commonly used tools for analysis and decision, cost-volume-profit and break-even.

Chapter 8 completes the costing segment by describing variable costing. Variable costing assigns only variable manufacturing costs to production as opposed to all manufacturing costs as was described in earlier chapters under the term *absorption costing*.

Upon the completion of Chapter 8, the costing approaches are twofold, job costing and process costing. Added to these are two definitions of costs, absorption and variable. This two by two combination can be extended using departmental and activity overhead approaches to disaggregate overhead as desired by management.

CHAPTER

3

LEARNING OBJECTIVES

After studying Chapter 3, you should be able to:

1. Distinguish between process costing and job-order costing and identify companies that would use each costing method.
2. Identify the documents used in a job-order costing system.
3. Compute predetermined overhead rates and explain why estimated overhead costs (rather than actual overhead costs) are used in the costing process.
4. Record the journal entries that reflect the flow of costs in a job-order costing system.
5. Apply overhead cost to Work in Process using a predetermined overhead rate.
6. Prepare schedules of cost of goods manufactured and cost of goods sold.
7. Compute under- or overapplied overhead cost and prepare the journal entry to close the balance in Manufacturing Overhead to the appropriate accounts.
8. (Appendix 3A) Explain the implications of basing the predetermined overhead rate on activity at capacity rather than on estimated activity for the period.

SYSTEMS DESIGN: JOB-ORDER COSTING

BUSINESS FOCUS

A Stringing Success

Cris Griffiths Guitar Works of Saint John's, Newfoundland, focuses on repair work and building custom guitars. Late one night while disassembling yet another guitar, Griffiths had a vision of a single bracing piece instead of the three-dozen separate internal reinforcements acoustic guitars typically have. "It was a simple idea that was easy to flesh out, but turning it from an idea into a corporation was a pretty lengthy process," he recalls. "I often say it took me six minutes to come up with the idea and six years to make it work."

Part of the problem was that using wood to make a one-piece brace was pretty much out of the question. It would take years to whittle down a wood block into a single piece, but Griffiths realized a composite material that could be punched out using injection-molding equipment could perform the same trick. Again, simple enough to conceive but it took three years before he had a solid business plan he could present to investors. Even then, Griffiths didn't have the $100,000 he needed to build a prototype, so he leveraged his existing business to the hilt, effectively putting the future of both companies on the line. Eventually, he convinced investors to pony up some seed money and he hit the road. At a Los Angeles trade show in early 2000, his guitar—lo and behold—was a hit, attracting lineups of people wanting to check out the new star.

Production started in mid-2001 and roughly $6 million was invested in the business over the next three years to keep it rolling. In 2003 the company switched to a lean manufacturing operation called the Toyota production system. That has meant a 50% cut in labour costs and manufacturing space as well as a 70% reduction in work-in-progress inventory.

Source: Andy Holloway, "Between the Rock and a Hard Place," *Canadian Business*, Dec. 27, 2004–Jan. 16, 2005, Vol. 78, Iss. 1, p. 69.

As discussed in Chapter 2, product costing is the process of assigning costs to the products and services provided by a company. An understanding of this costing process is vital to managers, because the way in which a product or service is costed can have a substantial impact on reported net income, as well as on key management decisions.

The essential purpose of any managerial costing system should be to provide cost data to help managers plan, control, direct, and make decisions. Nevertheless, external financial reporting and tax reporting requirements often heavily influence how costs are accumulated and summarized in managerial reports. This is true of product costing.

In this chapter and in Chapter 4, we use an *absorption costing* approach to determine product costs. This was also the method that was used in Chapter 2. In **absorption costing,** *all* manufacturing costs, fixed and variable, are assigned to units of product—units are said to *fully absorb manufacturing costs.* The absorption costing approach is also known as the **full cost** approach. Later, in Chapter 8, we look at product costing from a different point of view called *variable costing,* which is often advocated as an alternative to absorption costing. Chapter 8 also discusses the strengths and weaknesses of the two approaches.

Absorption costing
A costing method that includes all manufacturing costs—direct materials, direct labour, and both variable and fixed overhead—as part of the cost of a finished unit of product. This term is synonymous with *full cost.*

Full cost
Same as *absorption costing.*

Most companies around the world use some form of absorption costing for both external financial reporting and for tax reporting. In addition, most of these same companies also use absorption costing for managerial accounting purposes. Since absorption costing is the most common approach to product costing, we discuss it first and then deal with alternatives in subsequent chapters.

While studying product costing, we must keep in mind that the essential purpose of any costing system is to accumulate costs for managerial use. A costing system is not an end in itself. Rather, it is a managerial tool in that it exists to provide managers with the cost data needed to direct the affairs of organizations.

The design of the costing system depends on cost/benefit trade-offs as assessed by managers. The level of detail and sophistication in a cost accounting system will influence its costs of development and operation. Relevance to management and external regulatory requirements will be the benefit. Usually, more sophistication yields more benefit by providing more relevant information. But when the additional cost of providing added sophistication equals the benefits from the added relevance, the system's designer is at an optimal point in the cost/benefit trade-off and thus the added sophistication should stop.

The nature of systems design is also influenced by the nature of what is to be costed. The explanation provided in the pages that follow will focus on the nature of what is costed rather than the cost/benefit trade-offs. This will enable a description of what physically needs to be considered when the cost/benefit decision must be made. In other words, physical characteristics represent a fundamental consideration to the higher level and more subjective cost/benefit trade-off.

Absorption costing is a popular approach for determining the cost of goods sold and the cost of inventories for financial accounting and income taxes. These regulatory requirements influence how management determines costs because it may be easier and less expensive for the organization to use a single method of costing for both external and internal purposes.

Costing of products or services represents an approach that focuses on the costing of the efforts that make up the goods or services that are sold by the organization. This emphasis on costing products or services is one of the three common approaches used in managerial accounting. The discussion of costing begins with this focus because of its long tradition and its continued popularity for many types of organizations. After this approach to costing is thoroughly explored in the next few chapters, the alternatives, control and decision, will be studied so that a more complete picture will be available for your study of managerial accounting.

Process and Job-Order Costing

LEARNING OBJECTIVE 1
Distinguish between process costing and job-order costing and identify companies that would use each costing method.

In computing the cost of a product or a service, managers are faced with a difficult problem. Many costs (such as rent) do not change much from month to month, whereas production may change frequently, with production going up in one month and then down in another. In addition to variations in the level of production, several different products or services may be produced in a given period in the same facility. Under these conditions, how is it possible to accurately determine the cost of a product or service? In practice, assigning costs to products and services involves an averaging of some type across time periods and across products. The way in which this averaging is carried out will depend heavily on the type of production process involved.

Process Costing

Process costing system
A costing system used in those manufacturing situations where a single, homogeneous product (such as cement or flour) is produced for long periods of time.

A **process costing system** is used in situations where the company produces many units of a single product (such as frozen orange juice concentrate) for long periods at a time. Examples include producing paper at Bowater, refining aluminum ingots at Alcan, mixing and bottling beverages at Coca-Cola, and making wieners at J.M. Schneider Inc. All of these industries are characterized by an essentially homogeneous product that flows evenly through the production process on a continuous basis.

Process costing systems accumulate costs in a particular operation or department for an entire period (month, quarter, year) and then divide this total cost by the number of units produced during the period. The basic formula for process costing is as follows:

$$\text{Unit product cost (per litre, kilogram, bottle)} = \frac{\text{Total manufacturing cost}}{\text{Total units produced (litres, kilograms, bottles)}}$$

Since one unit of product (litre, kilogram, bottle) is indistinguishable from any other unit of product, each unit is assigned the same average cost. This costing technique results in a broad, average unit cost figure that applies to homogeneous units flowing in a continuous stream out of the production process.

Job-Order Costing

Job-order costing system
A costing system used in situations where many different products, jobs, or services are produced each period.

A **job-order costing system** is used in situations where many *different* products are produced each period. For example, a Levi Strauss clothing factory would typically make many different types of jeans for both men and women during a month. A particular order might consist of 1,000 stonewashed men's blue denim jeans, style number A312, with a 32-inch waist and a 30-inch inseam. This order of 1,000 jeans is called a *batch* or a *job.* In a job-order costing system, costs are traced and allocated to jobs and then the costs of the job are divided by the number of units in the job to arrive at an average cost per unit.

Other examples of situations where job-order costing would be used include large-scale construction projects managed by Bechtel International, commercial aircraft produced by Bombardier, greeting cards designed and printed at Hallmark, and airline meals prepared by Cara. All of these examples are characterized by diverse outputs. Each Bechtel project is unique and different from every other—the company may be simultaneously constructing a dam in Zaire and a bridge in Indonesia. Likewise, each airline orders a different type of meal from Cara's catering service.

Job-order costing is also used extensively in service industries. Hospitals, law firms, movie studios, accounting firms, advertising agencies, and repair shops all use a variation of job-order costing to accumulate costs for accounting and billing purposes. For example, the production of the British Open golf broadcast by TSN would be suitable as a job costing project.

Although the detailed example of job-order costing provided in the following section deals with a manufacturing firm, the same basic concepts and procedures are used by many service organizations. The essential difference for service organizations is the lack

of raw materials in the cost of their services. For example, a public accounting firm would have cost elements involving direct labour and overhead but not raw materials, because the firm does not make a physical item. However, to avoid duplicating the discussion that follows, the more comprehensive manufacturing environment will be presented, with the service application addressed in exercises and problems.

The record-keeping and cost assignment problems are more complex when a company sells many different products and services than when it has only a single product. Since the products are different, the costs are typically different. Consequently, cost records must be maintained for each distinct product or job. For example, a lawyer in a large criminal law practice would ordinarily keep separate records of the costs of advising and defending each of her clients. The Levi Strauss factory mentioned earlier would keep separate track of the costs of filling orders for particular styles, sizes, and colours of jeans. Thus, a job-order costing system requires more effort than a process costing system. Nevertheless, job-order costing is used by more than half the manufacturers in North America.

In this chapter, we focus on the design of a job-order costing system. In the following chapter, we focus on process costing and also look more closely at the similarities and differences between the two costing methods.

Job-Order Costing—An Overview

LEARNING OBJECTIVE 2
Identify the documents used in a job-order costing system.

To introduce job-order costing, we will follow a specific job as it progresses through the manufacturing process. This job consists of two experimental couplings that Yost Precision Machining has agreed to produce for Loops Unlimited, a manufacturer of roller coasters. Couplings connect the cars on the roller coaster and are a critical component in the performance and safety of the ride. Before we begin our discussion, recall from Chapter 2 that companies generally classify manufacturing costs into three broad categories: (1) direct materials, (2) direct labour, and (3) manufacturing overhead. As we study the operation of a job-order costing system, we will see how each of these three types of costs is recorded and accumulated.

Measuring Direct Materials Cost

Bill of materials
A document that shows the type and quantity of each major item of the materials required to make a product.

Yost Precision Machining will require four G7 connectors and two M46 housings to make the two experimental couplings for Loops Unlimited. If this were a standard product, there would be a *bill of materials* for the product. A **bill of materials** is a document that lists the type and quantity of each item of the materials needed to complete a unit of product. In this case, there is no established bill of materials, so Yost's production staff determined the materials requirements from the blueprints submitted by the customer. Each coupling requires two connectors and one housing, so to make two couplings, four connectors and two housings are required.

Materials requisition form
A detailed source document that specifies the type and quantity of materials that are to be drawn from the storeroom and identifies the job to which the costs of materials are to be charged.

A *production order* is issued when an agreement has been reached with the customer concerning the quantities, prices, and shipment date for the order. The Production Department then prepares a *materials requisition form* similar to the form in Exhibit 3–1. The **materials requisition form** is a detailed source document that (1) specifies the type and quantity of materials to be drawn from the storeroom, and (2) identifies the job to which the costs of the materials are to be charged. The form serves as a means for controlling the flow of materials into production and also for making entries in the accounting records.

The Yost Precision Machining materials requisition form in Exhibit 3–1 shows that the company's Milling Department has requisitioned two M46 housings and four G7 connectors for job 2B47. A production worker presents the completed form to the storeroom clerk who then issues the necessary raw materials. The storeroom clerk is not allowed to release materials without a completed and properly authorized requisition material requisition form.

Materials Requisition Number: 14873

Date: March 2

Job Number to Be Charged: 2B47

Department: Milling

Description	Quantity	Unit Cost	Total Cost
M46 Housing	2	$124	248
G7 Connector	4	103	412
			$660

Bill White

Authorized Signature

EXHIBIT 3–1 Materials Requisition Form

The previous paragraphs used the terms *direct materials* and *raw materials*. This distinction should be clarified. Direct materials represent materials that are directly traced to the product or service. Raw materials are ingredients that are converted into a finished product. Semi-finished materials, or supplies for a service job, could be considered direct materials if they were important enough to be directly traced to the job, but they will not be raw materials. In summary, because raw materials can be direct materials but all direct materials do not need to be raw materials, the terms often appear interchangeably in business terminology.

Job Cost Sheet

After being notified that the production order has been issued, the Accounting Department prepares a *job cost sheet* similar to the one presented in Exhibit 3–2. A **job cost sheet** is a form prepared for each separate job that records the materials, labour, and overhead costs charged to the job.

Job cost sheet
A form prepared for each job that records the materials, labour, and overhead costs charged to the job.

After direct materials are issued, the Accounting Department records their costs directly on the job cost sheet. Note from Exhibit 3–2, for example, that the $660 cost for direct materials shown earlier on the materials requisition form has been charged to job 2B47 on its job cost sheet. The requisition number 14873 is also recorded on the job cost sheet to make it easier to identify the source document for the direct materials charge.

In addition to serving as a means for charging costs to jobs, the job cost sheet also serves as a key part of a firm's accounting records. Job cost sheets serve as a subsidiary ledger to the Work in Process account because the detailed records that they provide for the jobs in process add up to the balance in Work in Process.

Measuring Direct Labour Cost

Direct labour cost is handled in much the same way as direct materials cost. Direct labour consists of labour charges that are easily traced to a particular job. Labour charges that cannot be easily traced directly to any job are treated as part of manufacturing overhead. As discussed in Chapter 2, this latter category of labour costs is termed *indirect labour* and includes tasks such as maintenance, supervision, and clean-up.

Time ticket
A detailed source document that is used to record an employee's hour-by-hour activities during a day.

Workers use *time tickets* to record the time they spend on each job and task. A completed **time ticket** is an hour-by-hour summary of the employee's activities throughout the day. An

IN BUSINESS

Raw Materials and Energy Costs Pressures

Energy and raw material costs are an increasing worry for global businesses according to the latest findings from the *Grant Thornton International Business Report* (IBR). The biggest worry for businesses is raw material costs with 44% of global businesses identifying these as having a major impact on cost pressures in the next 12 months, followed by 41% who were concerned about staff costs, 37% about energy costs and 34% about transport costs. Property costs (15%) are expected to have a lesser impact over the coming year.

Source: Canada News Wire, May 9, 2007.

example of an employee time ticket is shown in Exhibit 3–3. When working on a specific job, the employee enters the job number on the time ticket and notes the amount of time spent on that job. When not assigned to a particular job, the employee records the nature of the indirect labour task (such as clean-up and maintenance) and the amount of time spent on the task.

At the end of the day, the time tickets are gathered and the Accounting Department enters the direct labour-hours and costs on individual job cost sheets. (See Exhibit 3–2 for an example of how direct labour costs are entered on the job cost sheet.) The daily time tickets are source documents that are used as the basis for labour cost entries into the accounting records.

EXHIBIT 3–2 Job Cost Sheet

JOB COST SHEET

Job Number: 2B47	Date Initiated: March 2
Department: Milling	Date Completed:
Item:	Units Completed:
For Inventory:	

Direct Materials		Direct Labour			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount
14873	$660	843	5	$45			

Cost Summary		Units Shipped		
Direct Materials	$	Date	Number	Balance
Direct Labour	$			
Manufacturing Overhead	$			
Total Cost	$			
Unit Cost	$			

EXHIBIT 3–3 Employee Time Ticket

Time Ticket No.	Date
843	March 3
Employee	**Station**
Mary Holden	4

Started	Ended	Time Completed	Rate	Amount	Job Number
7:00	12:00	5.0	$9	$45	2B47
12:30	2:30	2.0	9	18	2B50
2:30	3:30	1.0	9	9	Maintenance
Totals		8.0		$72	

R.W. Pace

Supervisor

The system we have just described is a manual method for recording and posting labour costs. Many companies now rely on computerized systems and no longer record labour time by hand on sheets of paper. One computerized approach uses bar codes to enter the basic data into the computer. Each employee and each job has a unique bar code. When an employee begins work on a job, he or she scans three bar codes, using a handheld device much like the bar code readers at grocery store checkout stands. The first bar code indicates that a job is being started; the second is the unique bar code on the employee's identity badge; and the third is the unique bar code of the job itself. This information is fed automatically via an electronic network to a computer that notes the time and then records all of the data. When the employee completes the task, he or she scans a bar code indicating the task is complete, the bar code on the employee's identity badge, and the bar code attached to the job. This information is relayed to the computer that again notes the time, and a time ticket is automatically prepared. Since all of the source data is already in computer files, the labour costs can automatically be posted to job cost sheets (or their electronic equivalents). Computers, coupled with technology such as bar codes, can eliminate much of the drudgery involved in routine bookkeeping activities while at the same time increasing timeliness and accuracy.

IN BUSINESS

Canada's health care system gives Canadian business a striking competitive advantage with respect to labour costs. As Kirstin Downey writes:

> Employers in Canada pay only about $50 a month, or $600 a year, mostly for optional items such as eyeglasses and orthopedic shoes, said Elaine Bernard, executive director of the labour and worklife program at Harvard Law School. "Health care is significantly cheaper for corporations in Canada," she said. U.S. employers pay more than 10 times as much—an average $552 a month per employee for health insurance, according to the Kaiser Family Foundation.

Source: Kirstin Downey, "A Heftier Dose to Swallow Rising Cost of Health Care in U.S. Gives Other Developed Countries an Edge in Keeping Jobs," *Washington Post,* March 6, 2004, pp. E01.

Application of Manufacturing Overhead

LEARNING OBJECTIVE 3
Compute predetermined overhead rates and explain why estimated overhead costs (rather than actual overhead costs) are used in the costing process.

Manufacturing overhead must be included with direct materials and direct labour on the job cost sheet since manufacturing overhead is also a product cost. However, assigning manufacturing overhead to units of product can be a difficult task. There are three reasons for this.

1. Manufacturing overhead is an indirect cost. This means that it is either impossible or difficult to trace these costs to a particular product or job.
2. Manufacturing overhead consists of many different items, ranging from the grease used in machines to the annual salary of the production manager.
3. Even though output may fluctuate due to seasonal or other factors, manufacturing overhead costs tend to remain relatively constant due to the presence of fixed costs.

Given these problems, about the only way to assign overhead costs to products is to use an allocation process. This allocation of overhead costs is accomplished by selecting an *allocation base* that is common to all of the company's products and services. An **allocation base** is a measure such as direct labour-hours (DLH) or machine-hours (MH) that is used to assign overhead costs to products and services.

Allocation base
A measure of activity such as direct labour-hours or machine-hours that is used to assign costs to cost objects.

The most widely used allocation bases are direct labour-hours and direct labour cost, with machine-hours and even units of product (where a company has only a single product) also used to some extent.

Manufacturing overhead is commonly applied to products using a *predetermined overhead rate.* The **predetermined overhead rate** is computed by dividing the total estimatted manufacturing overhead cost for the period by the estimated total amount of the allocation base as follows:

Predetermined overhead rate
A rate used to charge overhead cost to jobs in production; the rate is established in advance for each period by use of estimates of total manufacturing overhead cost and of the total allocation base for the period.

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total units in the allocation base}}$$

Note that the predetermined overhead rate is based on *estimated* rather than actual results. This is because the *predetermined* overhead rate is computed *before* the period begins and is used to *apply* overhead cost to jobs throughout the period. The process of assigning overhead cost to jobs is called **overhead application.** The formula for determining the amount of overhead cost to apply to a particular job is:

Overhead application
The process of charging manufacturing overhead cost to job cost sheets and to the Work in Process account.

$$\begin{array}{c}\text{Overhead applied to}\\ \text{a particular job}\end{array} = \begin{array}{c}\text{Predetermined}\\ \text{overhead rate}\end{array} \times \begin{array}{c}\text{Amount of the allocation}\\ \text{base incurred by the job}\end{array}$$

For example, if the predetermined overhead rate is $8 per direct labour-hour, then $8 of overhead is *applied* to a job for each direct labour-hour incurred by the job. When the allocation base is direct labour-hours, the formula becomes:

$$\begin{array}{c}\text{Overhead applied to}\\ \text{a particular job}\end{array} = \begin{array}{c}\text{Predetermined}\\ \text{overhead rate}\end{array} \times \begin{array}{c}\text{Actual direct labour hours}\\ \text{charged to the job}\end{array}$$

Using the Predetermined Overhead Rate

To illustrate the steps involved in computing and using a predetermined overhead rate, let's return to Yost Precision Machining. The company has estimated its total manufacturing overhead costs will be $320,000 for the year and its total direct labour-hours will be 40,000. Its predetermined overhead rate for the year would be $8 per direct labour-hour, shown as follows:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total units in the allocation base}}$$

$$\frac{\$320{,}000}{40{,}000 \text{ direct labour-hours}} = \$8 \text{ per direct labour-hour}$$

The job cost sheet in Exhibit 3–4 indicates that 27 direct labour-hours were charged to job 2B47. Therefore, a total of $216 of overhead cost would be applied to the job:

Overhead applied to job 2B47 = Predetermined overhead rate × Actual direct labour-hours charged to job 2B47

$8/DLH × 27 direct labour-hours = $216 of overhead applied to job 2B47

This amount of overhead has been entered on the job cost sheet in Exhibit 3–4. Note that this is *not* the actual amount of overhead caused by the job. There is no attempt to trace actual overhead costs to jobs—if that could be done, the costs would be direct costs, not overhead. The overhead assigned to the job is simply a share of the total overhead that was estimated at the beginning of the year. When a company applies overhead cost to jobs as we have done—that is, by multiplying actual activity times the predetermined overhead rate—it is called a **normal cost system.**

Normal cost system
A costing system in which overhead costs are applied to jobs by multiplying a predetermined overhead rate by the actual amount of the allocation base incurred by the job.

