Solutions manual

to accompany

Management accounting

3rd edition

by

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Chapter 3: A costing framework and cost allocation

Questions

**3.1 What is a cost object? Give 3 examples.
(LO1)**

A cost object is anything for which a separate measurement of cost is desired. Examples include products, services, geographic regions, departments, segments and customers.

**3.2 Explain the difference between a direct cost and indirect cost.
(LO2)**

A direct cost can be directly traced to a cost object — a tracking system will enable the direct association. An indirect cost is incurred for the benefit of multiple cost objects and is not economically feasible to directly trace.

**3.3 Discuss the importance of selecting an appropriate cost driver for cost allocation.
(LO3)**

A cost driver provides the link between the indirect cost and the cost object. A cost driver should explain the use of resources by the cost object. The selection of an inappropriate cost driver will lead to an incorrect cost allocation and affect decision making which incorporates the allocated cost.

**3.4 Explain the differences and similarities among the direct, step-down, and reciprocal methods.
(LO4)**

Differences:
- Direct method ignores all interactions among support departments.
- The step-down method takes into account some of the interactions among support departments.
- The reciprocal method takes into account all of the interactions among support departments.

Similarities:
- All of the methods allocate support department costs to operating departments
- All of the methods rely on allocation bases to assign costs of support departments to operating departments.
- All of the methods result in a total allocated cost per unit
- All of the methods use cost pools, and those are usually departments.

3.5   Explain the similarities and differences between support department costs and manufacturing overhead costs.
(LO3)

Support department costs are direct costs of the department, but indirect costs when allocated to other departments. Manufacturing overhead is a direct cost of the production process but it becomes an indirect cost when it is allocated to units.

3.6   What should determine the choice of cost allocation method (direct, step-down and reciprocal) discussed in this chapter?
(LO4)

Management's objectives should be the determining factor, tempered by the availability of the data and the cost of performing the allocation. For example, if the primary purpose is cost control, a method that recognises interdepartmental relationships is appropriate. If the firm has a computer and appropriate software, the reciprocal allocation method is preferred. If the primary purpose is product costing and the firm has a manual system, the direct method may be preferred.

Following are other factors to consider in choosing an appropriate allocation method:
- As the number of cost pools increase, calculations become more complex under the reciprocal method,
- When there are four or more support cost pools, software is needed to perform the reciprocal method calculations
- The degree of interaction among support departments; fewer interactions result in fewer differences in allocation amounts

3.7   Explain how cost data is sourced in a costing framework.
(LO4)

A costing system can be structured based on either actual or budgeted cost data using a match cost driver.

Actual Data	**Budgeted Data**
- Costs would be sourced from general ledger - Cost driver would be based on actual usage and this would require a system to collect this information	- Costs would be sourced from budgeted information - Cost driver would be based on expected usage

3.8   Outline the key steps in a costing framework.
     (LO4)

Key steps in a costing framework**:**
Step 1   Identify cost objects of interest, trace direct costs and determine indirect costs pools and cost drivers
Step 2   Determine indirect cost rate for each cost pool
Step 3   Allocate indirect costs to the cost objects
Step 4   Allocate indirect cost to cost objects
Step 5   Determine full costs by totalling indirect costs and direct costs

3.9   What factors should be considered when choosing allocation bases?
     (LO3)

Following are factors to consider in choosing an allocation base:
- Costs and benefits of the information gathered
- Does one of the bases better reflect the use of the support department's resources?
- Will the allocation base be easy to measure and apply?
- Are data available for the allocation base? How accurate are the data?

3.10 A product is started in department 1 and completed in department 2. Is department 1 a support department or an operating department? Explain.
     (LO3)

Department 1 is an operating department because it works directly on the firm's final product.

3.11 Explain the difference between operating departments and support departments.
     (LO3)

Operating departments manufacture goods or produce services that are sold to clients. Support departments interact primarily with operating departments and other support departments, and not with outside customers. Support departments provide operating departments with internal services such as accounting, research and development, and so on.

3.12 What are the advantages and disadvantages of using estimated support cost allocation rates?
     (LO7)

Estimated (budgeted) cost rates provide information for managers to use in budgeting and some of their decision-making. Managers can predict charges as they use the service. In addition, each department's charges are not affected by other departments' use of service. A disadvantage of budgeted rates is that user departments have little incentive to use resources efficiently because their charge is already known, and will not change with usage, if it is based on a fixed rate.

3.13 **List at least three possible allocation bases that could be used to allocate accounting department costs to other departments. Give one advantage and one disadvantage of using each allocation base.**
(LO7)

Accounting department costs could be allocated using number of employees, departmental direct costs, or time spent on activities for individual departments. An advantage of number of employees is that it would be simple to use in calculations. A disadvantage is that it probably does not reflect the use of the department by other departments. An advantage of departmental direct costs is that accounting activities probably increase as direct costs increase, and direct costs are fairly easy to measure. A disadvantage is that there are some accounting activities that do not vary with direct costs. And advantage of time spent on accounting activities for every department is that it probably most accurately reflects the use of accounting by other departments, but it would be hard to track, and there is likely measurement error when time is not recorded as used, but estimated or recorded after the fact.

3.14 **Refer to the Partridge Insurance Illustration in the chapter. Explain how the support departments can be classified as both cost objects and cost pools in the costing system.**
(LO4)

The support departments at Partridge Insurance include: finance, personnel and computer services. Each of these are in the first instance cost objects as they are items for which we wish to accumulate costs (a cost object is anything for which a separate measurement of cost is required). Second, each can be viewed as a cost pool (a group of individual costs accumulated for a particular purpose). In this case the cost pools for finance, personnel and computer services are useful in themselves but are also used to allocate to the three operating departments.

Exercises

3.15 Direct and indirect costs
Frida's Tax Practice has two departments, tax and audit. The tax department has two product lines, business returns and individual returns. A list of costs and three cost objects from Frida's Tax Practice follow.

Required
For each cost, identify whether it is direct or indirect for each cost object. (LO2)

	Cost object		
Cost	Tax department	Personal returns	Mr Gruper's personal tax return
(a) Subscription to personal tax law updates publication			
(b) Ink supplies for tax department photocopy machine			
(c) Portion of total rent for tax department office space			
(d) Wages for tax department administrative assistant			
(e) Tax partner's salary			
(f) Charges for long-distance call to Mr Gruper about personal tax return questions			
(g) Tax partner lunch with Mr Gruper (the tax partner has lunch with each client at least once per year)			

Frida's Tax Practice

	Cost Object		
Cost	Tax Department	Personal Returns	Mr Gruper's Personal Tax Return
a. Subscription to personal tax law updates publication	D	D	I
b. Ink supplies for tax department photocopy machine	D	I	I
c. Portion of total rent for tax department office space	I	I	I
d. Wages for tax department administrative assistant	D	I	I
e. Tax partner's salary	D	I	I
f. Charges for long distance call to Mr Gruper about personal tax return questions	D	D	D
g. Tax partner lunch with Mr Gruper; the tax partner has lunch with each client at least once per year	D	D	D

(d) & (e) Notice that the wages of the tax department's administrative assistant are considered a direct cost when the cost object is the entire tax department but are considered indirect for the other two cost objects. The benefits of tracking the cost at that level do not exceed the benefits of the information that would be obtained. For the firm to make this cost direct for the personal returns cost object, the administrative assistant would have to maintain detailed time records as to time spent working on personal returns versus corporate returns. Now notice that the tax partner's salary is considered a direct cost for all three cost objects. CPAs do keep detailed time records. In a service business such as this, the CPA's time is the product being sold. The time records that the tax partner maintains support this cost as a direct cost. Of course, the tax partner probably spends some time in non-billable activities, so a portion of his or her salary is direct only to the tax department and indirect to the two other cost objects.

3.16 Direct and indirect costs; fixed, variable, and mixed costs
Your sister turned her hobby into a small business called Glazed Over. She is a potter and manufactures and sells bowls that can be used for decoration or for birdbaths. She has one employee who works 40 hours a week no matter how many bowls are made. She has asked your advice in developing a cost function for the bowls so that she can estimate costs for the next period.

Required
The following list of costs comes from your sister's general ledger. Assume the cost object is an individual unit (i.e. bowl). Categorise each cost as direct or indirect (D or I), and as fixed, variable or mixed (F, V or M).
(a) Employee wages
(b) Clay used to make bowls
(c) Depreciation on the kilns
(d) Glaze (the finish painted on the bowls)
(e) Brushes for the glaze
(f) Electricity
(g) Business licence
(h) Advertising
(i) Pottery studio maintenance (cost of weekly cleaning service)
(j) Packing materials for the bowls
(LO2)

[*Note about problem complexity*: Items F and H are coded as 'Extend' because judgment is needed for categorisation.]

a. D or I, F   Assuming that employee time can be traced to each bowl, wages are a direct cost. However, if time is not traced to individual bowls (for example, if the employee performs different types of tasks and records are not kept of the types of work performed) or if the employee does not work directly in production, then wages would be an indirect cost. Wages are fixed because they remain constant (the employee always works 40 hours).

b. D, V   Assuming that the cost of clay can be traced to each bowl, it is a direct cost. Total clay cost will vary with the number of bowls made.

c. I, F   Depreciation on the kilns is indirect because it cannot be directly traced to individual bowls, that is, it is a common cost of production for all of the bowls that are heat-treated in the kiln. The cost probably does not depend on production volume (assuming depreciation is not based on units produced), making it a fixed cost. Note: Depreciation using a method such as declining balance is not constant over time, but would still be considered fixed because it does not vary with production volume.

d.   D or I, V   If the glaze is expensive and therefore a relatively large cost, it is most likely traced to individual bowls, making it a direct and variable cost. If the cost of glaze is very small, it might not be traced to individual bowls, making it an indirect cost. Also, if the cost is small it might be grouped with overhead costs (variable).

e.   I, V or F   Brushes for the glaze are most likely used for multiple bowls, making them a common cost for multiple units and an indirect cost. They might be fixed or variable, depending on whether they are "used up" after a certain quantity of production.

f.   I, F or M   Electricity is an indirect cost because it cannot be traced to individual bowls. It might be fixed or mixed, depending on what causes the cost to vary. If the kiln is electric, part of the cost might vary proportionately with volume.

g.   I, F   The business license is not related to production, making it an indirect cost. It is mostly likely a flat fee or is calculated on a basis unrelated to production volume, making it a fixed cost.

h.   I, F   Advertising is not directly related to production, making it an indirect cost. This cost is also discretionary, so it is treated as fixed.

i.   I, F or M   Pottery studio is an indirect and fixed cost if it is the same payment every week. If it is an hourly charge, it is probably a mixed cost, because the production area may need more cleaning as volumes increase.

j.   D or I, V   Assuming that the cost of packing materials is traced to each bowl, this is a direct cost. If the packing materials are not traced (for example, if the cost is too small to justify tracing them), then this cost could be indirect. Packing costs are most likely variable because they will increase as production increases.

3.17 Cost driver selection
   For each of the following activities undertaken to bake pastries and cakes, identify a suitable cost driver to allocate costs.
   (a)   **Mixing ingredients**
   (b)   **Baking pastries and cakes**
   (c)   **Decorating cakes**
   (d)   **Packing pastries and cakes on trays**
   (e)   **Sales**
   (f)   **Dispatch to customers**
   (LO3)

	Activity	**Possible cost driver**
(a)	Mixing ingredients	Number of cakes
(b)	Baking pastries and cakes	Order size
(c)	Decorating cakes	Number of cakes
(d)	Packing pastries and cakes on trays	Number of cakes or number of trays
(e)	Sales	Number of orders
(f)	Dispatch to customers	Order size

3.18 Calculation of indirect cost rates
   Wright Medical Centre has identified the following activities and cost drivers for the coming financial year.

Activity	Cost	Cost driver	Total expected use of cost driver
Patient admission	$ 600 000	Number of patients	10 000 patients
Medical consultation	$5 000 000	Time taken for appointment	33 000 hours
X-ray	$1 500 000	Number of X-rays	15 000 X-rays
Prescriptions	$ 700 000	Number of items to be dispensed	200 000 items

   Required
   Calculate the activity cost rate for each activity.
   (LO4)

Activity	Cost	Cost Driver	Total Expected use of cost driver	Activity cost rate
Patient admission	$600,000	Number of patients	10,000	$60 per admission
Medical Consultation	$5,000,000	Time taken for appointment	33 000 hours	$151.51 per hour
X-Ray	$1,500,000	Number of X-Rays	15,000 x rays	$100 per hour
Prescriptions	$700,000	Number of items to be dispensed	200,000 items	$3.50 per item

3.19 Allocation rates

A housekeeping support department budgets its costs at $40 000 per month plus $12 per hour. For November the following were the estimated and actual hours provided by the housekeeping support department to three operating departments.

	Estimated hours spent cleaning	Actual hours spent cleaning
Department A	1 600	1 500
Department B	1 400	1 600
Department C	2 000	1 800
Total	5 000	4 900

Required
(a)   What is the support department's allocation rate if estimated activity is the allocation base?
(b)   What is the support department's allocation rate if actual activity is the allocation base?
(c)   List one advantage and one disadvantage for each type of allocation rate.
(LO6)

Allocation Rates

(a) Estimated costs = $40 000 + $12(5 000) = $100 000
    Estimated allocation rate = $100 000/5000 hours = $20/hour

(b) Estimated cost at actual output = $40 000 + $12(4 900) = $98 800
    Actual rate = $98 800/4900 hours = $20.16/hour

(c) An advantage of using an estimated allocation rate is that managers know in advance what their costs will be. A disadvantage is that there is no incentive to use housekeeping hours wisely because the cost rate is known and will not change during the period.

