

Cost assignment

Solutions to Chapter 3 questions

- (a) For the answer to this question see 'Budgeted overhead rates' in Chapter 3.
- (b) A lower production overhead rate does not necessarily indicate that factory X is more efficient than factory Y. The reasons for this are:
- Factory Y's operations might be highly mechanized, resulting in large depreciation costs, whereas factory X's operations might be labour-intensive. Consequently products produced in factory Y will incur higher overhead and lower labour costs, whereas products produced in factory X will incur lower overhead and higher labour costs.
 - Factory Y may have invested in plant with a larger operating capacity in order to meet future output. This will result in larger fixed costs and a higher overhead rate.
 - Both factories may use different denominators in calculating the overhead rates. For example, if factory Y uses normal capacity and factory X uses maximum practical capacity then factory Y will have a higher overhead rate.
 - Current budgeted activity might be used by both firms to calculate the overhead rate. The level of budgeted sales will determine budgeted activity. The lower overhead rate of factory X might be due to a higher sales volume rather than efficient factory operations.
 - Different cost classification might result in different overhead rates. Factory X might treat all expenditure as a direct cost wherever possible. For example, employers' costs might be charged out by means of an inflated hourly wage rate. Factory Y may treat such items as overhead costs.

Solution IM 3.1

See answer to Question 3.22 in the text for the answer to this question.

Solution IM 3.2

- (a) For the answer to this question see 'Blanket overhead rates' in Chapter 3.
- (b) For the answer to this question see Learning Note 3.1 on the open access website.

Solution IM 3.3

(a)

	Production department			Service department	Total
	A (£)	B (£)	C (£)	(£)	(£)
Direct	261 745	226 120	93 890	53 305	635 060
Indirect	135 400 (40%)	118 475 (35%)	67 700 (20%)	16 925 (5%)	338 500
Service dept appointment	23 410 ($\frac{1}{3}$)	23 410 ($\frac{1}{3}$)	23 410 ($\frac{1}{3}$)	(70 230)	
	<u>420 555</u>	<u>368 005</u>	<u>185 000</u>	<u>—</u>	<u>973 560</u>
Allocation base (1)	17 760 =£23.68 per direct labour hour	5 760 =£63.89 per m/c hour	148 000 =£1.25 per hour		

Solution IM 3.4

Note:

1. Dept. A direct labour hours
 $= 10 \times 37 \times 48$
 $= 17\,760$
- Dept. B machine hours
 $= 5 \times 24 \times 48$
 $= 5\,760$
- Dept. C units
 $= 148\,000$

(b)	Dept A	£	
	9 direct labour hours at £23.68		213.12
	Dept B		
	3 m/c hours at £63.89		191.67
	Dept C		
	100 units at £1.25		125.00
			529.79

Cost per unit = £5.30 (£529.79/100)

Solution IM 3.5

(a) *Overhead analysis sheet*

	Total (£)	Production			Service		
		Cutting (£)	Tents (£)	Bags (£)	Stores (£)	Canteen (£)	Maintenance (£)
Indirect wages	147 200	6 400	19 500	20 100	41 200	15 000	45 000
Consumable materials	54 600	5 300	4 100	2 300	—	18 700	24 200
Plant depreciation	84 200	31 200	17 500	24 600	2 500	3 400	5 000
Power ^a	31 700	5 389	12 046	10 144	951	2 536	634
Heat and light ^b	13 800	} 11 120	} 13 900	} 9 730	} 2 085	} 3 475	} 1 390
Rent and rates ^b	14 400						
Building insurance ^b	13 500						
	359 400	59 409	67 046	66 874	46 736	43 111	76 224
Reapportionment:							
Stores ^c	—	29 210	5 842	5 842	(46 736)	—	5 842
Canteen ^d	—	2 694	18 476	21 941	—	(43 111)	—
Maintenance ^e	—	1 887	37 731	42 448	—	—	(82 066)
	359 400	93 200	129 095	137 105			
Machine hours	87 000	2 000	40 000	45 000			
Labour hours	112 000	7 000	48 000	57 000			
Machine hour rate		£46.60	£3.23	£3.05			
Overheads per labour hour		£13.31	£2.69	£2.41			

Notes

Bases of apportionment: ^a estimated power usage; ^b area; ^c value of issues; ^d direct labour hours; ^e machine hours. Actual basis for other costs.