The overhead may be applied when direct labour-hours are charged to jobs, or all of the overhead can be applied at once when the job is completed. The choice is up to the company. If a job is not completed at year-end, however, overhead should be applied to jobs so as to value the work in process inventory.

EXHIBIT 3–4 A Completed Job Cost Sheet

JOB COST SHEET

Job Number: 2B47	Date Initiated: March 2
Department: Milling	Date Completed: March 8
Item: Special order coupling	Units Completed: 2
For Inventory:	

Direct Materials		Direct Labour			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount
14873	$ 660	843	5	$ 45	27	$8/DLH	$216
14875	506	846	8	60			
14912	238	850	4	21			
	$1,404	851	10	54			
			27	$180			

Cost Summary		Units Shipped		
Direct Materials	$1,404	Date	Number	Balance
Direct Labour	$ 180	March 8	—	2
Manufacturing Overhead	$ 216			
Total Cost	$1,800			
Unit Cost	$ 900*			

* $1,800 ÷ 2 units = $900 per unit

The Need For a Predetermined Rate Instead of using a predetermined rate, a company could wait until the end of the accounting period to compute an actual overhead rate based on the actual total manufacturing costs and the actual total units in the allocation base for the period. However, managers cite several reasons for using predetermined overhead rates instead of actual overhead rates:

1. Managers would like to know the accounting system's valuation of completed jobs *before* the end of the accounting period. Suppose, for example, that Yost Precision Machining waits until the end of the year to compute its overhead rate. Then the cost of goods sold for job 2B47 would not be known until the close of the year, even though the job was completed and shipped to the customer in March. This problem can be reduced by computing the actual overhead more frequently, but that immediately leads to another problem, as discussed below.
2. If actual overhead rates were computed frequently, seasonal factors in overhead costs or in the allocation base could produce fluctuations in the overhead rates. For example, the costs of heating and cooling a production facility in Halifax will be highest in the winter and summer months and lowest in the spring and fall. If an overhead rate were computed each month or each quarter, the predetermined overhead rate would go up in the winter and summer and down in the spring and fall. Two identical jobs, one completed in the winter and one completed in the spring, would be assigned different costs if the overhead rate were computed on a monthly or quarterly basis. Managers generally feel that such fluctuations in overhead rates and costs serve no useful purpose and are misleading.
3. The use of a predetermined overhead rate simplifies record-keeping. To determine the overhead cost to apply to a job, the accounting staff at Yost Precision Machining simply multiplies the direct labour-hours recorded for the job by the predetermined overhead rate of $8 per direct labour-hour.

For these reasons, most companies use predetermined overhead rates rather than actual overhead rates in their cost accounting systems.

Choice of an Allocation Base for Overhead Cost

Cost driver
A factor, such as machine-hours, beds occupied, computer time, or flight-hours, that causes overhead costs.

Ideally, the allocation base used in the predetermined overhead rate should *drive* the overhead cost. A **cost driver** is a factor, such as machine-hours, beds occupied, computer time, or flight-hours, that causes overhead costs. If a base is used to compute overhead rates that does not "drive" overhead costs, then the result will be inaccurate overhead rates and distorted product costs. For example, if direct labour-hours is used to allocate overhead, but in reality overhead has little to do with direct labour-hours, then products with high direct labour-hour requirements will shoulder an unrealistic burden of overhead and will be overcosted.

Most companies use direct labour-hours or direct labour cost as the allocation base for manufacturing overhead. However, as discussed in earlier chapters, major shifts are taking place in the structure of costs in many industries. In the past, direct labour accounted for up to 60% of the cost of many products, with overhead cost making up only a portion of the remainder. This situation has been changing for two reasons. First, sophisticated automated equipment has taken over functions that used to be performed by direct labour workers. Since the costs of acquiring and maintaining such equipment are classified as overhead, this increases overhead while decreasing direct labour. Second, products are themselves becoming more sophisticated and complex and change more frequently. This increases the need for highly skilled indirect workers such as engineers. As a result of these two trends, direct labour cost is decreasing relative to overhead as a component of product costs.

In companies where direct labour and overhead costs have been moving in opposite directions, it would be difficult to argue that direct labour "drives" overhead costs. Accordingly, in recent years, managers in some companies have used *activity-based*

costing principles to redesign their cost accounting systems. Activity-based costing is a costing technique that is designed to reflect more accurately the demands that products, customers, and other cost objects make on overhead resources. The activity-based approach is discussed in more detail in Chapter 5.

We hasten to add that although direct labour may not be an appropriate allocation basis in some industries, in others it continues to be a significant driver of manufacturing overhead. Indeed, most manufacturing companies in North America continue to use direct labour as the primary or secondary allocation base for manufacturing overhead. The key point is that the allocation base used by the company should really drive, or cause, overhead costs, and direct labour is not always an appropriate allocation base.

Computation of Unit Costs

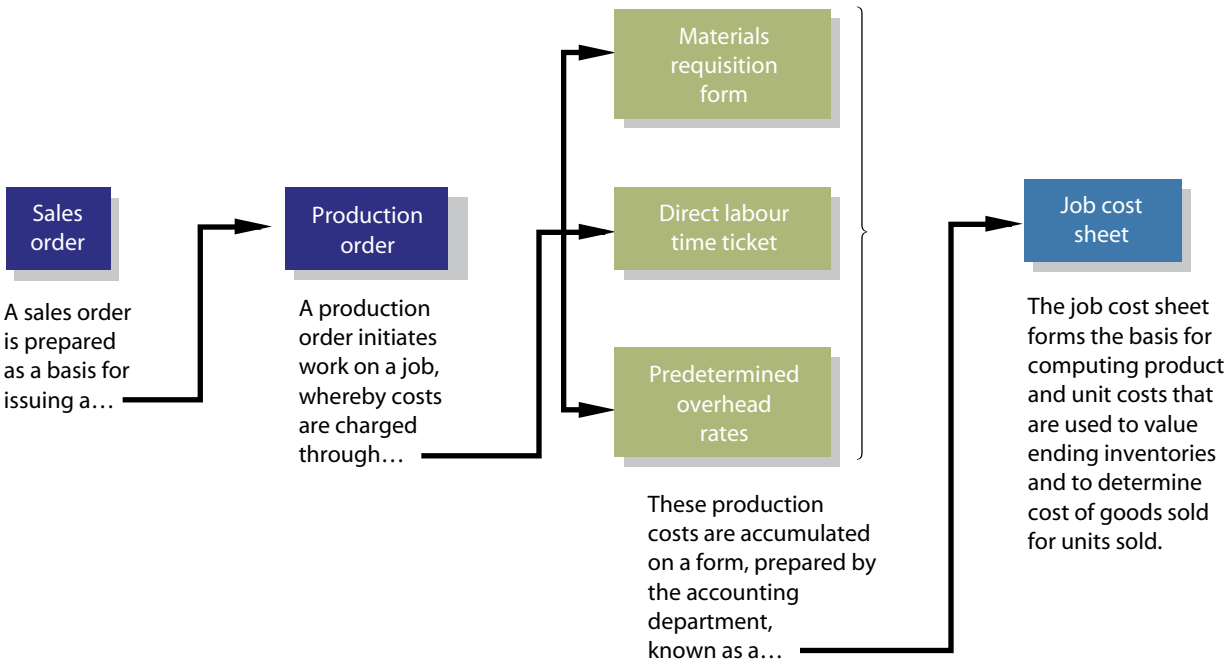
With the application of Yost Precision Machining's $216 manufacturing overhead to the job cost sheet in Exhibit 3–4, the job cost sheet is almost complete. There are two final steps. First, the totals for direct materials, direct labour, and manufacturing overhead are transferred to the Cost Summary section of the job cost sheet and added together to obtain the total cost for the job. Then the total cost ($1,800) is divided by the number of units (2) to obtain the unit cost ($900). As indicated earlier, *this unit cost is an average cost and should not be interpreted as the cost that would actually be incurred if another unit were produced.* Much of the actual overhead would not change at all if another unit was produced, so the incremental cost of an additional unit is something less than the average unit cost of $900.

The completed job cost sheet will serve as the basis for valuing unsold units in ending inventory and determining cost of goods sold.

Summary of Document Flows

The sequence of events discussed above is summarized in Exhibit 3–5. A careful study of the flow of documents in this exhibit provides a good overview of the overall operation of a job-order costing system.

EXHIBIT 3–5 The Flow of Documents in a Job-Order Costing System



Job-Order Costing—The Flow of Costs

LEARNING OBJECTIVE 4
Record the journal entries that reflect the flow of costs in a job-order costing system.

We are now ready to take a more detailed look at the flow of costs through the company's formal accounting system. To illustrate, we shall consider a single month's activity for Rand Company, a producer of gold and silver commemorative medallions. Rand Company has two jobs in process during April, the first month of its fiscal year. Job A, a special minting of 1,000 gold medallions commemorating the world hockey championships held in Halifax, was started during March and had $30,000 in manufacturing costs already accumulated on April 1. Job B, an order for 10,000 silver medallions commemorating the same event, was started in April.

The Purchase and Issue of Materials

On April 1, Rand Company had $7,000 in raw materials on hand. During the month, the company purchased an additional $60,000 in raw materials. The purchase is recorded in journal entry (1) below:

(1)

Raw Materials	60,000	
Accounts Payable		60,000

As explained in Chapter 2, Raw Materials is an asset account. Thus, when raw materials are purchased, they are initially recorded as an asset—not as an expense.

Issue of Direct and Indirect Materials During April, $52,000 in raw materials were requisitioned from the storeroom for use in production. These raw materials include $50,000 of direct materials and $2,000 of indirect materials. Entry (2) records the issue of the materials to the production departments:

(2)

Work in Process	50,000	
Manufacturing Overhead	2,000	
Raw Materials		52,000

The materials charged to Work in Process represent direct materials for specific jobs. As these materials are entered into the Work in Process account, they are also recorded on the appropriate job cost sheets. This point is illustrated in Exhibit 3–6, where $28,000 of the $50,000 in direct materials is charged to job A's cost sheet and the remaining $22,000 is charged to job B's cost sheet. (In this example, all data are presented in summary form and the job cost sheet is abbreviated.)

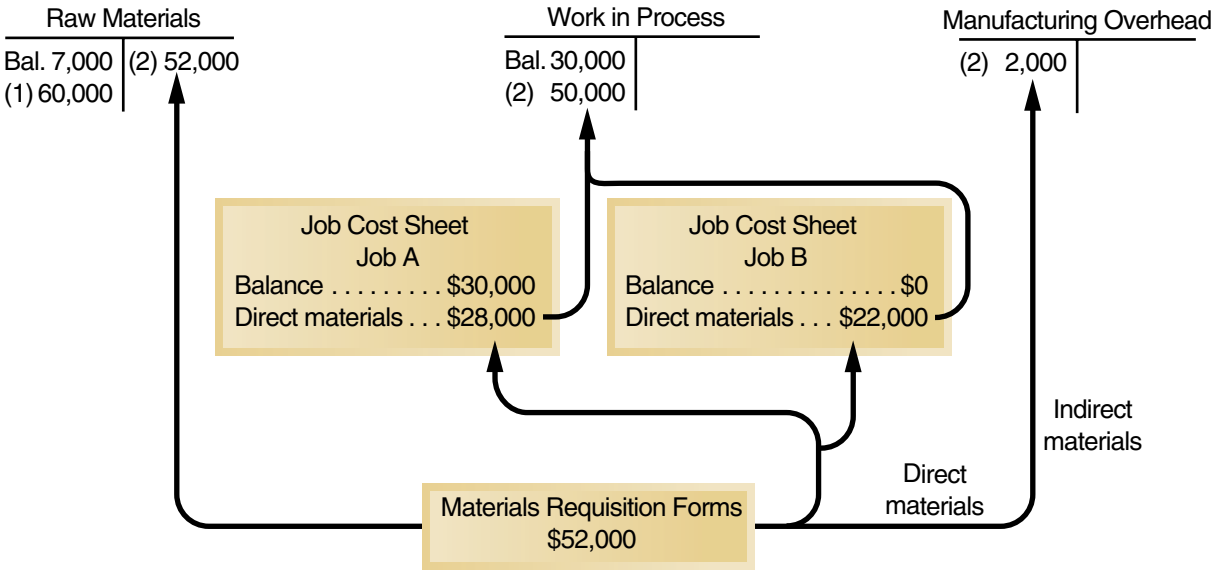
The $2,000 charged to Manufacturing Overhead in entry (2) represents indirect materials used in production during April. Observe that the Manufacturing Overhead account is separate from the Work in Process account. The purpose of the Manufacturing Overhead account is to accumulate all manufacturing overhead costs as they are incurred during a period.

Before leaving Exhibit 3–6, note that the job cost sheet for job A contains a beginning balance of $30,000. We stated earlier that this balance represents the cost of work done during March that has been carried forward to April. Also note that the Work in Process account contains the same $30,000 balance. *The reason the $30,000 appears in both places is that the Work in Process account is a control account and the job cost sheets form a subsidiary ledger. Thus, the Work in Process account contains a summarized total of all costs appearing on the individual job cost sheets for all jobs in process at any given point in time.* (Since Rand Company had only job A in process at the beginning of April, job A's $30,000 balance on that date is equal to the balance in the Work in Process account.)

Issue of Direct Materials Only Sometimes the materials drawn from the Raw Materials inventory account are all direct materials. In this case, the entry to record the issue of the materials into production would be as follows:

Work in Process	XXX	
Raw Materials		XXX

EXHIBIT 3–6 Raw Materials Cost Flows



Labour Cost

As work is performed in various departments of Rand Company from day to day, employee time tickets are filled out by workers, collected, and forwarded to the Accounting Department. In the Accounting Department, the tickets are costed according to the various employee wage rates, and the resulting costs are classified as either direct or indirect labour. In April, $60,000 was recorded for direct labour and $15,000 for indirect labour resulting in the following summary entry:

(3)

Work in Process	60,000	
Manufacturing Overhead	15,000	
Salaries and Wages Payable		75,000

Only direct labour is added to the Work in Process account. For Rand Company, this amounted to $60,000 for April.

At the same time that direct labour costs are added to Work in Process, they are also added to the individual job cost sheets, as shown in Exhibit 3–7. During April, $40,000 of direct labour cost was charged to job A and the remaining $20,000 was charged to job B.

The labour costs charged to Manufacturing Overhead represent the indirect labour costs of the period, such as supervision, janitorial work, and maintenance.

Manufacturing Overhead Costs

Recall that all costs of operating the factory other than direct materials and direct labour are classified as manufacturing overhead costs. These costs are entered directly into the Manufacturing Overhead account as they are incurred. To illustrate, assume that Rand Company incurred the following general factory costs during April:

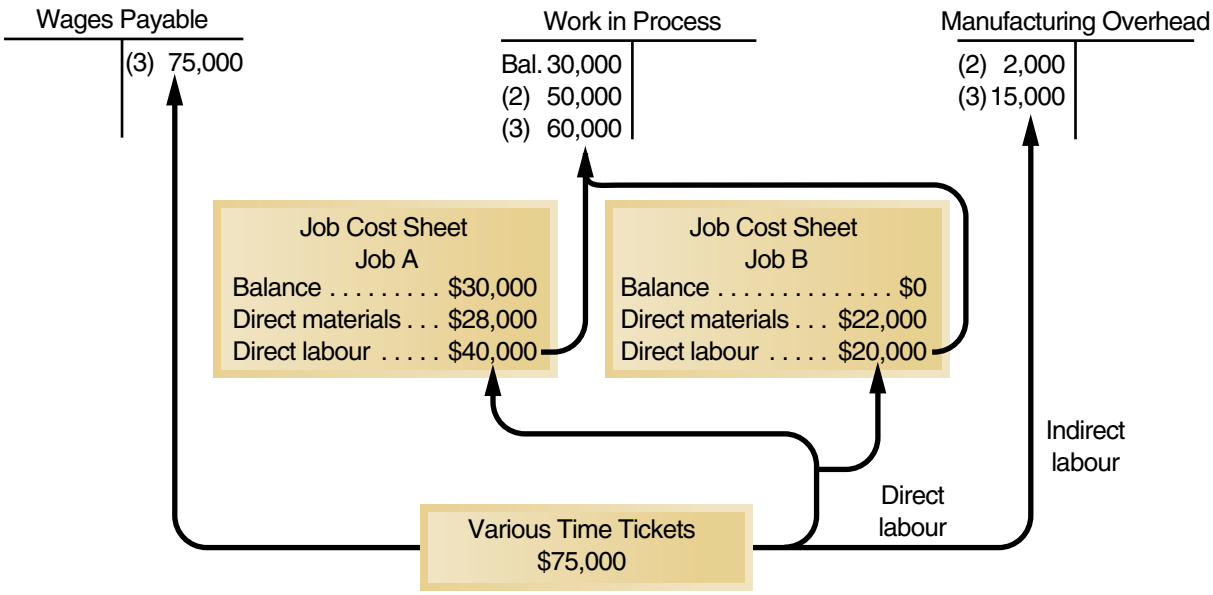
Utilities (heat, water, and power)	$21,000
Rent on factory equipment	16,000
Miscellaneous factory costs	3,000
Total	$40,000

The following entry records the incurrence of these costs:

(4)

Manufacturing Overhead	40,000	
Accounts Payable		40,000

EXHIBIT 3–7 Labour Cost Flows



In addition, let us assume that during April, Rand Company recognized $13,000 in accrued property taxes and that $7,000 in prepaid insurance expired on factory buildings and equipment. The following entry records these items:

(5)

Manufacturing Overhead	20,000	
Property Taxes Payable		13,000
Prepaid Insurance		7,000

Finally, assume that the company recognized $18,000 in depreciation on factory equipment during April. The following entry records the accrual of this depreciation:

(6)

Manufacturing Overhead	18,000	
Accumulated Depreciation		18,000

In short, *all* manufacturing overhead costs are recorded directly into the Manufacturing Overhead account as they are incurred day by day throughout a period. It is important to understand that Manufacturing Overhead is a control account for many—perhaps thousands—of subsidiary accounts such as Indirect Materials, Indirect Labour, Factory Utilities, and so forth. As the Manufacturing Overhead account is debited for costs during a period, the various subsidiary accounts are also debited. In the example above and also in the assignment material for this chapter, we omit the entries to the subsidiary accounts for the sake of brevity.

The Application of Manufacturing Overhead

LEARNING OBJECTIVE 5
Apply overhead cost to Work in Process using a predetermined overhead rate.

Since actual manufacturing overhead costs are charged to the Manufacturing Overhead control account rather than to Work in Process, how are manufacturing overhead costs assigned to Work in Process? The answer is, by means of the predetermined overhead rate. Recall from our discussion earlier in the chapter that a predetermined overhead rate is established at the beginning of each year. The rate is calculated by dividing the estimated total manufacturing overhead cost for the year by the estimated total units in the allocation base (measured in machine-hours, direct labour-hours, or some other base). The predetermined overhead rate is

then used to apply overhead costs to jobs. For example, if direct labour-hours is the allocation base, overhead cost is applied to each job by multiplying the number of direct labour-hours charged to the job by the predetermined overhead rate.

To illustrate, assume that Rand Company has used machine-hours in computing its predetermined overhead rate and that this rate is $6 per machine-hour. Also assume that during April, 10,000 machine-hours were worked on job A and 5,000 machine-hours were worked on job B (a total of 15,000 machine-hours). Thus, $90,000 in overhead cost (15,000 machine-hours × $6 = $90,000) would be applied to Work in Process. The following entry records the application of Manufacturing Overhead to Work in Process:

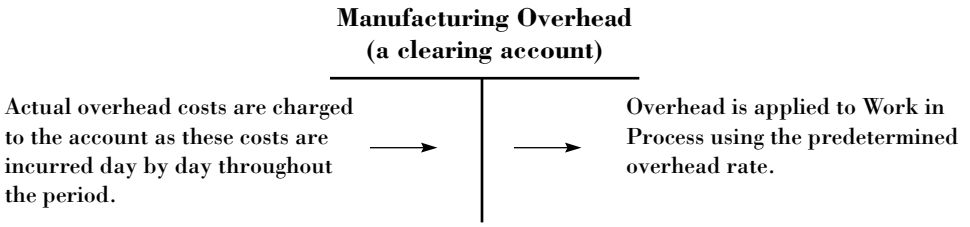
(7)

Work in Process	90,000	
Manufacturing Overhead		90,000

The flow of costs through the Manufacturing Overhead account is detailed in Exhibit 3–8.

The "actual overhead costs" in the Manufacturing Overhead account shown in Exhibit 3–8 are the costs that were added to the account in entries (2)–(6). Observe that the incurrence of these actual overhead costs [entries (2)–(6)] and the application of overhead to Work in Process [entry (7)] represent two separate and entirely distinct processes.