An advantage for using an actual allocation rate is that managers have a better idea about the effects of their use of housekeeping services on costs. A disadvantage is that they do not know their costs ahead of time, and they may have little control over whether the rate is higher or lower than expected.

3.20 Allocating support costs to units

A local hospital is required to account for the total cost of patient care, including support costs. Patients are assigned all direct costs. Support costs are $240 000 per month plus $90 per patient day. This 120-bed hospital averages 80 per cent occupancy.

Required
Calculate the average daily charge per patient for support costs, assuming 30 days in a month.
(LO6)

Allocating Support Costs to Units

Monthly occupancy = 120 beds × 0.8 × 30 days = 2880 patient days
Monthly costs = $240 000 + $90 × 2880 = $499 200
Average daily charge = $499 200/2880 = $173.33

3.21 Direct method using estimated costs, benchmarking
Devon Ltd allocates support department costs using the direct method and estimated costs. The support department costs are budgeted at $88 000 for department A, $63 000 for department B, and $40 000 for department C. These costs are allocated using the proportion of total cost the firm would pay to an outside service provider.

	Support			Operating	
	Dept. A	**Dept. B**	**Dept. C**	**Casting**	**Machine**
Direct costs	$88 000	$63 000	$40 000	—	—
Labour hours				6 000	4 000
Machine hours				2 000	10 000
Costs if support services were purchased outside:					
Department A				$50 000	$60 000
Department B				$40 000	$30 000
Department C				$20 000	$30 000

Required
(a) Allocate budgeted support department costs using the direct method, first using labour hours and then with the outside cost proportions as the allocation bases.
(b) Could Devon Ltd use the cost of purchasing outside as an efficiency benchmark for the cost of both the support departments and the user departments? List several advantages and disadvantages of this approach.
(LO6)

(a)

Direct method allocation using direct labour hours:

| | Support Departments | | | Operating Departments | | |
	Dept. A	Dept. B	Dept. C	Casting	Machining	Total
Allocation Base:						
Direct labour hours				6,000	4,000	10,000
				60%	40%	100%
Costs:						
Direct costs	$88,000	$63,000	$40,000			$191,000
Department A	(88,000)			$ 52,800	$35,200	0
Department B		(63,000)		37,800	25,200	0
Department C			(40,000)	24,000	16,000	0
Total allocated cost	$ 0	$ 0	$ 0	$114,600	$76,400	$191,000

Direct method allocation using costs to purchase outside:

| | Support Departments | | | Operating Departments | | |
	Dept. A	Dept. B	Dept. C	Casting	Machining	Total
Allocation Bases:						
Department A outside costs				$50,000	$60,000	$110,000
				45.45%	54.55%	100%
Department B outside costs				$40,000	$30,000	$70,000
				57.14%	42.86%	100%
Department C outside costs				$20,000	$30,000	$50,000
				40.00%	60.00%	100%
Costs:						
Direct costs	$88,000	$63,000	$40,000			$191,000
Department A	(88,000)			$40,000	$48,000	0
Department B		(63,000)		36,000	27,000	0
Department C			(40,000)	16,000	24,000	0
Total allocated cost	$ 0	$ 0	$ 0	$92,000	$99,000	$191,000

(b) Devon could use the cost of purchasing outside as a benchmark for both departments, but there are some advantages and disadvantages. Using the direct method, no interactions of support department services are reflected. This might understate the cost of services. However, fixed costs are included, and many of these may be sunk costs, for example depreciation expense. These could overstate the support department costs. If the costs for internal and external support services are similar, the cost to purchase outside might provide a good benchmark if it is equal to or less than the cost of internally providing the support. However, if the outside cost is more, incentive exists for increasing both the cost and use of services, which may be inefficient for the company overall. Alternatively, if the outside cost is much less, departments may begin to outsource the services and this duplicates services and may be inefficient for the overall company as well.

3.22 **Costing for a hospital**
Mercy Hospital uses a costing system for all patients who have surgery. The hospital uses a budgeted overhead rate for allocating overhead to patient stays. In March, the operating room had a budgeted allocation base of 1000 operating hours. The budgeted operating room overhead costs were $66 000.

Patient Dwight Schuller was in the operating room four hours during March. Other costs related to Schuller's four-hour surgery include:

Patient medicine	$ 250
Cost of nurses	3 500
Cost of supplies	800

Physician cost is not included because physicians bill patients separately from the hospital billing system.

Required
(a) Determine the budgeted (i.e., estimated) overhead rate for the operating room.
(b) Determine the total costs of Schuller's four-hour surgery.
(LO5)

Mercy Hospital

(a) Assumption that different types of surgeries are performed therefore it would be necessary to keep the costs of resources consumed by each patient

Estimated Costs $66 000
Estimated allocation base 1000 operating hours
Allocation rate => $66 000/1000 operating hours = $66 per operating hour

(b) Direct Costs: *(given in question)*
Patient medicine	$250
Cost of nurses	3500
Cost of supplies	800

Overhead *(to be applied based on use of allocation base)*
4 hours × $66	264
Total Cost	$4814

3.23 **Reciprocal method**
The Brown and Brinkley Brokerage firm is organised into two major sales divisions: institutional clients and retail clients. The firm also has two support departments: research and administration. The research department's costs are allocated to the other departments based on a log of hours spent on tasks for each user. The administration department's costs are allocated based on the number of employees in each department.

Records are available for last period as follows.

	Support departments		Operating departments	
	Research	**Administration**	**Institutional**	**Retail**
Payroll costs	$350 000	$300 000	$400 000	$550 000
Other costs	$230 000	$150 000	$120 000	$240 000
Research hours	100	200	500	300
Number of employees	7	10	8	10

Required
Using the reciprocal method, determine the total cost of operations for each sales division. Use either simultaneous equations or Excel Solver.
(LO5)

The Brown and Brinkley Brokerage

Manual Calculations using Simultaneous Equations:

	Support Departments		Operating Departments		
	Research	Administration	Institutional	Retail	Total
Allocation Bases:					
Research hours		200	500	300	1,000
		20%	50%	30%	100%
Number of employees	7		8	10	25
	28%		32%	40%	100.00%
Department costs:					
Payroll costs	$350,000	$300,000	$400,000	$550,000	$1,600,000
Other costs	230,000	150,000	120,000	240,000	740,000
Total department costs	$580,000	$450,000	$520,000	$790,000	$2,340,000

Given the above calculations, create simultaneous equations for the support costs:
Research = $580 000 + 28% × Administration
Administration = $450 000 + 20% × Research

Set the two equations equal to each other and solve for the fully allocated cost of one support department:
Research = $580 000 + 28% × ($450 000 + 20% × Research)
Research = $580 000 + $126 000 + 5.6% × Research
94.4% × Research = $706 000
Research = $706 000/94.4% = $747 881

Then solve for the fully allocated cost of the other support department:

Administration = $450 000 + 20% × Research

= $450 000 + 20% × $747 881

= $450 000 + $149 576

= $599 576

Finally, allocate the full cost of each support department to all departments:

	Support Departments		Operating Departments		
	Research	Administration	Institutional	Retail	Total
Allocation Bases:					
Research hours		200	500	300	1,000
		20%	50%	30%	100%
Number of employees	7		8	10	25
	28%		32%	40%	100.00%
Total department costs	$580,000	$450,000	$ 520,000	$ 790,000	$2,340,000
Cost allocations:					
Research	(747,881)	149,576	373,941	224,364	0
Administration	167,881	(599,576)	191,864	239,831	0
Total allocated costs	$ 0	$ 0	$1,085,805	$1,254,195	$2,340,000

3.24 Reciprocal method.

Paul's Valley Protection Service has three support departments (S1, S2 and S3) and three operating departments (P1, P2, and P3). The direct costs of each department are $30 000 for S1, $20 000 for S2, and $40 000 for S3. The proportions of service provided by each support department to the others are given in the following table.

	Support departments			Operating departments		
	S1	S2	S3	P1	P2	P3
S1	—	0.4	0.1	0.2	0.2	0.1
S2	0.1	—	0.2	0.2	—	0.5
S3	0.2	0.2	—	0.1	0.4	0.1

Required
Using the reciprocal method, allocate the support department costs to the operating departments.
(LO6)

Paul's Valley Protection Service

Manual Calculations using Simultaneous Equations:

Let S1 S2 and S3 represent the full cost of providing each department's service. The simultaneous equations for support department costs are:

$$S1 = \$30\,000 + 0.1 \times S2 + 0.2 \times S3$$
$$S2 = \$20\,000 + 0.4 \times S1 + 0.2 \times S3$$
$$S3 = \$40\,000 + 0.1 \times S1 + 0.2 \times S2$$

Substitute S1 into the equation for S2 and solve for S2:

$$S2 = \$20\,000 + 0.4(\$30\,000 + 0.1 \times S2 + 0.2 \times S3) + 0.2 \times S3$$
$$S2 = \$20\,000 + \$12\,000 + 0.04 \times S2 + 0.08 \times S3 + 0.2 \times S3$$
$$0.96 \times S2 = \$32\,000 + 0.28 \times S3$$
$$S2 = \$33\,333.33 + 0.291667 \times S3$$

Substitute S1 into the equation for S3:

$$S3 = \$40\,000 + 0.1(\$30\,000 + 0.1 \times S2 + 0.2 \times S3) + 0.2 \times S2$$
$$S3 = \$40\,000 + \$3\,000 + 0.01 \times S2 + 0.02 \times S3 + 0.2 \times S2$$
$$0.98 \times S3 = \$43\,000 + .21 \times S2$$

Substitute S2 into the equation for S3 and solve for S3:

$$0.98 \times S3 = \$43\,000 + 0.21(\$33\,333.33 + 0.291667 \times S3)$$
$$0.91875 \times S3 = \$43\,000 + \$7\,000$$
$$S3 = \$54\,422$$

Substitute S3 back into the equation for S2 and solve for S3:

$$S2 = \$33\,333.33 + 0.291667(\$54\,422) = \$49\,206$$

Substitute S2 and S3 back into the equation for S1 and solve for S1:

$$S1 = \$30\,000 + 0.1(\$49\,206) + 0.2(\$54\,422) = \$45\,805$$

Finally support costs are allocated to all of the departments:

	Support Departments			Operating Departments			
	S1	S2	S3	P1	P2	P3	Total
S1		40%	10%	20%	20%	10%	100%
S2	10%		20%	20%		50%	100%
S3	20%	20%		10%	40%	10%	100%
Department Costs	$30,000	$20,000	$40,000				$90,000
Cost Allocations:							
S1	(45,805)	18,322	4,581	$ 9,161	$ 9,161	$ 4,581	$ 0
S2	49,201	(49,206)	9,841	9,841	0	24,603	0
S3	10,884	10,884	(54,422)	5,442	21,769	5,442	0
Total Allocated Cost	$ 0	$ 0	$ 0	$24,444	$30,930	$34,625	$90,000

3.25 Step-down, direct, and reciprocal methods; accuracy of allocation
Software Plus Ltd produces flight and driving simulations and games for personal computers. The company's president has a complaint about the accounting for support department costs. He points to the following table describing the use of various support departments in the company and says, 'According to this table, every department receives services from all the support departments. But I understand that only some of the support departments are bearing costs from the other support departments. Why is that?'

Support department	Cost	Administration	Maintenance	Percentage use of services		
				Information systems	Games manufacturing	Simulation manufacturing
Administration	$40 000	0%	10%	50%	10%	30%
Maintenance	20 000	20	0	10	40	30
Information systems	50 000	35	5	0	40	20

Required
(a) What method has Software Plus Ltd been using to allocate support costs? Explain how you know.
(b) Which method would ignore all interactions among support departments? Explain.
(c) Which method would consider all interactions among support departments? Explain.
(d) Allocate the support department costs to Games and Simulations using the step-down method. Explain how you decided which department's costs to allocate first.
(e) Allocate the support department costs using the direct method.
(f) Allocate the support department costs using the reciprocal method.
(g) In your own words, explain how the step-down method improves upon the direct method.
(h) In your own words, explain how the reciprocal method improves upon the step-down method.
(LO 6 and 7)

(a) Software Plus has been using the step-down method that reflects half of the support department interactions. The costs of support departments are allocated one at a time. Once the costs of a particular support department are allocated, that department does not receive allocations from the remaining support departments.

(b) The direct method ignores all of the support department interactions. The costs of all support departments are allocated directly to operating departments. No support department costs are allocated to other support departments.

(c) The reciprocal method uses all of the support department interactions. The costs of support departments are allocated simultaneously to each other, and then support department costs are allocated to operating departments.

(d) The following solution for the step-down method allocates the costs of Information Systems first. This department was chosen because it is largest with respect to direct support department costs. The costs of Information Systems are allocated to the other departments based on the percentages given in the problem.

Administration is the next largest support department, so it is allocated second. When reviewing the allocation for Administration, remember that Information Systems is now out of the allocation, so the allocation percentages need to be adjusted. The percentage of Administration service remaining is (100%-50%), or 50%. To allocate Administration's cost to, divide 10% by 50%, so receives 1/5 or 20% of Administration cost. Also note that the total cost allocated for Administration is $57 500, which is equal to the direct cost of $40 000 plus the $17 500 allocated from Information Systems.

Because costs for all other support departments have already been allocated, costs are allocated only to the operating departments. The total cost allocated is $34 000, which is the sum of direct costs ($20 000) plus the costs allocated from Information Systems ($2500) and Administration ($11 500).

