Chapter 3

Systems design: job-order costing

Learning objectives

After studying Chapter 3, you should be able to:

1 Distinguish between process costing and job-order costing

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

3 Compute predetermined overhead rates

4 Prepare journal entries to record costs in a job-order costing system

5 Apply overhead cost to Work in Progress using a predetermined overhead rate

6 Prepare T-accounts to show the flow of costs in a job-order costing system

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

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

9 (Appendix 3A) Analyse the allocation of service department costs

Concepts in Context

'Net profit participation' contracts in which writers, actors and directors share in the net profits of films are common in Hollywood. For example, Winston Groom, the author of the novel *Forrest Gump,* has a contract with Paramount Pictures Corp. that calls for him to receive 3% of the net profits on the film. However, Paramount claims that *Forrest Gump* has yet to show any profits even though it has the third highest gross receipts of any film in history. How can this be?

Film studios assess a variety of overhead charges including a charge of about 15% on production costs for production overhead, a charge of about 30% of gross rentals for distribution overhead, and a charge for marketing overhead that amounts to about 10% of advertising costs. After all of these overhead charges and other hotly contested accounting practices, it is a rare film that shows a profit.

Fewer than 5% of released films show a profit for net profit participation purposes. Examples of 'money-losing' films include *Rain Man*, *Batman*, and *Who Framed Roger Rabbit?* as well as *Forrest Gump*. Disgruntled writers[1] and actors are increasingly suing studios, claiming unreasonable accounting practices that are designed to cheat them of their share of profits.[2]

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, since the way in which a product or service is costed can have a substantial impact on reported profit, as well as on key management decisions.

We should keep in mind that 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 on 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 on in the book, we look at product costing from a different point of view called *variable costing*, which is often advocated as an alternative to absorption costing.

In one form or another, most countries require absorption costing for both external financial reporting and for tax reporting. In addition, the vast majority of companies throughout the world also use absorption costing for management 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.

Process and job-order costing

1 LEARNING OBJECTIVE

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 determine accurately 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. Two costing systems are commonly used in manufacturing and in many service companies; these two systems are known as *process costing* and *job-order costing*.

Process costing

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. Other examples include producing paper, refining aluminium ingots, mixing and bottling beverages, and producing industrial chemicals. All of these industries are characterized by an essentially homogeneous product that flows evenly through the production process on a continuous basis.

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

$$\text{Unit cost (per litre, kilo, bottle)} = \frac{\text{total manufacturing cost}}{\text{Total units produced (litres, kilos, bottles)}}$$

Since one unit of product (litre, kilo, bottle) is indistinguishable from any other unit of product, each unit is assigned the same average cost as any other unit produced during the period. 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

2 LEARNING OBJECTIVE

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 denim jackets for both men and women during a month. A particular order might consist of 1,000 men's denim jackets, style number A312, medium size. This order of 1,000 jackets 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, commercial aircraft, greeting cards and airline meals. All of these examples are characterized by diverse outputs. Each construction project is unique and different from every other – the company may be constructing simultaneously a dam in Zaire and a bridge in Indonesia. Likewise, each airline orders a different type of meal from its catering supplier.

Job-order costing is also used extensively in service industries. Hospitals, law firms, TV studios, accounting firms, advertising agencies and repair shops, for example, all use a variation of job-order costing to accumulate costs for accounting and billing purposes. 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 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. And the Levi Strauss factory mentioned above 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.

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

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. The 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.

Management accounting in action: the issue

Yost Precision Machining is a small company in Birmingham that specializes in fabricating precision metal parts that are used in a variety of applications ranging from deep-sea exploration vehicles to the inertial triggers in car air bags. The company's top managers gather every day at 8:00 a.m. in the company's conference room for the daily planning meeting. Attending the meeting this morning are: Jean Yost, the company's managing director; David Fowler, the marketing manager; Debbie Turner, the production manager; and Marcus White, the company finance director. The managing director opened the meeting:

Jean: The production schedule indicates we'll be starting job 2B47 today. Isn't that the special order for experimental couplings, David?

David: That's right, Jean. That's the order from Loops Unlimited for two couplings for their new roller coaster ride for Magic Mountain.

Debbie: Why only two couplings? Don't they need a coupling for every car?

David: That's right. But this is a completely new roller coaster. The cars will go faster and will be subjected to more twists, turns, drops and loops than on any other existing roller coaster. To hold up under these stresses, Loops Unlimited's engineers had to redesign the cars and couplings completely. They want to test the design thoroughly before proceeding to large-scale production. So they want us to make just two of these new couplings for testing purposes. If the design works, then we'll have the inside track on the order to supply couplings for the whole ride.

Jean: We agreed to take on this initial order at our cost just to get our foot in the door. Marcus, will there be any problem documenting our cost so we can get paid?

Marcus: No problem. The contract with Loops stipulates that they will pay us an amount equal to our cost of goods sold. With our job-order costing system, I can tell you that number on the day the job is completed.

Jean: Good. Is there anything else we should discuss about this job at this time? No? Well then let's move on to the next item of business.

Measuring direct materials cost

Yost Precision Machining will require two M46 Housings and four G7 Connectors 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 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.

When an agreement has been reached with the customer concerning the quantities, prices and shipment date for the order, a *production order* is issued. 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. It 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. This completed form is presented to the storeroom, who then issue the necessary raw materials. The storeroom is not allowed to release materials without such a form, bearing an authorized signature.

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.

3.1 EXHIBIT

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

Authorized Signature Bill White

Exhibit 3.1 Materials requisition form

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. The job cost sheets form a subsidiary ledger to the Work in Progress account. They are detailed records for the jobs in process that add up to the balance in Work in Progress.

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 easily be 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.

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 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.

3.2 EXHIBIT

JOB COST SHEET

Job Number 2B47

Department Milling

Item Special order coupling

For Stock

Date Initiated March 2

Date Completed

Units Completed

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

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

Exhibit 3.2 Job cost sheet

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 a supermarket check-out. The first bar code indicates that a job is being started; the second is the unique bar code on his or her 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 that the task is complete, the bar code on his or her 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 be automatically 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.

3.3 EXHIBIT

Time Ticket No. 843 Date March 3

Employee Mary Holden Station 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	

Supervisor Bill White

Exhibit 3.3 Employee time ticket

3 LEARNING OBJECTIVE

Application of manufacturing overhead

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.

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.

The allocation base is used to compute the **predetermined overhead rate** in the following formula:

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

Note that the predetermined overhead rate is based on *estimated* rather than actual figures. 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:

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

So, for example, if the predetermined overhead rate is £8 per direct labour-hour, then £8 of overhead cost 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:

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

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 to be £320,000 for the year and its total direct labour-hours to be 40,000. Its predetermined overhead rate for the year would be £8 per direct labour-hour, as shown below:

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

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

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:

$$\text{Overhead applied to job 2B47} = \text{Predetermined overhead rate} \times \text{Actual direct labour} - \text{hours charged to job 2B47}$$

$$£8/\text{DLH} \times 27 \text{ direct labour-hours} = £216 \text{ of overhead applied to job 2B47}$$

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 by the predetermined overhead rate – it is called a **normal cost system**.

The overhead may be applied as 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 value the work in progress stock.

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. Before the end of the accounting period, managers would like to know the accounting system's valuation of completed jobs. Suppose, for example, that Yost Precision Machining waits until the end of the year to compute its overhead rate. Then there would be no way for managers to know the cost of goods sold for job 2B47 until the close of the year, even though the job was completed and shipped to the customer in March. The seriousness of this problem can be reduced to some extent by computing the actual overhead more frequently, but that immediately leads to another problem as discussed below.
2. If actual overhead rates are computed frequently, seasonal factors in overhead costs or in the allocation base can produce fluctuations in the overhead rates. Managers generally feel that such fluctuations in overhead rates 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.

3.4 EXHIBIT

JOB COST SHEET

Job Number 2B47 | Date Initiated March 2

Date Completed

Department Milling | Units Completed 2

Item Special order coupling

For Stock

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

*£1,800 ÷ 2 units = £900 per unit.

Exhibit 3.4 A completed job cost sheet

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

An allocation base should be used that is a *cost driver* of 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 over-costed.

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 is becoming less of a factor and overhead is becoming more of a factor in the cost of products in many industries.

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 8.

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.[3] 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 were produced, so the incremental cost of an additional unit is something less than the average unit cost of £900.

The completed job cost sheet is now ready to be transferred to the Finished Goods stock account, where it will serve as the basis for valuing unsold units in ending stock 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 will provide a good overview of the overall operation of a job-order costing system.

Management accounting in action: the wrap-up

In the 8:00 a.m. daily planning meeting on 9 March, Jean Yost, the managing director of Yost Precision Machining, once again drew attention to job 2B47, the experimental couplings:

Jean: I see job 2B47 is completed. Let's get those couplings shipped immediately to Loops Unlimited so they can get their testing program under way. Marcus, how much are we going to bill Loops for those two units?

Marcus: Just a second, let me check the job cost sheet for that job. Here it is. We agreed to sell the experimental units at cost, so we will be charging Loops Unlimited just £900 a unit.

Jean: Fine. Let's hope the couplings work out and we make some money on the big order later.

4 LEARNING OBJECTIVE

Job-order costing – the flow of costs

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 invention of motion pictures, was started during March and had £30,000 in manufacturing costs already accumulated on 1 April.

Job B, an order for 10,000 silver medallions commemorating the fall of the Berlin Wall, was started in April.

3.5 EXHIBIT

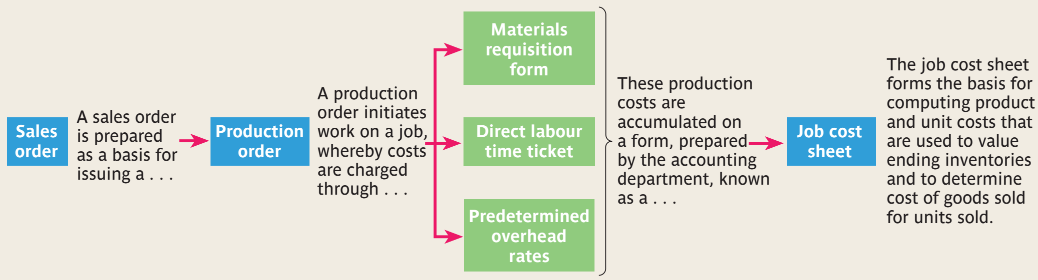

Exhibit 3.5 The flow of documents in a job-order costing system

The purchase and issue of materials

On 1 April, 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	
Creditors		£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. Entry (2) records the issue of the materials to the production departments.

	(2)	
Work in progress	50,000	
Manufacturing overhead	2,000	
Raw materials		52,000

The materials charged to Work in Progress represent direct materials for specific jobs. As these materials are entered into the Work in Progress 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 Progress 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 we need to point out one additional thing. Notice from the exhibit 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 Progress account contains the same £30,000 balance. *The reason the £30,000 appears in both places is that the Work in Progress account is a control account and the job cost sheets form a subsidiary ledger. Thus, the Work in Progress account contains a summarized total of all costs appearing on the individual job cost sheets for all jobs in progress at any given point in time*. (Since Rand Company had only job A in progress at the beginning of April, job A's £30,000 balance on that date is equal to the balance in the Work in Progress account.)