The Concept of a Clearing Account The Manufacturing Overhead account operates as a clearing account. As we have noted, actual factory overhead costs are debited to the accounts as they are incurred day by day throughout the year. At certain intervals during the year, usually when a job is completed, overhead cost is released from the Manufacturing Overhead account and is applied to the Work in Process account by means of the predetermined overhead rate. Work in Process is debited and Manufacturing Overhead is credited. This sequence of events is illustrated as follows:

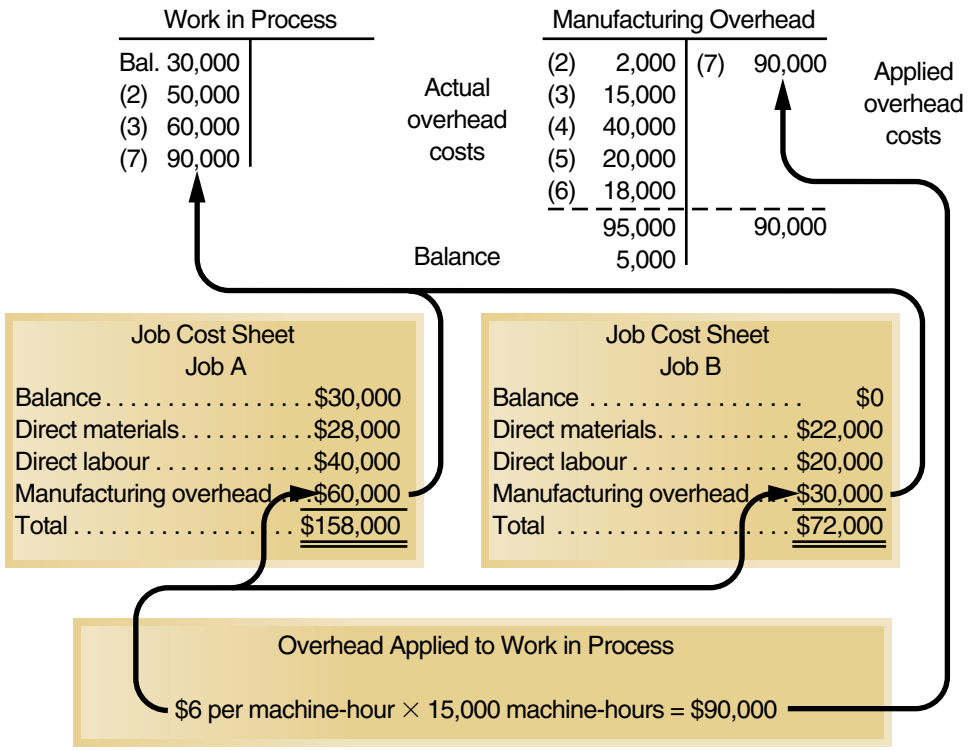


The actual overhead costs incurred and shown as debits in the manufacturing overhead account are a result of many different types of overhead costs. A brief list of some of the different types is presented in the journal entries, numbers 4, 5 and 6, or in the schedule of cost of goods manufactured, shown in Exhibit 3–11 on page 89 or previously in Exhibit 2–4 on page 39. The clearing account concept actually represents a general ledger control account for a subsidiary ledger that contains the detailed information on each type of overhead cost.

As we emphasized earlier, the predetermined overhead rate is based entirely on estimates of what overhead costs are *expected* to be, and it is established before the year begins. As a result, the overhead cost applied during a year will almost certainly turn out to be more or less than the overhead cost that is actually incurred. For example, notice from Exhibit 3–8 that Rand Company's actual overhead costs for the period are $5,000 greater than the overhead cost that has been applied to Work in Process, resulting in a $5,000 debit balance in the Manufacturing Overhead account. We will reserve discussion of what to do with this $5,000 balance until a later section in this chapter, Complications of Overhead Application.

For the moment, we can conclude by noting from Exhibit 3–8 that the cost of a completed job consists of the actual materials cost of the job, the actual labour cost of the job, and the overhead cost *applied* to the job. Pay particular attention to the following subtle but important point: *Actual overhead costs are not charged to jobs; actual overhead costs*

EXHIBIT 3–8 The Flow of Costs in Overhead Application



do not appear on the job cost sheet nor do they appear in the Work in Process account. Only the applied overhead cost, based on the predetermined overhead rate, appears on the job cost sheet and in the Work in Process account. Study this point carefully.

Non-Manufacturing Costs

In addition to manufacturing costs, companies also incur marketing and selling costs. As explained in Chapter 2, these costs should be treated as period expenses and charged directly to the income statement. *Non-manufacturing costs should not go into the Manufacturing Overhead account.* To illustrate the correct treatment of non-manufacturing costs, assume that Rand Company incurred $30,000 of selling and administrative costs during April. The following entry records these salaries:

(8)

Salaries Expense	30,000	
Salaries and Wages Payable		30,000

Assume that depreciation on office equipment during April was $7,000. The entry is as follows:

(9)

Depreciation Expense	7,000	
Accumulated Depreciation		7,000

Pay particular attention to the difference between this entry and entry (6) where we recorded depreciation on factory equipment. In journal entry (6), depreciation on factory equipment was debited to Manufacturing Overhead and is therefore a product cost. In journal entry (9) above, depreciation on office equipment was debited to Depreciation Expense. Depreciation on office equipment is considered to be a period expense rather than a product cost.

Finally, assume that advertising was $42,000 and that other selling and administrative expenses in April totalled $8,000. The following entry records these items:

(10)

Advertising Expense	42,000	
Other Selling and Administrative Expense	8,000	
Accounts Payable*		50,000

*Other accounts such as Cash may be credited.

Because the amounts in entries (8) through (10) all go directly into expense accounts, they will have no effect on product costs. The same will be true of any other selling and administrative expenses incurred during April, including sales commissions, depreciation on sales equipment, rent on office facilities, insurance on office facilities, and related costs.

The distinction between manufacturing overhead costs and non-manufacturing costs such as selling and administrative expenses is sometimes difficult because of the type of cost. For example, depreciation or salaries should be classified as product costs if related to manufacturing but are classified as period costs and expensed if related to non-manufacturing activities. In practice, the classification has to be based on what the firm does to incur the costs. If it sells or markets, then this is not production and the distinction is clear. If it involves administration then the distinction depends on what is administered and how important it is to separate production administration from overall administration. For example, if all the company does is produce the Hibernia oil platform, then administration is production (manufacturing) overhead. However, if the company is administering many jobs and marketing new jobs at the same time, it may not be able to distinguish overhead from administrative time on the part of the senior management. Thus, unless costs are needed for a cost-recovery billing, administration salaries expense may be the expeditious way to treat the salaries.

Cost of Goods Manufactured

LEARNING OBJECTIVE 6
Prepare schedules of cost of goods manufactured and cost of goods sold.

When a job has been completed, the finished output is transferred from the production departments to the finished goods warehouse. By this time, the Accounting Department will have charged the job with direct materials and direct labour cost, and manufacturing overhead will have been applied using the predetermined rate. A transfer of these costs must be made within the costing system that *parallels* the physical transfer of the goods to the finished goods warehouse. The costs of the completed job are transferred out of the Work in Process account and into the Finished Goods account. The sum of all amounts transferred between these two accounts represents the cost of goods manufactured for the period.

In the case of Rand Company, let us assume that job A was completed during April. The following entry transfers the cost of job A from Work in Process to Finished Goods:

(11)

Finished Goods	158,000	
Work in Process		158,000

The $158,000 represents the completed cost of job A, as shown on the job cost sheet in Exhibit 3–8. Since job A was the only job completed during April, the $158,000 also represents the cost of goods manufactured for the month.

Job B was not completed by month-end, so its cost will remain in the Work in Process account and carry over to the next month. If a balance sheet is prepared at the end of April, the cost accumulated thus far on job B will appear as "Work in process inventory" in the assets section.

Cost of Goods Sold

As units in finished goods are shipped to customers their cost is transferred from the Finished Goods account into the Cost of Goods Sold account. If a complete job is shipped, as in the case where a job has been done to a customer's specifications, then it is a simple

matter to transfer the entire cost appearing on the job cost sheet into the Cost of Goods Sold account. In most cases, however, only a portion of the units involved in a particular job will be immediately sold. In these situations, the unit cost must be used to determine how much product cost should be removed from Finished Goods and charged to Cost of Goods Sold.

For Rand Company, we will assume that 750 of the 1,000 gold medallions in job A were shipped to customers by the end of the month for total sales revenue of $225,000. Since 1,000 units were produced and the total cost of the job from the job cost sheet was $158,000, the unit product cost was $158. The following journal entries would record the sale (all sales are on account):

(12)

Accounts Receivable	225,000	
Sales		225,000

(13)

Cost of Goods Sold	118,500	
Finished Goods		118,500
($158 per unit × 750 units = $118,500)		

With entry (13), the flow of costs through our job-order costing system is completed.

Summary of Cost Flows

To pull the entire Rand Company example together, journal entries (1) through (13) are summarized in Exhibit 3–9. The flow of costs through the accounts is presented in T-account form in Exhibit 3–10.

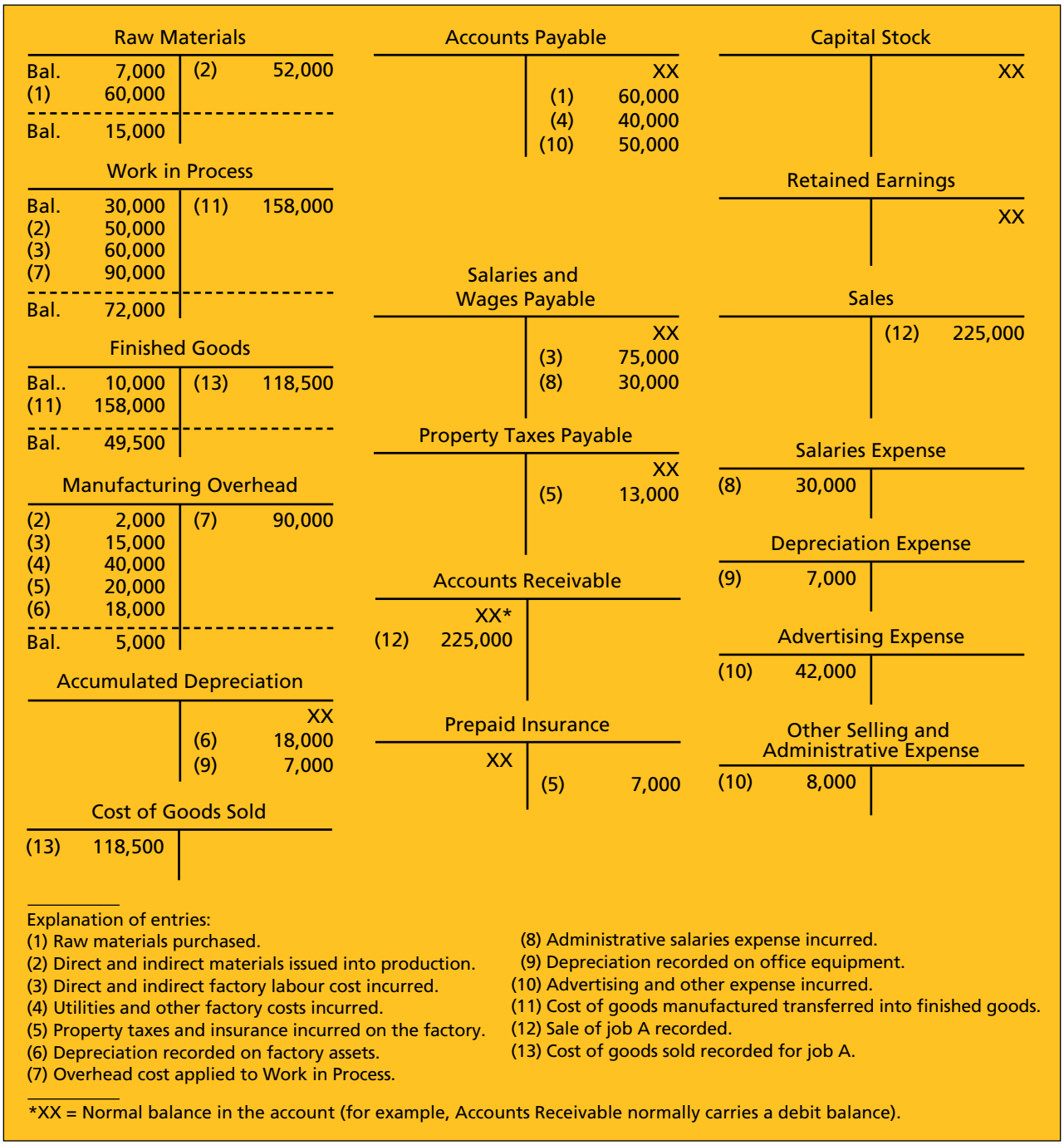
Exhibit 3–11 presents a schedule of cost of goods manufactured and a schedule of cost of goods sold for Rand Company. Note particularly from Exhibit 3–11 that the manufacturing overhead cost on the schedule of cost of goods manufactured is the overhead applied to jobs during the month—not the actual manufacturing overhead costs incurred. The reason for this can be traced back to journal entry (7) and the T-account for Work in Process that appears in Exhibit 3–10. Under a normal costing system as illustrated in this chapter, applied—not actual—overhead costs are applied to jobs and thus to Work in Process inventory. In contrast, in Chapter 2 actual overhead costs were assigned to Work in Process and included in the schedule of cost of goods manufactured. This is because we had not introduced the concept of normal costing in that chapter. Note also that the cost of goods manufactured for the month ($158,000) agrees with the amount transferred from Work in Process to Finished Goods for the month, as recorded earlier in entry (11). Also note that this $158,000 figure is used in computing the cost of goods sold for the month.

An income statement for April is presented in Exhibit 3–12. Observe that the cost of goods sold figure on this statement ($123,500) is carried down from Exhibit 3–11.

(1)		
Raw Materials	60,000	
Accounts Payable		60,000
(2)		
Work in Process	50,000	
Manufacturing Overhead	2,000	
Raw Materials		52,000
(3)		
Work in Process	60,000	
Manufacturing Overhead	15,000	
Salaries and Wages Payable		75,000
(4)		
Manufacturing Overhead	40,000	
Accounts Payable		40,000
(5)		
Manufacturing Overhead	20,000	
Property Taxes Payable		13,000
Prepaid Insurance		7,000
(6)		
Manufacturing Overhead	18,000	
Accumulated Depreciation		18,000
(7)		
Work in Process	90,000	
Manufacturing Overhead		90,000
(8)		
Salaries Expense	30,000	
Salaries and Wages Payable		30,000
(9)		
Depreciation Expense	7,000	
Accumulated Depreciation		7,000
(10)		
Advertising Expense	42,000	
Other Selling and Administrative Expense	8,000	
Accounts Payable		50,000
(11)		
Finished Goods	158,000	
Work in Process		158,000
(12)		
Accounts Receivable	225,000	
Sales		225,000
(13)		
Cost of Goods Sold	118,500	
Finished Goods		118,500

EXHIBIT 3–9 Summary of Rand Company Journal Entries

EXHIBIT 3–10 Summary of Cost Flows—Rand Company



Explanation of entries:
(1) Raw materials purchased.
(2) Direct and indirect materials issued into production.
(3) Direct and indirect factory labour cost incurred.
(4) Utilities and other factory costs incurred.
(5) Property taxes and insurance incurred on the factory.
(6) Depreciation recorded on factory assets.
(7) Overhead cost applied to Work in Process.
(8) Administrative salaries expense incurred.
(9) Depreciation recorded on office equipment.
(10) Advertising and other expense incurred.
(11) Cost of goods manufactured transferred into finished goods.
(12) Sale of job A recorded.
(13) Cost of goods sold recorded for job A.

*XX = Normal balance in the account (for example, Accounts Receivable normally carries a debit balance).

Cost of Goods Manufactured		
Direct materials:		
Raw materials inventory, beginning	$ 7,000	
Add: Purchases of raw materials	60,000	
Total raw materials available	67,000	
Deduct: Raw materials inventory, ending	15,000	
Raw materials used in production	52,000	
Less indirect materials included in manufacturing overhead	2,000	$ 50,000
Direct labour		60,000
Manufacturing overhead applied to work in process		90,000
Total manufacturing costs		200,000
Add: Beginning work in process inventory		30,000
		230,000
Deduct: Ending work in process inventory		72,000
Cost of goods manufactured		$158,000
Cost of Goods Sold		
Finished goods inventory, beginning		$ 10,000
Add: Cost of goods manufactured		158,000
Goods available for sale		168,000
Deduct: Finished goods inventory, ending		49,500
Unadjusted cost of goods sold		118,500
Add: Underapplied overhead*		5,000
Adjusted cost of goods sold		$123,500

*Note that the underapplied overhead is added to cost of goods sold. If overhead was overapplied, it would be deducted from costs of goods sold.

EXHIBIT 3–11 Schedules of Cost of Goods Manufactured and Cost of Goods Sold

RAND COMPANY
Income Statement
For the Month Ending April 30

Sales		$225,000
Less cost of goods sold ($118,500 + $5,000)		123,500
Gross margin		101,500
Less selling and administrative expenses:		
Salaries expense	$30,000	
Depreciation expense	7,000	
Advertising expense	42,000	
Other expense	8,000	87,000
Net income		$ 14,500

EXHIBIT 3–12 Income Statement

Complications of Overhead Application

We need to consider two complications relating to overhead application. These are (1) the computation of underapplied and overapplied overhead and (2) the disposition of any balance remaining in the Manufacturing Overhead account at the end of a period.

LEARNING OBJECTIVE 7
Compute under- or overapplied overhead cost and prepare the journal entry to close the balance in Manufacturing Overhead to the appropriate accounts.

Underapplied and Overapplied Overhead

Since the predetermined overhead rate is established before a period begins and is based entirely on estimated data, there generally will be a difference between the amount of overhead cost applied to Work in Process and the amount of overhead cost actually incurred

during a period. In the case of Rand Company, for example, the predetermined overhead rate of $6 per hour resulted in $90,000 of overhead cost being applied to Work in Process, whereas actual overhead costs for April proved to be $95,000 (as shown in Exhibit 3–8). The difference between the overhead cost applied to Work in Process and the actual overhead costs of a period is termed either **underapplied** or **overapplied overhead**. For Rand Company, overhead was underapplied because the applied cost ($90,000) was $5,000 less than the actual cost ($95,000). If the tables had been reversed and the company had applied $95,000 in overhead cost to Work in Process while incurring actual overhead costs of only $90,000, then the overhead would have been overapplied.

Underapplied overhead
A debit balance in the Manufacturing Overhead account that arises when the amount of overhead cost actually incurred is greater than the amount of overhead cost applied to Work in Process during a period.

Overapplied overhead
A credit balance in the Manufacturing Overhead account that arises when the amount of overhead cost applied to Work in Process is greater than the amount of overhead cost actually incurred during a period.

What is the cause of underapplied or overapplied overhead? The causes can be complex, and a full explanation will have to wait for Chapter 10. Nevertheless, the basic problem is that the method of applying overhead to jobs using a predetermined overhead rate assumes that actual overhead costs will be proportional to the actual amount of the allocation base incurred during the period. If, for example, the predetermined overhead rate is $6 per machine-hour, then it is assumed that actual overhead costs incurred will be $6 for every machine-hour that is actually worked. There are at least two reasons why this may not be true. First, much of the overhead often consists of fixed costs that do not change as the number of machine-hours incurred goes up or down. Second, spending on overhead items may or may not be under control. A fuller explanation of the causes of underapplied and overapplied overhead will have to wait for later chapters.

To illustrate what can happen, suppose that two companies—Turbo Crafters and Black & Howell—have prepared the following estimated data for the coming year:

	Company	
	Turbo Crafters	**Black & Howell**
Predetermined overhead rate based on	Machine-hours	Direct materials cost
Estimated manufacturing overhead (a)	$300,000 (a)	$120,000 (a)
Estimated amount of allocation base (b)	75,000	80,000
Predetermined overhead rate, (a) ÷ (b)	$4 per machine-hour	150% of direct materials cost

Note that when the allocation base is dollars—such as direct material cost in the case of Black and Howell—the predetermined overhead rate is a *percentage* of the allocation base. When dollars are divided by dollars, the result is a *percentage*.

Now assume that because of unexpected changes in overhead spending and changes in demand for the companies' products, the *actual* overhead cost and the *actual* activity recorded during the year in each company are as follows:

	Company	
	Turbo Crafters	**Black & Howell**
Actual manufacturing overhead costs	$290,000	$130,000
Actual amount of allocation base	68,000	$ 90,000

For each company, note that the actual data for both cost and the allocation base differ from the estimates used in computing the predetermined overhead rate. This results in underapplied and overapplied overhead as follows:

	Company	
	Turbo Crafters	**Black & Howell**
Actual manufacturing overhead cost	$290,000	$130,000
Manufactured overhead cost applied to Work in Process during the year:		
Predetermined overhead rate (a)	$4 per machine-hour	150% of direct material cost
Actual total amount of allocation base (b) . .	68,000 machine-hours	$90,000 direct material cost
Manufacturing overhead applied (a) × (b)	$272,000	$135,000
Underapplied (overapplied) manufacturing overhead	$ 18,000	$ (5,000)

For Turbo Crafters, notice that the amount of overhead cost that has been applied to Work in Process ($272,000) is less than the actual overhead cost for the year ($290,000). Therefore, overhead is underapplied. Also notice that the original estimate of overhead in Turbo Crafters ($300,000) is not directly involved in this computation. Its impact is felt only through the $4 predetermined overhead rate that is used.