	Support Departments			Operating Departments		
	Admin. Total	Maint.	Info. Sys.	Games	Simulation	
Allocation Percentages:						
Step 1: Information Systems	20%	20%	—	40%	20%	100%
Step 2: Administration	—	10%/50%	—	10%/50%	30%/50%	100%
Step 3: Maintenance	—	—	—	40%/70%	30%/70%	100%
Direct Support Costs	$40,000	$20,000	$50,000			$110,000
Allocations:						
Step 1: Information Systems	17,500	2,500	(50,000)	20,000	10,000	0
Step 2: Administration	(57,500)	11,500	0	11,500	34,500	0
Step 3: Maintenance	0	(34,000)	0	19,429	14,571	0
Total Allocated Costs	$ 0	$ 0	$ 0	$50,929	$59,071	$110,000

(e) When Administration is allocated using the direct method, only the percentages from Games and Simulations departments are used. So, Games receives 10%/(10% + 30%) ,or 1/4 of Administration's cost, and Simulations receives the remaining 3/4 of cost. For the allocation of 40%/(40% + 30%), or 57.143% goes to Games and the remaining 42.857% goes to Simulations. Information Systems costs are allocated in a similar manner.

	Support Departments			Operating Departments		
	Admin. Total	Maint.	Info. Sys.	Games	Simulation	
Allocation Percentages:						
Administration				10%.40%	30%/40%	100%
Maintenance				40%/70%	30%/70%	100%
Information Systems				40%/60%	20%/60%	100%
Direct Support Costs	$40,000	$20,000	$50,000			$110,000
Allocations:						
Administration	(40,000)	0	0	$10,000	$30,000	0
Maintenance	0	(20,000)	0	11,429	8,571	0
Information Systems	0	0	(50,000)	33,333	16,667	0
Total Allocated Costs	$ 0	$ 0	$ 0	$54,762	$55,238	$110,000

(f) Below is the solution under the reciprocal method. This solution was obtained using Solver with the following simultaneous equations:

$$\text{Admin} = \$40\ 000 + 10\%\,\text{Maint} + 50\%\,\text{Info}$$
$$\text{Maint} = \$20\ 000 + 20\%\,\text{Admin} + 10\%\,\text{Info}$$
$$\text{Info} = \$50\ 000 + 35\%\,\text{Admin} + 5\%\,\text{Maint}$$

	Support Departments			Operating Departments		
	Admin. Total	Maint.	Info. Sys.	Games	Simulation	
Use of Services:						
Administration	—	10%	50%	10%	30%	100%
Maintenance	20%	—	10%	40%	30%	100%
Information Systems	35%	5%	—	40%	20%	100%
Direct Support Costs	$40,000	$20,000	$50,000			$110,000
Allocations:						
Administration	(78,964)	7,896	39,482	7,896	23,689	0
Maintenance	6,507	(32,533)	3,253	13,013	9,760	0
Information Systems	32,457	4,637	(92,735)	37,094	18,547	0
Total Allocated Costs	$ 0	$ 0	$ 0	$58,004	$51,996	$110,000

(g) The direct method does not reflect any of the interactions among support departments. The step-down method improves upon this by allocating the costs of each support department to other support departments and operating departments, starting with the department that provides the most service (sometimes measured by the total direct costs assuming that larger departments provide more services to other departments). After each department's cost is allocated, that department drops out of the allocation scheme, so that not all interactions are reflected, but at least some of them are.

(h) The reciprocal method improves upon the step-down method by reflecting all of the support department interactions.

3.26 **Direct, step-down, and reciprocal methods; assign costs to departments. Cost information for Lake County Library is as follows.**

Direct costs	Support maintenance	Administration	Operating books	Other media	Total
Salaries	$20 000	$40 000	$50 000	$70 000	$180 000
Supplies	5 000	5 000	15 000	25 000	50 000
Allocation base volumes					
Square metres	500	500	1 200	300	2 500
Employees	1	1	2	1	5

In addition to directly traceable costs, the library incurred $24,000 for a building lease.

Required
(a) Allocate to departments any costs that have not been traced, and then calculate total costs assigned to each department.
(b) Allocate the support department costs to the operating departments using the direct method.
(c) Allocate the support department costs to the operating departments using the step-down method. Allocate first the costs for the support department having the largest direct costs.
(d) Allocate the support department costs to the operating departments using the reciprocal method. Use either simultaneous equations or Excel Solver.
(LO6)

(a) The only cost not already assigned is the building lease cost of $24 000. Either number of employees or square feet can be used as an allocation base. Square feet is a more logical base, reflecting the amount of space each department occupies. For example, the Maintenance department occupies 500/2,500 square feet, so it is allocated 20% of the lease cost. Total costs assigned to each department are computed by adding direct costs to allocated lease costs. Below is an excerpt from the sample spreadsheet for this problem:

Problem 3.26: Lake County Library					
	Support		Operating		
Direct Costs	Maintenance	Administration	Books	Other Media	Total
Salaries	$20,000	$40,000	$50,000	$70,000	$180,000
Supplies	5,000	5,000	15,000	25,000	50,000
Other Costs					
Building lease					24,000
Total Costs					$254,000
Allocation Base Volumes					
Square feet	500	500	1,200	300	2,500
Number of employees	1	1	2	1	5
Building Lease Allocation:					
% square feet	20%	20%	48%	12%	100%
Allocation	$4,800	$4,800	$11,520	$2,880	$24,000
Total Assigned Costs	$29,800	$49,800	$76,520	$97,880	$254,000

(b)   This problem is very similar to direct method problems illustrated in the chapter. However, students need to identify the departments that provide support services (administration and support) and the operating departments (books and other media). The solution shown below assumes that maintenance services are allocated using square feet and administration is allocated using number of employees. Here is an excerpt from the sample spreadsheet for this problem:

Problem 3.26: Lake County Library					
	Support Departments		Operating Departments		
	Maintenance	Administration	Books	Other Media	Total
Total Assigned Costs	$29,800	$49,800	$76,520	$97,880	$254,000
Allocation Base Volumes					
Square feet	500	500	1,200	300	2,500
Number of employees	1	1	2	1	5
DIRECT METHOD ALLOCATION					
	Support Departments		Operating Departments		
	Maintenance	Administration	Books	Other Media	Total

(c) Under the step-down method, it is necessary to identify the support department that provides the most services. Because Administration is the largest department when comparing support department costs, it will be allocated first. Below is an excerpt from the sample spreadsheet for this problem.

STEP-DOWN METHOD ALLOCATION					
	Support Departments		Operating Departments		
	Maintenance	Administration	Books	Other Media	Total
Allocation Bases:					
Square feet			1,200	300	1,500
			80.00%	20.00%	100%
Number of employees	1		2	1	4
	25%		50%	25%	100%
Total Assigned Costs	$29,800	$49,800	$76,520	$97,880	$254,000
Allocations:					
Administration	12,450	-49,800	24,900	12,450	0
Janitorial	-42,250	0	33,800	8,450	0
Total Allocated Costs	$0	$0	$135,220	$118,780	$254,000

(d) Under the reciprocal method, the simultaneous equations for the support department allocations are developed first.

Simultaneous equations:
Admin = $49 800 + (500/2 000 square feet) ×
= $29 800 + (1/4 employees) × Admin

Here are calculations for solving the simultaneous equations manually. First substitute the equation into the Admin equation and solve for Admin:
Admin = $49 800 + (500/2 000) × [$29 800 + (1/4) × Admin]
Admin = $49 800 + $7450 + 0.0625 Admin
Admin = $57 250/0.9375 = $61 067

Now substitute Admin into the Maintenance equation and solve for Janitor:
Maintenance = $29 800 + (1/4) × $61 067 = $45 067

Below is an excerpt from the sample spreadsheet for this problem. It shows the results using Excel Solver to solve the simultaneous equations and allocate the support department costs.

	Support Departments		Operating Departments		
	Maintenance	Administration	Books	Other Media	Total
Allocation Bases:					
Square feet		500	1,200	300	2,000
		25%	60%	15%	100%
Number of employees	1		2	1	4
	25%		50%	25%	100%
Total Assigned Costs	$29,800	$49,800	$76,520	$97,880	$254,000
Allocations:					
Administration	15,267	-61,067	30,533	15,267	0
Janitorial	-45,067	11,267	27,040	6,760	0
Total Allocated Costs	$0	$0	$134,093	$119,907	$254,000

3.27 **Step-down and reciprocal methods; uncertainties; pricing**
      Kovacik manufactures two types of piggy banks in two different
      departments: a kangaroo-shaped piggy bank and a platypus-shaped piggy
      bank. The plant is highly automated and contains only two other
      departments: (1) engineering and design, and (2) information systems.
      Kovacik allocates support department costs according to estimated service
      use. Estimated information for next year is as follows:

	Support		Operating	
	Engineering and design	**Information systems**	**Kangaroo bank**	**Platypus bank**
Direct costs	$2 700	$8 000	$10 000	$20 000
Services used				
Engineering and design		10%	40%	50%
Information systems	20%		30%	50%
Production volume			8 000	4 000

Total allocated costs are assigned to individual units using the production
volume.

Required
(a) Determine the estimated total allocated costs for the operating
departments using the stepdown method.
(b) Determine the estimated total allocated cost per unit of the kangaroo-
shaped piggy bank and the platypus-shaped piggy bank under the step-
down method.
(c) Explain why actual total allocated costs will turn out to be different
from the estimated total allocated costs.
(d) Determine the estimated total allocated costs for the operating
departments using the reciprocal method. Use either simultaneous
equations or Excel Solver.
(e) Determine the estimated total allocated cost per unit of the kangaroo-
shaped piggy bank and the platypus-shaped piggy bank under the
reciprocal method.
(LO5)

(a)   Under the step-down method, the direct costs of Information Systems are
        allocated first because they are larger than the direct costs for the other support
        department (Engineering). In the first step, Information Systems costs are
        allocated to all other departments using the percent of services used as given in
        the problem. In the second step, the percentages for Engineering and Design
        must be adjusted to remove the percent of services used by Information
        Systems. Thus, the percent allocated to the Kangaroo department is 40%/(100%-
        10%) or 44.444%. The percent allocated to the Platypus Bank department is
        50%/(100%-10%) or 55.5556%. The total cost allocated in step 2 of $4300 is
        equal to the Engineering and Design direct costs of $2700 plus $1600 in costs
        allocated from Information Systems.

| | Support Departments | | Operating Departments | | |
	Engineering and Design	Information Systems	Kangaroo Bank	Platypus Bank	Total
Allocation Bases:					
Information systems	20%		30%	50%	100%
Engineering and design			44.4444%	55.5556%	100%
Direct Costs	$2,700	$8,000	$10,000	$20,000	$40,700
Allocations:					
Step 1: Information systems	1,600	(8,000)	2,400	4,000	0
Step 2: Engineering and design	(4,300)	0	1,911	2,389	0
Total Allocated Costs	$ 0	$ 0	$14,311	$26,389	$40,700

(b) Calculation of estimated total allocated cost per unit using costs calculated under the step-down method:

	Allocated Cost/Production Volume	Allocated Cost Per Unit
Kangaroo bank	$14 311/8 000 units	$1.789
Platypus bank	$26 389/4 000 units	$6.597

(c) Actual total allocated costs will be different than budgeted total allocated costs because budgets never exactly predict costs or production levels. Production levels change because of unanticipated changes in product demand, unexpected production stoppages, delays in receipt of materials, and so on. There are many reasons for actual costs differing from budgeted costs, such as:

- There can be unexpected inflation or deflation in the costs of materials, labour, supplies, etc.
- Employment levels fluctuate because employees leave unexpectedly, it takes longer than expected to hire new employees, or management decides to change the number or types of employees.
- Unanticipated new types of materials, designs, or technologies can be adopted, altering production costs.
- Capacity constraints occur if demand is higher than usual. As organisations near their capacity levels, costs of congestion increase and money may be spent to relax the constraint.
- Changes in product design or the manufacturing process affect the amount and cost of materials and labour.

(d) Under the reciprocal method, the simultaneous equations for the two support departments are:

Engineer = $2700 + 20% Info
Info = $8000 + 10% Engineer

Substituting Engineer into the Info equation and solving for Info:

Info = $8000 + 10% ($2,700 + 20% Info)
0.98 Info = $8000 + $270
Info = $8439

Substituting Info back into the equation for Engineer:

Engineer = $2700 + 20% ($8439) = $4388

The cost allocations are performed as follows:

| | Support Departments | | Operating Departments | | |
	Engineering and Design	Information Systems	Kangaroo Bank	Platypus Bank	Total
Services used:					
Engineering and design		10%	40%	50%	100%
Information systems	20%		30%	50%	100%
Direct Costs	$2,700	$8,000	$10,000	$20,000	$40,700
Allocations:					
Engineering and design	(4,388)	439	1,755	2,194	0
Information systems	1,688	(8,439)	2,532	4,219	0
Total Allocated Costs	$ 0	$ 0	$14,287	$26,413	$40,700

(e) Calculation of estimated total allocated cost per unit using costs calculated under the reciprocal method:

	Allocated Cost/Production Volume	Allocated Cost Per Unit
Kangaroo bank	$14 287/8 000 units	$1.786
Platypus bank	$26 413/4 000 units	$6.603

Problems

3.28 Step-down and reciprocal methods; choosing methods; cost pools; uncertainties
Your brother is a physician and has decided to start a home health care agency. The government will reimburse treatment costs for about half of the patients under a new government-sponsored health insurance program for low-income residents. Your brother has asked you to explain the cost report that the government requires. He tells you that he can use either the step-down or the reciprocal allocation method. He has several choices in allocation bases, but has little choice in the type of cost pools that are allowed.