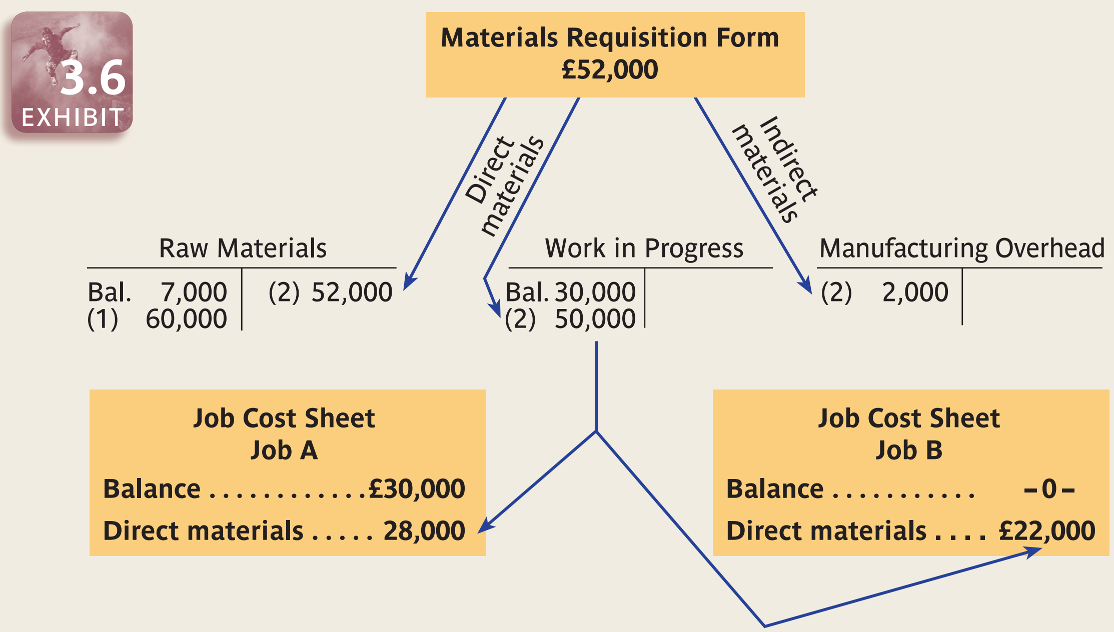

Exhibit 3.6 Raw materials cost flows

Issue of direct materials only

Sometimes the materials drawn from the Raw Materials stock 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 progress	XXX	
Raw materials		XXX

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. This costing and classification for April resulted in the following summary entry:

	(3)	
Work in progress	60,000	
Manufacturing overhead	15,000	
Salaries and wages payable		75,000

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

At the same time that direct labour costs are added to Work in Progress, 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.

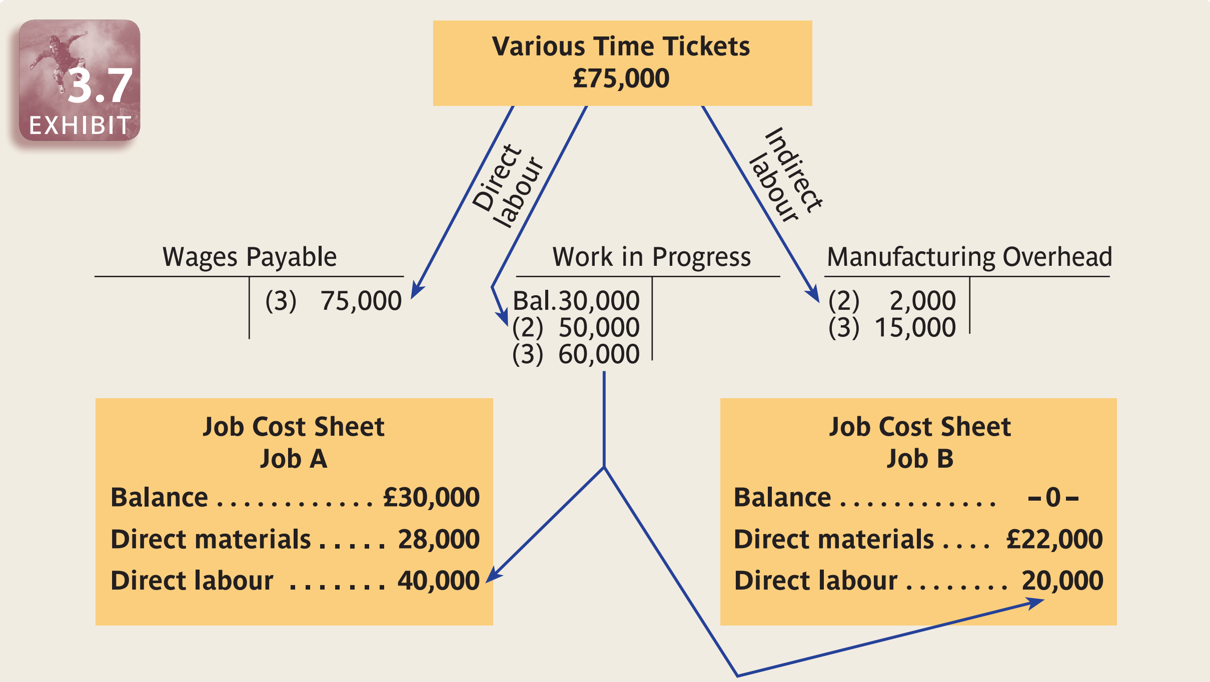

Exhibit 3.7 Labour cost flows

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	
Creditors		40,000

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, let us 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

5 LEARNING OBJECTIVE

Since actual manufacturing costs are charged to the Manufacturing Overhead control account rather than to Work in Progress, how are manufacturing overhead costs assigned to Work in Progress? 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 Progress. The following entry records the application of Manufacturing Overhead to Work in Progress:

	(7)	
Work in progress	90,000	
Manufacturing overhead		90,000

The flow of costs through the Manufacturing Overhead account is shown in Exhibit 3.8.

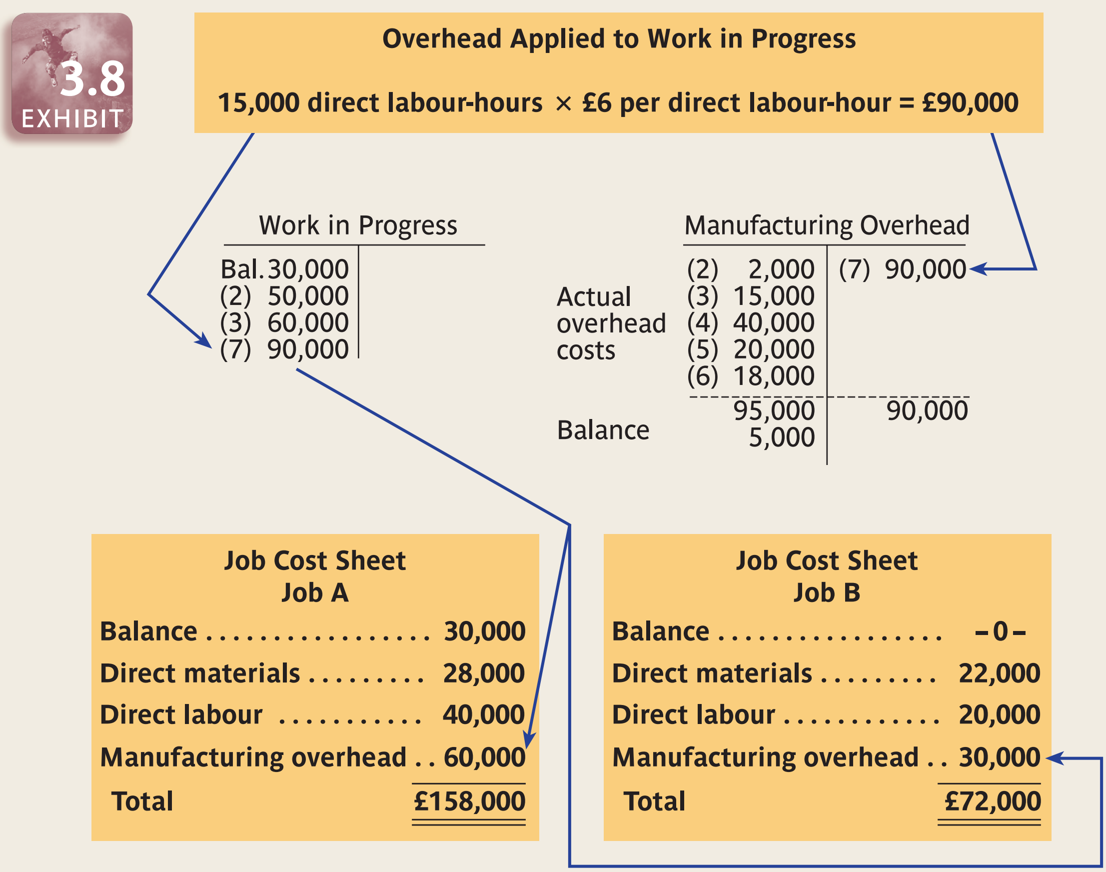

Exhibit 3.8 The flow of costs in overhead application

The 'actual overhead costs' in the Manufacturing Overhead account 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 Progress [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 Progress account by means of the predetermined overhead rate. This sequence of events is illustrated below:

Manufacturing overhead (a clearing account)	
Actual overhead costs are charged to the account as these costs are incurred day by day throughout the period →	→ Overhead is applied to Work in Progress using the predetermined overhead rate

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 Progress, 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, Problems 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 do not appear on the job cost sheet nor do they appear in the Work in Progress account. Only the applied overhead cost, based on the predetermined overhead rate, appears on the job cost sheet and in the Work in Progress 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 profit and loss account. *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 the following selling and administrative costs during April:

Top-management salaries	£21,000
Other office salaries	9,000
Total salaries	£30,000

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	
Creditors		50,000

Since the amounts in entries (8) to (10) all go directly into expense accounts, they will have no effect on the costing of Rand Company's production for April. 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.

Cost of goods manufactured

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 Progress 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. (This point was illustrated earlier in Exhibit 2.6 in Chapter 2.)

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 Progress to Finished Goods:

	(11)	
Finished goods	158,000	
Work in progress		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 the end of the month, so its cost will remain in the Work in Progress 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 progress stock' in the assets section.

Cost of goods sold

As units in finished goods are shipped to fill customers' orders, the unit cost appearing on the job cost sheets is used as a basis for transferring the cost of the items sold 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 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)	
Debtors	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

6 LEARNING OBJECTIVE

To pull the entire Rand Company example together, journal entries (1) to (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 Progress 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 Progress stock. Note also the cost of goods manufactured for the month (£158,000) agrees with the amount transferred from Work in Progress 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.

A profit and loss account 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.

Problems of overhead application

7 LEARNING OBJECTIVE

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.

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 Progress 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 Progress, whereas actual overhead costs for April proved to be £95,000 (see Exhibit 3.8). The difference between the overhead cost applied to Work in Progress 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 Progress while incurring actual overhead costs of only £90,000, then the overhead would have been overapplied.