For Black & Howell, the amount of overhead cost that has been applied to Work in Process ($135,000) is greater than the actual overhead cost for the year ($130,000), and so overhead is overapplied.

A summary of the concepts discussed above is presented in Exhibit 3–13.

IN BUSINESS

Overhead Costs Can Be Significant

Manufacturing overhead costs, exclusive of amortization, were $3,768,000 in the first quarter of 2007 as compared to $3,763,000 in the first quarter of 2006, representing an increase of $5,000 or 0.1%. Manufacturing overhead costs, exclusive of amortization, were 12.3% of sales in the first quarter of 2007 as compared to 9.7% in 2006. The increase in manufacturing overheads as a percentage of sales was primarily due to an underabsorption of overhead costs as a result of the lower sales volumes in the first quarter of 2007 as compared to the first quarter of 2006 and the fixed nature of certain manufacturing overhead costs.

Source: CPI Plastics Group Ltd. at www.cpiplastics.com.

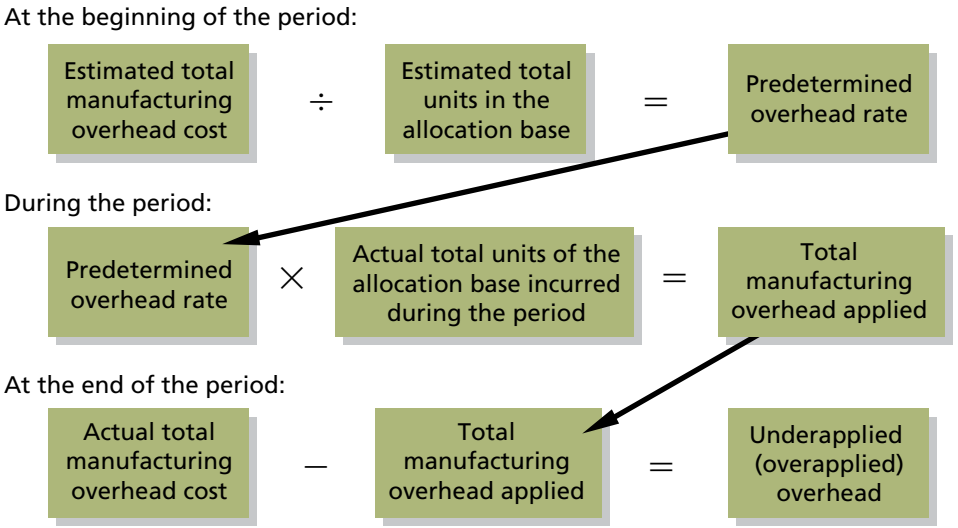


EXHIBIT 3–13 Summary of Overhead Concepts

Disposition of Under- or Overapplied Overhead Balances

What disposition should be made of any under- or overapplied balance remaining in the Manufacturing Overhead account at the end of a period? Generally, any balance in the account is treated in one of three ways:

1. Close out to Cost of Goods Sold.
2. Allocate between Work in Process, Finished Goods, and Cost of Goods Sold in proportion to the overhead applied during the current period in the ending balances of these accounts.[1]
3. Carry forward to the next period.

The second method, which allocates the under- or overapplied overhead among ending inventories and Cost of Goods Sold, is equivalent to using an "actual" overhead rate and is for that reason considered by many to be more accurate than the first method. Consequently, if the amount of underapplied or overapplied overhead is material, many accountants would insist that the second method be used. In problem assignments, we will always indicate which method you are to use for disposing of under- or overapplied overhead.

Close Out to Cost of Goods Sold As mentioned above, closing out the balance in Manufacturing Overhead to Cost of Goods Sold is simpler than the allocation method. Returning to the example of Rand Company, the entry to close the $5,000 of underapplied overhead to Cost of Goods Sold would be as follows:

	(14)	
Cost of Goods Sold	5,000	
Manufacturing Overhead		5,000

Note that since there is a debit balance in the Manufacturing Overhead account, Manufacturing Overhead must be credited to close out the account. This has the effect of increasing Cost of Goods Sold for April to $123,500:

Unadjusted cost of goods sold [from entry (13)]	$118,500
Add underapplied overhead [entry (14) above]	5,000
Adjusted cost of goods sold	$123,500

After this adjustment has been made, Rand Company's income statement for April will appear as was shown earlier in Exhibit 3–12.

Allocate among Accounts Allocation of under- or overapplied overhead among Work in Process, Finished Goods, and Cost of Goods Sold is more accurate than closing the entire balance into Cost of Goods Sold. This allocation assigns overhead costs to where they would have gone in the first place had it not been for the errors in the estimates going into the predetermined overhead rate.

Had Rand Company chosen to allocate the underapplied overhead among the inventory accounts and cost of goods sold, it would first be necessary to determine the amount of overhead that had been applied during April in each of the accounts. The computations would have been as follows:

Overhead applied in work in process inventory, April 30	$30,000	33.33%
Overhead applied in finished goods inventory, April 30 ($60,000/1,000 units = $60 per unit) × 250 units	15,000	16.67%
Overhead applied in cost of goods sold, April ($60,000/1,000 units = $60 per unit) × 750 units	45,000	50.00%
Total overhead applied	$90,000	100.00%

1. Some firms prefer to make the allocation on the basis of the total cost of direct materials, direct labour, and applied manufacturing overhead in each of the accounts at the end of the period. This method is not as accurate as allocating the balance in the Manufacturing Overhead account on the basis of just the overhead applied in each of the accounts during the current period.

Based on the above percentages, the underapplied overhead (i.e., the debit balance in Manufacturing Overhead) would be allocated as in the following journal entry:

Work in Process (33.33% × $5,000)	1,666.50	
Finished Goods (16.67% × $5,000)	833.50	
Cost of Goods Sold (50.00% × $5,000)	2,500.00	
Manufacturing Overhead		5,000.00

Note that the first step in the allocation was to determine the amount of overhead applied in each of the accounts. For Finished Goods, for example, the total amount of overhead applied to job A, $60,000, was divided by the total number of units in job A, 1,000 units, to arrive at the average overhead applied of $60 per unit. Since 250 units from job A were still in ending finished goods inventory, the amount of overhead applied in the Finished Goods Inventory account was $60 per unit multiplied by 250 units, or $15,000 in total.

If overhead had been overapplied, the entry above would have been just the reverse, since a credit balance would have existed in the Manufacturing Overhead account.

An alternative but less accurate way to allocate under- or overapplied overhead among Work in Process, Finished Goods, and Cost of Goods Sold is to use the entire cost of manufacturing in each account.

Had we chosen to allocate the underapplied overhead in the Rand Company example, the computations and entry would have been:

Work in process inventory, April 30		$ 72,000	36.00%
Finished goods inventory, April 30		49,500	24.75
Cost of goods sold	$118,500		
Less: Work in process inventory, April 1	30,000		
Less: Finished goods inventory, April 1	10,000	78,500	39.25
Total		$200,000	100.00%
Work in Process (36.0% × $5,000)	1,800		
Finished Goods (24.75% × $5,000)	1,237		
Cost of Goods Sold (39.25% × $5,000)	1,963		
Manufacturing Overhead		5,000	

A comparison of the percentages above with those using only overhead suggests that total manufacturing costs and overhead were not in the same proportions in each account. This difference is the inaccuracy in the problem resulting from using total manufacturing costs to conduct the allocation.

The rationale for deducting the beginning work in process and finished goods inventories from the cost of goods sold is to permit the allocation to be based on costs from the current period. By doing so, the 39.25% in the Rand Company example reflects only total manufacturing costs from April and thus corresponds to the period in which the underapplied overhead occurred. Without this adjustment, cost of goods sold would be assigned the overhead difference based on costs carried over from March and thus bear a disproportionate amount of the under- or overapplied overhead.

Carry the Balance Forward Recall the section earlier in this chapter entitled Application of Manufacturing Overhead. Notice that some firms have large seasonal variations in output while being faced with relatively constant overhead costs. Predetermined overhead was used to even out fluctuations in the cost of overhead caused by seasonal variations in output and seasonal variations in costs (e.g., heating costs). The predetermined overhead rate is computed using estimated total manufacturing costs for a year divided by estimated total units in the base. The result is an average rate. When the average predetermined rate is applied to actual production for the period, the applied overhead is determined. The under- or overapplied overhead is a result of two factors: an actual base that is different from one-twelfth of the annual estimated base and actual overhead costs that do not equal one-twelfth of the total estimated overhead costs. Therefore, for any given month, an under- or overapplied overhead amount would be expected. In some months, it would be positive; in other months, it would be negative. Over the year, these amounts may largely cancel out. If this is the situation, then significant debits and credits

could be carried forward to the year-end so that a final disposition can be made either by adjusting Cost of Goods Sold or allocating (sometimes termed prorating) the amount to the inventories and Cost of Goods Sold.

The Rand Company example would be treated as follows:

Underapplied Overhead		
[a deferred debit balance on the balance sheet]	5,000	
Manufacturing Overhead		5,000

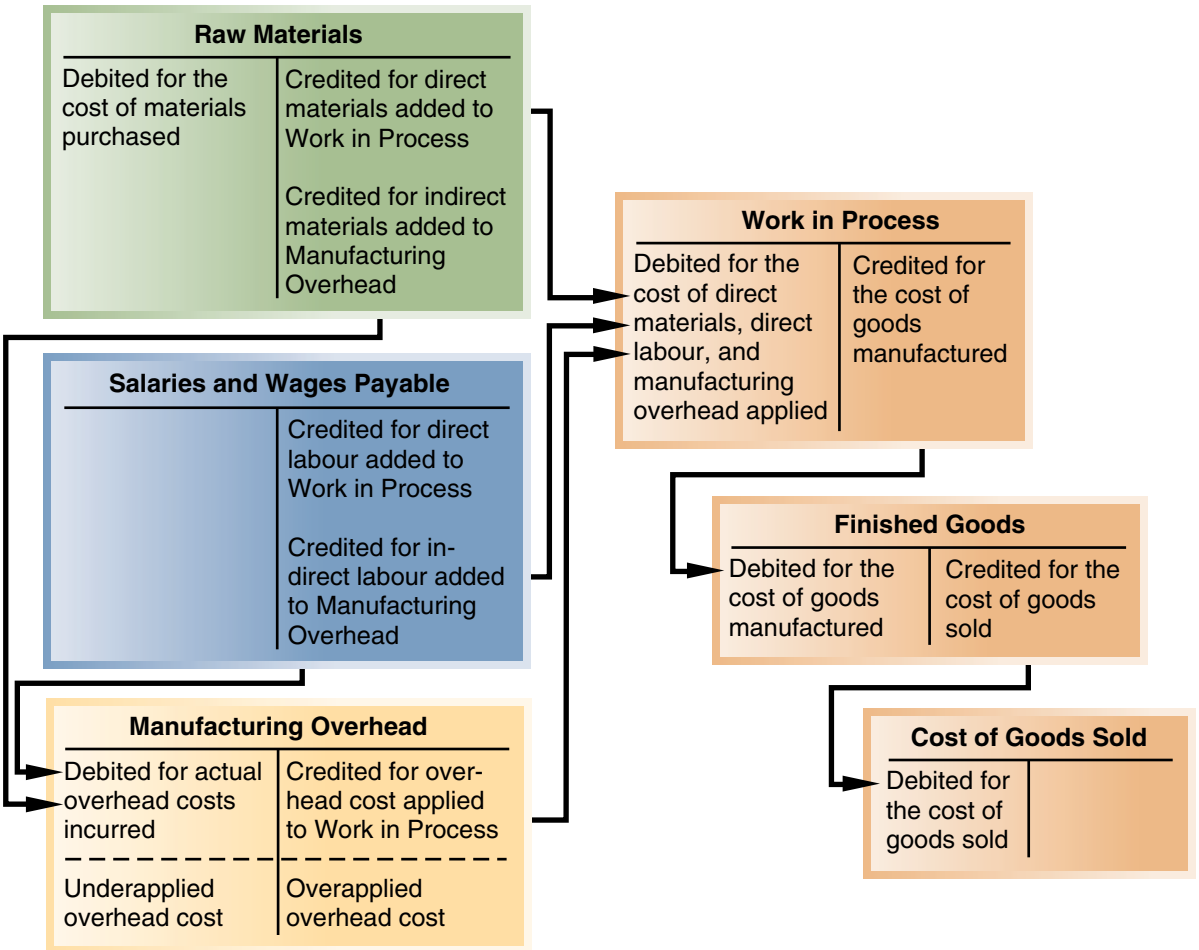
A General Model of Product Cost Flows

The flow of costs in a product costing system is presented in the form of a T-account model in Exhibit 3–14. This model applies as much to a process costing system as it does to a job-order costing system. Examination of this model can be very helpful in gaining a perspective as to how costs enter a system, flow through it, and finally end up as Cost of Goods Sold on the income statement.

Variations from the General Model of Product Cost Flow

Costing systems can vary from what is reflected by the general model. While the general model is the most complete description, circumstances may make such a complete system too costly. For example, a system variation known as *backflush costing* can permit labour

EXHIBIT 3–14 A General Model of Cost Flows



charges to be made directly to manufacturing overhead. Then, overhead is applied to the cost of completed jobs along with raw materials, so that the need to keep work in process records can be avoided. Such a minimal treatment of work in process is justified in a mechanized Lean Manufacturing (JIT) environment. Cost of completed jobs still reflects the material and overhead (including labour), but the record system reflects the simplified needs of the production environment.

Multiple Predetermined Overhead Rates

Our discussion of overhead in this chapter has assumed that there is a single predetermined overhead rate for an entire factory called a **plantwide overhead rate**. This is, in fact, a common practice—particularly in smaller companies. But in larger companies, *multiple predetermined overhead rates* are often used. In a **multiple predetermined overhead rate** system there is usually a different overhead rate for each production department. Such a system, while more complex, is considered to be more accurate, because it can reflect differences across departments in how overhead costs are incurred. For example, overhead might be allocated based on direct labour-hours in departments that are relatively labour-intensive and based on machine-hours in departments that are relatively machine-intensive. When multiple predetermined overhead rates are used, overhead is applied in each department according to its own overhead rate as a job proceeds through the department.

Plantwide overhead rate
A single predetermined overhead rate that is used throughout a plant.

Multiple predetermined overhead rates
A costing system in which there are multiple overhead cost pools with a different predetermined rate for each cost pool, rather than a single predetermined overhead rate for the entire company. Frequently, each production department is treated as a separate overhead cost pool.

To illustrate, refer to the data in the following table where Cook Company has two departments (A and B) and several jobs in process. Data is provided for two of these jobs (X and Y). If the company uses a plantwide overhead rate of $12 ($336,000 ÷ 28,000 DLH) then the overhead costs applied to Job X and Job Y will be $8,400 ($12 × 700 hours + $12 × 0) and $12 ($12 × 0 hours + $12 × 1 hour) respectively. However, if overhead is applied using department overhead rates then Job X will be assigned $2,800 ($4 × 700 direct labour-hours) and Job Y will be assigned $8,400 ($12 × 700 machine-hours).

Cook Company	Department A	Department B	Total
Overhead cost	$84,000	$252,000	$336,000
Direct labour-hours	21,000	7,000	28,000 DLH
Machine-hours	7,000	21,000	28,000 MH
Overhead cost driver	21,000 DLH	21,000 MH	
Overhead rate: Plant wide			$12 per DLH
By department	$4/DLH	$12/MH	
Direct labour-hours—Job X	700	0	
Direct labour-hours—Job Y	0	1	
Machine-hours—Job X	1	0	
Machine-hours—Job Y	0	700	

The decision to use a plantwide rate versus separate rates for each department comes down to cost/benefit. It is cheaper to use a plantwide rate but separate rates are more informative when the activities that drive overhead costs differ among departments. Improved decision making resulting from more accurate overhead data can justify the added costs of gathering separate departmental overhead data.

Use of Information Technology

Earlier in the chapter, we discussed how bar code technology can be used to record labour time—reducing the drudgery in that task and increasing accuracy. Bar codes have many other uses.

In a company with a well-developed bar code system, the manufacturing cycle begins with the receipt of a customer's order in electronic form. Until very recently, the order would have been received via electronic data interchange (EDI), which involves a network

of computers linking organizations. An EDI network allows companies to electronically exchange business documents and other information that extend into all areas of business activity from ordering raw materials to shipping completed goods. EDI was developed in the 1980s and requires significant investments in programming and networking hardware. Recently, EDI has been challenged by a far cheaper Internet-based alternative—XML (Extensible Markup Language), an extension of HTML (Hypertext Markup Language). HTML uses codes to tell your Web browser how to display information on your screen, but the computer doesn't know what the information is—it just displays it. XML provides additional tags that identify the kind of information that is being exchanged. For example, price data might be coded as <price> 14.95 <price>. When your computer reads this data and sees the tag <price> surrounding 14.95, your computer will immediately know that this is a price. XML tags can designate many different kinds of information—customer orders, medical records, bank statements, and so on—and the tags will indicate to your computer how to display, store, and retrieve the information. Office Depot was an early adopter of XML, which it is using to facilitate e-commerce with its big customers.

Once an order has been received via EDI or over the Internet in the form of an XML file, the computer draws up a list of required raw materials and sends out electronic purchase orders to suppliers. When materials arrive at the company's plant from the suppliers, bar codes that have been applied by the suppliers are scanned to update inventory records and to trigger payment for the materials. The bar codes are scanned again when the materials are requisitioned for use in production. At that point, the computer credits the Raw Materials inventory account for the amount and type of goods requisitioned and charges the Work in Process inventory account.

A unique bar code is assigned to each job. This bar code is scanned to update Work in Process records for labour and other costs incurred in the manufacturing process. When goods are completed, another scan is performed that transfers both the cost and quantity of goods from the Work in Process inventory account to the Finished Goods inventory account, or charges Cost of Goods Sold for goods ready to be shipped.

Goods ready to be shipped are packed into containers, which are bar-coded with information that includes the customer number, the type and quantity of goods being shipped, and the order number. This bar code is then used for preparing billing information and for tracking the packed goods until placed on a carrier for shipment to the customer. Some customers require that the packed goods be bar-coded with point-of-sale labels that can be scanned at retail checkout counters. These scans allow the retailer to update inventory records, verify price, and generate a customer receipt.

In short, bar code technology is being integrated into all areas of business activity. When combined with EDI or XML, it eliminates a lot of clerical drudgery and allows companies to capture and exchange more data and to analyze and report information much more quickly and completely and with less error than with manual systems.

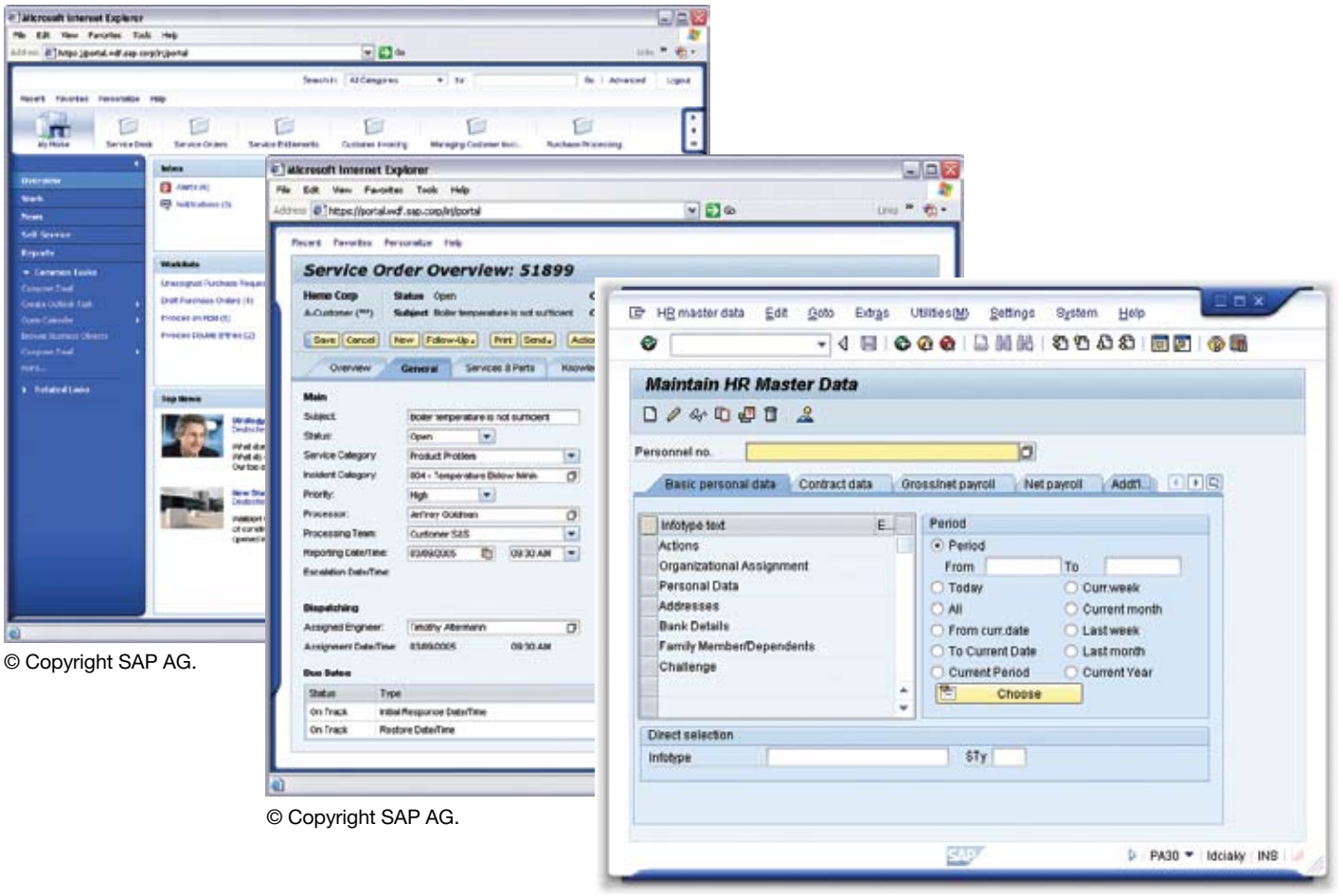
The integration of XML and the internal computer system for management reporting is called an *enterprise resource planning system* (ERP system). An ERP system represents a real-time computer system using a single uniform database that is coupled with modules for accounting, logistics, and human resources. Full use of these modules permits an integrated systems response for Internet-based orders in XML, supplier purchases and payables, inventory management, production, sales and receivables, treasury, and capital (fixed) assets management. Major suppliers of such ERP systems include Oracle, SAP, and Baan.[2] Other companies provide certified software that is compatible with these systems. Samples of the overall menus for SAP are shown in Exhibit 3–15.