Required
(a) Explain to your brother the differences in the two allocation methods. Remember that your brother is not familiar with accounting, use language he will understand.
(b) Your brother wants to know how to choose the best allocation method and bases for his business. List some of the factors your brother should consider as he makes these decisions.
(c) One of the cost pools allowed by the government is a pool for transportation-related costs. Your brother asked colleagues at other home health care agencies to list the costs they include in this pool. Each organisation has some costs that are identical, such as depreciation on vehicles, gas, and repairs. However, other costs in the pool are different; some agencies include facilities-related costs, and others do not. Why would cost pools for the same activity include different types of cost?
(LO3)

(a) Both methods are appropriate for allocating support department costs to health program departments. The step-down method ranks support departments in order of service provided and then allocates their costs to other departments according to a cascading method. The support department providing most services is allocated first to all other departments, and is then dropped from the allocation process. Next, the support department providing the second-most services is allocated to the remaining departments, and then it drops out, and so on until all support department costs are allocated. Therefore, this method partially takes into account the fact that the support departments provide services for each other.

The reciprocal method uses simultaneous equations to reflect all of the services provided among the support departments. Therefore, the reciprocal method more accurately measures support department costs before those costs are allocated to the health program departments.

(b)   Here are some factors that the physician should consider to choose the best allocation method and best allocation bases.

Choosing the allocation method: If you only have a few support activities, the two methods are likely to produce similar allocations. However, the step-down method is easier to calculate and understand, so you may prefer that method. Alternatively, if there are a number of support departments, you will want to use the reciprocal method because it more accurately measures the cost of support services. You can either purchase software for these allocations, or I can set up a spreadsheet and show you how to use it.

Choosing an allocation base: An allocation base is some measure of activity that is used to determine the amount of a support department's cost that is allocated to each of the other departments. Ideally, you would like to choose allocation bases that are also cost drivers, that is, they cause costs to vary. For example, the number of patients would be a good allocation base for the cost of medical records because costs such as supplies and employee time are likely to vary with the number of patients. Square footage might be a good allocation base for the cost of maintenance services because those costs might vary with the square feet of space that is cleaned. If you choose cost drivers for allocation bases, the resulting allocations do a better job of measuring the use of resources. Give some thought to what might cause costs to change when you choose allocation bases for each cost pool.

(c)   The types of costs in a cost pool depend on the size and structure of the organisation and also the manner of service provision. Some organisations may own no vehicles and incur costs only for renting and operating vehicles. Other organisations may have a large motor pool that requires a manager and several employees to maintain the vehicles.

3.29 **Cost pools and allocation bases.**
You are an accountant for the Department of Defence. The government is considering a change of rules for the allocation of research and development costs. The government is asking contractors to submit a list of potential cost pools and allocation bases for activities within research and development. The government wants contractors to separate their research and development activities into several smaller cost pools with separate allocation bases.

Your research department performs a variety of different duties, including developing new designs for products, developing and testing new materials for use in these products, designing the manufacturing processes for new products, and redesigning old products and their manufacturing processes. In addition, the research and development department creates commercial uses for new technology that have been developed under government contracts.

Required
(a) **List at least four potential research and development activities that could be used as the basis for separate cost pools within the research and development department.**
(b) **List two or more potential cost allocation bases for each cost pool listed in part (a).**
(c) **List factors that you might consider in making a choice about the cost pools and the allocation bases.**
(LO3)

(a) Examples include: new product design, design of the manufacturing process, product re-design, and product testing.

(b) Possible allocation bases:
- New product design: number of new products, labour hours
- Design of manufacturing process: labour hours, number of designs
- Product redesign: number of engineering change orders
- Product testing: number of hours in testing, number of products tested

(c) Factors to consider in choosing cost pools and allocation bases:
- The cost and benefit tradeoffs for collecting information.
- Whether cost can be measured accurately for each pool.
- Whether the activity uses as an allocation base that can be measured accurately.
- Whether the activity uses as an allocation base that reflects the flow of resources used, at least partially.

3.30 Step-down method; choosing allocation order and bases

Space Products manufactures commercial and military satellites. Under its government contracts, the company is permitted to allocate administrative and other costs to its military division. These costs are then reimbursed by the government department. Government guidelines allow administrative costs to be allocated using either the direct costs incurred in the operating divisions or the number of employees as an allocation base. Management information systems (MIS) costs can be allocated either on the basis of direct costs incurred in the operating divisions or on the basis of CPUs (a measure of computer resources used). Data concerning the company's operations appear here.

	Support departments		Operating departments	
	Administrative	MIS	Commercial	Military
Direct costs	$600 000	$200 000	$2 000 000	$4 000 000
Employees	20	10	40	50
CPUs (millions)	20	50	30	70

The MIS department is responsible for computer equipment and systems, and it maintains databases for the entire organisation.

Required

(a) Suppose Space Products uses the step-down method for allocating support department costs. Administrative costs are allocated first on the basis of the number of employees, and then MIS costs are allocated on the basis of CPUs. How much support department cost will be allocated to the military division?

(b) Space Products produced 100 military satellites in the period considered in this problem. Assuming the company uses the allocations calculated in part (a), what is the average cost per military satellite?

(c) Is the average cost that you calculated in part (b) most likely an underestimate, overestimate, or unbiased estimate of the incremental cost of producing one more military satellite? Explain.

(d) Suppose Space Products uses the direct method of allocating support department costs. What is the maximum amount of support department cost that can be allocated to the military division under the government rules?

(e) Suppose the management of Space Products always calculates its support department cost allocations to maximise the amount of contribution received from the government. Management selects this policy because it allows the company to be more competitive in its commercial markets.

  (i) Discuss possible reasons why the government does not specify a single, unambiguous support cost allocation method.

  (ii) From a taxpayer's point of view, discuss whether you would agree with Space Product's policy.

  (iii) From a competitor's point of view, discuss whether you would agree with Space Product's policy.

 (LO6)

(a) Step-down method allocation:

	Administrative	MIS	Commercial	Military
Direct costs	$ 600,000	$ 200,000	$2,000,000	$4,000,000

Allocation of Administrative Costs:

Number of Employees		10	40	50
Percent		10%	40%	50%
Cost	(600,000)	60,000	240,000	300,000

Allocation of MIS Costs:

CPUs			30	70
Percent			30%	70%
Cost		$(260,000)	78,000	182,000
Total Allocated Cost	$ 0	$ 0	$2,318,000	$4,482,000

Support dept costs allocated to Military:
Total allocated cost less direct cost
$4 482 000 – $4 000 000 = $482 000

(b) Average Cost Per Military Satellite
= Total allocated cost ÷ Number of satellites produced
= $4 482 000 ÷ 100 = $44 820

(c) The average cost is most likely an overstatement of incremental cost. The average cost includes fixed costs which do not vary with the level of production (in the short run).

(d) Direct method allocation; Maximum support costs allocated to military

DOD allocation bases for Administrative:

	Commercial		Military	
Direct costs	$2,000,000	(33%)	$4,000,000	(67%)
Employees	40	(44%)	50	(56%)

More administrative costs would be allocated to Military if direct costs were used as the allocation base (because 67% is greater than 56%).

DOD allocation bases for MIS:

	Commercial		Military	
Direct costs	$2,000,000	(33%)	$4,000,000	(67%)
CPUs	30	(30%)	70	(70%)

In this case, CPUs would maximise the cost allocated to the Military division.

Allocations:

	Commercial	Military
Administrative (based on direct costs)	$200,000	$400,000
MIS (based on CPUs)	$ 60,000	$ 140,000
Total Allocated Support Costs	$260,000	**$540,000**

(e)   Policy to Maximise DOD Contribution

      (i)   The DOD does not mandate a single allocation method because different defence contractors are organised differently and have different types of costs. In addition, there is always discretion because there are uncertainties in defining cost pools, assigning costs to cost pools, and specifying allocation bases. It would be impossible to prescribe a single allocation method that would accurately measure support costs on defence contracts and that would be fair to all contractors.

      (ii)   As a taxpayer, I would prefer that the cost be allocated in a manner that fairly represents the amount of overhead used by military projects. I would prefer not to subsidise the overhead costs of a private corporation.

      (iii)   As a competitor, I would prefer that the cost be allocated in such a manner that the contractor did not have an unfair competitive advantage. The government should pay its fair share, but no more. I would like to see some benchmark information about the amount of internal support department cost per job for commercial versus government contracts.

3.31 Categorisation of support costs

Suppose a charitable organisation called Food on Wheels provides meals for low-income individuals who are unable to leave their homes. To support its services, it solicits contributions from individuals and businesses. Food on Wheels needs to submit financial statements to its major sponsor. The sponsor requires expenses to be assigned to the following cost pools: administrative, fund-raising, and programs.

The bookkeeper for Food on Wheels is a volunteer who is taking accounting classes at the local community college. He knows that all of the costs to prepare and deliver meals should be assigned to the program. However, he is not sure how to assign some of the costs. In particular, he is concerned about the following two items.

Costs for printing and mailing a monthly newsletter

The newsletter is sent out to donors and clients and asks for donations. It also describes the organisation's activities, provides information for obtaining meal services, and provides recipes for some of the meals that are served. The director of the organisation wants the cost of the news-letter to be classified as a program cost. She maintains that the program information and recipes should be considered educational material. Not-for-profit organisations typically classify educational materials as program expenses.

Director's salary and benefits

The director of Food on Wheels spends much of her time raising funds, meeting with the board of directors, and performing other administrative duties. She also manages the cooks and drivers, purchases food and delivery supplies, and schedules the food deliveries. The director has instructed the bookkeeper to allocate her salary and benefit costs as follows: 50 per cent to the program, 25 per cent to fund-raising, and 25 per cent to administration.

Required

(a) Identify and discuss uncertainties about how each of the following costs should be classified:
   (i) Costs to print and mail the newsletter
   (ii) Director's salary and benefits
(b) Does this situation involve an ethical dilemma for the bookkeeper? Why?
(c) Explain why the director has a preference for costs to be assigned to program expenses.
(d) Explain how you think sponsors would prefer for the costs in part (a) to be assigned.
(e) Suppose you are reviewing cost information for another organisation. Would you expect the organisation's program costs to be biased upward, biased downward, or to be unbiased? Explain.
(f) How would you classify the costs in part (a) if you were the bookkeeper for Food on Wheels? Explain your reasoning.

(LO2 and 7)

(a) Uncertainties in cost classification:

(i) The newsletter costs have no clear classification because the function of the newsletter seems to be partly fundraising and partly educational. Perhaps the cost should be allocated between fundraising and program. However, it might not be possible to identify an appropriate allocation base to separate these activities. Also, it could be argued that providing recipes is not educational. However, the recipes are most likely designed to save costs and to be nutritious, which would support their classification as educational. In addition, classification as "educational" does not necessarily mean that the newsletter is a program activity. On the one hand, knowledge about the needs of low-income individuals is probably conveyed through the newsletter. Educating the public and promoting greater awareness can be important program goals for a charitable organisation. It can also be important for the public to learn about the activities of charitable organisations. On the other hand, the newsletter probably provides little, if any, direct benefit to the target of its charitable mission—low-income individuals who are unable to leave their homes.

(ii) Classification of the director's salary and benefits is uncertain because the proportion of cost is unknown that relates to fundraising activities, to administration, or to program activities. Even if detailed information were available about the time the director spends on various activities, there would still be uncertainty about whether to use time spent to assign her salary and benefits. An alternative might be to identify the proportion of 'value' she devotes to various activities. In addition, some of the director's activities probably relate to more than one cost category. For example, her time at a board of director's meeting might be considered administrative. However, the board probably discusses program issues such as whether to hire a new cook or to purchase a new delivery vehicle. She might also persuade board members to donate money while at a meeting.

(b) This situation involves an ethical dilemma for the bookkeeper, who must decide how to assign costs. It also involves an ethical dilemma for the director, who is responsible for the financial statements. Both of these individuals have a responsibility to the organisation, to individuals who receive the organisation's services, and to donors and other parties who rely on its financial statements. This situation involves a possible conflict of interest among interested parties, and requires the bookkeeper and director to apply judgment, along with personal and organisational values, in deciding what to do.

(c) The director probably prefers to classify costs as related to the program cost pool. A larger proportion of program costs makes the organisation look more efficient in its use of resources, and also gives the appearance of appropriate effort from management.

(d)   Donors would prefer costs to be assigned in an unbiased way—program costs should include the resources used for program purposes, fundraising costs should include resources used for raising money, and administrative costs should include resources used for general management of the organisation. However, as discussed in Part A above, there are many uncertainties about classification. Therefore, it is also not clear how the donors would prefer to see these costs classified.

(e)   Because of the incentives discussed in C above, costs are likely to be classified in the program cost pool when (1) the classification is uncertain and (2) a reasonable argument can be made for classification as program. This creates a bias in favour of classifying costs as program. Accordingly, program costs on average are likely to be overstated.

(f)   This is an open-ended problem, so there is no single solution. It is possible to argue for different types of allocations. The best solutions: (1) take into account uncertainties about how the costs should be classified, and (2) are designed to create an unbiased classification of costs (i.e., to avoid misleading donors and others).