- (b) See section on budgeted overhead rates in Chapter 3 for the answer to this question. In addition the following points should be made:
- (i) It draws attention to the under/over recovery of overheads arising from changes in production levels.
 - (ii) There is difficulty in determining estimated overheads and an appropriate level of activity when calculating predetermined overhead rates.

Solution IM 3.7

(a) Predetermined machine hour rate = $\frac{\text{machine department overheads (£1 080 000)}}{\text{machine hours (80 000)}}$

Machining department = £13.50 per machine hour
 Hand finishing department = £760 000/120 000 labour hours
 = £6.33 per labour hour

(b) (i)	Machine department (£)		Hand finishing department (£)
Overhead incurred	84 500		67 100
Overhead absorbed	<u>81 000</u> (6000 × £13.50)		<u>60 800</u> (9600 × £6.33)
Under recovery of overheads	<u>3 500</u>		<u>6 300</u>

(ii) Overheads that are apportioned to cost centres tend to be on an arbitrary basis and are unlikely to be controllable by the cost centre manager. Managers should be held accountable for only those overheads that they can control. See 'Guidelines for applying the controllability principle' in Chapter 16 for a more detailed discussion of controllable and non-controllable costs.

(c) Absorption costing is used by companies to ensure that all products/services bear an equitable share of company overheads. Statement of Standard Accounting Practice 9 (Replaced by Financial Reporting Standard 102) requires that stocks should be valued at full production cost. Therefore absorption costing is required to allocate overheads to products in order to meet financial accounting requirements.

Solution IM 3.8

(a) In order to ascertain the actual overhead traced to the production departments, it is necessary to allocate the service department overheads to the filling and sealing departments:

	Filling (£)	Sealing (£)	Maintenance (£)	Canteen (£)
Allocated	74 260	38 115	25 050	24 375
Reallocation of:				
Canteen	14 625 (60%)	7 800 (32%)	1 950 (8%)	(24 375)
Maintenance	18 900 (70%)	7 290 (27%)	(27 000)	810 (3%)
Canteen	486 (60%)	259 (32%)	65 (8%)	(810)
Maintenance	<u>47 (70/97)</u>	<u>18 (27/97)</u>	<u>-</u>	<u>-</u>
	<u>108 318</u>	<u>53 482</u>		

Predetermined overhead rates:

	Filling (£)	Sealing (£)
Budgeted overheads	110 040	53 300
Budgeted direct labour hours	13 100	10 250
Direct labour hour overhead rate	8.40	5.20
Overhead incurred	108 318	53 482
Overhead allocated (£5.20)	107 688 (12 820 × £8.40)	52 390 (10 075 × 5.20)
(Under)/over recovery	(630)	(1 092)

- (b) The objectives of overhead apportionment and absorption are:
- (i) To meet the stock valuation and profit measurement requirements for financial accounting purposes. Financial accounting regulations in most countries require that all manufacturing overheads be traced to products for stock valuation purposes.
 - (ii) For various decisions, such as pricing decisions, management require estimates of the total product costs.
 - (iii) Overhead costs may be traced to different segments of the business, such as product groups or geographical regions, in order to assess the performance of each segment.

Overhead apportionment and absorption can be criticized on the following grounds:

- (i) The process includes many arbitrary apportionments and does not provide an accurate indication of the resources consumed by each product. In tracing overheads to products, the allocation procedure assumes that all overheads are related to volume. This is inappropriate for many fixed overheads, since they are fixed in the short term, and tend to be caused by factors other than volume, such as the diversity of the product range, number of set-ups and range of component parts which the firm stocks.
- (ii) Fixed overheads are sunk costs, and will tend not to change in the short term. Hence they are unaffected in the short term, irrespective of which decisions are taken. Arbitrary overhead allocations should not be used for decision-making purposes.
- (iii) Overhead allocations are normally undertaken for stock valuation purposes. The procedures are not intended to meet other requirements, such as decision-making and performance evaluation.
- (iv) Individuals should not be held accountable for costs which they cannot control. Arbitrary apportionment of overheads is therefore inappropriate for cost control and performance measurement purposes.