Operationally, these systems can provide global capabilities to regulate the variety of financial accounting and tax situations and do so in the appropriate language. Combining (better known as *consolidation*) of these different reports is performed by the system, along with drill-down capabilities for investigating details.

Critical to the installation of these systems is a well-specified operating system and well-trained personnel. Configurations for these systems to suit specific industries are

2. Internet sites for these companies provide details about each of their products and services: http://www.oracle.com/, http://www.sap.com/, http://www.baan.com/, and http://www.jdedwards.com/.

EXHIBIT 3–15 Sample SAP menus[3]



provided with the software installation. For example, SAP, the world leader in such software, provides configurations for such industries as defence, apparel, automotive, construction, chemicals, and education, to mention only a few.

ERP systems combined with Web-based software and executive decision support reporting represent the current technology used by progressive organizations in both the commercial and not-for-profit fields. The size of an organization has to be sufficient to support the larger systems mentioned here, but small business software is available to do similar activities in an appropriately simplified way.[4]

International Job Costing

Studies of the international accounting scene suggest that the general principles of product costing are universally applicable. Nevertheless, differences do exist from country to country in how specific costs are classified. For example, a study of Russian operational

3. This book contains references to the products of SAP AG, Dietmar-Hopp-Allee 16, 69190 Walldorf, Germany. The names of these products are registered and/or unregistered trademarks of SAP AG. SAP AG is neither the author nor the publisher of this book and is not responsible for its contents.
4. For background information on ERP, see Gerald Trites, *Enterprise Resource Planning* (Toronto, ON: The Canadian Institute of Chartered Accountants, 2000), and F. Robert Jacobs and D. Clay Whyback, *Why ERP? A Primer on SAP Implementation* (New York, NY: McGraw-Hill/Irwin, 2000).

accounting and statistical record-keeping, the equivalent of product costing, suggests that the required reporting structure in Russia would assign some cost elements to inventory that we might classify as selling or administrative. Other costs such as the rent on plant facilities would be classified outside of the usual overhead category. If a company was executing a contract with a foreign government, the differences in what is or is not permitted as contract costs would be particularly important. Similarly, what Public Works and Government Services Canada will allow as contract costs is described by the word "prudent" and elaborated in a specific list of costs excluded from product costs.[5] For example, these requirements would permit certain general and selling costs to be included if a prudent person would incur such costs as part of the contract. Thus, while the general principles may be similar, the specifics can vary as a result of government regulations.

IN BUSINESS

Cost Trends (2006)

Cost differentials among the returning countries (G7 plus Netherlands) have narrowed since the previous (2004) edition of *Competitive Alternatives*, with most countries moving closer to the US benchmark:

- Japan has experienced the greatest gain in cost competitiveness, assisted by the weakening of the yen relative to the US dollar, and improvements in local business costs.
- Germany, the Netherlands, France, and Italy have all experienced improvements in their cost competitiveness, relative to the US benchmark.
- The United Kingdom has retained a cost advantage over the United States, Japan, and Germany.
- Canada has retained its top ranking among G7 countries, although the size of its advantage has been reduced by the strong appreciation in value of the Canadian dollar relative to the US dollar over the last two years.

Source: *Competitive Alternatives Highlights: KPMG's Guide to International Business Costs.* www.competitivealternatives.com

Recorded Costs for Quality

Deficiencies in quality result in scrap, rework, delays in production, extra inventory, warranty claims, and poor customer relations. Such costs have been estimated at 25% to 35% of total product costs for some companies. Chapter 11 presents an elaboration of various reports used to manage quality costs.

To illustrate the accounting process for defective units, assume that 2,000 units were started for a job, but only 1,900 good units were finished. If raw material, direct labour, and overhead applied amounted to $4,800 at the end of production, then each good unit would have a unit cost of $4,800 ÷ by 1,900, or $2.53 per unit. If management wanted to charge the 100 units to all production instead of the particular 1,900-unit job, the situation could be recorded as follows:

Manufacturing Overhead	240	
Work in Process Inventory		240

Calculations:

$4,800 ÷ 2,000 units = $2.40 per unit
100 defective units would cost 100 × $2.40
The 1,900 good units would cost ($4,800 – $240) = $4,560, or $2.40 per unit.

5. Section 3, General Conditions, DSS-MAS 1031-2, "Contract Cost Principles," *Standard Acquisition Clauses and Conditions Manual*, Public Works and Government Services Canada, 1997.

Any recovery from the 100 units of scrap would be credited to manufacturing overhead or the job costs, depending on the procedure used for the initial recording. If repair or rework was undertaken on the 100 defective units, then material, direct labour, and overhead costs would be charged to the job or the overhead account to be offset by any recovery.

The logic of whether to charge scrap or rework costs to all production or to a specific job is determined by deciding if defect costs were a normal cost of all production (thus a charge to overhead) or a cost of the specific situation surrounding a particular job (thus a charge solely of that job).

Environmentally hazardous scrap or defects can require disposal costs. Such environmental costs can be presented in a manner that they would provide management with evidence of the remediation or disposal requirements for their production processes.

Summary

Job-order costing and process costing are widely used to track costs. Job-order costing is used in situations where the organization offers many different products or services, such as in furniture manufacturing, hospitals, and legal firms. Process costing is used where units of product are homogeneous, such as in flour milling or cement production.

Materials requisition forms and labour time tickets are used to assign direct materials and direct labour costs to jobs in a job-costing system. Manufacturing overhead costs are assigned to jobs through use of a predetermined overhead rate. The predetermined overhead rate is determined before the period begins by dividing the estimated total manufacturing overhead cost for the period by the estimated total allocation base for the period. The most frequently used allocation bases are direct labour-hours and machine-hours. Overhead is applied to jobs by multiplying the predetermined overhead rate by the actual amount of the allocation base used by the job.

Since the predetermined overhead rate is based on estimates, the actual overhead cost incurred during a period may be more or less than the amount of overhead cost applied to production. Such a difference is referred to as under- or overapplied overhead. The under- or overapplied overhead for a period can be (1) closed out to Cost of Goods Sold or (2) allocated among Work in Process, Finished Goods, and Cost of Goods Sold or (3) carried forward to the end of the year. When overhead is underapplied, manufacturing overhead costs have been understated and therefore inventories and/or expenses must be adjusted upward. When overhead is overapplied, manufacturing overhead costs have been overstated and therefore inventories and/or expenses must be adjusted downward.

Review Problem: Job-Order Costing

Hogle Company is a manufacturing firm that uses job-order costing. On January 1, the beginning of its fiscal year, the company's inventory balances were as follows:

Raw materials	$20,000
Work in process	15,000
Finished goods	30,000

The company applies overhead cost to jobs on the basis of machine-hours worked. For the current year, the company estimated that it would work 75,000 machine-hours and incur $450,000 in manufacturing overhead cost. The following transactions were recorded for the year:

a. Raw materials were purchased on account, $410,000.

b. Raw materials were requisitioned for use in production, $380,000 ($360,000 direct materials and $20,000 indirect materials).
c. The following costs were incurred for employee services: direct labour, $75,000; indirect labour, $110,000; sales commissions, $90,000; and administrative salaries, $200,000.
d. Sales travel costs were incurred, $17,000.
e. Utility costs were incurred in the factory, $43,000.
f. Advertising costs were incurred, $180,000.
g. Depreciation was recorded for the year, $350,000 (80% relates to factory operations, and 20% relates to selling and administrative activities).
h. Insurance expired during the year, $10,000 (70% relates to factory operations, and the remaining 30% relates to selling and administrative activities).
i. Manufacturing overhead was applied to production. Due to greater than expected demand for its products, the company worked 80,000 machine-hours during the year.
j. Goods costing $900,000 to manufacture according to their job cost sheets were completed during the year.
k. Goods were sold on account to customers during the year at a total selling price of $1,500,000. The goods cost $870,000 to manufacture according to their job cost sheets.

Required:

1. Prepare journal entries to record the preceding transactions.
2. Post the entries in (1) above to T-accounts (do not forget to enter the opening balances in the inventory accounts).
3. Is Manufacturing Overhead underapplied or overapplied for the year? Prepare a journal entry to close any balance in the Manufacturing Overhead account to Cost of Goods Sold. Do not allocate the balance between ending inventories and Cost of Goods Sold.
4. Prepare an income statement for the year and a schedule of cost of goods manufactured.

Solution to Review Problem

1.

a.	Raw Materials	410,000	
	Accounts Payable		410,000
b.	Work in Process	360,000	
	Manufacturing Overhead	20,000	
	Raw Materials		380,000
c.	Work in Process	75,000	
	Manufacturing Overhead	110,000	
	Sales Commissions Expense	90,000	
	Administrative Salaries Expense	200,000	
	Salaries and Wages Payable		475,000
d.	Sales Travel Expense	17,000	
	Accounts Payable		17,000
e.	Manufacturing Overhead	43,000	
	Accounts Payable		43,000
f.	Advertising Expense	180,000	
	Accounts Payable		180,000
g.	Manufacturing Overhead	280,000	
	Depreciation Expense	70,000	
	Accumulated Depreciation		350,000
h.	Manufacturing Overhead	7,000	
	Insurance Expense	3,000	
	Prepaid Insurance		10,000

i. The predetermined overhead rate for the year would be computed as follows:

$$\frac{\text{Estimated manufacturing overhead, \$450,000}}{\text{Estimated machine-hours, 75,000}} = \$6 \text{ per machine-hour}$$

Based on the 80,000 machine-hours actually worked during the year, the company would have applied $480,000 in overhead cost to production: 80,000 machine-hours × $6 = $480,000. The following entry records this application of overhead cost:

Work in Process	480,000	
Manufacturing Overhead		480,000

j. Finished Goods	900,000		
Work in Process		900,000	
k. Accounts Receivable	1,500,000		
Sales		1,500,000	
Cost of Goods Sold	870,000		
Finished Goods		870,000	

2.

Raw Materials

Bal.	20,000	(b)	380,000
(a)	410,000		
Bal.	50,000		

Work in Process

Bal.	15,000	(j)	900,000
(b)	360,000		
(c)	75,000		
(i)	480,000		
Bal.	30,000		

Finished Goods

Bal.	30,000	(k)	870,000
(j)	900,000		
Bal.	60,000		

Cost of Goods Sold

(k)	870,000		

Manufacturing Overhead

(b)	20,000	(i)	480,000
(c)	110,000		
(e)	43,000		
(g)	280,000		
(h)	7,000		
	460,000		480,000
		Bal.	20,000

Prepaid Insurance

		(h)	10,000

Accumulated Depreciation

		(g)	350,000

Accounts Receivable

(k)	1,500,000		

Commissions Expense

(c)	90,000		

Administrative Salary Expense

(c)	200,000		

Sales Travel Expense

(d)	17,000		

Accounts Payable

		(a)	410,000
		(d)	17,000
		(e)	43,000
		(f)	180,000

Sales

		(k)	1,500,000

Advertising Expense

(f)	180,000		

Depreciation Expense

(g)	70,000		

Salaries and Wages Payable

		(c)	475,000

Insurance Expense

(h)	3,000		

3. Manufacturing overhead is overapplied for the year. The entry to close it out to Cost of Goods Sold is as follows:

Manufacturing Overhead	20,000	
Cost of Goods Sold		20,000

4.

HOGLE COMPANY
Income Statement
For the Year Ended December 31

Sales		$1,500,000
Less cost of goods sold ($870,000 − $20,000)		850,000
Gross margin		650,000
Less selling and administrative expenses:		
Commissions expense	$ 90,000	
Administrative salaries expense	200,000	
Sales travel expense	17,000	
Advertising expense	180,000	
Depreciation expense	70,000	
Insurance expense	3,000	560,000
Operating income		$ 90,000

HOGLE COMPANY
Schedule of Cost of Goods Manufactured and Cost of Goods Sold

Direct Materials:		
Raw materials inventory, January 1	$ 20,000	
Add: Purchases of raw materials	410,000	
Total raw materials available	430,000	
Deduct: Raw materials inventory, December 31	50,000	
Raw materials used in production	380,000	
Less: Indirect materials (below)	20,000	
Direct materials used in production		$360,000
Direct Labour		75,000
Manufacturing Overhead:		
Indirect materials	20,000	
Indirect labour	110,000	
Utilities	43,000	
Depreciation	280,000	
Insurance	7,000	
Actual overhead costs	460,000	
Add: Overapplied overhead	20,000	
Overhead applied to work in process		480,000*
Total manufacturing costs		915,000
Add: Beginning work in process inventory		15,000
		930,000
Deduct: Ending work in process inventory		30,000
Cost of goods manufactured		900,000
Add: Finished goods inventory, January 1		30,000
Goods available for sale		930,000
Deduct: Finished goods inventory, December 31		60,000
Cost of Goods Sold		870,000
Deduct: Overapplied overhead		20,000
Adjusted cost of goods sold		$850,000

*The details of manufacturing overhead may be omitted as shown in Exhibit 3–11. If these are not omitted then the overapplied overhead must be added to actual overhead costs and only the total ($480,000) is added to direct materials and direct labour. The reason is that the schedule of cost of goods manufactured represents a summary of costs flowing through the Work in Process account during a period and therefore must include only overhead applied to production. If a reverse situation had existed and overhead had been underapplied during the period, then the amount of underapplied overhead would have been deducted from actual overhead costs on the schedule. This would have brought the actual overhead costs down to the amount that had been applied to production.

Appendix 3A: The Predetermined Overhead Rate and Capacity

LEARNING OBJECTIVE 8
Explain the implications of basing the predetermined overhead rate on activity at capacity rather than on estimated activity for the period.

Companies typically base their predetermined overhead rates on the estimated, or budgeted, amount of the allocation base for the upcoming period. This is the method that is used in the chapter, but it is a practice that has recently come under severe criticism. An example will be very helpful in understanding why. Prahad Corporation manufactures music CDs for local recording studios. The company has a CD duplicating machine that is capable of producing a new CD every 10 seconds from a master CD. The company leases the CD duplicating machine for $180,000 per year, and this is the company's only manufacturing overhead. With allowances for set-ups and maintenance, the machine is theoretically capable of producing up to 900,000 CDs per year. However, due to weak retail sales of CDs, the company's commercial customers are unlikely to order more than 600,000 CDs next year. The company uses machine time as the allocation base for applying manufacturing overhead. These data are summarized below:

PRAHAD CORPORATION DATA

Total manufacturing overhead cost	$180,000 per year
Allocation base: machine time per CD	10 seconds per CD
Capacity	900,000 CDs per year
Budgeted output for next year	600,000 CDs

If Prahad follows common practice and computes its predetermined overhead rate using estimated, or budgeted, figures, then its predetermined overhead rate for next year would be $0.03 per second of machine time, computed as follows:

$$\frac{\text{Estimated total manufacturing overhead cost, \$180,000}}{\text{Estimated total units in the allocation base, 600,000 CDs} \times \text{10 seconds per CD}} = \text{\$0.03 per second}$$

Since each CD requires 10 seconds of machine time, each CD will be charged for $0.30 of overhead cost.

Critics charge that there are two problems with this procedure. First, if predetermined overhead rates are based on budgeted activity, then the unit product costs will fluctuate, depending on the budgeted level of activity for the period. For example, if the budgeted output for the year was only 300,000 CDs, the predetermined overhead rate would be $0.06 per second of machine time or $0.60 per CD rather than $0.30 per CD. In general, if budgeted output falls, the overhead cost per unit will increase; it will appear that the CDs cost more to make. Managers may then be tempted to increase prices at the worst possible time—just as demand is falling.

Second, critics charge that under the traditional approach, products are charged for resources that they do not use. When the fixed costs of capacity are spread over estimated activity, the units that are produced must shoulder the costs of unused capacity. That is why the applied overhead cost per unit increases as the level of activity falls. The critics argue that products should be charged only for the capacity that they use; they should not be charged for the capacity they do not use. This can be accomplished by basing the predetermined overhead rate on capacity as follows:

$$\frac{\text{Total manufacturing overhead cost at capacity, \$180,000}}{\text{Total units in the allocation base at capacity, 900,000 CDs} \times \text{10 seconds per CD}} = \text{\$0.02 per second}$$

Since the predetermined overhead rate is $0.02 per second, the overhead cost applied to each CD would be $0.20. This charge is constant and would not be affected by the level of activity during a period. If output falls, the charge would still be $0.20 per CD.

The use of capacity will almost certainly result in underapplied overhead. If actual output at Prahad Corporation is 600,000 CDs, then only $120,000 of overhead cost would be applied to products ($0.20 per CD × 600,000 CDs). Since the actual overhead cost is $180,000, there would be underapplied overhead of $60,000. In another departure from

tradition, the critics suggest that the underapplied overhead that results from idle capacity should be separately disclosed on the income statement as the Cost of Unused Capacity—a period expense. Disclosing this cost as a lump sum on the income statement, rather than burying it in Cost of Goods Sold or ending inventories, makes it much more visible to managers.

Official pronouncements do not prohibit basing predetermined overhead rates on capacity for external reports. Nevertheless, basing the predetermined overhead rate on estimated, or budgeted, activity is a long-established practice in industry, and some managers and accountants may object to the large amounts of underapplied overhead that would often result from using capacity to determine predetermined overhead rates. And some may insist that the underapplied overhead be allocated among Cost of Goods Sold and ending inventories—which would defeat the purpose of basing the predetermined overhead rate on capacity.

Glossary

Visit the Online Learning Centre at **http://www.mcgrawhill.ca/olc/garrison/** for a review of glossary terms and definitions.

Questions

3–1 Why aren't actual overhead costs traced to jobs just as direct materials and direct labour costs are traced to jobs?

3–2 When would job-order costing be used instead of process costing?

3–3 What is the purpose of the job cost sheet in a job-order costing system?

3–4 What is a predetermined overhead rate, and how is it computed?

3–5 Explain how a sales order, a production order, a materials requisition form, and a labour time ticket are involved in producing and costing products.

3–6 Explain why some production costs must be assigned to products through an allocation process.

3–7 Why do companies use predetermined overhead rates rather than actual manufacturing overhead costs to apply overhead to jobs?

3–8 What factors should be considered in selecting a base to be used in computing the predetermined overhead rate?

3–9 If a company fully allocates all of its overhead costs to jobs, does this guarantee that a profit will be earned for the period?

3–10 What account is credited when overhead cost is applied to Work in Process? Would you expect the amount applied for a period to equal the actual overhead costs of the period? Why or why not?

3–11 What is underapplied overhead? Overapplied overhead? What disposition is made of these amounts at the end of the period?

3–12 Provide two reasons why overhead might be underapplied in a given year.

3–13 What adjustment is made for underapplied overhead on the schedule of cost of goods sold? What adjustment is made for overapplied overhead?

3–14 Sigma Company applies overhead cost to jobs on the basis of direct labour cost. Job A, which was started and completed during the current period, shows charges of $5,000 for direct materials, $8,000 for direct labour, and $6,000 for overhead on its job cost sheet. Job B, which is still in process at year-end, shows charges of $2,500 for direct materials and $4,000 for direct labour. Should any overhead cost be added to Job B at year-end? Explain and show the amount.

3–15 A company assigns overhead cost to completed jobs on the basis of 125% of direct labour cost. The job cost sheet for Job 313 shows that $10,000 in direct materials has been used

on the job and that $12,000 in direct labour cost has been incurred. If 1,000 units were produced in Job 313, what is the unit product cost?

3–16 What is a plantwide overhead rate? Why are multiple overhead rates, rather than a plantwide overhead rate, used in some companies?

3–17 What happens to overhead rates based on direct labour when automated equipment replaces direct labour?

3–18 Predetermined overhead rates smooth product costs. Do you agree? Why?

3–19 Explain clearly the rationale for why under- and overapplied overhead for an interim period should be carried to the balance sheet. What conceptual factor is assumed in the argument?

3–20 Why does the calculation of the percentages for prorating the under- or overapplied overhead reduce the costs of goods sold by the opening inventories? What would happen if such a deduction were not made?

3–21 (Appendix 3A) If the plant is operated at less than capacity and the predetermined overhead rate is based on the estimated total units in the allocation base at capacity, will overhead ordinarily be overapplied or underapplied?

3–22 (Appendix 3A) Rather than netting underapplied overhead against Cost of Goods Sold or Cost of Goods Sold and ending inventories, some critics suggest an alternative way to disclose underapplied overhead. What is this alternative method?

3–23 Quality control is one way companies can become more sustainable. Explain.