3.32 **Direct, step-down and reciprocal methods using dual rate and three departments**

In comprehensive example 6 (Middletown Children's Clinic), we did not perform direct or step-down methods for the dual-rate costs. Following are the allocation bases for these costs. The support cost data are in comprehensive example 6.
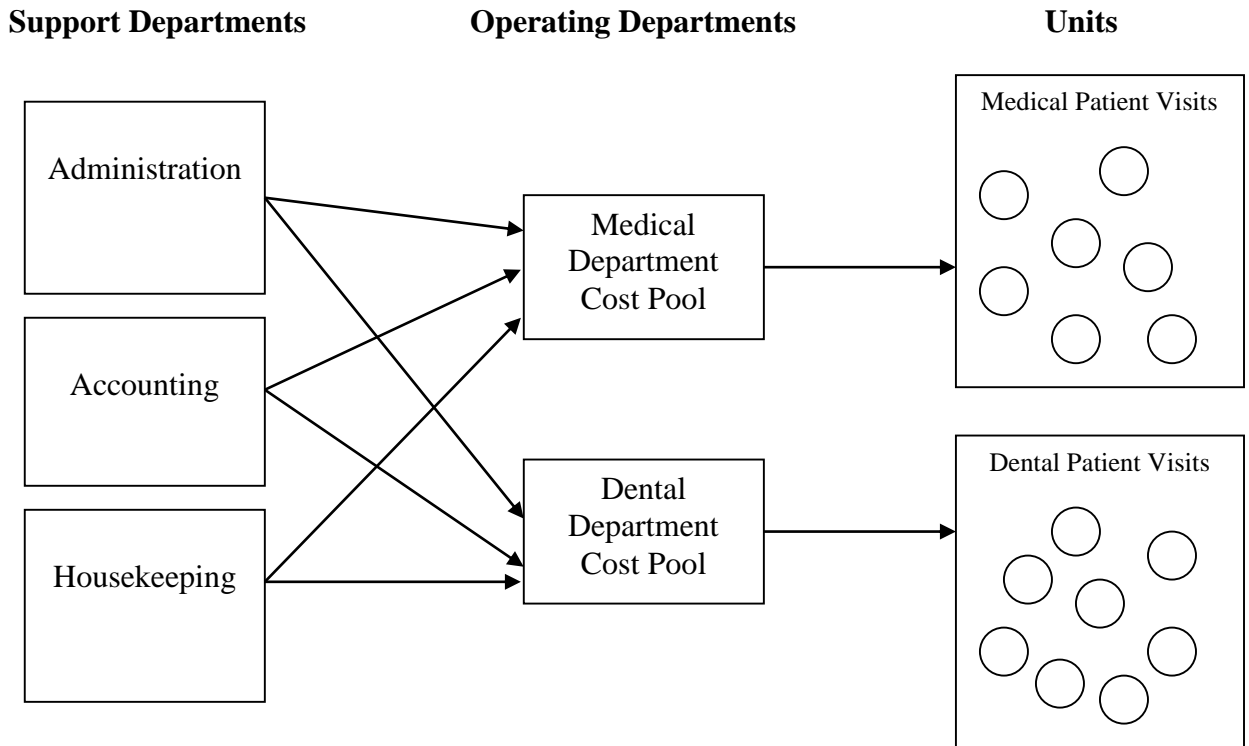
	Administration	Accounting	Housekeeping	Medical	Dental	Total
Number of employees	1	1	2	5	3	12
Square metres	600	300	100	8 000	1 000	10 000
Time spent accounting	15%		10%	50%	25%	100%
Time spent cleaning	10%	5%		55%	30%	100%

Required
(a) Draw a diagram of the direct method for the Middletown Children's Clinic allocations using three support departments.
(b) Allocate the support department costs using dual rates and the direct method.
(c) Draw a diagram of the step-down method using the three support departments.
(d) Allocate the support department costs using dual rates and the step-down method.
(e) Write out the simultaneous equations for the reciprocal allocation.
(f) Set up a spreadsheet that uses Excel Solver to solve the simultaneous equations and then allocates support costs using dual rates and the reciprocal method. Check to see that your solution matches the solution in the text.
(LO4 and 6)

(a) Following is a diagram of the direct method allocation for Middletown
     Children's Clinic.

Support Departments　　　　　**Operating Departments**　　　　　**Units**

(b) Following is the dual-rate, direct method allocation for Middletown
     Children's Clinic.

	Support Departments			Operating Departments		
	Administration	Accounting	Housekeeping	Medical	Dental	Total
<u>Allocation Bases:</u>						
Variable and fixed administration costs:						
Number of employees				5	3	8
				62.5000%	37.5000%	100%
Variable and fixed accounting costs:						
Time spent accounting				(50%/75%)	(25%/75%)	
				67%	33%	100%
Variable housekeeping costs:						
Time spent cleaning				(55%/85%)	(30%/85%)	
				65%	35%	100%
Fixed housekeeping costs:						
Square feet				8,000	1,000	9,000
				88.8889%	11.1111%	100%

Cost Allocations:

Direct support costs	$61,400	$36,840	$60,360			$158,600
Allocate administration:						
Variable	(11,052)			$ 6,908	$ 4,145	0
Fixed	(50,348)			31,468	18,881	0
Allocate accounting:						
Variable		(9,210)		6,140	3,070	0
Fixed		(27,630)		18,420	9,210	0
Allocate housekeeping:						
Variable			(30,180)	19,528	10,652	0
Fixed			(30,180)	26,827	3,353	0
Total Support Allocations	$ 0	$ 0	$ 0	$109,290	$49,310	$158,600

(c)   Following is a diagram of the step-down method allocation for Middletown Children's Clinic.

Step 1 Allocation:

Other Support Departments:

Operating Departments

Step 2 Allocation:

Other Support Department:

Administration → Accounting

Operating Departments:

Administration → Medical Department Cost Pool

Administration → Dental Department Cost Pool

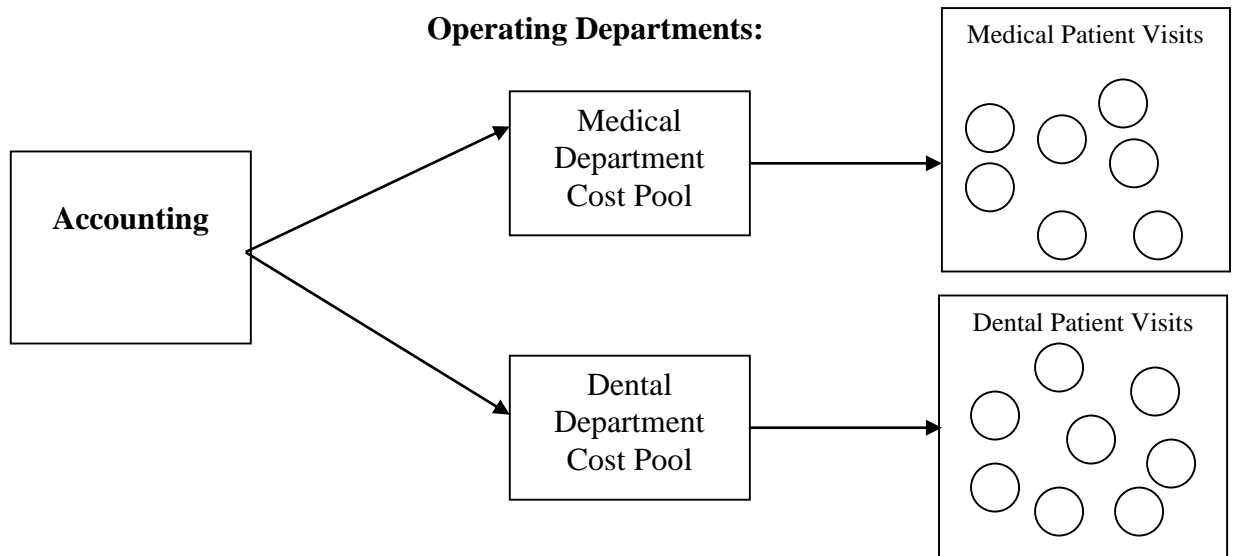**Step 3 Allocation:**

Operating Departments:

Accounting → Medical Department Cost Pool → Medical Patient Visits

Accounting → Dental Department Cost Pool → Dental Patient Visits
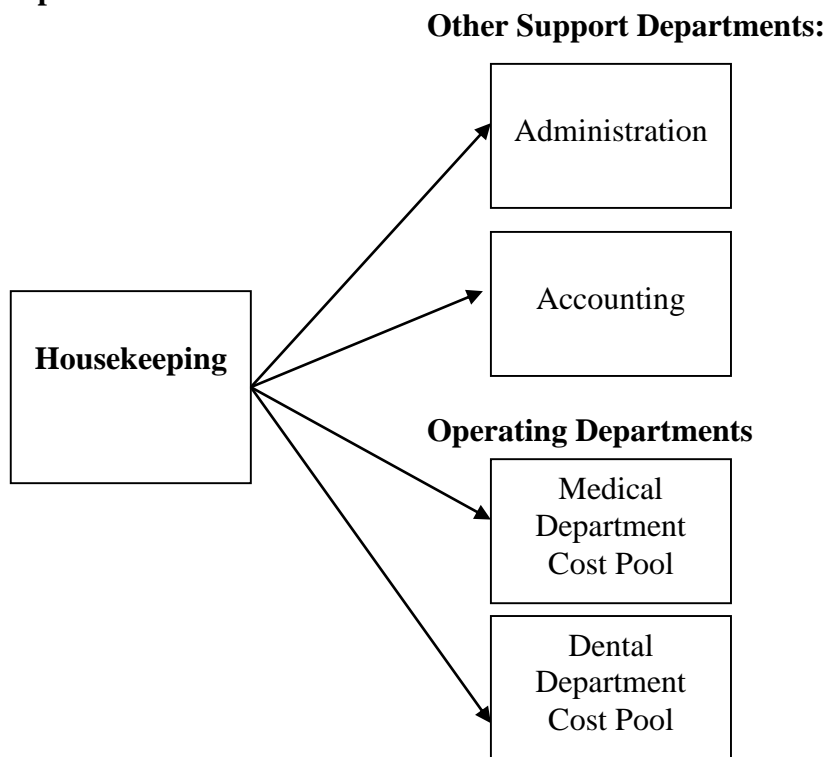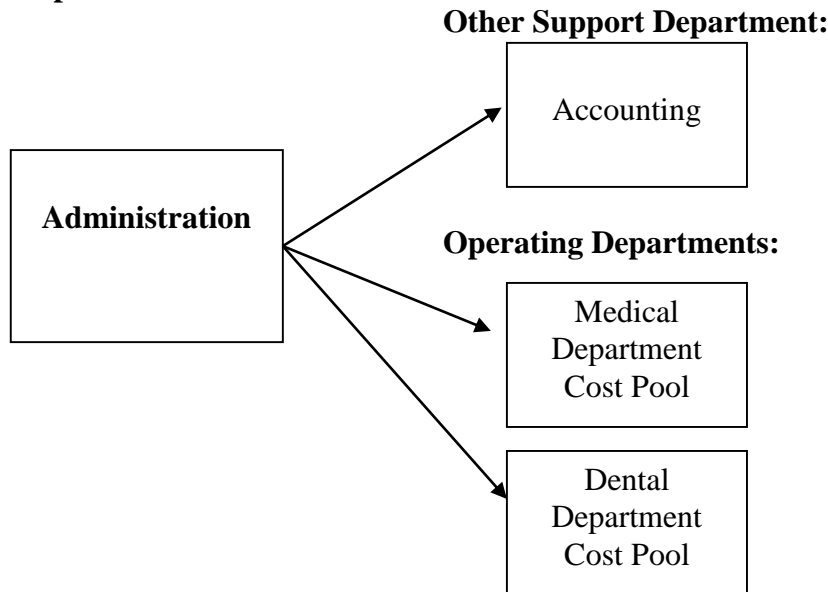
(d)   When performing dual-rate allocations under the step-down method, it is necessary to decide whether to rank supports based on their total services performed, or to rank them separately for fixed and variable support services. Solutions for both approaches are shown below. (Differences in addition are due to rounding.)

Approach #1: Rank support departments based on total services (fixed and variable costs)
Under this approach, Administration costs are allocated first because its total direct costs are greater than the other two support departments. Housekeeping is allocated second, and Accounting is allocated third.

| | Support Departments | | | Operating Departments | | |
	Administration	Housekeeping	Accounting	Medical	Dental	Total
Allocation Bases:						
Variable and fixed administration costs:						
Number of employees	2	1	5	3		11
		18.1818%	9.0909%	45.4545%	27.2727%	100%
Variable housekeeping costs:						
Time spent cleaning			(5%/90%)	(55%/90%)	(30%/90%)	
			5.5556%	61.1111%	33.3333%	100%
Fixed housekeeping costs:						
Square feet			300	8,000	1,000	9,300
			3.2258%	86.0215%	10.7527%	100%
Variable and fixed accounting costs:						
Time spent accounting				50%/75%	25%/75%	
				66.6667%	33.3333%	100%
Cost Allocations:						
Direct support costs	$61,400	$36,840	$60,360			$158,600
Step 1: Administration						
Variable	(11,052)	2,009	1,005	$ 5,024	$ 3,014	0
Fixed	(50,348)	9,154	4,577	22,885	13,731	0
Step 2: Housekeeping						
Variable		(32,189)	1,788	19,671	10,730	0
Fixed		(39,334)	1,269	33,836	4,229	0
Step 3: Accounting						
Variable			(12,003)	8,002	4,001	0
Fixed			(33,476)	22,317	11,159	0
Total Support Allocations	$ 0	$ 0	$ 0	$111,736	$46,864	$158,600

Approach #2: Rank support departments separately for fixed and variable cost allocations

For variable support costs under this approach, Housekeeping costs are allocated first because its direct variable costs are greater than the other two support departments. Administration is allocated second, and Accounting is allocated third. For fixed support costs, Administration is allocated first, Housekeeping second, and Accounting third.

| | Support Departments | | | Operating Departments | | |
	Administration	Housekeeping	Accounting	Medical	Dental	Total
Variable Support Allocation Bases:						
Variable housekeeping costs:						
Time spent cleaning	10%		5%	55%	30%	100%
Variable administration costs:						
Number of employees			1	5	3	9
			11.1111%	55.5556%	33.3333%	100%
Variable accounting costs:						
Time spent accounting				50%/75%	25%/75%	
				66.6667%	33.3333%	100%

<u>Fixed Support Allocation Bases:</u>
Fixed administration costs:

Number of employees	2	1	5	3	11
	18.1818%	9.0909%	45.4545%	27.2727%	100%

Fixed housekeeping costs:

Square feet		300	8,000	1,000	9,300
		3.2258%	86.0215%	10.7527%	100%

Fixed accounting costs:

Time spent accounting			50%/75%	25%/75%	
			66.6667%	33.3333%	100%

<u>Variable Cost Allocations:</u>

Variable support costs	$11,052	$30,180	$ 9,210			$ 50,442
Step 1: Housekeeping	3,018	(30,180)	1,509	$ 16,599	$ 9,054	0
Step 2: Administration	(14,070)		1,563	7,817	4,690	0
Step 3: Accounting			(12,282)	8,188	4,094	0
Total Variable	0	0	0	32,604	17,838	50,442

<u>Fixed Cost Allocations:</u>

Fixed support costs	$50,348	$30,180	$27,630			108,158
Step 1: Administration	(50,348)	9,154	4,577	22,885	13,731	0
Step 2: Housekeeping		(39,334)	1,269	33,836	4,229	0
Step 3: Accounting			(33,476)	22,317	11,159	0
Total Fixed	0	0	0	79,038	29,119	108,158
Total Allocations	$ 0	$ 0	$ 0	$111,642	$46,958	$158,600

(e)   The dual-rate method requires two sets of simultaneous equations for the reciprocal allocations.