Solution IM 3.9

- (a) (i) An over-absorption of overheads occurs because the actual overhead charged to products (or clients) exceeds the overheads incurred. Therefore £747 360 (£742 600 actual overheads + £4760 over-absorption) were charged to clients during direct hours worked, the actual professional staff hours worked during the period were 99 648 (£747 360/£7.50 hourly overhead rate). Therefore budgeted professional staff hours = 98 288 (99 648 – 1360).

(ii) Budgeted overhead expenditure

$$= \text{Budgeted hours (98 288)} \times \text{Overhead rate (£7.50)}$$

$$= \text{£737 160}$$

- (b) To determine the overhead rate the senior staff hours should be weighted by a factor of 1.4 and the junior staff hours by a factor of 1.0:

$$\begin{array}{l} \text{Senior staff} = 21\,600 \times 1.4 = 30\,240 \\ \text{Junior staff} = 79\,300 \times 1.0 = 79\,300 \\ \hline 109\,540 \end{array}$$

Allocation of overheads:

$$\begin{array}{l} \text{Senior staff} = 30\,240/109\,540 \times \text{£784 000} = \text{£216 434} \\ \text{Junior staff} = 79\,300/109\,540 \times \text{£784 000} = \text{£567 566} \\ \hline \text{£784 000} \end{array}$$

Senior staff overhead allocation rate = £216 434/21 600
= £10.020 per hour
Junior staff overhead allocation rate = £567 566/79 300 hours
= £7.157 per hour

- (c) Presumably the senior staff consume a greater proportion of the overhead costs than the junior staff and the revised method is an attempt to reflect this difference in resource consumption. For example, senior staff are likely to require more office space and make greater demands on secretarial time, telephones, etc. The revised method creates two separate cost centres and overhead rates whereas the previous method used a single blanket rate for the whole organization.
- (d) See the section on under- and over-recovery of overheads in Chapter 3 for the answer to this question. Differences between overhead incurred and overhead absorbed may be due to:
- (1) differences between actual and budgeted expenditure;
 - (2) differences between actual and budgeted activity level.

Solution IM 3.10

- (i) With the step-wise method the costs of the first service department (Department G specified in the question) are reapportioned to the second department but return allocations are not made from the second department back to the first department.

	Production depts			Internal services	
	1	2		G	H
	(£000)	(£000)		(£000)	(£000)
Overheads	870	690	Costs	160	82
G apportioned	96 (60%)	48 (30%)		<u>-160</u>	<u>16 (10%)</u>
H apportioned	<u>61</u> (⁵⁰ / ₈₀)	<u>37</u> (³⁰ / ₈₀)			<u>98</u>
	<u>1027</u>	<u>775</u>			<u>-98</u>

- (ii) Let G = Service Department G overheads
Let H = Service Department H overheads

$$G = 160 + 0.2H$$

$$H = 82 + 0.1G$$

Rearranging the above equations

$$-0.2H + G = 160 \tag{1}$$

$$1H - 0.1G = 82 \tag{2}$$

Multiply equation (1) by 1 and equation (2) by 10

$$-0.2H + G = 160$$

$$10H - G = 820$$

Add the above equations together:

$$9.8H = 980$$

$$H = 100$$

Substituting for the value of H in equation (1)

$$-0.2(100) + G = 160$$

$$G = 180$$

Internal Services	Total (£000)	Production depts	
		1 (£000)	2 (£000)
G (180 × 90%)	162	$(\frac{6}{9})$ 108	$(\frac{3}{9})$ 54
H (100 × 80%)	80	$(\frac{3}{8})$ 50	$(\frac{3}{8})$ 30
	<u>242</u>	<u>158</u>	<u>84</u>
Overheads (given)		<u>870</u>	<u>690</u>
		<u>1028</u>	<u>774</u>

(iii) The simultaneous equation method will yield more accurate allocations because it takes into account the fact that service departments serve each other whereas the step-wise method ignores such reciprocal usage. The step-wise method involves simpler computations and, in this question, does not give a significantly different answer. However, the step-wise method may yield inaccurate results where service costs are high and there are more than two service departments with significantly different usage ratios between the departments.