Exercises

EXERCISE 3–1 Process Costing and Job-Order Costing [LO1]

Which would be more appropriate in each of the following situations—job-order costing or process costing?

a. A custom yacht builder.
b. A golf course designer.
c. A potato chip manufacturer.
d. A business consultant.
e. A plywood manufacturer.
f. A soft-drink bottler.
g. A film studio.
h. A firm that supervises bridge construction projects.
i. A manufacturer of fine custom jewellery.
j. A made-to-order clothing factory.
k. A factory making one personal computer model.
l. A fertilizer factory.

EXERCISE 3–2 Job-Order Costing Documents [LO2]

Mountain Gearing Company has incurred the following costs on Job ES34, an order for 40 gearing wheels to be delivered at the end of next month.

Direct materials:

On March 5, requisition number 870 was issued for 40 titanium blanks to be used in the special order. The blanks cost $8.00 each.

On March 8, requisition number 873 was issued for 960 hardened nibs also to be used in the special order. The nibs cost $0.60 each.

Direct labour:

On March 9, Harry Kerst worked from 9:00 A.M. until 12:15 P.M. on Job ES34. He is paid $12.00 per hour.

On March 21, Mary Rosas worked from 2:15 P.M. until 4:30 P.M. on Job ES34. She is paid $14.00 per hour.

Required:

1. On what documents would these costs be recorded?
2. How much cost should have been recorded on each of the documents for Job ES34?

EXERCISE 3–3 Compute the Predetermined Overhead Rate [LO3]

Logan Products computes its predetermined overhead rate annually on the basis of direct labour-hours. At the beginning of the year it estimated that its total manufacturing overhead would be $586,000 and the total direct labour would be 40,000 hours. Its actual total manufacturing overhead for the year was $713,400 and its actual total direct labour was 41,000 hours.

Required:

Compute the company's predetermined overhead rate for the year.

EXERCISE 3–4 Prepare Journal Entries [LO4]

Kirkaid Company recorded the following transactions for the just completed month.

a. $86,000 in raw materials were purchased on account.
b. $84,000 in raw materials were requisitioned for use in production. Of this amount, $72,000 was for direct materials and the remainder was for indirect materials.
c. Total labour wages of $108,000 were incurred. Of this amount, $105,000 was for direct labour and the remainder was for indirect labour.
d. Additional manufacturing overhead costs of $197,000 were incurred.

Required:

Record the above transactions in journal entries.

EXERCISE 3–5 Apply Overhead [LO5]

Westan Corporation uses a predetermined overhead rate of $23.10 per direct labour-hour. This predetermined rate was based on 12,000 estimated direct labour-hours and $277,200 of estimated total manufacturing overhead.

The company incurred actual total manufacturing overhead costs of $266,000 and 12,600 total direct labour-hours during the period.

Required:

Determine the amount of manufacturing overhead that would have been applied to units of product during the period.

EXERCISE 3–6 Applying Overhead; Cost of Goods Manufactured [LO5, LO6, LO7]

The following cost data relate to the manufacturing activities of Black Company during the just completed year:

Manufacturing overhead costs:	
Property taxes, factory	$ 3,000
Utilities, factory	5,000
Indirect labour	10,000
Depreciation, factory	24,000
Insurance, factory	6,000
Total actual manufacturing overhead costs	$48,000
Other costs incurred:	
Purchases of raw materials	$32,000
Direct labour cost	$40,000
Inventories:	
Raw materials, beginning	$ 8,000
Raw materials, ending	$ 7,000
Work in process, beginning	$ 6,000
Work in process, ending	$ 7,500

The company uses a predetermined overhead rate to apply overhead cost to production. The rate for the year was $5 per machine-hour; a total of 10,000 machine-hours was recorded for the year. All raw materials ultimately become direct materials—none are classified as indirect materials.

Required:

1. Compute the amount of underapplied or overapplied overhead cost for the year.
2. Prepare a schedule of cost of goods manufactured for the year.

EXERCISE 3–7 Prepare T-Accounts [LO4, LO6]

Granger Products recorded the following transactions for the just completed month. The company had no beginning inventories.

a. $75,000 in raw materials were purchased for cash.
b. $73,000 in raw materials were requisitioned for use in production. Of this amount, $67,000 was for direct materials and the remainder was for indirect materials.
c. Total labour wages of $152,000 were incurred and paid. Of this amount, $134,000 was for direct labour and the remainder was for indirect labour.
d. Additional manufacturing overhead costs of $126,000 were incurred and paid.
e. Manufacturing overhead costs of $178,000 were applied to jobs using the company's predetermined overhead rate.
f. All of the jobs in progress at the end of the month were completed and shipped to customers.
g. The underapplied or overapplied overhead for the period was closed out to Cost of Goods Sold.

Required:

1. Post the above transactions to T-accounts.
2. Determine the cost of goods sold for the period.

EXERCISE 3–8 Underapplied and Overapplied Overhead [LO7]

Cretin Enterprises uses a predetermined overhead rate of $21.40 per direct labour-hour. This predetermined rate was based on 8,000 estimated direct labour-hours and $171,200 of estimated total manufacturing overhead.

The company incurred actual total manufacturing overhead costs of $172,500 and 8,250 total direct labour-hours during the period.

Required:

1. Determine the amount of underapplied or overapplied manufacturing overhead for the period.
2. Assuming that the entire amount of the underapplied or overapplied overhead is closed out to cost of goods sold, what would be the effect of the underapplied or overapplied overhead on the company's gross margin for the period?

EXERCISE 3–9 Applying Overhead in a Service Company [LO2, LO3, LO5]

Pearson Architectural Design began operations on January 2. The following activity was recorded in the company's Work in Process account for the first month of operations:

Work in Process

Costs of subcontracted work	90,000	To completed projects	570,000
Direct staff costs	200,000		
Studio overhead	320,000		

Pearson Architectural Design is a service firm, so the names of the accounts it uses are different from the names used in manufacturing companies. Costs of Subcontracted Work is comparable to Direct Materials; Direct Staff Costs is the same as Direct Labour; Studio Overhead is the same as Manufacturing Overhead; and Completed Projects is the same as Finished Goods. Apart from the difference in terms, the accounting methods used by the company are identical to the methods used by manufacturing companies.

Pearson Architectural Design uses a job-order costing system and applies studio overhead to Work in Process on the basis of direct staff costs. At the end of January, only one job was still in process. This job (the Krimmer Corporation Headquarters project) had been charged with $13,500 in direct staff costs.

Required:

1. Compute the predetermined overhead rate that was in use during January.
2. Complete the following job cost sheet for the partially completed Krimmer Corporation Headquarters project.

Job Cost Sheet Krimmer Corporation Headquarters Project As of January 31	
Costs of subcontracted work	$?
Direct staff costs	?
Studio overhead	?
Total cost to January 31	$?

EXERCISE 3–10 Journal Entries and T-Accounts [LO4, LO5]

Foley Company uses a job-order costing system. The following data relate to the month of October, the first month of the company's fiscal year:

a. Raw materials purchased on account, $210,000.
b. Raw materials issued to production, $190,000 (80% direct and 20% indirect).
c. Direct labour cost incurred, $49,000; and indirect labour cost incurred, $21,000.
d. Depreciation recorded on factory equipment, $105,000.
e. Other manufacturing overhead costs incurred during October, $130,000 (credit Accounts Payable).
f. The company applies manufacturing overhead cost to production on the basis of $4 per machine-hour. There were 75,000 machine-hours recorded for October.
g. Production orders costing $510,000 according to their job cost sheets were completed during October and transferred to Finished Goods.
h. Production orders that had cost $450,000 to complete according to their job cost sheets were shipped to customers during the month. These goods were sold on account at 50% above cost.

Required:

1. Prepare journal entries to record the information given above.
2. Prepare T-accounts for Manufacturing Overhead and Work in Process. Post the relevant information above to each account. Compute the ending balance in each account, assuming that Work in Process has a beginning balance of $35,000.

EXERCISE 3–11 Applying Overhead in a Service Company; Journal Entries [LO4, LO5, LO7]

Heritage Gardens uses a job-order costing system to track the costs of its landscaping projects. The company provides complete garden design and landscaping services. The following table provides data concerning the three landscaping projects that were in progress during May. There was no work in process at the beginning of May.

	Project		
	Williams	Chandler	Nguyen
Designer-hours	200	80	120
Direct materials cost	$4,800	$1,800	$3,600
Direct labour cost	$2,400	$1,000	$1,500

Actual overhead costs were $16,000 for May. Overhead costs are applied to projects on the basis of designer-hours since most of the overhead is related to the costs of the garden design studio. The predetermined overhead rate is $45 per designer-hour. The Williams and Chandler projects were completed in May; the Nguyen project was not completed by the end of the month. No other jobs were in process during May.

Required:

1. Compute the amount of overhead cost that would have been charged to each project during May.
2. Prepare a journal entry showing the completion of the Williams and Chandler projects and the transfer of costs to the Completed Projects (i.e., Finished Goods) account.
3. What is the balance in the Work in Process account at the end of the month?
4. What is the balance in the Overhead account at the end of the month? What is this balance called?

EXERCISE 3–12 Varying Predetermined Overhead Rates [LO3, LO5]

Javadi Company makes a composting bin that is subject to wide seasonal variations in demand. Unit product costs are computed on a quarterly basis by dividing each quarter's manufacturing costs (materials, labour, and overhead) by the quarter's production in units. The company's estimated costs, by quarter, for the coming year are given below:

	Quarter			
	First	Second	Third	Fourth
Direct materials	$240,000	$120,000	$ 60,000	$180,000
Direct labour	96,000	48,000	24,000	72,000
Manufacturing overhead	228,000	204,000	192,000	216,000
Total manufacturing costs	$564,000	$372,000	$276,000	$468,000
Number of units to be produced	80,000	40,000	20,000	60,000
Estimated unit product cost	$7.05	$9.30	$13.80	$7.80

Management finds the variation in unit product costs to be confusing and difficult to work with. It has been suggested that the problem lies with manufacturing overhead, since it is the largest element of cost. Accordingly, you have been asked to find a more appropriate way of assigning manufacturing overhead cost to units of product. After some analysis, you have determined that the company's overhead costs are mostly fixed and therefore show little sensitivity to changes in the level of production.

Required:

1. The company uses a job-order costing system. How would you recommend that manufacturing overhead cost be assigned to production? Be specific, and show computations.
2. Recompute the company's unit product costs in accordance with your recommendations in (1) above.

EXERCISE 3–13 Applying Overhead; Journal Entries; Disposition of Underapplied or Overapplied Overhead [LO4, LO7]

The following information is taken from the accounts of FasGrow Company. The entries in the T-accounts are summaries of the transactions that affected those accounts during the year.

Manufacturing Overhead

(a)	380,000	(b)	410,000
		Bal.	30,000

Work in Process

Bal.	105,000	(c)	760,000
	210,000		
	115,000		
(b)	410,000		
Bal.	80,000		

Finished Goods

Bal.	160,000	(d)	820,000
(c)	760,000		
Bal.	100,000		

Cost of Goods Sold

(d)	820,000

The overhead that had been applied to production during the year is distributed among the ending balances in the accounts as follows:

Work in Process, ending	$ 32,800
Finished Goods, ending	41,000
Cost of Goods Sold	336,200
Overhead applied	$410,000

For example, of the $80,000 ending balance in Work in Process, $32,800 was overhead that had been applied during the year.

Required:

1. Identify the reasons for entries (a) through (d).
2. Assume that the company closes any balance in the Manufacturing Overhead account directly to Cost of Goods Sold. Prepare the necessary journal entry.
3. Assume instead that the company allocates any balance in the Manufacturing Overhead account to the other accounts in proportion to the overhead applied during the year that is in the ending balance in each account. Prepare the necessary journal entry, with supporting computations.

EXERCISE 3–14 (Appendix 3A) Overhead Rates and Capacity Issues [LO3, LO5, LO7, LO8]

Estate Pension Services helps clients to set up and administer pension plans that are in compliance with tax laws and regulatory requirements. The firm uses a job-order costing system in which overhead is applied to clients' accounts on the basis of professional staff hours charged to the accounts. Data concerning two recent years appear below:

	2007	2008
Estimated professional staff hours to be charged to clients' accounts	2,400	2,250
Estimated overhead cost	$144,000	$144,000
Professional staff hours available	3,000	3,000

"Professional staff hours available" is a measure of the capacity of the firm. Any hours available that are not charged to clients' accounts represent unused capacity.

Required:

1. Jennifer Miyami is an established client whose pension plan was set up many years ago. In both 2007 and 2008, only five hours of professional staff time were charged to Ms. Miyami's account. If the company bases its predetermined overhead rate on the estimated overhead cost and the estimated professional staff hours to be charged to clients, how much overhead cost would have been applied to Ms. Miyami's account in 2007? In 2008?
2. Suppose that the company bases its predetermined overhead rate on the estimated overhead cost and the estimated professional staff hours to be charged to clients as in (1) above. Also suppose that the actual professional staff hours charged to clients' accounts and the actual overhead costs turn out to be exactly as estimated in both years. By how much would the overhead be underapplied or overapplied in 2007? In 2008?
3. Refer back to the data concerning Ms. Miyami in (1) above. If the company bases its predetermined overhead rate on the estimated overhead cost and the professional staff hours available, how much overhead cost would have been applied to Ms. Miyami's account in 2007? In 2008?
4. Suppose that the company bases its predetermined overhead rate on the estimated overhead cost and the professional staff hours available as in (3) above. Also suppose that the actual professional staff hours charged to clients' accounts and the actual overhead costs turn out to be exactly as estimated in both years. By how much would the overhead be underapplied or overapplied in 2007? In 2008?

EXERCISE 3–15 Departmental Overhead Rates [LO3, LO5]

Diewold Company has two departments, Milling and Assembly. The company uses a job-order cost system and computes a predetermined overhead rate in each department. The Milling Department bases its rate on machine-hours, and the Assembly Department bases its rate on direct labour cost. At the beginning of the year, the company made the following estimates:

	Department	
	Milling	Assembly
Direct labour-hours	8,000	75,000
Machine-hours	60,000	3,000
Manufacturing overhead cost	$510,000	$800,000
Direct labour cost	$72,000	$640,000

Required:

1. Compute the predetermined overhead rate to be used in each department.
2. Assume that the overhead rates you computed in (1) above are in effect. The job cost sheet for Job 407, which was started and completed during the year, showed the following:

	Department	
	Milling	**Assembly**
Direct labour-hours	5	20
Machine-hours	90	4
Materials requisitioned	$800	$370
Direct labour cost	$45	$160

   Compute the total overhead cost applied to Job 407.
3. Would you expect substantially different amounts of overhead cost to be charged to some jobs if the company used a plantwide overhead rate based on direct labour cost instead of using departmental rates? Explain. No computations are necessary.

EXERCISE 3–16 Applying Overhead; T-Accounts; Journal Entries [LO3, LO4, LO5, LO7]

Medusa Products uses a job-order costing system. Overhead costs are applied to jobs on the basis of machine-hours. At the beginning of the year, management estimated that the company would incur $170,000 in manufacturing overhead costs for the year and work 85,000 machine-hours.

Required:

1. Compute the company's predetermined overhead rate.
2. Assume that during the year the company actually works only 80,000 machine-hours and incurs the following costs in the Manufacturing Overhead and Work in Process accounts:

Manufacturing Overhead			**Work in Process**	
(Utilities)	14,000	?	(Direct materials)	530,000
(Insurance)	9,000		(Direct labour)	85,000
(Maintenance)	33,000		(Overhead)	?
(Indirect materials)	7,000			
(Indirect labour)	65,000			
(Depreciation)	40,000			

   Copy the data in the T-accounts above onto your answer sheet. Compute the amount of overhead cost that would be applied to Work in Process for the year, and make the entry in your T-accounts.
3. Compute the amount of underapplied or overapplied overhead for the year, and show the balance in your Manufacturing Overhead T-account. Prepare a journal entry to close out the balance in this account to Cost of Goods Sold.
4. Explain why the manufacturing overhead was underapplied or overapplied for the year.

EXERCISE 3–17 Applying Overhead; Journal Entries; T-Accounts [LO3, LO4, LO5]

Custom Metal Works produces castings and other metal parts to customer specifications. The company uses a job-order costing system and applies overhead costs to jobs on the basis of machine-hours. At the beginning of the year, the company estimated that it would work 576,000 machine-hours and incur $4,320,000 in manufacturing overhead cost.

The company had no work in process at the beginning of the year. The company spent the entire month of January working on one large order—Job 382, which was an order for 8,000 machined parts. Cost data for January follow:

a. Raw materials purchased on account, $315,000.
b. Raw materials requisitioned for production, $270,000 (80% direct and 20% indirect).
c. Labour cost incurred in the factory, $190,000, of which $80,000 was direct labour and $110,000 was indirect labour.
d. Depreciation recorded on factory equipment, $63,000.

e. Other manufacturing overhead costs incurred, $85,000 (credit Accounts Payable).
f. Manufacturing overhead cost was applied to production on the basis of 40,000 machine-hours actually worked during January.
g. The completed job was moved into the finished goods warehouse on January 31 to await delivery to the customer. (In computing the dollar amount for this entry, remember that the cost of a completed job consists of direct materials, direct labour, and *applied* overhead.)

Required:
1. Prepare journal entries to record items (a) through (f) above. Ignore item (g) for the moment.
2. Prepare T-accounts for Manufacturing Overhead and Work in Process. Post the relevant items from your journal entries to these T-accounts.
3. Prepare a journal entry for item (g) above.
4. Compute the unit product cost that will appear on the job cost sheet for Job 382.

Problems

PROBLEM 3–18 Comprehensive Problem [LO3, LO4, LO5, LO6, LO7]

Sovereign Millwork, Ltd., produces reproductions of antique residential moldings at a plant located in Manchester, England. Since there are hundreds of products, some of which are made only to order, the company uses a job-order costing system. On July 1, the start of the company's fiscal year, inventory account balances were as follows:

Raw Materials	£10,000
Work in Process	£4,000
Finished Goods	£8,000

The company applies overhead cost to jobs on the basis of machine-hours. For the fiscal year starting July 1, it was estimated that the plant would operate 45,000 machine-hours and incur £99,000 in manufacturing overhead cost. During the year, the following transactions were completed:

a. Raw materials purchased on account, £160,000.
b. Raw materials requisitioned for use in production, £140,000 (materials costing £120,000 were chargeable directly to jobs; the remaining materials were indirect).
c. Costs for employee services were incurred as follows:

Direct labour	£90,000
Indirect labour	£60,000
Sales commissions	£20,000
Administrative salaries	£50,000

d. Prepaid insurance expired during the year, £18,000 (£13,000 of this amount related to factory operations, and the remainder related to selling and administrative activities).
e. Utility costs incurred in the factory, £10,000.
f. Advertising costs incurred, £15,000.
g. Depreciation recorded on equipment, £25,000. (£20,000 of this amount was on equipment used in factory operations; the remaining £5,000 was on equipment used in selling and administrative activities.)
h. Manufacturing overhead cost was applied to jobs, £__?__. (The company recorded 50,000 machine-hours of operating time during the year.)
i. Goods that had cost £310,000 to manufacture according to their job cost sheets were completed.
j. Sales (all on account) to customers during the year totalled £498,000. These goods had cost £308,000 to manufacture according to their job cost sheets.

Required:
1. Prepare journal entries to record the transactions for the year.
2. Prepare T-accounts for inventories, Manufacturing Overhead, and Cost of Goods Sold. Post relevant data from your journal entries to these T-accounts (don't forget to enter the opening balances in your inventory accounts). Compute an ending balance in each account.

3. Is Manufacturing Overhead underapplied or overapplied for the year? Prepare a journal entry to close any balance in the Manufacturing Overhead account to Cost of Goods Sold.
4. Prepare an income statement for the year. (Do not prepare a schedule of cost of goods manufactured; all of the information needed for the income statement is available in the journal entries and T-accounts you have prepared.)

PROBLEM 3–19 Journal Entries; T-Accounts; Cost Flows [LO4, LO5, LO6, LO7]

Ravsten Company uses a job-order costing system. On January 1, the beginning of the current year, the company's inventory balances were as follows:

Raw materials	$16,000
Work in process	$10,000
Finished goods	$30,000

The company applies overhead cost to jobs on the basis of machine-hours. For the current year, the company estimated that it would work 36,000 machine-hours and incur $153,000 in manufacturing overhead cost. The following transactions were recorded for the year:

a. Raw materials purchased on account, $200,000.
b. Raw materials requisitioned for use in production, $190,000 (80% direct and 20% indirect).
c. The following costs were incurred for employee services:

Direct labour	$160,000
Indirect labour	$27,000
Sales commissions	$36,000
Administrative salaries	$80,000

d. Heat, power, and water costs incurred in the factory, $42,000.
e. Prepaid insurance expired during the year, $10,000 (90% relates to factory operations, and 10% relates to selling and administrative activities).
f. Advertising costs incurred, $50,000.
g. Depreciation recorded for the year, $60,000 (85% relates to factory operations, and 15% relates to selling and administrative activities).
h. Manufacturing overhead cost was applied to production. The company recorded 40,000 machine-hours for the year.
i. Goods that cost $480,000 to manufacture according to their job cost sheets were transferred to the finished goods warehouse.
j. Sales for the year totalled $700,000 and were all on account. The total cost to manufacture these goods according to their job cost sheets was $475,000.