Variable support cost simultaneous equations (*Note*: These equations were shown in the textbook on page 313):
Administration = $11 052 + 15%*Accounting + 10%*Housekeeping
Accounting = $9210 + (1/11)*Administration + 5%*Housekeeping
Housekeeping = $30 180 + (2/11)*Administration + 10%*Accounting

Fixed support cost simultaneous equations:
Administration = $50 348 + (600/9 900)*Housekeeping + 15% * Accounting
Accounting = $27 630 + (1/11)*Administration + 300/9 900)*Housekeeping
Housekeeping = $30 180 + (2/11)*Administration + 10%*Accounting

(f)   Below is an excerpt from the sample spreadsheet for this problem, showing the variable support cost allocation under the reciprocal method. Except for minor rounding differences, these allocations agree with those shown in Figure 3.12, textbook page 390.

RECIPROCAL ALLOCATIONS FOR VARIABLE SUPPORT COSTS						
	Support Departments			**Operating Departments**		
	Administration	**Accounting**	**Housekeeping**	**Medical**	**Dental**	**Total**
Allocation Bases:						
Variable and fixed administration costs:						
Number of employees		1	2	5	3	11
		9.0909%	18.1818%	45.4545%	27.2727%	100%
Variable and fixed accounting costs:						
Time spent accounting	15%		10%	50%	25%	100%
Variable housekeeping costs:						
Time spent cleaning	10%	5%		55%	30%	100%
Solver for Variable Costs						
	Admin	**Account**	**House**			
Change cells for Solver	$16,354	$12,416	$34,395			
Simultaneous equations	$16,354	$12,416	$34,395			
Target function:						
$63,166						
	Support Departments			**Operating Departments**		
	Administration	**Accounting**	**Housekeeping**	**Medical**	**Dental**	**Total**
Varible Support Costs	$11,052	$9,210	$30,180			$50,442
Variable Support Allocations:						
Administration	(16,354)	1,487	2,973	$7,434	$4,460	0
Accounting	1,862	(12,416)	1,242	6,208	3,104	0
Housekeeping	3,440	1,720	(34,395)	18,917	10,319	0
Total Variable Allocations	$0	$0	$0	$32,559	$17,883	$50,442

Below is an excerpt from the sample spreadsheet for this problem, showing the fixed support cost allocation under the reciprocal method. Except for minor rounding differences, these allocations agree with those shown in Figure 3.12, textbook page 390.

RECIPROCAL ALLOCATIONS FOR FIXED SUPPORT COSTS						
	Support Departments			**Operating Departments**		
	Administration	**Accounting**	**Housekeeping**	**Medical**	**Dental**	**Total**
Allocation Bases:						
Variable and fixed administration costs:						
Number of employees		1	2	5	3	11
		9.0909%	18.1818%	45.4545%	27.2727%	100%
Variable and fixed accounting costs:						
Time spent accounting	15%		10%	50%	25%	100%
Fixed housekeeping costs:						
Square feet	600	300		8,000	1,000	9,900
	6.0606%	3.0303%		80.8081%	10.1010%	100%
Solver for Fixed Costs						
	Admin	**Account**	**House**			
Change cells for Solver	$58,164	$34,256	$44,181			
Simultaneous equations	$58,164	$34,256	$44,181			
Target function:						
$136,602						
	Support Departments			**Operating Departments**		
	Administration	**Accounting**	**Housekeeping**	**Medical**	**Dental**	**Total**
Fixed Support Costs	$50,348	$27,630	$30,180			$108,158
Fixed Support Allocations:						
Administration	(58,164)	5,288	10,575	26,438	15,863	0
Accounting	5,138	(34,256)	3,426	17,128	8,564	0
Housekeeping	2,678	1,339	(44,181)	35,702	4,463	0
Total Fixed Allocations	($0)	$0	$0	$79,268	$28,890	$108,158

Here is a summary of the reciprocal method variable and fixed support cost allocations to the operating departments:

	Operating Departments		
	Medical	Dental	Total
Variable support costs	$ 32 559	$17 883	$ 50 442
Fixed support costs	79 268	28 890	108 158
Total allocation	$111 827	$46 773	$158 600

3.33 Total cost under alternative allocation bases; special order price
Danish Hospital recently installed a RAP Scanner, which is a diagnostic tool used both in suspected cancer cases and for detecting certain birth defects while the foetus is still in the womb. The scanner is leased for $5000 per month, and a full-time operator is paid $3000 per month. Data concerning use of the scanner for a typical month follow.

	Cancer detection	Birth defect detection
Revenue per scan	$600	$400
Direct costs per scan	$100	$50
Minutes required per scan	30	10
Number of scans performed	20	40

The direct costs consist primarily of supplies that are consumed in the scanning process. Currently, less than 20 per cent of the machine's capacity is used.

Required
The following questions will help you analyse the information for this problem.
(a) If the lease cost and the operator salary are allocated on the basis of minutes on the scanner, what is the total cost of a cancer scan?
(b) Suppose the cancer scans are experimental. Rather than charging $600 per scan, the hospital costs are reimbursed under a national contract. The contract will reimburse direct costs as well as an allocated share of the lease cost and operator's salary. As an allocation base, the contract allows either the number of scans or total minutes on the machine. What is the maximum reimbursable cost per cancer scan?
(c) The hospital is bidding on a government contract to supply birth defect scans to indigent pregnant women. The hospital would provide up to 14 scans a month for a fixed fee per scan. Assuming the hospital does not want to lose money on this contract, what is the minimum acceptable fee? Explain how you decided which costs are relevant.
(d) Identify uncertainties about which costs should be included in bidding for the contract described in part (c).
(e) Discuss the pros and cons of using total allocated costs, including administrative overhead, in bidding for the contract described in part (c).
(f) Suppose the hospital is bidding on the contract described in part (c). You have been asked to prepare a report of the hospital's expected costs for the contract. Write a memo to the chief accountant recommending the costs you think should be included in the expected costs. Attach to the memo a schedule showing your computations. As appropriate, refer to the schedule in the memo.
(LO5)

(a) The fixed costs should be allocated based on total activity during the period, which in this case is a month. If minutes are used as an allocation base, this means that total minutes per month must first be estimated.

	Cancer	Birth Defects
Minutes per scan	30 min	10 min
Times number of scans per month	20 scans	40 scans
Total minutes per month	600 minutes	400 minutes
Percent of Combined Minutes	60%	40%

Using total minutes per month as the allocation base, the cost allocations and cost per scan are calculated as follows:

	Cancer	Birth Defects
Lease	$3000	$2000
Operator salary	1800	1200
Total allocated cost	$4800	$3200
Divided by number of scans	20 scans	40 scans
Allocated cost per scan	$240	$ 80
Add direct costs per scan	100	50
Total assigned cost per scan	$340	$130

Note: Caution should be exercised in interpreting the $340 as 'the cost of a cancer scan'. It is the average cost, including allocated fixed costs. This cost does not represent the *incremental* cost of a cancer scan.

(b) Following is a comparison of the percent of costs that would be allocated to each type of scan under each of the allowed allocation bases:

	Cancer	Birth Defects
Number of scans	20 (33%)	40 (67%)
Minutes	600 (60%)	400 (40%)

The percent of costs allocated to cancer scans would be higher using minutes as an allocation base (60% of allocated costs, compared to only 33% using number of scans). Thus, the maximum reimbursement would be achieved using minutes as the allocation base. As computed in part A, this means that the maximum reimbursement would be $340 per scan.

(c) Since there is ample idle capacity, the total amount of fixed costs would probably not be affected if the hospital receives the contract. The direct costs are primarily for supplies that are consumed with each scan, so these costs are probably variable. The relevant costs for this decision are the costs that Danish would charge under the contract. In this situation, incremental costs consist only of the direct costs. As long as the fee at least covers the direct cost per scan of **$50**, the hospital is not expected to lose money and more patients will be served.

(d)   The minimum acceptable fixed fee is the fee that would cover the hospital's incremental costs, as discussed in Part C. The calculation in Part C assumed that no fixed costs would change based on the government contract. However, the hospital managers cannot be certain that fixed costs would be unaffected by the contract. For example, demand for the machine is uncertain. More paying patients might need the machine, leading to a capacity constraint. In that case, the contract would cause the hospital to forego providing services to other patients (an opportunity cost). Even if no capacity constraint occurs, the hospital managers might want the government contract to cover some of its fixed costs. In that case, the managers would need to decide which fixed costs to include in the bid calculations. They cannot be certain which fixed costs to include because the inclusion of more costs would increase the bid price and reduce the likelihood of obtaining the contract.

(e)   Possible arguments to discuss in favour of using total allocated costs:
   • The organisation calculates them for other reports, so the information is readily available.
   • Because the information is available, the cost of providing reports for the state will be low if the hospital wins the contract.
   • By incorporating overhead costs into the bid, the hospital can recover some of those costs.
   • This cost measure approximates the complete cost of providing scan services, at the predicted volume levels
   • It is not fair to require other hospital services to pay for support that is necessary for the scan services.
   Possible arguments against using total allocated costs:
   • It is not necessary to cover all costs; support costs such as administration are covered by the hospital's primary activities
   • Part of the hospital's mission is to serve indigent individuals; it is unfair to use a cost measure that might reduce the availability of services to those in need.
   • The hospital might lose the contract if it uses total allocated costs; another hospital could submit a lower cost bid.
   • The total allocated cost changes as volumes change. If the number of indigent patients varies widely from period to period, this cost can underestimate or overestimate the hospital's actual costs by large amounts. Factors such as economic changes and occasional flu epidemics that are worse than usual will affect volumes of indigent patients using services.

(f)   This is an open-ended problem, so there is no single solution. It is possible to reasonably argue for several different types of cost to be included or excluded. The best solutions to this question provide: (1) a clear recommendation for the cost report, (2) reasonable arguments for the recommendation, (3) evidence of having considered multiple cost measures, (4) evidence of having considered major issues, and (5) support for the hospital's interests while also considering interests of other stakeholders, such as the state, taxpayers, and service recipients. In addition, the memo should follow proper formatting and conventions. It should be concise, but at the same time provide sufficient information for the reader to evaluate the quality of the recommendation and to draw his or her own conclusions. In this scenario, the memo can use technical

accounting jargon because the hypothetical reader is the head of the accounting department. However, if the memo were written to a non-accountant, technical jargon should be avoided.

3.34 Step-down method; multiple versus single pool allocations; manager incentives.

The Gleason Company, a division of a large international company, has prepared estimated costs for next year that can be traced to each department as follows.

Building and grounds	$41 010
Factory administration	78 270
Cafeteria — operating loss	4 920
Machining	104 100
Assembly	146 700
Total	$375 000

Management would like to know the estimated total allocated product cost per unit. These costs will be used as a benchmark for future period operations. The following information is available and can be used as possible allocation bases. The difference between direct labour hours and total labour hours represents hours of supervisory labour or labour hours that are used indirectly for manufacturing. The cost of these hours in machining and assembly is part of manufacturing overhead.

Department	Direct labour hours	Number of employees	Square metres	Total labour hours	Number of purchase orders
Factory administration		2	500		500
Cafeteria	1 000	2	1 000	1 000	4 000
Machining	3 000	4	500	8 000	2 000
Assembly	6 000	5	5 000	10 000	1 000
Total	10 000	13	7 000	19 000	7 500

Required
(a) Allocate the building and grounds costs to all other departments using square metres. Add the allocated costs to direct costs to arrive at the total costs assigned to each department.
(b) Explain whether each remaining department is a support or operating department.
(c) Select a reasonable allocation base for the costs of each support department. Justify your choices.
(d) Compute allocated overhead costs for each operating department. Given the allocation bases you selected in part (b), allocate support department costs to each operating department using the step-down method. Then calculate an overhead rate per direct labour hour for each operating department.
(e) Calculate overhead rates for the operating departments assuming that Gleason uses an average, plant-wide factory overhead allocation rate based on direct labour hours. That is, aggregate the support department overhead costs into one cost pool and use direct labour hours as the allocation base to determine the overhead rate per direct labour hour.
(f) What causes the difference between the rates you calculated in parts (d) and (e)?
(g) Assume that factory administration costs are allocated based on

         total labour hours and that the total allocated cost is used to charge other departments for administrative services. List one advantage and one disadvantage of this charge system.