What is the cause of underapplied or overapplied overhead? The causes can be complex. Nevertheless, the basic problem is that the method of applying overhead to jobs using a predetermined overhead

3.9 EXHIBIT

(1)		
Raw materials	60,000	
Creditors		60,000
(2)		
Work in progress	50,000	
Manufacturing overhead	2,000	
Raw materials		52,000
(3)		
Work in progress	60,000	
Manufacturing overhead	15,000	
Salaries and wages payable		75,000
(4)		
Manufacturing overhead	40,000	
Creditors		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 progress	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	
Creditors		50,000
(11)		
Finished goods	158,000	
Work in progress		158,000
(12)		
Debtors	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

3.10 EXHIBIT

Debtors

	XX*		
(12)	225,000		

Creditors

			XX
		(1)	60,000
		(4)	40,000
		(10)	50,000

Capital Stock

			XX

Prepaid Insurance

	XX		
		(5)	7,000

Retained Earnings

			XX

Raw Materials

Bal.	7,000	(2)	52,000
(1)	60,000		
Bal.	15,000		

Salaries and Wages Payable

			XX
		(3)	75,000
		(8)	30,000

Sales

		(12)	225,000

Work in Progress

Bal.	30,000	(11)	158,000
(2)	50,000		
(3)	60,000		
(7)	90,000		
Bal.	72,000		

Property Taxes Payable

			XX
		(5)	13,000

Cost of Goods Sold

(13)	118,500		

Salaries Expense

(8)	30,000		

Finished Goods

Bal.	10,000	(13)	118,500
(11)	158,000		
Bal.	49,500		

Depreciation Expense

(9)	7,000		

Advertising Expense

(10)	42,000		

Accumulated Depreciation

			XX
		(6)	18,000
		(9)	7,000

Other Selling and Administrative Expense

(10)	8,000		

Manufacturing Overhead

(2)	2,000	(7)	90,000
(3)	15,000		
(4)	40,000		
(5)	20,000		
(6)	18,000		
Bal.	5,000		

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 Progress
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, Debtors normally carries a debit balance)

Exhibit 3.10 Summary of cost flows – Rand Company

Cost of goods manufactured		
Direct materials		
Raw materials stock, beginning	£7,000	
Add: Purchases of raw materials	60,000	
Total raw materials available	67,000	
Deduct: Raw materials stock, 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 progress		90,000
Total manufacturing costs		200,000
Add: Beginning work in progress stock		30,0002
		230,000
Deduct: Ending work in progress stock		72,000
Cost of goods manufactured		£158,000
Cost of goods sold		
Finished goods stock, beginning		£10,000
Add: Cost of goods manufactured		158,000
Goods available for sale		168,000
Deduct: Finished goods stock, 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 under applied overhead is added to cost of goods sold. If overhead were over applied, it would be deducted from costs of goods sold.

Exhibit 3.11 Schedules of cost of goods manufactured and cost of goods sold

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. Since these costs are fixed, they do not grow as the number of machine-hours incurred increases. Second, spending on overhead items may or may not be under control. If individuals who are responsible for overhead costs do a good job, those costs should be less than were expected at the beginning of the period. If they do a poor job, those costs will be more than expected. As we indicated above, however, 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:

3.12 EXHIBIT

Rand Company
Profit and Loss Account
For the month ending 30 April

Sales		£225,000
Less cost of goods sold (118,500 1 £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
Profit		£14,500

Exhibit 3.12 Profit and loss account

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

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 machine-hours	68,000	–
Actual direct material costs	–	£90,000

For each company, note that the actual data for both cost and activity 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 costs	£290,000	£130,000
Manufacturing overhead cost applied to Work in Progress during the year:		
68,000 actual machine-hours × £4	£272,000	
£90,000 actual direct materials cost × 150%		£135,000
Underapplied (overapplied) overhead	£18,000	£(5,000)

For Turbo Crafters, notice that the amount of overhead cost that has been applied to Work in Progress (£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 Progress (£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.

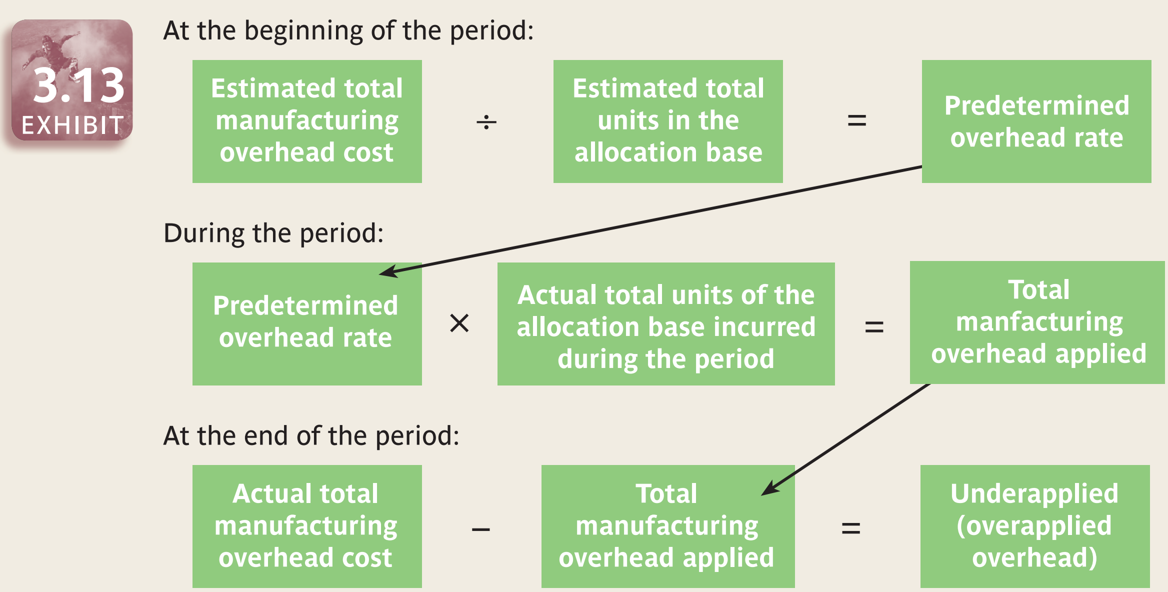

Exhibit 3.13 Summary of overhead concepts

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 two ways:

1 Closed out of Cost of Goods Sold.

2 Allocated between Work in Progress, Finished Goods, and Cost of Goods Sold in proportion to the overhead applied during the current period in the ending balances of these accounts.

The second method, which allocates the under- or overapplied overhead among ending stock 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.

Closed 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 the 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 profit and loss account for April will appear as was shown earlier in Exhibit 3.12.

Allocated between accounts

Allocation of under- or overapplied overhead between Work in Progress, Finished Goods, and Cost of Goods Sold is more accurate than closing the entire balance into Cost of Goods Sold. The reason is that 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 stock 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 progress stock, 30 April	£30,000	33.33%
Overhead applied in finished goods stock, 30 April		
(£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%

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 progress (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 there were still 250 units from job A in ending finished goods stock, the amount of overhead applied in the Finished Goods Stock 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.

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 profit and loss account.

Multiple predetermined overhead rates

Our discussion 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. 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, since 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.

Job-order costing in service companies

We stated earlier in the chapter that job-order costing is also used in service organizations such as law firms, film studios, hospitals and repair shops, as well as in manufacturing companies. In a law firm, for example, each client represents a 'job', and the costs of that job are accumulated day by day on a job cost sheet as the client's case is handled by the firm. Legal forms and similar inputs represent the direct materials for the job; the time expended by lawyers represents the direct labour; and the costs of secretaries, clerks, rent, depreciation, and so forth, represent the overhead. An example of a job costing approach for a legal firm is shown in Exhibit 3.15.

In a film studio each film produced by the studio is a 'job', and costs for direct materials (costumes, props, film, etc.) and direct labour (actors, directors and extras) are accounted for and charged to each film's job cost sheet. A share of the studio's overhead costs, such as utilities, depreciation of equipment, salaries of maintenance workers, and so forth, is also charged to each film. However, there is considerable controversy about the methods used by some studios to distribute overhead costs among films, and these controversies sometimes result in lawsuits.

In total, the reader should be aware that job-order costing is a versatile and widely used costing method, and may be encountered in virtually any organization where there are diverse products or services.

3.14 EXHIBIT

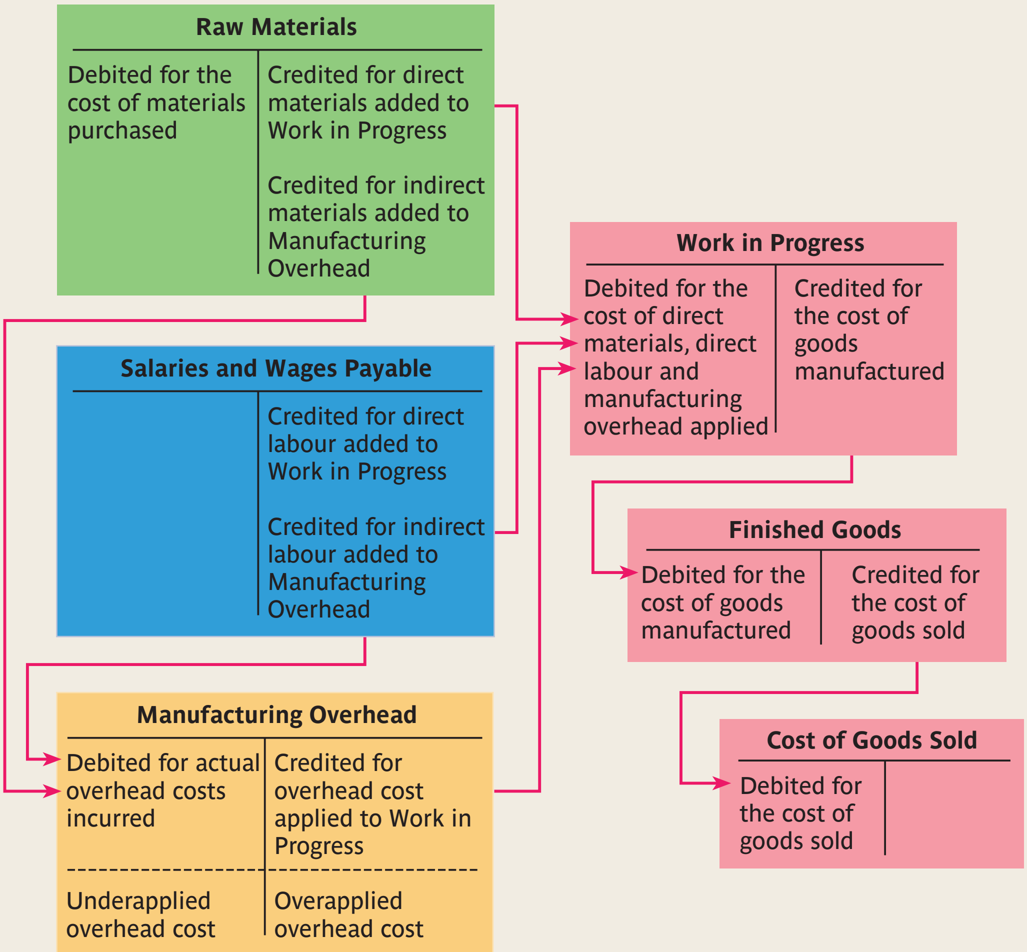

Exhibit 3.14 A general model of cost flows

The predetermined overhead rate and capacity

8 LEARNING OBJECTIVE

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.[4] 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 £3,600,000 per year, and this is the company's only manufacturing overhead. With allowances for setups 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:

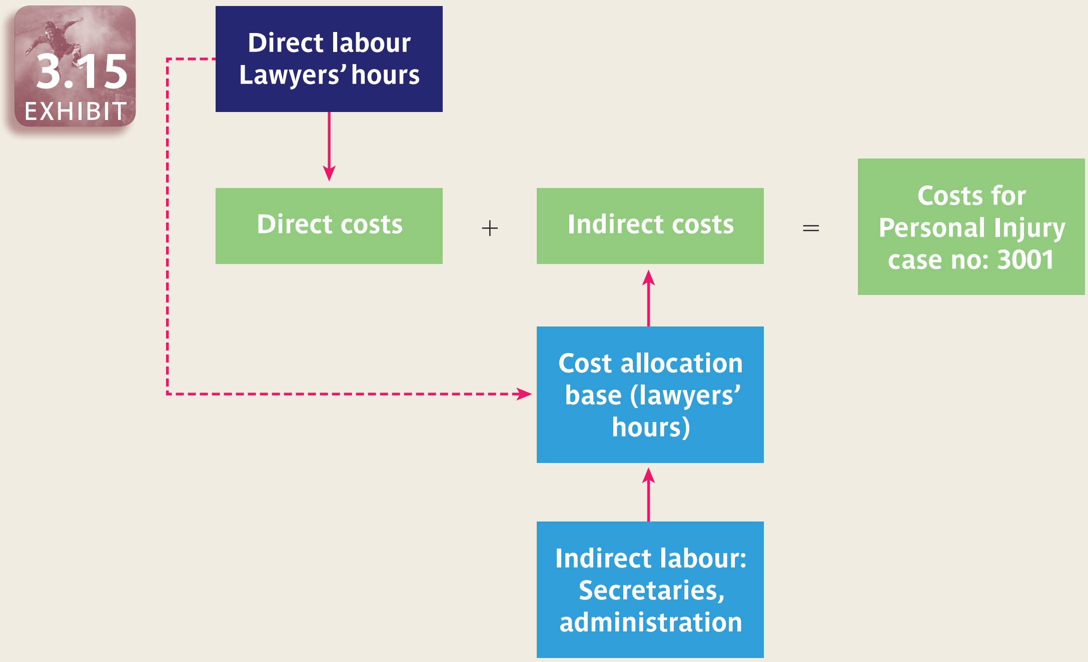

Exhibit 3.15 Job costing in a service firm: Sue Emall & Co

Prahad Corporation data	
Total manufacturing overhead cost	£3,600,000 per year
Allocation base: machine time per CD	10 seconds
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 £0.60 per second of machine time computed as follows:

$$\frac{\text{Estimated total manufacturing overhead cost, £3,600,000}}{\text{Estimated total units in the allocation base, 600,000 CDs} \times \text{10 seconds per CD}} = \text{£0.60 per second}$$

Since each CD requires 10 seconds of machine time, each CD will be charged for £6.00 of overhead cost.

Critics point out 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 450,000 CDs, the predetermined overhead rate would be £0.80 per second of machine time or £8.00 per CD rather than £6.00 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 point out 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:

$$\frac{\text{Total manufacturing cost at capacity, £3,600,000}}{\text{Total units in the allocation base at capacity, 900,000 CDs} \times \text{10 seconds per CD}} = \text{£0.40 per second}$$

Since the predetermined overhead rate is £0.40 per second, the overhead cost applied to each CD would be £4.00. 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 £4.00 per CD.

This method will almost certainly result in underapplied overhead. If actual output at Prahad Corporation is 600,000 CDs, then only £2,400,000 of overhead cost would be applied to products (£4.00 per CD × 600,000 CDs). Since the actual overhead cost is £3,600,000, there would be underapplied overhead of £1,200,000. In another departure from tradition, the critics suggest that the underapplied overhead that results from idle capacity should be separately disclosed on the profit and loss account as the Cost of Unused Capacity – a period expense. Disclosing this cost as a lump sum on the profit and loss account, rather than burying it in Cost of Goods Sold or ending stocks, 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 stocks – which would defeat the purpose of basing the predetermined overhead rate on capacity.

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, accounting 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 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 either (1) closed out to Cost of Goods Sold or (2) allocated between Work in Progress, Finished Goods, and Cost of Goods Sold.
- When overhead is underapplied, manufacturing overhead costs have been understated and therefore stocks and/or expenses must be adjusted upwards. When overhead is overapplied, manufacturing overhead costs have been overstated and therefore stocks and/or expenses must be adjusted downwards.

Key terms for review

Absorption costing (p. xx).

Allocation base (p. xx).

Bill of materials (p. xx).

Cost driver (p. xx).

Full cost (p. xx).

Job cost sheet (p. xx).

Job-order costing system (p. xx).

Materials requisition form (p. xx).

Multiple predetermined overhead rates (p. xx).

Normal cost system (p. xx).

Overapplied overhead (p. xx).

Overhead application (p. xx).

Plantwide overhead rate (p. xx).

Predetermined overhead rate (p. xx).

Process costing system (p. xx).

Time ticket (p. xx).

Underapplied overhead (p. xx).

Review problem: job-order costing

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

Raw materials	£20,000
Work in progress	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 per cent 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 (don't forget to enter the opening balances in the stock 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 stock and Cost of Goods Sold.

4 Prepare a profit and loss account for the year.

Solution to review problem

1 (a)	Raw materials	410,000	
	Creditors		410,000
(b)	Work in progress	360,000	
	Manufacturing overhead	20,000	
	Raw materials		380,000

(c)	Work in progress	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	
	Creditors		17,000
(e)	Manufacturing overhead	43,000	
	Creditors		43,000
(f)	Advertising expense	180,000	
	Creditors		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:

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

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 3 £6 5 £480,000.The following entry records this application of overhead cost:

	Work in progress	480,000	
	Manufacturing overhead		480,000
(j)	Finished goods	900,000	
	Work in progress		900,000
(k)	Debtors	1,500,000	
	Sales		1,500,000
	Cost of goods sold	870,000	
	Finished goods		870,000

2

Debtors

(k)	1,500,000		

Manufacturing overhead

(b)	20,000	**(i)**	480,000
(c)	119,000		
(e)	43,000		
(g)	280,000		
(h)	7,000		
	460,000		480,000
		Bal.	20,000

Sales

		(k)	1,500,000

Cost of goods sold

(k)	870,000		

Prepaid Insurance

(h)	10,000		

Raw Materials

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

Work in progress

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		

Accumulated Depreciation

(g)	350,000		

Creditors

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

Salaries and Wages Payable

		(c)	475,000

Commissions Expense

(c)	90,000		

Administrative Salary Expense

(c)	200,000		

Sales Travel Expense

(k)	1,500,000		

Advertising Expense

(f)	180,000		

Depreciation Expense

(g)	70,000		

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
Profit and loss account
For the year ended 31 December

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
Profit		£90,000

Appendix 3A: Service department costing

9 LEARNING OBJECTIVE

Departments within an organization can be divided into two broad classes: (1) operating departments and (2) service departments. **Operating departments** include those departments or units where the central purposes of the organization are carried out. Examples of such departments or units would include the Surgery Department in hospitals and producing departments such as Milling, Assembly, and Painting in manufacturing companies.

Service departments, by contrast, do not engage directly in operating activities. Rather, they provide services or assistance to the operating departments. Examples of service departments include Cafeteria, Internal Auditing, Personnel, Cost Accounting, and Purchasing. Although service departments do not engage directly in the operating activities of an organization, the costs that they incur are generally viewed as being part of the cost of the final product or service, the same as are materials, labour and overhead in a manufacturing company or medications in a hospital. As we shall see in Chapter 19, one emerging trend is for companies to either outsource service activities and/or concentrate them in a shared service centre.

Chapter 1 stated that most organizations have one or more service departments that provide services for the entire organization. The major question we consider here is: How much of a service department's cost is to be allocated to each of the units that it serves? This is an important question, since the amount of service department cost allocated to a particular unit can have a significant impact on the computed cost of the goods or services that the unit is providing and can affect an operating unit's performance evaluation.

Allocations using the direct and step methods

Allocating service department costs begins with selecting the proper allocation base – the first topic in this section. After completing this discussion, we will move on to consider how to account for services that service departments provide to each other.

Selecting allocation bases

Many companies use a two-stage costing process. In the first stage, costs are assigned to the operating departments; in the second stage, costs are assigned from the operating departments to products and services. We focused on the second stage of this allocation process in the main part of this chapter. Costs are usually assigned from a service department to other departments using an allocation base, which is some measure of activity. The costs being allocated should be 'driven' by the allocation base. Ideally, the total cost of the service department should be proportional to the size of the allocation base. Managers also often argue that the allocation base should reflect as accurately as possible the benefits that the various departments receive from the services that are being provided. For example, most managers would argue that the square feet of building space occupied by each operating department should be used as the allocation base for janitorial services since both the benefits and costs of janitorial services tend to be proportional to the amount of space occupied by a department. Examples of allocation bases for some service departments are listed in Exhibit 3A.1. A given service department's costs may be allocated using more than one base. For example, data processing costs may be allocated on the basis of CPU minutes for mainframe computers and on the basis of the number of personal computers used in each operating department.

Although the previous paragraph explains how to select an allocation base, another critical factor should not be overlooked. The allocations should be clear and straightforward and easily understood by the managers to whom the costs are being allocated.

Interdepartmental services

Many service departments provide services for each other, as well as for operating departments. The Cafeteria Department, for example, provides food for all employees, including those assigned to other service departments. In turn, the Cafeteria Department may receive services from other service departments, such as from Custodial Services or from Personnel. Services provided between service departments are known as **interdepartmental or reciprocal services**.

3A.1 EXHIBIT

Service Department	Bases (cost drivers) Involved
Laundry	Kilos of laundry
Airport Ground Services	Number of flights
Cafeteria	Number of employees; number of meals
Medical Facilities	Cases handled; number of employees; hours worked
Materials Handling	Hours of service; volume handled
Data Processing	CPU minutes; lines printed; disk storage used; number of personal computers
Custodial Services (buildings and grounds)	Square metres occupied
Cost Accounting	Labour-hours; clients or patients serviced
Power	KWh used; capacity of machines
Human Resources	Number of employees; employee turnover; training hours
Receiving, Shipping, and Stores	Units handled; number of requisitions; space occupied
Factory Administration	Total labour-hours
Maintenance	Machine-hours

Exhibit 3A.1 Examples of bases used in allocating service department costs

3A.2 EXHIBIT

	Service Department		Operating Department		
	Hospital Administration	Custodial Services	Laboratory	Daily Patient Care	Total
Departmental costs before allocation	£360,000	£90,000	£261,000	£689,000	£1,400,000
Allocation:					
Hospital Administration costs (18/48, 30/48)*	(360,000)	(135,000)	225,000		
Custodial Services costs (5/50, 45/50)†		(90,000)	9,000	81,000	
Total costs after allocation	£ –0–	£ –0–	£405,000	£995,000	£1,400,000

* Based on the employee-hours in the two operating departments, which are 18,000 hours + 30,000 hours = 48,000 hours.