Required:

1. Prepare journal entries to record the transactions given above.
2. Prepare T-accounts for inventories, Manufacturing Overhead, and Cost of Goods Sold. Post relevant data from your journal entries to these T-accounts (don't forget to enter the opening balances in your inventory accounts). Compute an ending balance in each account.
3. Is Manufacturing Overhead underapplied or overapplied for the year? Prepare a journal entry to close any balance in the Manufacturing Overhead account to Cost of Goods Sold.
4. Prepare an income statement for the year. (Do not prepare a schedule of cost of goods manufactured; all of the information needed for the income statement is available in the journal entries and T-accounts you have prepared.)

PROBLEM 3–20 T-Accounts; Applying Overhead [LO3, LO5, LO6, LO7]

Durham Company's trial balance as of January 1, the beginning of the current year, is is shown at the top of the next page.

Durham Company uses a job-order costing system. During the year, the following transactions took place:

a. Raw materials purchased on account, $45,000.
b. Raw materials requisitioned for use in production, $40,000 (80% direct and 20% indirect).
c. Factory utility costs incurred, $14,600.
d. Depreciation recorded on plant and equipment, $28,000. Three-fourths of the depreciation relates to factory equipment, and the remainder relates to selling and administrative equipment.

Cash	$ 8,000	
Accounts Receivable	13,000	
Raw Materials	7,000	
Work in Process	18,000	
Finished Goods	20,000	
Prepaid Insurance	4,000	
Plant and Equipment	230,000	
Accumulated Depreciation		$ 42,000
Accounts Payable		30,000
Capital Stock		150,000
Retained Earnings		78,000
Total	$300,000	$300,000

e. Costs for salaries and wages were incurred as follows:

Direct labour	$40,000
Indirect labour	$18,000
Sales commissions	$10,400
Administrative salaries	$25,000

f. Prepaid insurance expired during the year, $3,000 (80% relates to factory operations, and 20% relates to selling and administrative activities).
g. Miscellaneous selling and administrative expenses incurred, $18,000.
h. Manufacturing overhead was applied to production. The company applies overhead on the basis of 150% of direct labour cost.
i. Goods that cost $130,000 to manufacture according to their job cost sheets were transferred to the finished goods warehouse.
j. Goods that had cost $120,000 to manufacture according to their job cost sheets were sold on account for $200,000.
k. Collections from customers during the year totalled $197,000.
l. Payments to suppliers on account during the year, $100,000; and payments to employees for salaries and wages, $90,000.

Required:

1. Prepare a T-account for each account in the company's trial balance, and enter the opening balances shown above.
2. Record the transactions above directly into the T-accounts. Prepare new T-accounts as needed. Key your entries to the letters (a) through (l) above. Find the ending balance in each account.
3. Is manufacturing overhead underapplied or overapplied for the year? Make an entry in the T-accounts to close any balance in the Manufacturing Overhead account to Cost of Goods Sold.
4. Prepare an income statement for the year. (Do not prepare a schedule of cost of goods manufactured; all of the information needed for the income statement is available in the T-accounts you have prepared.)

PROBLEM 3–21 Cost Flows; T-Accounts; Income Statement [LO3, LO5, LO6, LO7]

Fantastic Props, Inc., designs and fabricates movie props such as mock-ups of star-fighters and cybernetic robots. The company's balance sheet as of January 1, the beginning of the current year, appears on the next page.

Since each prop is a unique design and may require anything from a few hours to a month or more to complete, Fantastic Props uses a job-order costing system. Overhead in the fabrication shop is charged to props on the basis of direct labour cost. The company estimated that it would incur $80,000 in manufacturing overhead and $100,000 in direct labour cost during the year. The following transactions were recorded during the year:

a. Raw materials, such as wood, paints, and metal sheeting, were purchased on account, $80,000.
b. Raw materials were issued to production, $90,000; $5,000 of this amount was for indirect materials.
c. Payroll costs incurred and paid: direct labour, $120,000; indirect labour, $30,000; and selling and administrative salaries, $75,000.

Fantastic Props, Inc.
Balance Sheet
January 1

Assets		
Current assets:		
Cash		$ 15,000
Accounts receivable		40,000
Inventories:		
Raw materials	$ 25,000	
Work in process	30,000	
Finished goods (props awaiting shipment)	45,000	100,000
Prepaid insurance		5,000
Total current assets		160,000
Buildings and equipment	500,000	
Less accumulated depreciation	210,000	290,000
Total assets		$450,000
Liabilities and Shareholders' Equity		
Accounts payable		$ 75,000
Capital stock	$250,000	
Retained earnings	125,000	375,000
Total liabilities and shareholders' equity		$450,000

d. Fabrication shop utilities costs incurred, $12,000.
e. Depreciation recorded for the year, $30,000 ($5,000 on selling and administrative assets; $25,000 on fabrication shop assets).
f. Prepaid insurance expired, $4,800 ($4,000 related to fabrication shop operations, and $800 related to selling and administrative activities).
g. Shipping expenses incurred, $40,000.
h. Other manufacturing overhead costs incurred, $17,000 (credit Accounts Payable).
i. Manufacturing overhead was applied to production. Overhead is applied on the basis of direct labour cost.
j. Movie props that cost $310,000 to produce according to their job cost sheets were completed.
k. Sales for the year totalled $450,000 and were all on account. The total cost to produce these movie props was $300,000 according to their job cost sheets.
l. Collections on account from customers, $445,000.
m. Payments on account to suppliers, $150,000.

Required:

1. Prepare a T-account for each account on the company's balance sheet, and enter the beginning balances.
2. Make entries directly into the T-accounts for the transactions given above. Create new T-accounts as needed. Determine an ending balance for each T-account.
3. Was manufacturing overhead underapplied or overapplied for the year? Assume that the company allocates any overhead balance between the Work in Process, Finished Goods, and Cost of Goods Sold accounts using the overall balances in each account. Prepare a journal entry to show the allocation. (Round allocation percentages to one decimal place.)
4. Prepare an income statement for the year. (Do not prepare a schedule of cost of goods manufactured; all of the information needed for the income statement is available in the T-accounts.)

PROBLEM 3–22 T-Accounts; Overhead Rates; Journal Entries [LO2, LO3, LO4, LO5]

Kenworth Company uses a job-order costing system. Only three jobs—Job 105, Job 106, and Job 107—were worked on during November and December. Job 105 was completed on December 10; the other two jobs were still in production on December 31, the end of the company's operating year. Data from the job cost sheets of the three jobs follows:

	Job Cost Sheet		
	Job 105	Job 106	Job 107
November costs incurred:			
Direct materials	$16,500	$9,300	$0
Direct labour	$13,000	$7,000	$0
Manufacturing overhead	$20,800	$11,200	$0
December costs incurred:			
Direct materials	$0	$8,200	$21,300
Direct labour	$4,000	$6,000	$10,000
Manufacturing overhead	?	?	?

The following additional information is available:

a. Manufacturing overhead is applied to jobs on the basis of direct labour cost.
b. Balances in the inventory accounts at November 30 were as follows:

Raw Materials	$40,000
Work in Process	?
Finished Goods	$85,000

Required:

1. Prepare T-accounts for Raw Materials, Work in Process, Finished Goods, and Manufacturing Overhead. Enter the November 30 inventory balances given above; in the case of Work in Process, compute the November 30 balance and enter it into the Work in Process T-account.
2. Prepare journal entries for *December* as follows:
   a. Prepare an entry to record the issue of materials into production and post the entry to appropriate T-accounts. (In the case of direct materials, it is not necessary to make a separate entry for each job.) Indirect materials used during December totalled $4,000.
   b. Prepare an entry to record the incurrence of labour cost and post the entry to appropriate T-accounts. (In the case of direct labour cost, it is not necessary to make a separate entry for each job.) Indirect labour cost totalled $8,000 for December.
   c. Prepare an entry to record the incurrence of $19,000 in various actual manufacturing overhead costs for December (credit Accounts Payable). Post this entry to the appropriate T-accounts.
3. What apparent predetermined overhead rate does the company use to assign overhead cost to jobs? Using this rate, prepare a journal entry to record the application of overhead cost to jobs for December (it is not necessary to make a separate entry for each job). Post this entry to the appropriate T-accounts.
4. As stated earlier, Job 105 was completed during December. Prepare a journal entry to show the transfer of this job off of the production line and into the finished goods warehouse. Post the entry to the appropriate T-accounts.
5. Determine the balance at December 31 in the Work in Process inventory account. How much of this balance consists of costs charged to Job 106? Job 107?

PROBLEM 3–23 Multiple Departments; Overhead Rates; Underapplied or Overapplied Overhead [LO3, LO5, LO7]

Winkle, Kotter, and Zale is a small law firm that contains 10 partners and 10 support persons. The firm employs a job-order costing system to accumulate costs chargeable to each client, and it is organized into two departments—the Research and Documents Department and the Litigation Department. The firm uses predetermined overhead rates to charge the costs of these departments to its clients. At the beginning of the current year, the firm's management made the following estimates for the year:

	Department	
	Research and Documents	Litigation
Research-hours	20,000	—
Direct lawyer-hours	9,000	16,000
Materials and supplies	$18,000	$5,000
Direct lawyer cost	$430,000	$800,000
Departmental overhead cost	$700,000	$320,000

The predetermined overhead rate in the Research and Documents Department is based on research-hours, and the rate in the Litigation Department is based on direct lawyer cost.

The costs charged to each client are made up of three elements: materials and supplies used, direct lawyer costs incurred, and an applied amount of overhead from each department in which work is performed on the case.

Case 618-3 was initiated on February 10 and completed on June 30. During this period, the following costs and time were recorded on the case:

	Department	
	Research and Documents	Litigation
Research-hours	18	—
Direct lawyer-hours	9	42
Materials and supplies	$50	$30
Direct lawyer cost	$410	$2,100

Required:

1. Compute the predetermined overhead rate used during the year in the Research and Documents Department. Compute the rate used in the Litigation Department.
2. Using the rates you computed in (1) above, compute the total overhead cost applied to Case 618-3.
3. What would be the total cost charged to Case 618-3? Show computations by department and in total for the case.
4. At the end of the year, the firm's records revealed the following *actual* cost and operating data for all cases handled during the year:

	Department	
	Research and Documents	Litigation
Research-hours	23,000	—
Direct lawyer-hours	8,000	15,000
Materials and supplies	$19,000	$6,000
Direct lawyer cost	$400,000	$725,000
Departmental overhead cost	$770,000	$300,000

Determine the amount of underapplied or overapplied overhead cost in each department for the year.

PROBLEM 3–24 Journal Entries; T-Accounts; Disposition of Underapplied or Overapplied Overhead; Income Statement [LO3, LO4, LO5, LO6, LO7]

Celestial Displays, Inc., puts together large-scale fireworks displays—primarily for Fourth of July celebrations sponsored by corporations and municipalities. The company assembles and orchestrates complex displays using pyrotechnic components purchased from suppliers throughout the world. The company has built a reputation for safety and for the awesome power and brilliance of its computer-controlled shows. Celestial Displays builds its own launch platforms and its own electronic controls. Because of the company's reputation, customers order shows up to a year in advance. Since each show is different in terms of duration and components used, Celestial Displays uses a job-order costing system.

Celestial Displays' trial balance as of January 1, the beginning of the current year, is given on the next page. The company charges manufacturing overhead costs to jobs on the basis of direct labour-hours. (Each customer order for a complete fireworks display is a separate job.) Management estimated that the company would incur $135,000 in manufacturing overhead costs in the fabrication and electronics shops and would work 18,000 direct labour-hours during the year. The following transactions occurred during the year:

a. Raw materials, consisting mostly of skyrockets, mortar bombs, flares, wiring, and electronic components, were purchased on account, $820,000.
b. Raw materials were issued to production, $830,000 ($13,000 of this amount was for indirect materials, and the remainder was for direct materials).

Cash	$ 9,000	
Accounts Receivable	30,000	
Raw Materials	16,000	
Work in Process	21,000	
Finished Goods	38,000	
Prepaid Insurance	7,000	
Buildings and Equipment	300,000	
Accumulated Depreciation		$128,000
Accounts Payable		60,000
Salaries and Wages Payable		3,000
Capital Stock		200,000
Retained Earnings		30,000
Total	$421,000	$421,000

c. Fabrication and electronics shop payrolls were accrued, $200,000 (70% direct labour and 30% indirect labour). A total of 20,800 direct labour-hours were worked during the year.
d. Sales and administrative salaries were accrued, $150,000.
e. The company prepaid additional insurance premiums of $38,000 during the year. Prepaid insurance expiring during the year was $40,000 (only $600 relates to selling and administrative; the other $39,400 relates to the fabrication and electronics shops because of the safety hazards involved in handling fireworks).
f. Marketing cost incurred, $100,000.
g. Depreciation charges for the year, $40,000 (70% relates to fabrication and electronics shop assets, and 30% relates to selling and administrative assets).
h. Property taxes accrued on the shop buildings, $12,600 (credit Accounts Payable).
i. Manufacturing overhead cost was applied to jobs.
j. Jobs completed during the year had a total production cost of $1,106,000 according to their job cost sheets.
k. Revenue (all on account), $1,420,000. Cost of Goods Sold (before any adjustment for underapplied or overapplied overhead), $1,120,000.
l. Cash collections on account from customers, $1,415,000.
m. Cash payments on accounts payable, $970,000. Cash payments to employees for salaries and wages, $348,000.

Required:

1. Prepare journal entries for the year's transactions.
2. Prepare a T-account for each account in the company's trial balance, and enter the opening balances given above. Post your journal entries to the T-accounts. Prepare new T-accounts as needed. Compute the ending balance in each account.
3. Is manufacturing overhead underapplied or overapplied for the year? Prepare the necessary journal entry to close the balance in the Manufacturing Overhead account to Cost of Goods Sold.
4. Prepare an income statement for the year. (Do not prepare a statement of cost of goods manufactured; all of the information needed for the income statement is available in the T-accounts.)

PROBLEM 3–25 Multiple Departments; Applying Overhead [LO3, LO5, LO7]

WoodGrain Technology makes home office furniture from fine hardwoods. The company uses a job-order costing system and predetermined overhead rates to apply manufacturing overhead cost to jobs. The predetermined overhead rate in the Preparation Department is based on machine-hours, and the rate in the Fabrication Department is based on direct materials cost. At the beginning of the year, the company's management made the following estimates for the year:

	Department	
	Preparation	Fabrication
Machine-hours	80,000	21,000
Direct labour-hours	35,000	65,000
Direct materials cost	$190,000	$400,000
Direct labour cost	$280,000	$530,000
Manufacturing overhead cost	$416,000	$720,000

Job 127 was started on April 1 and completed on May 12. The company's cost records show the following information concerning the job:

	Department	
	Preparation	Fabrication
Machine-hours	350	70
Direct labour-hours	80	130
Direct materials cost	$940	$1,200
Direct labour cost	$710	$980

Required:

1. Compute the predetermined overhead rate used during the year in the Preparation Department. Compute the rate used in the Fabrication Department.
2. Compute the total overhead cost applied to Job 127.
3. What would be the total cost recorded for Job 127? If the job contained 25 units, what would be the unit product cost?
4. At the end of the year, the records of WoodGrain Technology revealed the following *actual* cost and operating data for all jobs worked on during the year:

	Department	
	Preparation	Fabrication
Machine-hours	73,000	24,000
Direct labour-hours	30,000	68,000
Direct materials cost	$165,000	$420,000
Manufacturing overhead cost	$390,000	$740,000

What was the amount of underapplied or overapplied overhead in each department at the end of the year?

PROBLEM 3–26 (Appendix 3A) Predetermined Overhead Rate and Capacity [LO3, LO5, LO7, LO8]

Skid Road Recording, Inc., is a small audio recording studio located in Calgary. The company handles work for advertising agencies—primarily for radio ads—and has a few singers and bands as clients. Skid Road Recording handles all aspects of recording from editing to making a digital master from which CDs can be copied. The competition in the audio recording industry in Calgary has always been tough, but it has been getting even tougher over the last several years. The studio has been losing customers to newer studios that are equipped with more up-to-date equipment and that are able to offer very attractive prices and excellent service. Summary data concerning the last two years of operations follow:

	2007	2008
Estimated hours of studio service	1,000	750
Estimated studio overhead cost	$90,000	$90,000
Actual hours of studio service provided	900	600
Actual studio overhead cost incurred	$90,000	$90,000
Hours of studio service at capacity	1,800	1,800

The company applies studio overhead to recording jobs on the basis of the hours of studio service provided. For example, 30 hours of studio time were required to record, edit, and master the *Slug Fest* music CD for a local band. All of the studio overhead is fixed, and the actual overhead cost incurred was exactly as estimated at the beginning of the year in both 2007 and 2008.

Required:

1. Skid Road Recording computes its predetermined overhead rate at the beginning of each year based on the estimated studio overhead and the estimated hours of studio service for the year. How much overhead would have been applied to the *Slug Fest* job if it had been done in 2007? In 2008? By how much would overhead have been underapplied or overapplied in 2007? In 2008?

2. The president of Skid Road Recording has heard that some companies in the industry have changed to a system of computing the predetermined overhead rate at the beginning of each year based on the estimated studio overhead for the year and the hours of studio service that could be provided at capacity. He would like to know what effect this method would have on job costs. How much overhead would have been applied using this method to the *Slug Fest* job if it had been done in 2007? In 2008? By how much would overhead have been underapplied or overapplied in 2007 using this method? In 2008?
3. How would you interpret the underapplied or overapplied overhead that results from using studio hours at capacity to compute the predetermined overhead rate?
4. What fundamental business problem is Skid Road Recording facing? Which method of computing the predetermined overhead rate is likely to be more helpful in facing this problem? Explain.

PROBLEM 3–27 T-Account Analysis of Cost Flows [LO3, LO6, LO7]

Selected ledger accounts for Rolm Company are given below for the just completed year:

Raw Materials

Bal. 1/1	30,000	Credits	?
Debits	420,000		
Bal. 12/31	60,000		

Manufacturing Overhead

Debits	385,000	Credits	?

Work in Process

Bal. 1/1	70,000	Credits	810,000
Direct materials	320,000		
Direct labour	110,000		
Overhead	400,000		
Bal. 12/31	?		

Factory Wages Payable

Debits	179,000	Bal. 1/1	10,000
		Credits	175,000
		Bal. 12/31	6,000

Finished Goods

Bal. 1/1	40,000	Credits	?
Debits	?		
Bal. 12/31	130,000		

Cost of Goods Sold

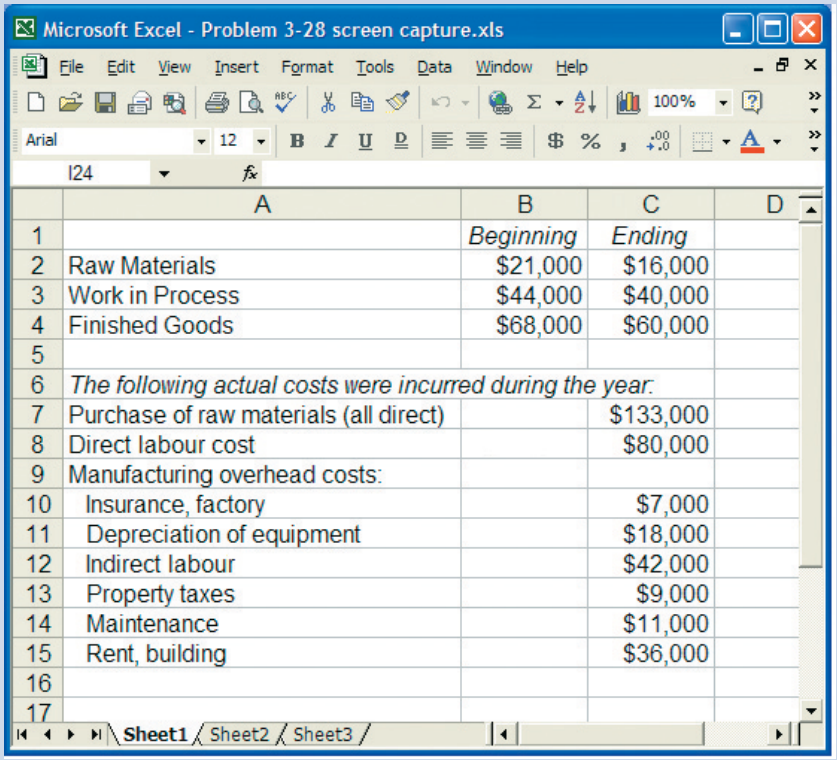
Debits	?		

Required:

1. What was the cost of raw materials put into production during the year?
2. How much of the materials in (1) above consisted of indirect materials?
3. How much of the factory labour cost for the year consisted of indirect labour?
4. What was the cost of goods manufactured for the year?
5. What was the cost of goods sold for the year (before considering underapplied or overapplied overhead)?
6. If overhead is applied to production on the basis of direct materials cost, what rate was in effect during the year?
7. Was manufacturing overhead underapplied or overapplied? By how much?
8. Compute the ending balance in the Work in Process inventory account. Assume that this balance consists entirely of goods started during the year. If $32,000 of this balance is direct materials cost, how much of it is direct labour cost? Manufacturing overhead cost?