(h)   **Suppose that you are the manager of the machining department at Gleason. You can outsource some of your department's work. Outsourcing would reduce direct labour hours and, therefore, reduce the amount of overhead allocated to your department. What factors should you consider in deciding whether to outsource?**

(i)   **Now suppose that you are the director of finance for Gleason. The manager of the machining department has decided to outsource some tasks. When you analyse the current period results, you notice that while direct labour costs decreased in machining, outsourcing costs are slightly higher this period than the prior period's direct labour costs. When you ask the manager about these costs, he replies that the outsourcing does cost more than using direct labour, but because the amount of overhead for the department decreases, it is more profitable. What happened to the overhead that is no longer allocated to machining? Is the manager's decision beneficial to Gleason Company as a whole? Explain.**

    (LO6)

(a)   Building and grounds costs are most often allocated based on square feet. None of the other potential allocation bases relate to the services provided by building and grounds. The proportion of square feet used by each department is as follows:

	Administration	Cafeteria	Machining	Assembly	Total
Square feet	500	1,000	3,500	5,000	10,000
Percent	5%	10%	35%	50%	100%
Direct Costs	$78,270	$4,920	$104,100	$146,700	$333,990
Allocation:					
Building and grounds	2,051	4,101	14,353	20,505	41,010
Total Assigned Costs	$80,321	$9,021	$118,453	$167,205	$375,000

(b)   Administration provides services to other departments, making it a support department. Cafeteria provides meals for the employees, so it is a support department. Products are machined and assembled in Machining and Assembly. Because these products are then sold, these departments are considered operating departments.

(c)   The support departments consist of Factory Administration and the Cafeteria, so this question requires selection and justification of an allocation base for the costs of each of these departments. This is an open-ended question; there is no single answer. The best solutions would evaluate the likelihood that a given allocation base would adequately differentiate between the service resources used by the other departments. This means that reasonable judgment needs to be applied in evaluating how well the various allocation base options would correlate with the use of service resources. Following are examples of reasonable arguments for each of the support departments:

Allocation Base for Factory Administration: The services of Factory Administration relate to running the factory operations. Square feet might be a reasonable choice if administrative services are driven by the physical space a department occupies. However, this is unlikely. The number of purchase orders might be a reasonable choice if administrative services are driven by responsibility for departmental costs, which may be related to the effort involved in purchasing and paying for supplies. Using this same line of reasoning, the dollar amount of direct or assigned costs in each department might be appropriate as an allocation base. Direct labour hours, total labour hours, or number of employees are reasonable choices if administrative services tend to be driven by the management of employees. For Gleason, insufficient information is available about the types of activities that are most closely related to administration services. However, the management of employees is often the primary administrative service in a factory, and number of employees is likely to be representative of this effort. Therefore, the solution in Part D uses number of employees as the allocation base.

Allocation Base for Cafeteria: The services of the Cafeteria relate to providing meals for employees. Because of this, a measure of employees (number or hours) would be the best choice. Because each employee would probably eat one or two meals a day, regardless of hours worked, hours may not reflect the use of meals as well as number of employees. In the following computations, the number of employees is used as the allocation base.

(d) In this part, students are NOT asked to calculate total allocated costs. Instead, they are asked to calculate the amount of overhead costs allocated to each operating department using the step-down method and then to compute an overhead rate per direct labour hour. For this reason, the calculations shown below do not include the operating department direct costs.

Although the number of employees is used to allocate the costs for both support departments, the percentages are different because (1) the total volume of the allocation base does not include the volume of the support department being allocated, and (2) under the step-down method the total volume of the allocation base used in the second step excludes the volume of the support department that was allocated in the first step.

	Support Departments		Operating Departments		
	Administration	Cafeteria	Machining	Assembly	Total
Number of employees:					
For administration allocation		2	4	5	11
		18.1818%	36.3636%	45.4546%	100%
For cafeteria allocation			4	5	9
		10%	44.4444%	55.5556%	100%
Support Costs (Part A)	$ 80,321	$ 9,021			$89,342
Allocations:					
Step 1: Administration	(80,321)	14,604	$29,208	$36,509	0
Step 2: Cafeteria		(23,625)	10,500	13,125	0
Allocated Overhead Costs	$ 0	$ 0	$39,708	$49,634	$89,342
Divide by direct labour hours			3,000	6,000	
Overhead rate per hour			$13.236	$8.272	

(e) Calculate the plant-wide overhead rate by dividing total overhead costs by total direct labour hours as follows:

Total overhead costs (Part B) / Total operating department direct labour hours

= $89 342 / (3000 + 6000)

= $9.927

(f) When the step-down method is used, half of the support department interactions are reflected. Because assembly uses more direct labour hours than machining, it receives more overhead cost when direct labour hours are used in a plant-wide, single cost pool. Therefore, it receives more cost than if the services of departments are allocated based on use of the services. The opposite is true for the machining department; it receives less cost under a plant-wide allocation rate than when support costs are allocated based on services used. The step-down method more accurately reflects the use of resources.

(g) An advantage of this method is that it is easy to calculate and understand. A disadvantage is that the cost per labour hour is likely to be high because it includes fixed costs that do not change with the number of employees or hours worked. High charges could lead other departments to consider reducing the number of employees in the department by outsourcing some service or product when it may not be cost effective to outsource. Another disadvantage is that the allocation does not attempt to match the flow of resources to products, so some products will appear to be subsidising other products because overhead resources used by all products is aggregated into only one pool.

(h) The machining department manager would consider the cost of outsourcing versus the cost of using direct labour. Quality could also be a factor. In addition, the manager would want to know how department performance would appear to change as a result of outsourcing. If the manager receives a bonus based on the department's performance (including allocated costs) and is able to offload part of the overhead allocation by reducing use of labour hours, then he/she would have a greater incentive to outsource.

(i) The Director of Finance would be unhappy with the decision to outsource. The overhead that is not allocated to machining is spread among other departments, so the overhead allocations to other departments increase. Because the machining manager's decision increases incremental costs and does not reduce any of the overhead costs, it increases total cost and is suboptimal for the company as a whole.

3.35 **Cost allocation; behavioural issues**
In recent years, slow response times and frequent repairs have plagued Jetson Engineering's computer system. The cause was a substantial increase in computer-aided design work that pushed the system beyond its intended capacity. Bob Wilson, the production manager, decided that a new computer should be acquired to absorb some of the additional work. Surprisingly, six months after installing the new computer, he noticed that many of the engineers continued to use the old computer system, even though the new system had excess capacity and several features that simplified programming.

Bob discussed the situation with the supervisors of the entity's six design teams. They explained that the finance director's office allocates the cost of each computer to their work, based on the number of hours they use the computer. One responded, 'Look, the old computer didn't cost much and it's highly utilised — even the accounting department uses that machine. When the cost per hour of use is calculated, it's very low. The new machine, on the other hand, cost a lot of money, and in the first couple of months we didn't use it much because it takes time to learn a new system. I was shocked when I saw how high my charges were for using the new machine. Because the cost is high and use is low, the cost per hour charged to my work was incredible. I'll tell you something: next month we'll probably use the new computer even less. Our job performance doesn't look very good when our jobs cost a fortune to complete because of huge allocations of computer cost.'

'What a mess,' Bob sighed. 'Even though the new computer is bought and paid for and has plenty of capacity, the engineers aren't using it. Don't they realise that most of the computer costs are fixed costs? Using the new computer for 200 hours a month doesn't really cost the company much more than using it for 20 hours a month.'

Required
Recommend a change in the allocation system at Jetson that will change the behaviour of the design teams.
(LO7)

The new computer system was purchased to absorb extra computer-aided design work. This should lead to jobs being undertaken more efficiently, and not lead to a backlog of jobs due to the inability of the design team members to access the technology.

However, we can see from the information in the question that the improved efficiency may not be realised as the new computer is underutilised. This lack of use is not due to the inability of the computer to assist the design team members, but rather due to the consequences of the current cost allocation system. The design team members consider that jobs are been over-costed with the current allocation system.
Jetson Engineering have implemented an internal charging system, in that individual departments are allocated costs for the use of central resources in this instance the computer system. The cost driver chosen is the number of hours of use. This is a

volume based driver which would lead to a higher allocation to those jobs which make more use of the new computer. This has led to a disincentive to use the machine as higher costs are allocated. One reason behind the higher cost would be due to the depreciation charge, which would obviously be higher for a newer rather than older asset.

It is in the interests of Jetson Engineering to encourage the use of the new computer – this will lead to higher productivity and efficiency.

Bob's comment about the total cost of the computer being fixed is correct, however, from the design team's perspective it is viewed as a variable cost as it is being allocated based on its use.

Possible changes to the allocation system could be:
1. Consider the cost as a facility level cost and not allocate to individual design teams.
2. Allocate it to all design teams evenly so that no one team is being penalised.

3.36 Internet activity
Go to the website of the Nokia Group (www.company.nokia.com). Write a brief report to the managing director advising how cost allocation can assist the entity.
(LO7)

Internet activity – ask students to present their findings.

3.37 **Comprehensive problem; dual versus single rates; purpose of allocation**
Vines Company is a manufacturer of women's and men's swimsuits. The company uses a dual-rate system to allocate support costs. Last year's support departments' fixed and variable costs are as follows.

	Accounting	Human resources	Maintenance	Total
Variable costs	$18 420	$ 22 104	$ 60 360	$100 884
Fixed costs	55 260	100 696	60 360	216 316
Total cost	$73 680	$122 800	$120 720	$317 200

Allocation base amounts for all of the departments are:

	Accounting	Human resources	Maintenance	Women's	Men's	Total
Employees	2	2	4	10	6	24
Time spent for accounting	15%	10%	20%	30%	25%	100%
Time spent cleaning	5%	10%	15%	30%	40%	100%
Square metres	800	1 000	1 200	5 000	5 000	13 000
Direct costs	$73 680	$122 800	$120 720	$800 000	$500 000	$1 617 200

Required
(a) Use the following allocation bases for fixed support costs: direct costs for accounting, number of employees for human resources, and squares for maintenance.
  (i) Allocate fixed support costs using the direct method.
  (ii) Allocate fixed support costs using the step-down method.
  (iii) Allocate fixed support costs using the reciprocal method.
(b) Use the following allocation bases for variable support costs: time spent for accounting, number of employees for human resources, and time spent for maintenance.
  (i) Allocate variable support costs using the direct method.
  (ii) Allocate variable support costs using the step-down method.
  (iii) Allocate variable support costs using the reciprocal method.
(c) Suppose support costs were not broken down into fixed and variable cost pools. What allocation base would you use to allocate the costs for each support department? Explain.
(d) Describe several possible reasons why the managers of Vines Company allocate support costs to operating departments.
(e) Discuss whether a dual-rate support cost allocation system is likely to be better for Vines Company than a single-rate system.
(LO6)

(a) Below are excerpts from the sample spreadsheet for this problem, which show the direct, step-down, and reciprocal method allocations of fixed support costs. The reciprocal method allocations were performed using Excel Solver.

1. Direct method

Solver for Variable Costs:						
	AccountF	**HRF**	**Maintenance F**			
Change cells for Solver	$71,471	$113,723	$86,627			
Simultaneous equations	$71,471	$113,723	$86,627			
Target function:						
$271,822						
Fixed support costs	$55,260	$100,696	$60,360			$216,316
Allocations:						
Accounting	-71,471	5,686	5,590	37,043	23,152	0
Human resources	10,338	-113,723	20,677	51,692	31,015	0
Janitorial	5,873	7,341	-86,627	36,706	36,706	0
Total allocations	($0)	($0)	$0	$125,442	$90,874	$216,316

2. Step down method

Solver for Variable Costs:						
	AccountF	**HRF**	**Maintenance F**			
Change cells for Solver	$71,471	$113,723	$86,627			
Simultaneous equations	$71,471	$113,723	$86,627			
Target function:						
$271,822						
Fixed support costs	$55,260	$100,696	$60,360			$216,316
Allocations:						
Accounting	-71,471	5,686	5,590	37,043	23,152	0
Human resources	10,338	-113,723	20,677	51,692	31,015	0
Maintenance	5,873	7,341	-86,627	36,706	36,706	0
Total allocations	($0)	($0)	$0	$125,442	$90,874	$216,316

3. Reciprocal method

RECIPROCAL METHOD ALLOCATION--FIXED SUPPORT COSTS						
		Support Departments		Operating Departments		
	Accounting	Human Resources	Maintenance	Women's	Men's	Total
Allocation bases for reciprocal method fixed support cost allocation:						
Direct costs		$122,800	$120,720	$800,000	$500,000	$1,543,520
% for allocation		7.9558%	7.8211%	51.8296%	32.3935%	100%
Employees	2		4	10	6	22
% for allocation	9.0909%		18.1818%	45.4545%	27.2727%	100%
Square feet	800	1,000		5,000	5,000	11,800
% for allocation	6.7797%	8.4746%		42.3729%	42.3729%	100%
Solver for Variable Costs:						
	AccountF	**HRF**	**MaintenanceF**			
Change cells for Solver	$71,471	$113,723	$86,627			
Simultaneous equations	$71,471	$113,723	$86,627			
Target function:						
$271,822						
Fixed support costs	$55,260	$100,696	$60,360			$216,316
Allocations:						
Accounting	-71,471	5,686	5,590	37,043	23,152	0
Human resources	10,338	-113,723	20,677	51,692	31,015	0
Maintainenance	5,873	7,341	-86,627	36,706	36,706	0
Total allocations	($0)	($0)	$0	$125,442	$90,874	$216,316

(b) Below are excerpts from the sample spreadsheet for this problem, which show the direct, step-down, and reciprocal method allocations of variable support costs. The reciprocal method allocations were performed using Excel Solver.