† Based on the space occupied by the two operating departments, which is 5,000 square metres + 45,000 square metres = 50,000 square metres.

Exhibit 3A.2 Direct method of allocation

Three approaches are used to allocate the costs of service departments to other departments. These are known as the *direct method*, the *step method*, and the *reciprocal method*. All three methods are discussed in the following paragraphs.

Direct method

The **direct method** is the simplest of the three cost allocation methods. It ignores the services provided by a service department to other service departments and allocates all costs directly to operating departments. Even if a service department (such as personnel) provides a large amount of service to another service department (such as the cafeteria), no allocations are made between the two departments. Rather, all costs are allocated directly to the operating departments. Hence the term direct method.

To provide an example of the direct method, assume that Mountain View Hospital has two service departments and two operating departments as shown below:

	Service department		Operating department		
	Hospital Administration	Custodial Services	Laboratory	Daily Patient Care	Total
Departmental costs before allocation	£360,000	£90,000	£261,000	£689,000	£1,400,000
Employee hours	12,000	6,000	18,000	30,000	66,000
Space occupied (square metres)	10,000	200	5,000	45,000	60,200

In the allocations that follow, Hospital Administration costs will be allocated on the basis of employee-hours and Custodial Services costs will be allocated on the basis of square metres occupied.

The direct method of allocating the hospital's service department costs to the operating departments is shown in Exhibit 3A.2. Several things should be carefully noted in this exhibit. First, even though there are employee-hours in both the Hospital Administration Department itself and in the Custodial Services Department, these employee-hours are ignored when allocating service department costs using the direct method. *Under the direct method, any of the allocation base attributable to the service departments themselves is ignored; only the amount of the allocation base attributable to the operating departments is used in the allocation.* Note that the same rule is used when allocating the costs of the Custodial Services Department. Even though the Hospital Administration and Custodial Services departments occupy some space, this is ignored when the Custodial Services costs are allocated. Finally, note that after all allocations have been completed, all of the departmental costs are contained in the two operating departments. These costs will form the basis for preparing overhead rates for purposes of costing products and services produced in the operating departments.

Although the direct method is simple, it is less accurate than the other methods since it ignores interdepartmental services. This can lead to distorted product and service costs. Even so, many organizations use the direct method because of its simplicity.

Step method

Unlike the direct method, the **step method** provides for allocation of a service department's costs to other service departments, as well as to operating departments. The step method is sequential. The sequence typically begins with the department that provides the greatest amount of service to other service departments. After its costs have been allocated, the process continues, step by step, ending with the department that provides the least amount of services to other service departments. This step procedure is illustrated in graphic form in Exhibit 3A.3, assuming that the Hospital Administration costs are allocated first at Mountain View Hospital.

Exhibit 3A.4 uses the allocations of the Mountain View Hospital to show the details of the step method. Note the following three key points about these allocations. First, under the Allocation heading

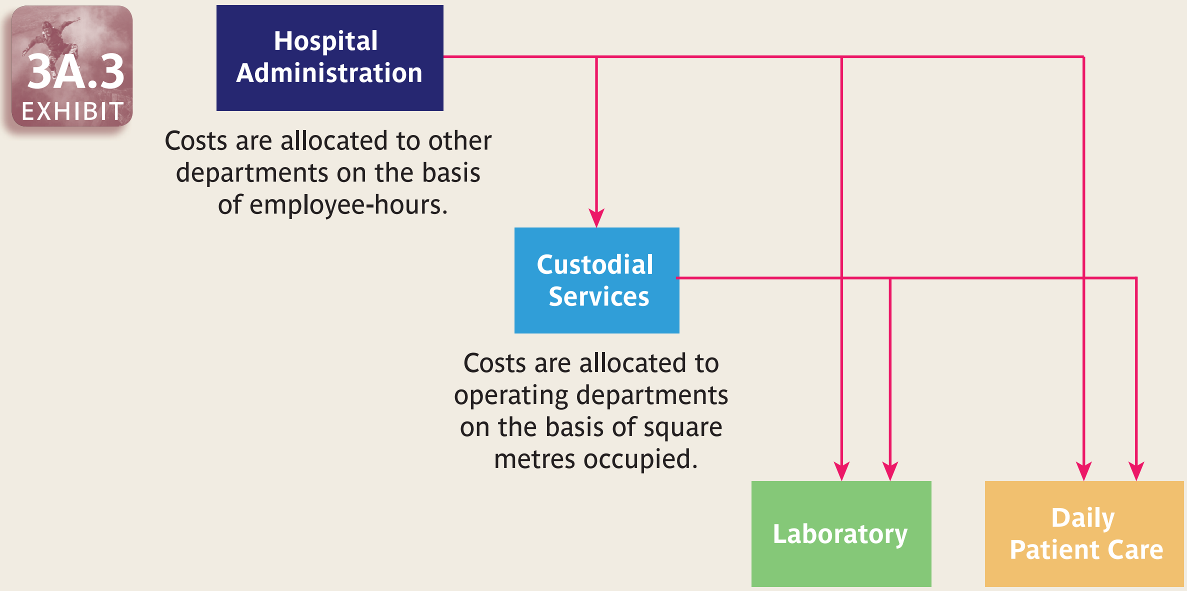

Exhibit 3A.3 Graphic illustration – step method

in Exhibit 3A.4, you see two allocations, or steps. In the step method, the first step allocates the costs of Hospital Administration to another service department (Custodial Services) as well as to the operating departments. The allocation base for Hospital Administration costs now includes the employee-hours for Custodial Services as well as for the operating departments. However, the allocation base still excludes the employee-hours for Hospital Administration itself. *In both the direct and step methods, any amount of the allocation base attributable to the service department whose cost is being allocated is always ignored.* Second, looking again at Exhibit 3A.4, note that in the second step under the Allocation heading, the cost of Custodial Services is allocated to the two operating departments, and none of the cost is allocated to Hospital Administration even though Hospital Administration occupies space in the building. *In the step method, any amount of the allocation base that is attributable to a service department whose cost has already been allocated is ignored.* After a service department's costs have been allocated, costs of other service departments are not reallocated back to it. Third, note that the cost of Custodial Services allocated to other departments in the second step (£130,000) in Exhibit 3A.4 includes the costs of Hospital Administration that were allocated to Custodial Services in the first step in Exhibit 3A.4.

Reciprocal method

The **reciprocal method** gives full recognition to interdepartmental services. Under the step method discussed above only partial recognition of interdepartmental services is possible, since the step method always allocates costs forward – never backward. The reciprocal method, by contrast, allocates service department costs in *both* directions. Thus, since Custodial Services in the prior example provides service for Hospital Administration, part of Custodial Services' costs will be allocated *back* to Hospital Administration if the reciprocal method is used. At the same time, part of Hospital Administration's costs will be allocated forward to Custodial Services. This type of reciprocal allocation requires the use of simultaneous linear equations. These equations can be complex and will not be illustrated here. Examples of the reciprocal method can be found in more advanced cost accounting texts.

The reciprocal method is rarely used in practice for two reasons. First, the computations are relatively complex. Although the complexity issue could be overcome by use of computers, there is no evidence that computers have made the reciprocal method more popular. Second, the step method usually provides results that are a reasonable approximation of the results that the reciprocal method would provide. Thus, companies have little motivation to use the more complex reciprocal method.

3A.4 EXHIBIT

	Service Department		Operating Department		
	Hospital Administration	Custodial Services	Laboratory	Daily Patient Care	Total
Departmental costs before allocation	£360,000	£90,000	£261,000	£689,000	£1,400,000
Allocation:					
Hospital Administration costs (6/54, 18/54, 30/54)*	(360,000)	40,000	120,000	200,000	
Custodial Services costs (5/50, 45/50)†		(130,000)	13,000	17,000	
Total costs after allocation	£ –0–	£ –0–	£394,000	£1,006,000	£1,400,000

* Based on the employee-hours in Custodial Services and the two operating departments, which are 6,000 hours + 18,000 hours + 30,000 hours = 54,000 hours.

† As in Exhibit 3A.2, this allocation is based on the space occupied by the two operating departments.

Exhibit 3A.4 Step method of allocation

Revenue producing departments

It is important to note that even though most service departments are cost centres and therefore generate no revenues, a few service departments, such as the cafeteria, may charge for the services they perform. If a service department generates revenues, these revenues should be offset against the department's costs, and only the net amount of cost remaining after this offset should be allocated to other departments within the organization. In this manner, the other departments will not be required to bear costs for which the service department has already been reimbursed.

Effect of allocations on operating departments

Once allocations have been completed, what do the operating departments do with the allocated service department costs? The allocations are typically included in performance evaluations of the operating departments and also included in determining their profitability.

In addition, if the operating departments are responsible for developing overhead rates for costing of products or services, then the allocated costs are combined with the other costs of the operating departments, and the total is used as a basis for rate computations. This rate development process is illustrated in Exhibit 3A.5.

Some cautions in allocating service department costs

Pitfalls in allocating fixed costs

Rather than allocate fixed costs in predetermined lump-sum amounts, some firms allocate them by use of a *variable* allocation base that fluctuates from period to period. This practice can distort decisions and create serious inequities between departments. The inequities will arise from the fact that the fixed costs allocated to one department will be heavily influenced by what happens in *other* departments or segments of the organization.

To illustrate, assume that Kolby Products has a car service centre that provides maintenance work on the fleet of cars used in the company's two sales territories. The car service centre costs are all fixed.

3A.5 EXHIBIT

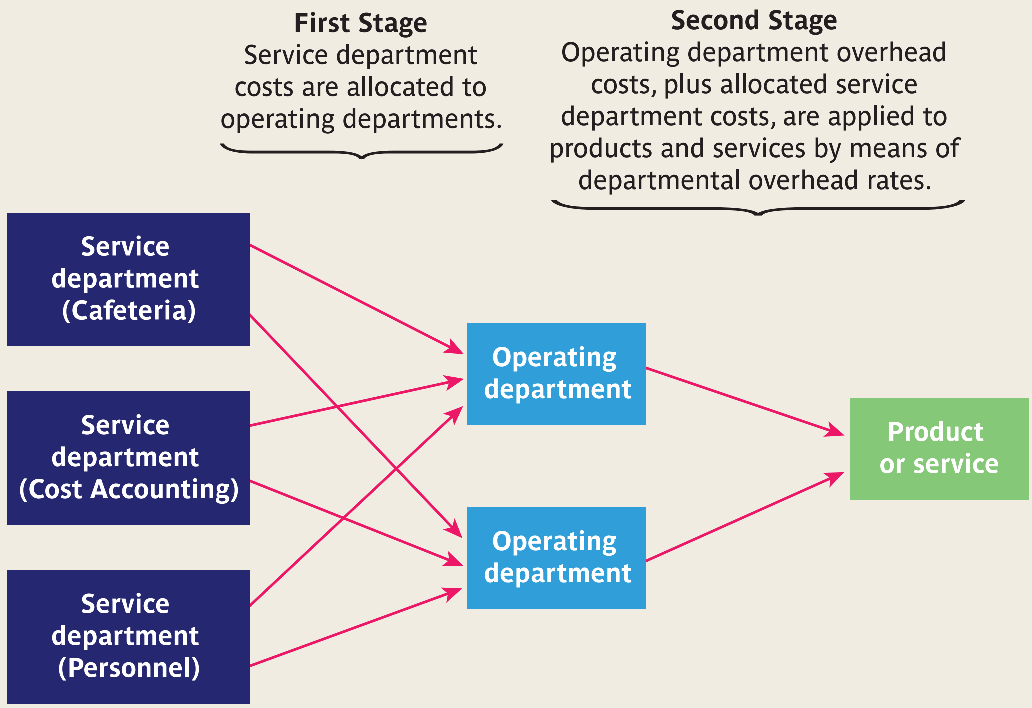

Exhibit 3A.5 Effect of allocation on products and services

Contrary to good practice, the company allocates these fixed costs to the sales territories on the basis of actual miles driven (a variable base). Selected cost data for the last two years follow:

	Year 1	Year 2
Car service centre costs (all fixed)	£120,000 (a)	£120,000 (a)
Western sales territory (miles driven)	1,500,000	1,500,000
Eastern sales territory (miles driven)	1,500,000	900,000
Total miles driven	3,000,000 (b)	2,400,000 (b)
Allocation rate per mile, (a)/(b)	£0.04	£0.05

Notice that the Western sales territory maintained an activity level of 1,500,000 miles driven in both years. On the other hand, the Eastern sales territory allowed its activity to drop off from 1,500,000 miles in Year 1 to only 900,000 miles in Year 2. The car service centre costs that would have been allocated to the two sales territories over the two-year span using actual miles driven as the allocation base are as follows:

Year 1:	
Western sales territory: 1,500,000 miles at £0.04	£60,000
Eastern sales territory: 1,500,000 miles at £0.04	60,000
Total cost allocated	£120,000
Year 2:	
Western sales territory: 1,500,000 miles at £0.05	£75,000
Eastern sales territory: 900,000 miles at £0.05	45,000
Total cost allocated	£120,000

In Year 1, the two sales territories share the service department costs equally. In Year 2, however, the bulk of the service department costs are allocated to the Western sales territory. This is not because of any increase in activity in the Western sales territory; rather, it is because of the decrease in activity in the Eastern sales territory. Even though the Western sales territory maintained the same level of activity in both years, the use of a variable allocation base has caused it to be penalized with a heavier cost allocation in Year 2 because of what has happened in another part of the company.

This kind of inequity is almost inevitable when a variable allocation base is used to allocate fixed costs. The manager of the Western sales territory undoubtedly will be upset about the inequity forced on his territory, but he will feel powerless to do anything about it. The result will be a loss of confidence in the system and considerable ill feeling.

Beware of sales as an allocation base

Over the years, sales have been a favourite allocation base for service department costs. One reason is that a sales base is simple, straightforward, and easy to work with. Another reason is that people tend to view sales as a measure of well-being, or 'ability to pay', and, hence, as a measure of how readily costs can be absorbed from other parts of the organization.

Unfortunately, sales are often a very poor allocation base, for the reason that sales vary from period to period, whereas the costs being allocated are often largely fixed in nature. As discussed earlier, if a variable base is used to allocate fixed costs, inequities can result between departments, since the costs being allocated to one department will depend in large part on what happens in *other* departments. For example, a let-up in sales effort in one department will shift allocated costs off that department and onto other, more productive departments. In effect, the departments putting forth the best sales efforts are penalized in the form of higher allocations, simply because of inefficiencies elsewhere that are beyond their control. The result is often bitterness and resentment on the part of the managers of the better departments.

Consider the following situation encountered by one of the authors:

A large men's clothing store has one service department and three sales departments – Suits, Shoes and Accessories. The Service Department's costs total £60,000 per period and are allocated to the three sales departments according to sales. A recent period showed the following allocation:

	Department			
	Suits	**Shoes**	**Accessories**	**Total**
Sales by department	£260,000	£40,000	£100,000	£400,000
Percentage of total sales	65%	10%	25%	100%
Allocation of service department costs, based on percentage of total sales	£39,000	£6,000	£15,000	£60,000

In a following period, the manager of the Suits Department launched a very successful programme to expand sales by £100,000 in his department. Sales in the other two departments remained unchanged. Total service department costs also remained unchanged, but the allocation of these costs changed substantially, as shown below:

	Department			
	Suits	**Shoes**	**Accessories**	**Total**
Sales by department	£360,000	£40,000	£100,000	£500,000
Percentage of total sales	72%	8%	20%	100%
Allocation of service department costs, based on percentage of total sales	£43,200	£4,800	£12,000	£60,000
Increase (or decrease) from prior allocation	4,200	(1,200)	(3,000)	–

The manager of the Suits Department complained that as a result of his successful effort to expand sales in his department, he was being forced to carry a larger share of the service department costs. On the other hand, the managers of the departments that showed no improvement in sales were relieved of a portion of the costs that they had been carrying. Yet there had been no change in the amount of services provided for any department.

The manager of the Suits Department viewed the increased service department cost allocation to his department as a penalty for his outstanding performance, and he wondered whether his efforts had really been worthwhile after all in the eyes of top management.

Sales should be used as an allocation base only in those cases where there is a direct causal relationship between sales and the service department costs being allocated. In those situations where service department costs are fixed, they should be allocated according to the three guidelines discussed earlier.

Should all costs be allocated?

As a general rule, any service department costs that are incurred as a result of specific services provided to operating departments should be allocated back to these departments and used to compute overhead rates and to measure performance and profitability. The only time when this general rule is not followed is in those situations where, in the view of the management, allocation would result in an undesirable behavioural response from people in the operating departments. This is particularly a problem when, in violation of the principles stated earlier, fixed costs are allocated to operating units on the basis of their actual usage of a service. For example, in periods when departments are under pressure to cut costs, they may be reluctant to use the services of systems design analysts and internal consultants because of the charges that would be involved.

To avoid discouraging use of a service that is beneficial to the entire organization, some firms do not charge for the service at all. These managers feel that by making such services a free commodity, departments will be more inclined to take full advantage of their benefits.

Other firms take a somewhat different approach. They agree that charging according to usage may discourage utilization of such services as systems design, but they argue that such services should not be free. Instead of providing free services, these firms take what is sometimes called a **retainer fee approach**. Each department is charged a flat amount each year, regardless of how much or how little of the service it utilizes. If a department knows it is going to be charged a certain amount for systems design services, *regardless of usage*, then it is more likely to use the service. We will discuss these issues further in Chapter 19 in the section on shared service centres.

Key terms for review (Appendix 3A)

Direct method (p. xx).

Interdepartmental services (p. xx).

Operating department (p. xx).

Reciprocal method (p. xx).

Retainer fee approach (p. xx).

Service department (p. xx).

Step method (p. xx).

Questions

3–1 Why are actual overhead costs not traced to jobs as are direct materials and direct labour costs?

3–2 When would job-order costing be used in preference to 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. Name several such costs. Would such costs be classified as direct or as indirect costs?

3–7 Why do firms use predetermined overhead rates rather than actual manufacturing overhead costs in applying 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 Progress? 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 period end?

3–12 Enumerate 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.

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 cost per unit?

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

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

3–18 What is the difference between a service department and an operating department? Give several examples of service departments.

3–19 How are service department costs assigned to products and services?

3-20 What are interdepartmental service costs? How are such costs allocated to other departments under the step method?

3-21 How are service department costs allocated to other departments under the direct method?

EXERCISES

Exercises

E3–1 Time allowed: 10 minutes

Which method of determining product costs, job-order costing or process costing, would be more appropriate in each of the following situations?

(a) A glue factory

(b) A textbook publisher such as McGraw-Hill

(c) An Esso oil refinery

(d) A facility that makes frozen orange juice

(e) A paper mill

(f) A custom home builder

(g) A garage that customizes vans

(h) A manufacturer of speciality chemicals

(i) A car repair garage

(j) A tyre manufacturing plant

(k) An advertising agency

(l) A law firm.

E3–2 Time allowed: 20 minutes

Kingsport Containers Ltd, of the Bahamas, experiences wide variation in demand for the 200-litre steel drums it fabricates. The leakproof, rustproof steel drums have a variety of uses from storing liquids and bulk materials to serving as makeshift musical instruments. The drums are made to order and are painted according to the customer's specifications – often in bright patterns and designs. The company is well known for the artwork that appears on its drums. Unit 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 follow:

	Quarter			
	First	Second	Third	Fourth
Direct materials	£240,000	£120,000	£60,000	£180,000
Direct labour	128,000	64,000	32,000	96,000
Manufacturing overhead	300,000	220,000	180,000	260,000
Total manufacturing costs	£668,000	£404,000	£272,000	£536,000
Number of units to be produced	80,000	40,000	20,000	60,000
Estimated cost per unit	£8.35	£10.10	£13.60	£8.93

Management finds the variation in unit 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 costs in accordance with your recommendations in Question 1 above.

E3–3 Time allowed: 20 minutes
The Polaris Company uses a job-order costing system. The following data relate to 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 (£178,000 direct materials and £12,000 indirect materials).

(c) Direct labour cost incurred, £90,000; indirect labour cost incurred, £110,000.

(d) Depreciation recorded on factory equipment, £40,000.

(e) Other manufacturing overhead costs incurred during October, £70,000 (credit Creditors).

(f) The company applies manufacturing overhead cost to production on the basis of £8 per machine-hour. There were 30,000 machine-hours recorded for October.

(g) Production orders costing £520,000 according to their job cost sheets were completed during October and transferred to Finished Goods.

(h) Production orders that had cost £480,000 to complete according to their job cost sheets were shipped to customers during the month. These goods were sold at 25% above cost. The goods were sold on account.

Required

1 Prepare journal entries to record the information given above.

2 Prepare T-accounts for Manufacturing Overhead and Work in Progress. Post the relevant information above to each account. Compute the ending balance in each account, assuming that Work in Progress has a beginning balance of £42,000.

E3–4 Time allowed: 15 minutes
The following cost data relate to the manufacturing activities of Chang Company during the just completed year:

Manufacturing overhead costs incurred:	
Indirect materials	£15,000
Indirect labour	130,000
Property taxes, factory	8,000
Utilities, factory	70,000
Depreciation, factory	240,000
Insurance, factory	10,000
Total actual costs incurred	£473,000
Other costs incurred:	
Purchases of raw materials (both direct and indirect)	£400,000
Direct labour cost	60,000
Stocks:	
Raw materials, beginning	20,000
Raw materials, ending	30,000
Work in progress, beginning	40,000
Work in progress, ending	70,000

The company uses a predetermined overhead rate to apply overhead cost to production. The rate for the year was £25 per machine-hour. A total of 19,400 machine-hours was recorded for the year.

Required

1 Compute the amount of under- or overapplied overhead cost for the year.

2 Prepare a schedule of cost of goods manufactured for the year.

E3–5 Time allowed: 15 minutes

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

Manufacturing overhead

(a)	460,000	**(b)**	390,000
Bal.	70,000		

Work in progress

Bal.	5,000	**(c)**	710,000
	260,000		
	85,000		
(b)	390,000		
Bal.	40,000		

Finished goods

Bal.	50,000	**(d)**	640,000
(c)	710,000		
Bal.	120,000		

Cost of goods sold

(d)	640,000		

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

Work in progress, ending	£19,500
Finished goods, ending	58,500
Cost of goods sold	312,000
Overhead applied	£390,000

For example, of the £40,000 ending balance in Work in Progress, £19,500 was overhead that had been applied during the year.