PROBLEM 3–28 Schedule of Cost of Goods Manufactured; Overhead Analysis [LO3, LO5, LO6, LO7]

The Pacific Manufacturing Company operates a job-order costing system and applies overhead cost to jobs on the basis of direct labour cost. In computing an overhead rate for the year, the company's estimates were: manufacturing overhead cost, $126,000; and direct labour cost, $84,000. The company has provided the following data in the form of an Excel worksheet:


Microsoft Excel - Problem 3-28 screen capture.xls

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	A	B	C	D
1		*Beginning*	*Ending*	
2	Raw Materials	$21,000	$16,000	
3	Work in Process	$44,000	$40,000	
4	Finished Goods	$68,000	$60,000	
5				
6	*The following actual costs were incurred during the year:*			
7	Purchase of raw materials (all direct)		$133,000	
8	Direct labour cost		$80,000	
9	Manufacturing overhead costs:			
10	Insurance, factory		$7,000	
11	Depreciation of equipment		$18,000	
12	Indirect labour		$42,000	
13	Property taxes		$9,000	
14	Maintenance		$11,000	
15	Rent, building		$36,000	
16				
17				

Sheet1 Sheet2 Sheet3

Required:

1. *a.* Compute the predetermined overhead rate for the year.
   b. Compute the amount of underapplied or overapplied overhead for the year.
2. Prepare a schedule of cost of goods manufactured for the year.
3. Compute the cost of goods sold for the year. (Do not include any underapplied or overapplied overhead in your cost of goods sold figure.) What options are available for disposing of underapplied or overapplied overhead?
4. Job 137 was started and completed during the year. What price would have been charged to the customer if the job required $3,200 in materials and $4,200 in direct labour cost, and the company priced its jobs at 40% above the job's cost according to the accounting system?
5. Direct labour made up $8,000 of the $40,000 ending Work in Process inventory balance. Supply the information missing below:

Direct materials	$?
Direct labour	8,000
Manufacturing overhead	?
Work in process inventory	$40,000

PROBLEM 3–29 Predetermined Overhead Rate; Disposition of Underapplied or Overapplied Overhead [LO3, LO7]

Savallas Company is highly automated and uses computers to control manufacturing operations. The company uses a job-order costing system and applies manufacturing overhead cost to products on the basis of computer-hours. The following estimates were used in preparing the predetermined overhead rate at the beginning of the year:

Computer-hours	85,000
Manufacturing overhead cost	$1,530,000

During the year, a severe economic recession resulted in cutting back production and a buildup of inventory in the company's warehouse. The company's cost records revealed the following actual cost and operating data for the year:

Computer-hours	60,000
Manufacturing overhead cost	$1,350,000
Inventories at year-end:	
Raw materials	$400,000
Work in process	$160,000
Finished goods	$1,040,000
Cost of goods sold	$2,800,000

Required:

1. Compute the company's predetermined overhead rate for the year.
2. Compute the underapplied or overapplied overhead for the year.
3. Assume the company closes any underapplied or overapplied overhead directly to Cost of Goods Sold. Prepare the appropriate entry.
4. Assume that the company allocates any underapplied or overapplied overhead to Work in Process, Finished Goods, and Cost of Goods Sold on the basis of the amount of overhead applied during the year that remains in each account at the end of the year. These amounts are $43,200 for Work in Process, $280,800 for Finished Goods, and $756,000 for Cost of Goods Sold. Prepare the journal entry to show the allocation.
5. How much higher or lower will operating income be for the year if the underapplied or overapplied overhead is allocated rather than closed directly to Cost of Goods Sold?

PROBLEM 3–30 Comprehensive Problem: Journal Entries; T-Accounts; Financial Statements [LO3, LO4, LO5, LO6, LO7]

Southworth Company uses a job-order costing system and applies manufacturing overhead cost to jobs on the basis of the cost of direct materials used in production. At the beginning of the current year, the following estimates were made for the purpose of computing the predetermined overhead rate: manufacturing overhead cost, $248,000; and direct materials cost, $155,000. The following transactions took place during the year (all purchases and services were acquired on account):

a. Raw materials purchased, $142,000.
b. Raw materials requisitioned for use in production (all direct materials), $150,000.
c. Utility bills incurred in the factory, $21,000.
d. Costs for salaries and wages were incurred as follows:

Direct labour	$216,000
Indirect labour	$90,000
Selling and administrative salaries	$145,000

e. Maintenance costs incurred in the factory, $15,000.
f. Advertising costs incurred, $130,000.
g. Depreciation recorded for the year, $50,000 (90% relates to factory assets, and the remainder relates to selling and administrative assets).
h. Rental cost incurred on buildings, $90,000 (80% of the space is occupied by the factory, and 20% is occupied by sales and administration).
i. Miscellaneous selling and administrative costs incurred, $17,000.
j. Manufacturing overhead cost was applied to jobs, $__?__.
k. Cost of goods manufactured for the year, $590,000.
l. Sales for the year (all on account) totalled $1,000,000. These goods cost $600,000 according to their job cost sheets.

The balances in the inventory accounts at the beginning of the year were as follows:

Raw Materials	$18,000
Work in Process	$24,000
Finished Goods	$35,000

Required:

1. Prepare journal entries to record the above data.
2. Post your entries to T-accounts. (Don't forget to enter the opening inventory balances above.) Determine the ending balances in the inventory accounts and in the Manufacturing Overhead account.

3. Prepare a schedule of cost of goods manufactured.
4. Prepare a journal entry to close any balance in the Manufacturing Overhead account to Cost of Goods Sold. Prepare a schedule of cost of goods sold.
5. Prepare an income statement for the year.
6. Job 218 was one of the many jobs started and completed during the year. The job required $3,600 in direct materials and 400 hours of direct labour time at a rate of $11 per hour. If the job contained 500 units and the company billed at 75% above the unit product cost on the job cost sheet, what price per unit would have been charged to the customer?

PROBLEM 3–31 Plantwide versus Departmental Overhead Rates; Underapplied or Overapplied Overhead [LO3, LO5, LO7]

"Don't tell me we've lost another bid!" exclaimed Sandy Kovallas, president of Lenko Products, Inc. "I'm afraid so," replied Doug Martin, the operations vice-president. "One of our competitors underbid us by about $10,000 on the Hastings job." "I just can't figure it out," said Kovallas. "It seems we're either too high to get the job or too low to make any money on half the jobs we bid. What's happened?"

Lenko Products manufactures specialized goods to customers' specifications and operates a job-order costing system. Manufacturing overhead cost is applied to jobs on the basis of direct labour cost. The following estimates were made at the beginning of the year:

	Department			
	Cutting	Machining	Assembly	Total Plant
Direct labour	$300,000	$200,000	$400,000	$900,000
Manufacturing overhead	$540,000	$800,000	$100,000	$1,440,000

Jobs require varying amounts of work in the three departments. The Hastings job, for example, would have required manufacturing costs in the three departments as follows:

	Department			
	Cutting	Machining	Assembly	Total Plant
Direct materials	$12,000	$900	$5,600	$18,500
Direct labour	$6,500	$1,700	$13,000	$21,200
Manufacturing overhead	?	?	?	?

The company uses a plantwide overhead rate to apply manufacturing overhead cost to jobs.

Required:

1. Assuming the use of a plantwide overhead rate:
   a. Compute the rate for the current year.
   b. Determine the amount of manufacturing overhead cost that would have been applied to the Hastings job.
2. Suppose that instead of using a plantwide overhead rate, the company had used a separate predetermined overhead rate in each department. Under these conditions:
   a. Compute the rate for each department for the current year.
   b. Determine the amount of manufacturing overhead cost that would have been applied to the Hastings job.
3. Explain the difference between the manufacturing overhead that would have been applied to the Hastings job using the plantwide rate in question 1(b) above and using the departmental rates in question 2(b).
4. Assume that it is customary in the industry to bid jobs at 150% of total manufacturing cost (direct materials, direct labour, and applied overhead). What was the company's bid price on the Hastings job? What would the bid price have been if departmental overhead rates had been used to apply overhead cost?
5. At the end of the year, the company assembled the following *actual* cost data relating to all jobs worked on during the year:

	Department			
	Cutting	Machining	Assembly	Total Plant
Direct materials	$760,000	$90,000	$410,000	$1,260,000
Direct labour	$320,000	$210,000	$340,000	$870,000
Manufacturing overhead	$560,000	$830,000	$92,000	$1,482,000

Compute the underapplied or overapplied overhead for the year (*a*) assuming that a plantwide overhead rate is used, and (*b*) assuming that departmental overhead rates are used.

Cases


CASE 3–32 (Appendix 3A) Ethics; Predetermined Overhead Rate and Capacity [LO5, LO8]

Melissa Ostwerk, the new controller of TurboDrives, Inc., has just returned from a seminar on the choice of the activity level in the predetermined overhead rate. Even though the subject did not sound exciting at first, she found that there were some important ideas presented that should get a hearing at her company. After returning from the seminar, she arranged a meeting with the production manager, Jan Kingman, and the assistant production manager, Lonny Chan.

Melissa: I ran across an idea that I wanted to check out with both of you. It's about the way we compute predetermined overhead rates.

Jan: We're all ears.

Melissa: We compute the predetermined overhead rate by dividing the estimated total factory overhead for the coming year by the estimated total units produced for the coming year.

Lonny: We've been doing that as long as I've been with the company.

Jan: And it has been done that way at every other company I've worked at, except at most places they divide by direct labour-hours.

Melissa: We use units because it is simpler and we basically make one product with minor variations. But, there's another way to do it. Instead of dividing the estimated total factory overhead by the estimated total units produced for the coming year, we could divide by the total units produced at capacity.

Lonny: Oh, the Marketing Department will love that. It will drop the costs on all of our products. They'll go wild over there cutting prices.

Melissa: That is a worry, but I wanted to talk to both of you first before going over to Marketing.

Jan: Aren't you always going to have a lot of underapplied overhead?

Melissa: That's correct, but let me show you how we would handle it. Here's an example based on our budget for next year.

Budgeted (estimated) production	80,000 units
Budgeted sales	80,000 units
Capacity	100,000 units
Selling price	$70 per unit
Variable manufacturing cost	$18 per unit
Total manufacturing overhead cost (all fixed)	$2,000,000
Selling and administrative expenses (all fixed)	$1,950,000
Beginning inventories	$0

Traditional approach to computation of the predetermined overhead rate:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$2{,}000{,}000}{80{,}000 \text{ units}} = \$25 \text{ per unit}$$

Budgeted Income Statement

Revenue (80,000 units × $70 per unit)		$5,600,000
Cost of goods sold:		
Variable manufacturing		
(80,000 units × $18 per unit)	$1,440,000	
Manufacturing overhead applied		
(80,000 units × $25 per unit)	2,000,000	3,440,000
Gross margin		2,160,000
Selling and administrative expenses		1,950,000
Operating income		$ 210,000

New approach to computation of the predetermined overhead rate using capacity in the denominator:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost at capacity}}{\text{Estimated total amount of the allocation base at capacity}}$$

$$= \frac{\$2{,}000{,}000}{100{,}000 \text{ units}} = \$20 \text{ per unit}$$

Budgeted Income Statement

Revenue (80,000 units × $70 per unit)		$5,600,000
Cost of goods sold:		
Variable manufacturing		
(80,000 units × $18 per unit)	$1,440,000	
Manufacturing overhead applied		
(80,000 units × $20 per unit)	1,600,000	3,040,000
Gross margin		2,560,000
Cost of unused capacity		
[(100,000 units − 80,000 units) × $20 per unit]		400,000
Selling and administrative expenses		1,950,000
Operating income		$ 210,000

Jan: Whoa!! I don't think I like the looks of that "Cost of unused capacity." If that thing shows up on the income statement, someone from headquarters is likely to come down here looking for some people to lay off.

Lonny: I'm worried about something else, too. What happens when sales are not up to expectations? Can we pull the "hat trick"?

Melissa: I'm sorry, I don't understand.

Jan: Lonny's talking about something that happens fairly regularly. When sales are down and profits look like they are going to be lower than the president told the owners they were going to be, the president comes down here and asks us to deliver some more profits.

Lonny: And we pull them out of our hat.

Jan: Yeah, we just increase production until we get the profits we want.

Melissa: I still don't understand. You mean you increase sales?

Jan: Nope, we increase production. We're the production managers, not the sales managers.

Melissa: I get it. Since you have produced more, the sales force has more units it can sell.

Jan: Nope, the marketing people don't do a thing. We just build inventories and that does the trick.

Required:

In all of the questions below, assume that the predetermined overhead rate under the traditional method is $25 per unit, and under the new method it is $20 per unit. Also assume that under the traditional method any underapplied or overapplied overhead is taken directly to the income statement as an adjustment to Cost of Goods Sold.

1. Suppose actual production is 80,000 units. Compute the operating incomes that would be realized under the traditional and new methods if actual sales are 75,000 units and everything else turns out as expected.
2. How many units would have to be produced under each of the methods in order to realize the budgeted operating income of $210,000 if actual sales are 75,000 units and everything else turns out as expected?

3. What effect does the new method based on capacity have on the volatility of operating income?
4. Will the "hat trick" be easier or harder to perform if the new method based on capacity is used?
5. Do you think the "hat trick" is ethical?

CASE 3–33 Critical Thinking; Interpretation of Manufacturing Overhead Rates [LO3, LO5]

Sharpton Fabricators Corporation manufactures a variety of parts for the automotive industry. The company uses a job-order costing system with a plantwide predetermined overhead rate based on direct labour-hours. On December 10, 2007, the company's controller made a preliminary estimate of the predetermined overhead rate for 2008. The new rate was based on the estimated total manufacturing overhead cost of $2,475,000 and the estimated 52,000 total direct labour-hours for 2008:

$$\text{Predetermined overhead rate} = \frac{\$2{,}475{,}000}{52{,}000 \text{ hours}}$$
$$= \$47.60 \text{ per direct labour-hour}$$

This new predetermined overhead rate was communicated to top managers in a meeting on December 11. The rate did not cause any comment because it was within a few pennies of the overhead rate that had been used during 2007. One of the subjects discussed at the meeting was a proposal by the production manager to purchase an automated milling machine centre built by Central Robotics. The president of Sharpton Fabricators, Kevin Reynolds, agreed to meet with the regional sales representative from Central Robotics to discuss the proposal.

On the day following the meeting, Mr. Reynolds met with Jay Warner, Central Robotics' sales representative. The following discussion took place:

Reynolds: Larry Winter, our production manager, asked me to meet with you since he is interested in installing an automated milling machine centre. Frankly, I am skeptical. You're going to have to show me this isn't just another expensive toy for Larry's people to play with.

Warner: That shouldn't be too difficult, Mr. Reynolds. The automated milling machine centre has three major advantages. First, it is much faster than the manual methods you are using. It can process about twice as many parts per hour as your present milling machines. Second, it is much more flexible. There are some up-front programming costs, but once those have been incurred, almost no setup is required on the machines for standard operations. You just punch in the code of the standard operation, load the machine's hopper with raw material, and the machine does the rest.

Reynolds: Yeah, but what about cost? Having twice the capacity in the milling machine area won't do us much good. That centre is idle much of the time anyway.

Warner: I was getting there. The third advantage of the automated milling machine centre is lower cost. Larry Winters and I looked over your present operations, and we estimated that the automated equipment would eliminate the need for about 6,000 direct labour-hours a year. What is your direct labour cost per hour?

Reynolds: The wage rate in the milling area averages about $21 per hour. Fringe benefits raise that figure to about $30 per hour.

Warner: Don't forget your overhead.

Reynolds: Next year the overhead rate will be about $48 per hour.

Warner: So including fringe benefits and overhead, the cost per direct labour-hour is about $78.

Reynolds: That's right.

Warner: Since you can save 6,000 direct labour-hours per year, the cost savings would amount to about $468,000 a year.

Reynolds: That's pretty impressive, but you aren't giving away this equipment are you?

Warner: Several options are available, including leasing and outright purchase. Just for comparison purposes, our 60-month lease plan would require payments of only $300,000 per year.

Reynolds: Sold! When can you install the equipment?

Shortly after this meeting, Mr. Reynolds informed the company's controller of the decision to lease the new equipment, which would be installed over the Christmas vacation period. The controller realized that this decision would require a recomputation of the predetermined overhead rate for the year 2008 since the decision would affect both the manufacturing overhead and the direct labour-hours for the year. After talking with both the production manager and the sales representative from Central Robotics, the controller discovered that in addition

to the annual lease cost of $300,000, the new machine would also require a skilled technician/programmer who would have to be hired at a cost of $45,000 per year to maintain and program the equipment. Both of these costs would be included in factory overhead. There would be no other changes in total manufacturing overhead cost, which is almost entirely fixed. The controller assumed that the new machine would result in a reduction of 6,000 direct labour-hours for the year from the levels that had initially been planned.

When the revised predetermined overhead rate for the year 2008 was circulated among the company's top managers, there was considerable dismay.

Required:

1. Recompute the predetermined rate assuming that the new machine will be installed. Explain why the new predetermined overhead rate is higher (or lower) than the rate that was originally estimated for the year 2008.
2. What effect (if any) would this new rate have on the cost of jobs that do not use the new automated milling machine?
3. Why would managers be concerned about the new overhead rate?
4. After seeing the new predetermined overhead rate, the production manager admitted that he probably wouldn't be able to eliminate all of the 6,000 direct labour-hours. He had been hoping to accomplish the reduction by not replacing workers who retire or quit, but that would not be possible. As a result, the real labour savings would be only about 2,000 hours—one worker. In the light of this additional information, evaluate the original decision to acquire the automated milling machine from Central Robotics.

CASE 3–34 Ethics and the Manager [LO3, LO5, LO7]

Cristin Madsen has recently been transferred to the Appliances Division of Solequin Corporation. Shortly after taking over her new position as divisional controller, she was asked to develop the division's predetermined overhead rate for the upcoming year. The accuracy of the rate is important because it is used throughout the year and any overapplied or underapplied overhead is closed out to Cost of Goods Sold at the end of the year. Solequin Corporation uses direct labour-hours in all of its divisions as the allocation base for manufacturing overhead.

To compute the predetermined overhead rate, Cristin divided her estimate of the total manufacturing overhead for the coming year by the production manager's estimate of the total direct labour-hours for the coming year. She took her computations to the division's general manager for approval but was quite surprised when he suggested a modification in the base. Her conversation with the general manager of the Appliances Division, Lance Jusic, went like this:

Madsen: Here are my calculations for next year's predetermined overhead rate. If you approve, we can enter the rate into the computer on January 1 and be up and running in the job-order costing system right away this year.

Jusic: Thanks for coming up with the calculations so quickly, and they look just fine. There is, however, one slight modification I would like to see. Your estimate of the total direct labour-hours for the year is 110,000 hours. How about cutting that to about 105,000 hours?

Madsen: I don't know if I can do that. The production manager says she will need about 110,000 direct labour-hours to meet the sales projections for next year. Besides, there are going to be over 108,000 direct labour-hours during the current year and sales are projected to be higher next year.

Jusic: Cristin, I know all of that. I would still like to reduce the direct labour-hours in the base to something like 105,000 hours. You probably don't know that I had an agreement with your predecessor as divisional controller to shave 5% or so off the estimated direct labour-hours every year. That way, we kept a reserve that usually resulted in a big boost to operating income at the end of the fiscal year in December. We called it our Christmas bonus. Corporate headquarters always seemed as pleased as punch that we could pull off such a miracle at the end of the year. This system has worked well for many years, and I don't want to change it now.

Required:

1. Explain how shaving 5% off the estimated direct labour-hours in the base for the predetermined overhead rate usually results in a big boost in operating income at the end of the fiscal year.
2. Should Cristin Madsen go along with the general manager's request to reduce the direct labour-hours in the predetermined overhead rate computation to 105,000 direct labour-hours?

Research

R 3–35 Job Costing Systems and Risks [LO1, LO2, LO3]

The questions in this exercise are based on Bird Construction Income Fund, a general contractor that operates branches through its subsidiary, Bird Construction Company, in Toronto, Winnipeg, Calgary, Edmonton, Vancouver, and Seattle, Washington. To answer the questions, you will need to download Bird's 2006 annual report. Go to www.sedar.com and find Bird Construction by clicking "company profiles" and searching for the company under "B." You do not need to print these documents to answer the questions.

Required

1. What are the key drivers for success of Bird Construction Income Fund?
2. What business risks does Bird Construction face that may threaten the company's ability to satisfy unit-holder expectations? What are some examples of control activities that the company could use to reduce these risks?
3. Would Bird Construction be more likely to use process costing or job-order costing? Why?
4. What are some examples of Bird Construction's direct material costs? Would you expect the bill of materials for each of Bird's residential buildings to be the same or different? Why?
5. Describe the type of direct labour costs incurred by Bird Construction when constructing a residential building. Would Bird Construction use employee time tickets at their home sites under construction? Why or why not?
6. What are some examples of overhead costs that are incurred by Bird Construction to create a housing community?
7. Assume that Bird is engaged in building several planned communities. Suggest how overhead costs related to these planned communities may be assigned. From a financial reporting standpoint, why does the entity need to assign manufacturing overhead costs to cost objects? What kinds of cost related to residential construction would be included in inventory?

R 3–36 Enterprise Systems and Job Costing [LO1, LO2, LO4, LO6]

Use the web sites of Oracle or SAP to locate applications of ERP and XML to company costing operations. Form a list of five companies and determine if job costing is appropriate for them or whether any is a merchandiser.

R 3–37 Costing Systems and Overhead [LO1, LO3, LO7, LO8]

Windpower is a popular environmentally friendly electrical power-generating system. In 2006, 944 megawatts of capacity (944,000 kilowatts) were reportedly installed in Canada and much more is in the planning stages.

The Natural Resources Canada web site (www.canren.gc.ca) and the Canadian Wind Energy Association web site (www.canea.ca) provide historical, technical, and operational descriptions of activities in Canada. www.canea.ca even provides brief case studies of some Canadian projects.

Required

1. Describe how you believe the operations of wind farms would be costed. List as many cost elements as you deem appropriate.
2. Would the use of different definitions of activity amounts be useful in providing cost information?