(a)

	Overhead analysis (ignoring reciprocal allocations)				
	General factory overhead (£)	Service cost centres		Production cost centres	
		1 (£)	2 (£)	A (£)	B (£)
Primary allocation	210 000	93 800	38 600	182 800	124 800
Apportionment of general factory overhead ^a	<u>(210 000)</u>	<u>10 500</u>	<u>21 000</u>	<u>31 500</u>	<u>147 000</u>
	<u>—</u>	<u>104 300</u>	<u>59 600</u>	<u>214 300</u>	<u>271 800</u>
Charges by service cost centre 1 ^b		<u>(104 300)</u>	<u>—</u>	<u>91 262</u>	<u>13 038</u>
		<u>—</u>	<u>59 600</u>	<u>305 562</u>	<u>284 838</u>
Charges by service cost centre 2 ^c			<u>(59 600)</u>	<u>8 221</u>	<u>51 379</u>
			<u>—</u>	<u>£313 783</u>	<u>£336 217</u>
Budgeted direct labour hours				<u>120 000</u>	<u>20 000</u>
Absorption rates				<u>£2.61</u>	<u>£16.81</u>

Solution IM 3.11

Notes

^a General factory overhead is apportioned to service cost centres before reallocation to production centres as indicated in note (i) of the question.

^b Because reciprocal allocations are not made, the costs allocated to service cost centre 1 are reallocated as follows:

£91 262 $(63/72 \times £104 300)$ to production cost centre A
£13 038 $(9/72 \times £104 300)$ to production cost centre B

^c Reciprocal charges are not made. Therefore the allocation is as follows:

$4 000/29 000 \times £59 600 = £8 221$ to production cost centre A
 $25 000/29 000 \times £59 600 = £51 379$ to production cost centre B

- (b) The difference may be due to the following:
- (i) Changes occurred in projected overhead expenditure compared with expenditure which was used to determine the current year's overhead rate.
 - (ii) Current overhead rates do not include a proportion of the service cost centres overhead.
 - (iii) Budgeted activity for the next year is greater than the current year for production cost centre A. If this is not matched by a corresponding increase in overhead expenditure then the hourly overhead rate will decline. Budgeted activity for production cost centre B is lower than the current year, resulting in an increase in the overhead rate. Because fixed overheads do not change in relation to activity, the hourly overhead rate will fluctuate whenever changes in activity occur. (See Example 3.2 in Chapter 3 for an illustration.)
- (c) This question can be answered by using either the repeated distribution or simultaneous equation methods. Both methods are illustrated in Appendix 3.1 to Chapter 3. The simultaneous equation method is illustrated below:

Let X = total overhead of service cost centre 1
 Y = total overhead of service cost centre 2

Then

$$X = 104\,300 + \frac{1}{30}Y \text{ (i.e. 1000/30 000 hrs of service cost centre 2 overheads)}$$

$$Y = 59\,600 + \frac{1}{5}X \text{ (i.e. 18% out of total of 90% of service cost centre 1 overheads)}$$

Rearranging the above equations:

$$X - \frac{1}{30}Y = 104\,300 \quad (1)$$

$$-\frac{1}{5}X + Y = 59\,600 \quad (2)$$

Multiply equation (1) by 1 and equation (2) by 5:

$$X - \frac{1}{30}Y = 104\,300$$

$$-X + 5Y = 298\,000$$

Adding the above equations together:

$$\frac{149}{30}Y = 402\,300$$

$$Y = \frac{402\,300 \times 30}{149}$$

$$Y = 81\,000$$

Substituting for Y in equation (1) results in the following equation:

$$X - \frac{1}{30} \times 81\,000 = 104\,300$$

$$X = 107\,000$$

The service cost centre overheads of £107 000 (service cost centre 1) and £81 000 (service cost centre 2) are now apportioned to the production cost centres as follows:

	General	Service cost		Production cost	
	factory	centre		centre	
	overhead	1	2	A	B
	(£)	(£)	(£)	(£)	(£)
Primary allocation	210 000	93 800	38 600	182 800	124 800
Apportionment of general factory overhead	(210 000)	10 500	21 000	31 500	147 000
	<u>—</u>	<u>104 300</u>	<u>59 600</u>	<u>214 300</u>	<u>271 800</u>
Charges by service cost centre 1 ^a		(107 000)	21 400	74 900	10 700
Charges by service cost centre 2 ^b		2 700	(81 000)	10 800	67 500
		<u>—</u>	<u>—</u>	<u>£300 000</u>	<u>£350 000</u>
Budgeted direct labour hours				120 000	20 000
Absorption rates				<u>£2.50</u>	<u>£17.50</u>

Notes

^a $18/90 \times £107\ 000 = £21\ 400$ to service cost centre 2 (18% out of 90%)

$63/90 \times £107\ 000 = £74\ 900$ to production cost centre A

$9/90 \times £107\ 000 = £10\ 700$ to production cost centre B

^b $1000/30\ 000 \times £81\ 000 = £2\ 700$ to service cost centre 1

$4000/30\ 000 \times £81\ 000 = £10\ 800$ to production cost centre A

$25\ 000/30\ 000 \times £81\ 000 = £67\ 500$ to production cost centre B

(d) The answer should include the following points:

- (i) The overhead rate calculations do not distinguish between fixed and variable elements. Such an analysis is necessary for decision-making purposes.
- (ii) The majority of service cost centre 1 costs are variable. It is preferable to determine an activity measure which exerts most influence on the variable costs and apportion the costs on the basis of this measure. The present method of apportionment appears to be inappropriate.
- (iii) Service cost centre 2 is the maintenance department and the majority of costs are fixed, thus suggesting preventive maintenance be undertaken. The question does not make it clear which hourly base is used for allocating overheads (direct labour hours or machine hours). Machine hours should be used for allocating variable costs, since these costs are likely to vary with this activity base. Preventive maintenance should be apportioned on the basis of the planned hours which the maintenance staff intend to allocate to each department.
- (iv) Production cost centre B is highly mechanized, thus suggesting that a machine hour rate might be preferable to the present direct labour hour rate.

Solution IM 3.12 (a)

Department cost statement

	Belts (£000)	Braces (£000)	Administration (£000)	Maintenance (£000)	Warehousing (£000)	Total (£000)
Direct variable costs:						
Materials	120	130	—	20	30	300
Labour	80	70	50	80	20	300
	<u>200</u>	<u>200</u>	<u>50</u>	<u>100</u>	<u>50</u>	<u>600</u>
Factory-wide indirect cost per floorspace	400	400	50	100	50	1000
	<u>600</u>	<u>600</u>	<u>100</u>	<u>200</u>	<u>100</u>	<u>1600</u>
Service departments						
Administration ^a	40	40	(100)	10	10	—
	<u>640</u>	<u>640</u>	<u>—</u>	<u>210</u>	<u>110</u>	<u>1600</u>
Maintenance ^b	79	79	—	(264)	106	—
Warehousing ^b	108	54	—	54	(216)	—
	<u>£827</u>	<u>£773</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>£1600</u>

Cost per unit:

Belts $\frac{£827\ 000}{100\ 000} = £8.27$

Braces $\frac{£773\ 000}{50\ 000} = £15.46$

Notes

^a Administration does not receive any charges from the other service departments. Therefore the reciprocal basis does not apply.

^b The simultaneous equation method is used to allocate the maintenance and warehouse costs.

Let M = total cost of the maintenance department
 W = total cost of the warehousing department

Then $M = 210 + 0.25W$ (1)
 $W = 110 + 0.4M$ (2)

Multiplying equation (1) by 4 and equation (2) by 1, and rearranging the resulting equations:

$$\begin{array}{r} 4M - W = 840 \\ -0.4M + W = 110 \\ \hline 3.6M = 950 \\ M = £263.89 \end{array}$$

Substituting the value of M into equation (2):

$$\begin{array}{l} W = 110 + 0.4 \times 263.89 \\ W = £215.56 \end{array}$$

(b) Kaminsky Ltd has spare capacity, and therefore any sales revenue in excess of variable costs will provide a contribution towards fixed costs and profit. Therefore it is necessary to calculate the variable cost per unit for belts and braces. The calculations of the unit variable cost are as follows:

	Belts (£000)	Braces (£000)	Administration (£000)	Maintenance (£000)	Warehousing (£000)	Total (£000)
Direct variable costs:						
Materials	120	130	—	20	30	300
Labour	80	70	50	80	20	300
	<u>200</u>	<u>200</u>	<u>50</u>	<u>100</u>	<u>50</u>	<u>600</u>
Service departments						
Administration	20	20	(50)	5	5	—
	<u>220</u>	<u>220</u>	<u>—</u>	<u>105</u>	<u>55</u>	<u>600</u>
Maintenance ^a	39.6	39.6	—	(132)	52.8	—
Warehousing ^a	53.9	26.9	—	26.95	(107.8)	—
	<u>313.5</u>	<u>286.5</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>600</u>

Variable cost per unit:	Belts	$\frac{£313\,500}{100\,000} = £3.135$
	Braces	$\frac{£286\,500}{50\,000} = £5.73$

Note

^a The simultaneous equation method is used to allocate the service department costs as follows:

Let M = maintenance department variable costs
 W = warehousing department variable costs

Then $M = 105 + 0.25W$ (1)
 $W = 55 + 0.4M$ (2)

Multiplying equation (1) by 4 and equation (2) by 1:

$$\begin{array}{r}
 4M - W = 420 \\
 -0.4M + W = 55 \\
 \hline
 3.6M = 475 \\
 M = 131.94
 \end{array}$$

Substituting in equation (2):

$$\begin{array}{l}
 W = 55 + 0.4 \times 131.94 \\
 W = 107.8
 \end{array}$$

Camfan order

	(£)
Contract price	5000
Variable costs (1000 belts at £3.135)	<u>3135</u>
Contribution	<u>1865</u>

If this order is accepted, profits will increase by £1865, provided that better opportunities are not available and the normal selling price will not be affected. It is unlikely that such a small order will affect the normal selling price.

Mixon Spenders contract

The normal unit cost based on a normal activity of 100 000 belts is £8.27. If this unit cost is used as the basis for determining the 'cost-plus' selling price then the agreed selling price will be £9.10 (£8.27 + 10%). The normal selling price will be £9.92 (£8.27 + 20%). The contribution from supplying 100 000 belts will be £596 500 [(£9.10 - £3.135 variable cost) × 100 000]. Total demand will now be 200 000 belts, but maximum output is 150 000 belts. Therefore existing sales will be reduced by 50 000 belts. The lost contribution is £339 250 [50 000 × (£9.92 - £3.135)]. Consequently total contribution will increase by £257 250.

Alternatively, Kaminsky might base selling price on unit costs at maximum capacity of 150 000 units. The revised unit cost will be as follows:

Fixed costs apportioned to belts	= £513 500 (£827 000 total cost – £313 500 variable cost)
Fixed costs per unit (£)	= 3.42 (£513 500/150 000 units)
Variable cost per unit (£)	= 3.135
Total cost per unit (£)	= <u>6.555</u>
Selling price for contract	= £7.21 (£6.555 + 10%).

The total contribution from the contract will be £407 500, consisting of 100 000 units at a contribution per unit of £4.075 (£7.21 – £3.135). This will still cover the contribution sacrificed on existing business. On the basis of the above quantitative information, the contract should be accepted. However, before acceptance, the following qualitative factors should be considered:

- (i) Will the long-term disadvantages from a loss of customer goodwill from depriving normal customers of 50 000 units outweigh the short-term advantage of taking on the contract?
 - (ii) An attractive feature of the contract is that it will result in certain sales of 2000 units per week, thus enabling production, cash flows etc. to be forecasted more accurately.
- (c) For the answer to this question see ‘alternative denominator level measures’ in Chapter 7. In addition the answer should emphasize that normal overhead rates reflect a long-term planned activity base which is expected to satisfy demand levels over a series of years. Over this period, fluctuations in customer demand, seasonal and cyclical changes will be incorporated into an annual rate. A normalized overhead rate recognizes that the company’s overhead cost commitment is related to the long-run demand for its products. A normalized overhead rate is preferable for pricing purposes, since the alternative of basing overhead rates on the activity for next year will result in higher selling prices when demand is low if cost-plus pricing is used. Prices should be lower when demand is depressed. A normalized overhead rate should avoid such inconsistencies.