Required

1. Identify reasons for entries (a) to (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 in their ending balances. Prepare the necessary journal entry, with supporting computations.

E3–6 Time allowed: 15 minutes
Estimated cost and operating data for three companies for the upcoming year follow:

	Company		
	X	Y	Z
Direct labour-hours	80,000	45,000	60,000
Machine-hours	30,000	70,000	21,000
Direct materials cost	£400,000	£290,000	£300,000
Manufacturing overhead cost	536,000	315,000	480,000

Predetermined overhead rates are computed using the following bases in the three companies:

Company	Overhead rate based on:
X	Direct labour-hours
Y	Machine-hours
Z	Direct materials cost

Required

1. Compute the predetermined overhead rate to be used in each company during the upcoming year.
2. Assume that Company X works on three jobs during the upcoming year. Direct labour-hours recorded by job are: job 418, 12,000 hours; job 419, 36,000 hours; job 420, 30,000 hours. How much overhead cost will the company apply to Work in Progress for the year? If actual overhead costs total £530,000 for the year, will overhead be under- or overapplied? By how much?

E3–7 Time allowed: 15 minutes
White Company has two departments, Cutting and Finishing. The company uses a job order cost system and computes a predetermined overhead rate in each department. The Cutting Department bases its rate

on machine-hours, and the Finishing Department bases its rate on direct labour cost. At the beginning of the year, the company made the following estimates:

	Department	
	Cutting	Finishing
Direct labour-hours	6,000	30,000
Machine-hours	48,000	5,000
Manufacturing overhead cost	£360,000	£486,000
Direct labour cost	50,000	270,000

Required

1 Compute the predetermined overhead rate to be used in each department.

2 Assume that the overhead rates that you computed in Question 1 above are in effect. The job cost sheet for job 203, which was started and completed during the year, showed the following:

	Department	
	Cutting	Finishing
Direct labour-hours	6	20
Machine-hours	80	4
Materials requisitioned	£500	£310
Direct labour cost	70	150

Compute the total overhead cost applied to job 203.

Would you expect substantially different amounts of overhead cost to be assigned to some jobs if the company used a plantwide overhead rate based on direct labour cost, rather than using departmental rates? Explain. No computations are necessary.

E3–8 Time allowed: 25 minutes

The Ferre Publishing Company has three service departments and two operating departments. Selected data from a recent period on the five departments follow:

The company allocates service department costs by the step method in the following order: A (number of employees), B (space occupied), and C (hours of press time). The company makes no distinction between variable and fixed service department costs.

	Service department			Operating department		
	A	B	C	1	2	Total
Overhead costs	£140,000	£105,000	£48,000	£275,000	£430,000	£998,000
Number of employees	60	35	140	315	210	760
Square feet of space occupied	15,000	10,000	20,000	40,000	100,000	185,000
Hours of press time	–	–	–	30,000	60,000	90,000

Required

Using the step method, allocate the service department costs to the operating departments.

E3–9 Time allowed: 25 minutes

Refer to the data for the Ferre Publishing Company in E8–1. Assume that the company allocates service department costs by the direct method, rather than by the step method.

Required

Assuming that the company uses the direct method, how much overhead cost would be allocated to each operating department?

Problems

P3–10 Straightforward journal entries; partial T-accounts; profit and loss account Time allowed: 35 minutes

Gold Nest Company of Guandong, China, is a family-owned enterprise that makes birdcages for the South China market. A popular pastime among older Chinese men is to take their pet birds on daily excursions to teahouses and public parks where they meet with other bird owners to talk and play mahjong. A great deal of attention is lavished on these birds, and the birdcages are often elaborately constructed from exotic woods and contain porcelain feeding bowls and silver roosts. Gold Nest Company makes a broad range of birdcages that it sells through an extensive network of street vendors who receive commissions on their sales. The Chinese currency is the renminbi, which is denoted by Rmb. All of the company's transactions with customers, employees and suppliers are conducted in cash; there is no credit.

The company uses a job-order costing system in which overhead is applied to jobs on the basis of direct labour cost. At the beginning of the year, it was estimated that the total direct labour cost for the year would be Rmb200,000 and the total manufacturing overhead cost would be Rmb330,000. At the beginning of the year, the stock balances were as follows:

During the year, the following transactions were completed:

Raw materials	Rmb25,000
Work in progress	10,000
Finished goods	40,000

(a) Raw materials purchased for cash, Rmb275,000.

(b) Raw materials requisitioned for use in production, Rmb280,000 (materials costing Rmb220,000 were charged directly to jobs; the remaining materials were indirect).

(c) Costs for employee services were incurred as follows:

Direct labour	Rmb180,000
Indirect labour	72,000
Sales commissions	63,000
Administrative salaries	90,000

(d) Rent for the year was Rmb18,000 (Rmb13,000 of this amount related to factory operations, and the remainder related to selling and administrative activities).

(e) Utility costs incurred in the factory, Rmb57,000.

(f) Advertising costs incurred, Rmb140,000.

(g) Depreciation recorded on equipment, Rmb100,000. (Rmb88,000 of this amount was on equipment used in factory operations; the remaining Rmb12,000 was on equipment used in selling and administrative activities.)

(h) Manufacturing overhead cost was applied to jobs, Rmb.—?—

(i) Goods that cost Rmb675,000 to manufacture according to their job cost sheets were completed during the year.

(j) Sales for the year totalled Rmb1,250,000. The total cost to manufacture these goods according to their job cost sheets was Rmb700,000.

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 beginning balances in your stock 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 a profit and loss account for the year. (Do not prepare a schedule of cost of goods manufactured; all of the information needed for the profit and loss account is available in the journal entries and T-accounts you have prepared.)

P3–11 Disposition of under- or overapplied overhead Time allowed: 25 minutes
Bieler & Cie of Altdorf, Switzerland, makes furniture using the latest automated technology. The company uses a job-order costing system and applies manufacturing overhead cost to products on the basis of machine-hours. The following estimates were used in preparing the predetermined overhead rate at the beginning of the year:

Machine-hours	75,000
Manufacturing overhead cost	Sfr900,000

The currency in Switzerland is the Swiss franc, which is denoted by Sfr.

During the year, a glut of furniture on the market resulted in cutting back production and a buildup of furniture in the company's warehouse. The company's cost records revealed the following actual cost and operating data for the year:

Machine-hours	60,000
Manufacturing overhead cost	Sfr850,000
Stocks at year-end:	
Raw materials	30,000
Work in progress (includes overhead applied of 36,000)	100,000
Finished goods (includes overhead applied of 180,000)	500,000
Cost of goods sold (includes overhead applied of 504,000)	1,400,000

Required

1. Compute the company's predetermined overhead rate.
2. Compute the under- or overapplied overhead.
3. Assume that the company closes any under- or overapplied overhead directly to Cost of Goods Sold. Prepare the appropriate journal entry.
4. Assume that the company allocates any under- or overapplied overhead to Work in Progress, Finished Goods, and Cost of Goods Sold on the basis of the amount of overhead applied in each account. Prepare the journal entry to show the allocation for the year.

5 How much higher or lower will profit be if the under- or overapplied overhead is allocated rather than closed directly to Cost of Goods Sold?

P3–12 T-account analysis of cost flows Time allowed: 35 minutes

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

Raw Materials

Bal. 1/1	15,000	Credits	?
Debits	120,000		
Bal. 12/31	25,000		

Manufacturing Overhead

Debits	230,000	Credits	?

Work in progress

Bal. 1/1	20,000	Credits	470,000
Direct materials	90,000		
Direct labour	150,000		
Overhead	240,000		
Bal. 12/31	?		

Factory Wages Payable

Debits	185,000	Bal. 1/1	9,000
		Credits	180,000
		Bal. 12/31	4,000

Finished Goods

Bal. 1/1	40,000	Credits	?
Debits	?		
Bal. 12/31	60,000		

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 Question 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 under- or overapplied overhead)?

6 If overhead is applied to production on the basis of direct labour cost, what rate was in effect during the year?

7 Was manufacturing overhead under- or overapplied? By how much?

8 Compute the ending balance in the Work in Progress stock account. Assume that this balance consists entirely of goods started during the year. If £8,000 of this balance is direct labour cost, how much of it is direct materials cost? Manufacturing overhead cost?

P3–13 Job cost sheets; overhead rates; journal entries Time allowed: 60 minutes

AOZT Volzhskije Motory of St Petersburg, Russia, makes marine motors for vessels ranging in size from harbour tugs to open-water icebreakers. (The Russian currency is the rouble, which is denoted by RUR. All currency amounts below are in thousands of RUR.)

The company uses a job-order costing system. Only three jobs – 208, 209, and 210 – were worked on during May and June. Job 208 was completed on 20 June; the other two jobs were uncompleted on 30 June. Job cost sheets on the three jobs are given below:

	Job cost sheet		
	Job 208	**Job 209**	**Job 210**
May costs incurred:*			
Direct materials	RUR 9,500	RUR 5,100	RUR –
Direct labour	8,000	3,000	–
Manufacturing overhead	11,200	4,200	–
June costs incurred:			
Direct materials	–	6,000	7,200
Direct labour	4,000	7,500	8,500
Manufacturing overhead	?	?	?

* Jobs 208 and 209 were started during May.

The following additional information is available:

(a) Manufacturing overhead is applied to jobs on the basis of direct labour cost.

(b) Balances in the stock accounts at 31 May were:

Raw materials	RUR30,000
Work in progress	?
Finished goods	50,000

Required

1 Prepare T-accounts for Raw Materials, Work in Progress, Finished Goods, and Manufacturing Overhead. Enter the 31 May balances given above; in the case of Work in Progress, compute the 31 May balance and enter it into the Work in Progress T-account.

2 Prepare journal entries for *June* 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 June totalled RUR3,600.

(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 RUR7,000 for June.

(c) Prepare an entry to record the incurrence of RUR19,400 in various actual manufacturing overhead costs for June (credit Creditors). 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 June (it is not necessary to make a separate entry for each job). Post this entry to appropriate T-accounts.

4 As stated earlier, Job 208 was completed during June. 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 appropriate T-accounts.

5 Determine the balance at 30 June in the Work in Progress stock account. How much of this balance consists of costs charged to Job 209? To Job 210?

P3–14 Journal entries; T-accounts; statements; pricing Time allowed: 120 minutes
Froya Fabrikker A/S of Bergen, Norway, is a small company that manufactures specialty heavy equipment for use in North Sea oil fields. (The Norwegian currency is the krone, which is denoted by Nkr.) The

company uses a job-order costing system and applies manufacturing overhead cost to jobs on the basis of direct labour-hours. At the beginning of the year, the following estimates were made for the purpose of computing the predetermined overhead rate: manufacturing overhead cost, Nkr360,000; and direct labour-hours, 900.

The following transactions took place during the year (all purchases and services were acquired on account):

(a) Raw materials were purchased for use in production, Nkr200,000.

(b) Raw materials were requisitioned for use in production (all direct materials), Nkr185,000.

(c) Utility bills were incurred, Nkr70,000 (90% related to factory operations, and the remainder related to selling and administrative activities).