1. Direct method

Target function:						
$131,954						
Variable support costs	$18,420	$22,104	$60,360			$100,884
Allocations:						
Accounting	-25,748	3,029	6,058	9,087	7,573	0
Human resources	3,061	-33,667	6,121	15,303	9,182	0
Maintenance	4,267	8,534	-72,540	25,602	34,136	0
Total allocations	$0	$0	$0	$49,993	$50,891	$100,884

2. Step-down method

Problem 8.33: Vines Company						
		Support Departments		Operating Departments		
	Accounting	Human Resources	Maintenenance	Women's	Men's	Total
Variable support costs	$18,420	$22,104	$60,360			$100,884
Fixed support costs	$55,260	$100,696	$60,360			$216,316
Total direct costs	$73,680	$122,800	$120,720	$800,000	$500,000	$1,617,200
Potential allocation bases:						
Employees	2	2	4	10	6	24
Time spent accounting	15%	10%	20%	30%	25%	100%
Time spent cleaning	5%	10%	15%	30%	40%	100%
Square feet	800	1,000	1,200	5,000	5,000	13,000
DIRECT METHOD ALLOCATION--VARIABLE SUPPORT COSTS						

3. Reciprocal method

	Support Departments			Operating Departments		
	Accounting	Human Resources	Maintenance	Women's	Men's	Total
Allocation bases for step-down method variable support cost allocation:						
Step 1: Time spent cleaning	5%	10%		30%	40%	85%
% for allocation	5.8824%	11.7647%		35.2941%	47.0588%	100%
Step 2: Employees	2			10	6	18
% for allocation	11.1111%			55.5556%	33.3333%	100%
Step 3: Time spent accounting				30%	25%	55%
% for allocation				54.5455%	45.4545%	100%
Variable support costs	$18,420	$22,104	$60,360			$100,884
Allocations:						
Step 1: Janitorial	3,551	7,101	-60,360	21,304	28,405	0
Step 2: Human resources	3,245	-29,205	0	16,225	9,735	0
Step 3: Accounting	-25,216	0	0	13,754	11,462	25,216
Total allocations	$0	$0	$0	$51,283	$49,601	$100,884
RECIPROCAL METHOD ALLOCATION--VARIABLE SUPPORT COSTS						
	Support Departments			Operating Departments		
	Accounting	Human Resources	Maintenance	Women's	Men's	Total
Allocation bases for reciprocal method variable support cost allocation:						
Time spent accounting		10%	20%	30%	25%	85%
% for allocation		11.7647%	23.5294%	35.2941%	29.4118%	100%
Employees	2		4	10	6	22
% for allocation	9.0909%		18.1818%	45.4545%	27.2727%	100%
Time spent cleaning	5%	10%		30%	40%	85%

(c)   For accounting I would use time spent because it probably reflects the use of accounting employees and their salaries would be a large part of the fixed costs. Number of employees is already used for both fixed and variable costs, so I would continue to use it. Time spent in maintenance services probably provides a more accurate reflection of the resources used by each department for maintenance staff, and it's likely as they spend more time in an area they also use more supplies.

(d)   Managers may want to use this information for benchmarks to compare current performance to past performance. It's possible that they use these calculations to develop a transfer price policy for the use of support services.

(e)   If Vines is using this information for transfer prices, the variable portion is probably a better reflection of the marginal costs to the company of providing support services. These categories also give more precise information for benchmarks. It would be easier to investigate variances if cost pools are smaller and reflect only fixed or variable costs.

3.38 **Costing, service sector**
Hawk and Eagle Co., a law firm, had the following costs last year:

Direct professional labour	$15 000 000
Overhead	21 000 000
Total costs	$36 000 000

The following costs were included in overhead:

Fringe benefits for direct professional labour	$ 5 000 000
Paralegal costs	2 700 000
Telephone call time with clients (estimated but not tabulated)	600 000
Computer time	1 800 000
Photocopying	900 000
Total overhead	$11 000 000

The firm recently improved its ability to document and trace costs to individual cases. Revised bookkeeping procedures now allow the firm to trace fringe benefit costs for direct professional labour, paralegal costs, telephone charges, computer time, and photocopying costs to each case individually. The managing partner needs to decide whether more costs than just direct professional labour should be traced directly to jobs to allow the firm to better justify billings to clients.

During the last year, more costs were traced to client engagements. Two of the case records showed the following.

	Client cases	
	875	876
Direct professional labour	$20 000	$20 000
Fringe benefits for direct labour	3 000	3 000
Secretarial costs	2 000	6 000
Telephone call time with clients	1 000	2 000
Computer time	2 000	4 000
Photocopying	1 000	2 000
Total costs	$29 000	$37 000

Three methods are being considered for allocating overhead this year:
- **Method 1: Allocate overhead based on direct professional labour cost. Calculate the allocation rate using last year's direct professional labour costs of $15 million and overhead costs of $21 million.**
- **Method 2: Allocate overhead based on direct professional labour cost. Calculate the allocation rate using last year's direct professional labour costs of $15 million and overhead costs of $10 million ($21 million less $11 million in direct costs that are traced this year).**
- **Method 3: Allocate the $10 million overhead based on total direct costs. Calculate the allocation rate using last year's direct costs (professional labour of $15 million plus other direct costs of $11**

million).

Required
a. **Calculate the overhead allocation rate for method 1.**
b. **Calculate the overhead allocation rate for method 2.**
c. **Calculate the overhead allocation rate for method 3.**
d. **Using each of the three rates computed in parts (a), (b), and (c), calculate the total costs of cases 875 and 876.**
e. **Explain why the total costs allocated to cases 875 and 876 are not the same under the three methods.**
f. **Explain why method 1 would be inappropriate.**
g. **Would method 2 or method 3 be better? Explain.**
h. **Explain how job costing in a service business is different from job costing in a manufacturing business.**
(LO5)

(a)   Last year's costs:

Direct professional labour	$15 000 000
Overhead costs (all other costs)	21 000 000
Total costs	$36 000 000

Overhead rate ($21 000 000/$15 000 000) 140% of direct professional labour cost

(b)   Last year's costs:

Direct costs:	
Direct professional labour	$15 000 000
Other direct costs	11 000 000
Total direct costs	26 000 000
Overhead costs (remaining costs)	10 000 000
Total costs	$36 000 000

Overhead rate ($10 000 000/$15 000 000) 67% of direct professional labour cost

(c)   Last year's costs:

Direct costs:	
Direct professional labour	$15 000 000
Other direct costs	11 000 000
Total direct costs	26 000 000
Overhead costs (remaining costs)	10 000 000
Total costs	$36 000 000

Overhead rate ($10 000 000/$26 000 000) 38.5% of total direct costs

(d) Calculation of overhead allocated under three methods:

	Case 875	Case 876
Method 1: Direct professional labour * 140%		
$20 000 * 140%	$28 000	$28 000
Method 2: Direct professional labour * 67%		
$20 000 * 67%	$13 400	$13 400
Method 3: Total direct costs * 38.5%		
Case 875: $29 000 * 38.5%	$11 165	
Case 876: $37 000 * 38.5%		$14 245

Total costs under alternative allocation methods:

	Method 1	Method 2	Method 3
Case # 875:			
Direct costs	$20 000	$29 000	$29 000
Allocated overhead	28 000	13 400	11 165
Total job costs	48 000	42 400	40 165
Case # 876:			
Direct costs	20 000	37 000	37 000
Allocated overhead	28 000	13 400	14 245
Total job costs	48 000	50 400	51 245
Total costs assigned	$96 000	$92 800	$91 410

(e) The allocation base is different for all three methods. In Method 1, only direct professional labour costs are used as allocation base and no direct costs were traced to jobs, so $21 million had to be allocated. This method has the highest overhead rate (140% of direct professional labour cost). None of the specific costs are traced to jobs. Therefore, the use of actual resources is not reflected other than the use of direct professional labour.

In Method 2, $11 million in cost was traced directly to jobs, so only $10 million had to be allocated. Direct professional labour is the allocation base, but because the amount of common costs is less than half, the allocation rate is less than half (67% of direct professional labour cost).

In Method 3, labour is combined with the direct costs (professional labour and all other direct costs) and this sum is used as the allocation base ($26 million). Divide the common overhead costs ($10 million) by the total direct costs ($26 million) to develop the allocation rate which is the lowest of all three (38.5% of total direct costs).

(f) Method 1 would allocate overhead based on last year's overhead costs, which included $11 million in costs that this year are traced as direct costs. It would be inappropriate to use Method 1 for allocating overhead costs this year because the method would significantly overestimate overhead costs.

(g)   Method 2 separated out these direct costs and then allocated the overhead based only on the direct labour costs. This method gives more accurate costs than not separating the other direct costs from overhead. This method is still not the best, however, because in cases with equal direct labour cost but different direct costs, the overhead allocated to each job would be the same amount. Method 3 solves this problem by separating costs into three pools: direct professional labour, other direct costs, and overhead. The overhead is then allocated based on total direct costs (direct labour plus other direct costs). This method is the best option for allocating overhead and should be used to give law firm managers and clients an accurate breakdown of costs per case.

(h)   Most service industry organisations do not have as many direct materials to trace, although supplies and other materials used might be traced to each job, depending on the service. Professional labour or some measure of direct costs is used as an allocation base. Service organisations or industries rarely use machines, so machine hours are not usually used as an allocation base. Direct professional labour is often traced to each job, and the overhead in a service industry can include most of the support service costs such as accounting, receptionists, and so on.

3.39 **Allocating variable and fixed overhead in the service sector**
Prime Personal Trainers is a personal training service in Bankstown for people who want to work out at home. Prime offers two different types of services: Setup and Continuous Improvement. Setup services consist of several home visits by a personal trainer who specialises in determining the proper equipment for each client and helping the client set up a home gym. Continuous Improvement services provide daily, weekly, or biweekly home visits by trainers.

Prime's accountant wants to create a job costing system for Setup services. She decides to use direct labour cost as the allocation base for variable overhead costs, and direct labour hours for fixed overhead cost. To estimate normal capacity, she calculates the average direct labour cost over the last several years. She estimates overhead by updating last year's overhead cost with expected increases in rent, supervisor's salaries, and so on. Following are her estimates (given in euros) for the current period.

Direct labour hours (based on 250 normal hours per month)	3 000
Direct labour cost	$ 75 000
Indirect labour cost	25 000
Variable overhead (primarily fringe benefits)	150 000
Fixed overhead (office related costs)	120 000

Inventories consist of exercise equipment and supplies that are used by Prime for new clients. The following information summarises operations during the month of October.

A number of new jobs were begun in October, but only two jobs were completed: job 20 and job 22.

Account balances on October 1:

Equipment and supplies (raw materials)	$5 000
Client contracts in process (job 20)	3 500
Client contracts in process (job 22)	1 500

Purchases of equipment and supplies:

Equipment	$54 000
Supplies	500
Total	$54 500

Equipment and supplies requisitioned for clients:

Job 20	$ 1 000
Job 21	500
Job 22	4 000
Job 23	5 000
Other jobs	40 000
Indirect supplies	500
Total	$51 000

Direct labour hours and cost:

	Hours	Cost
Job 20	10	$ 250
Job 21	18	450
Job 22	15	375
Job 23	6	150
Other clients	180	4 500
Total	229	$5 725

Labour costs:

Direct labour wages	$ 5 725
Indirect labour wages (160 hours)	1 920
Manager's salary	6 250
Total	$13 895

Office costs:

Rent	$1 000
Utilities	100
Insurance and taxes	900
Miscellaneous	1 000
Total	$3 000

Required
(a) What are the estimated allocation rates for fixed and variable overhead for the current period?
(b) What is the total overhead cost allocated to Job 20 in October?
(c) What is the total cost of job 20?
(d) Calculate the amounts of fixed and variable overhead allocated to jobs in October.
(e) Why would the accountant choose to use two cost pools instead of one? Will this method make a difference in client bills when the job includes more equipment and less labour than other jobs?
(LO5)

(a) Set-up overhead estimated allocation rates
Variable rate = Variable overhead costs/Direct labour costs
= €150 000/€75 000
= 200% of direct labour costs

Fixed rate = Fixed overhead costs/Normal direct labour hours
= €120 000/3000 hours
= €40 per direct labour hour

(b) Overhead allocated to Job 20 during October:

Variable overhead (€250 * 200%)	€500
Fixed overhead (10 hours * €40)	400
Total	€900

(c)   Total cost of Job 20:

Costs during October:

Equipment and supplies	€1000
Direct labour cost	250
Variable overhead allocated	500
Fixed overhead allocated	400
Subtotal	2150
Beginning work in process	3500
Total cost for Job 20	€5650

(d)   Amount of fixed overhead allocated to jobs in October:

229 direct labour hours * €40 fixed overhead allocation rate per DL hour = €9160

Amount of variable overhead allocated to jobs in October:

€5725 direct labour costs * 200% variable overhead allocation rate = €11 450

(e)   Because some of the overhead varies with labour hours used, separating costs into two pools will better reflect the flow of variable overhead resources. When variable and fixed overhead costs are lumped into one pool, jobs that include more equipment and less labour would receive more cost under the single pool method than under the dual rate method.