(d) Salary and wage costs were incurred:

Direct labour (975 hours)	Nkr230,000
Indirect labour	90,000
Selling and administrative salaries	110,000

(e) Maintenance costs were incurred in the factory, Nkr54,000.

(f) Advertising costs were incurred, Nkr136,000.

(g) Depreciation was recorded for the year, Nkr95,000 (80% related to factory equipment, and the remainder related to selling and administrative equipment).

(h) Rental cost incurred on buildings, Nkr120,000 (85% related to factory operations, and the remainder related to selling and administrative facilities).

(i) Manufacturing overhead cost was applied to jobs, Nkr.—?—

(j) Cost of goods manufactured for the year, Nkr770,000.

(k) Sales for the year (all on account) totalled Nkr1,200,000. These goods cost Nkr800,000 to manufacture according to their job cost sheets.

(l) The balances in the stock accounts at the beginning of the year were:

Raw materials	Nkr30,000
Work in progress	21,000
Finished goods	60,000

Required

1. Prepare journal entries to record the preceding data.
2. Post your entries to T-accounts. (Don't forget to enter the beginning stock balances above.) Determine the ending balances in the stock 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 a profit and loss account for the year.
6. Job 412 was one of the many jobs started and completed during the year. The job required Nkr8,000 in direct materials and 39 hours of direct labour time at a total direct labour cost of Nkr9,200. The job contained only four units. If the company bills at a price 60% above the unit cost on the job cost sheet, what price per unit would have been charged to the customer?

P3–15 Job and service costing Time allowed: 35 minutes

A company has been carrying out work on a number of building contracts (including Contract ABC) over the six month period ended 31 May 1999. The following information is available:

	All contracts (including ABC)	Contract ABC
Number of contracts worked on in the six months to 31.5.99	10	–
Value	£76.2m	£6.4m
Duration (average 13 months)	8–22 months	11 months
Contract months	53*	6
Direct labour costs in the period	£9.762m	£1.017m
Raw material costs in the period	£10.817m	£1.456m
Distance from base (average)	16 kilometres	23 kilometres
Value of work certified at 31.5.99	–	£5.180m

*Contract months for 'All Contracts' are the sum contract during the six month period.

Contract ABC commenced on 1 September 1998. As at 30 November 1998 cumulative costs on the contract, held in work-in-progress, totalled £1.063m (including overheads).

The company confidently predicts that further costs after 31 May 1999 to complete Contract ABC on time (including overheads) will not exceed £0.937m. Overheads incurred over the six month period to 31 May 1999, which are to be apportioned to individual contracts, are:

	£m
Stores operations	1.56
Contract general management	1.22
Transport	1.37
General administration	4.25
The bases of apportionment are:	
Stores operations	– contract value × contract months
Contract general management	– direct labour costs
Transport	– distance from base × contract months
General administration	– contract months

Required

1

(a) Apportion overheads to Contract ABC for the six month period to 31 May 1999 (to the nearest £000 for each overhead item). *(6 marks)*

(b) Determine the expected profit/loss on Contract ABC, and the amount of profit/loss on the contract that you recommend be included in the accounts of the company for the six month period to 31 May 1999. *(7 marks)*

2 The company is introducing a service costing system into its stores operations department. Outline the key factors to consider when introducing the service costing system. *(7 marks)*

(Total 5 20 marks)

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P3–16 Cost Allocation: Step Method versus Direct Method Time allowed: 40 minutes

The Sendai Co. Ltd. of Japan has budgeted costs in its various departments as follows for the coming year:

Factory Administration	¥270,000,000
Custodial Services	68,760,000
Personnel	28,840,000
Maintenance	45,200,000
Machining – overhead	376,300,000
Assembly – overhead	175,900,000
Total cost	¥965,000,000

The Japanese currency is the yen, denoted by . The company allocates service department costs to other departments in the order listed below.

Department	Number of employees	Total labour-hours	Square feet of space occupied	Direct labour-hours	Machine-hours
Factory administration	12	–	5,000	–	–
Custodial Services	4	3,000	2,000	–	–
Personnel	5	5,000	3,000	–	–
Maintenance	25	22,000	10,000	–	–
Machining	40	30,000	70,000	20,000	70,000
Assembly	60	90,000	20,000	80,000	10,000
	146	150,000	110,000	100,000	80,000

Machining and Assembly are operating departments; the other departments all act in a service capacity. The company does not make a distinction between fixed and variable service department costs. Factory Administration is allocated on the basis of labour-hours; Custodial Services on the basis of square feet occupied; Personnel on the basis of number of employees; and Maintenance on the basis of machine-hours.

Required

1 Allocate service department costs to departments using the step method. Then compute predetermined overhead rates in the operating departments using a machine-hours basis in Machining and a direct labour-hours basis in Assembly.

2 Repeat (1) above, this time using the direct method. Again compute predetermined overhead rates in Machining and Assembly.

3 Assume that the company doesn't want to bother with allocating service department costs but simply wants to compute a single plantwide overhead rate based on total overhead costs (both service department and operating department) divided by total direct labour-hours. Compute the overhead rate.

4 Suppose a job requires machine and labour time as follows:

	Machine-hours	Direct labour-hours
Machining department	190	25
Assembly department	10	75
Total hours	200	100

Using the overhead rates computed in (1), (2), and (3) above, compute the amount of overhead cost that would be assigned to the job if the overhead rates were developed using the step method, the direct method and the plantwide method.

Cases

C3–17 Critical thinking; interpretation of manufacturing overhead rates Time allowed: 40 minutes

Kelvin Aerospace plc manufactures parts such as rudder hinges for the aerospace industry. The company uses a job-order costing system with a plantwide predetermined overhead rate based on direct labour-hours. On 16 December 2005, the company's finance director made a preliminary estimate of the predetermined overhead rate for the year 2006. The new rate was based on the estimated total manufacturing overhead cost of £3,402,000 and the estimated 63,000 total direct labour-hours for 2006:

$$\text{Predetermined overhead rate} = \frac{£3{,}402{,}000}{63{,}000 \text{ hours}} = £54 \text{ per direct labour hour}$$

This new predetermined overhead rate was communicated to top managers in a meeting on 19 December. The rate did not cause any comment because it was within a few pennies of the overhead rate that had been used during 2005. One of the subjects discussed at the meeting was a proposal by the production manager to purchase an automated milling machine built by Sunghi Industries. The managing director of Kelvin Aerospace, Harry Arcany, agreed to meet with the sales representative from Sunghi Industries to discuss the proposal.

On the day following the meeting, Mr Arcany met with Jasmine Chang, Sunghi Industries' sales representative. The following discussion took place:

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

Chang: This is a great machine with direct bottom-line benefits. The automated milling machine 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 to run a standard operation. You just punch in the code for the standard operation, load the machine's hopper with raw material, and the machine does the rest.

Arcany: 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.

Chang: I was getting there. The third advantage of the automated milling machine is lower cost. Wally 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?

Arcany: The wage rate in the milling area averages about £32 per hour. Fringe benefits raise that figure to about £41 per hour.

Chang: Don't forget your overhead.

Arcany: Next year the overhead rate will be £54 per hour.

Chang: So including fringe benefits and overhead, the cost per direct labour-hour is about £95.

Arcany: That's right.

Chang: Since you can save 6,000 direct labour-hours per year, the cost savings would amount to about £570,000 a year. And our 60-month lease plan would require payments of only £348,000 per year.

Arcany: That sounds like a no-brainer. When could you install the equipment?

Shortly after this meeting, Mr Arcany informed the company's finance director of the decision to lease the new equipment, which would be installed over the Christmas holiday period. The finance director realized that this decision would require a recomputation of the predetermined overhead rate for the year 2006 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 Sunghi Industries, the finance director discovered that in addition to the annual lease cost of £348,000, the new machine would also require a skilled technician/programmer who would have to be hired at a cost of £50,000 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 finance director assumed that the new machine would result in a reduction of 6,000 direct labour-hours for the year from the levels that initially had been planned.

When the revised predetermined overhead rate for the year 2006 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 2006.
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 retired or quit, but that had not been 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 Sunghi Industries.

C3–18 Ethics predetermined overhead rate and capacity Time allowed: 90 minutes

Pat Miranda, the new controller of Vault Hard Drives plc, 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 J. Stevens and the assistant production manager Marvin Washington.

Pat: 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.

J.: We're all ears.

Pat: 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.

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

J.: 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.

Pat: 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.

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

Pat: That *is* a worry, but I wanted to talk to both of you first before going over to Sales.

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

Pat: 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	160,000 units
Budgeted sales	160,000 units
Capacity	200,000 units
Selling price	£60 per unit
Variable manufacturing cost	£15 per unit
Total manufacturing overhead cost (all fixed)	£4,000,000
Administrative and selling expenses (all fixed)	£2,700,000
Beginning inventories	–0–

Traditional approach to computation of the predetermined overhead rate

$$\frac{\text{Estimated total manufacturing overhead cost, £4,000,000}}{\text{Estimated total units produced, 160,000}} = \text{£ 25 per unit}$$

Budgeted Profit Statement

Revenue (160,000 units × £60)		£9,600,000
Cost of goods sold:		
Variable manufacturing (160,000 units × £15)	£2,400,000	
Manufacturing overhead applied (160,000 units × £25)	4,000,000	6,400,000
Gross margin		3,200,000
Administration and selling expenses		2,700,000
Profit		£ 500,000

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

$$\frac{\text{Estimated total manufacturing overhead cost, £4,000,000}}{\text{Total units at capacity, 200,000}} = \text{£20 per unit}$$

Budgeted Profit Statement

Revenue (160,000 units × £60)		£9,600,000
Cost of goods sold:		
Variable manufacturing (160,000 units × £15)	£2,400,000	
Manufacturing overhead applied (160,000 units × £20)	3,200,000	5,600,000
Gross margin		4,000,000
Cost of unused capacity [(200,000 units – 160,000 units) × £20]		800,000
Administrative and selling expenses		2,700,000
Profit		£ 500,000

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

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

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

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

Marvin: And we pull them out of our hat.

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

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

J.: No, we increase production. We're the production managers, not the sales managers.

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

J.: No, 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 under- or overapplied overhead is taken directly to the income statement as an adjustment to Cost of Goods Sold.

1 Suppose actual production is 160,000 units. Compute the profits that would be realized under the traditional and new methods if actual sales are 150,000 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 profit of £500,000 if actual sales are 150,000 units and everything else turns out as expected?
3 What effect does the new method based on capacity have on the volatility of profit?
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?

Further reading

One of the drawbacks of traditional cost accounting systems is their inability to provide different information for different purposes without undergoing an extensive special study. Kaplan identifies the major functions of accounting systems and outlines a number of the major characteristics or demands of different functions addressed by cost data. See Kaplan (1988).

Part of the reason for overhead costs rising is that companies are investing in new manufacturing technology. Modern computer-integrated manufacturing systems and other highly automated manufacturing systems have different cost structures and, therefore, different product costing requirements than conventional manufacturing systems. Dhavale (1989) develops a model for flexible manufacturing systems.

Endnotes

1 As this edition is under preparation, writers in Hollywood are on strike!

2 Engel and Ikawa (1997).

3 Foster and Gupta (1990). In the UK, survey data have suggested that 68–73% of manufacturing companies used direct labour as an allocation base – see Drury and Tayles (1994).

4 McNair (1994).