Answers

1 (a) Full budgeted production cost per unit using absorption costing

Product	**X**	**Y**	**Z**	**Total**
Budgeted annual production (units)	20,000	16,000	22,000	
Labour hours per unit	2·5	3	2	
Total labour hours	50,000	48,000	44,000	142,000

Overhead absorption rate = $1,377,400/142,000 = $9·70 per hour.

Product	**X**	**Y**	**Z**
	$ per unit	**$ per unit**	**$ per unit**
Direct materials	25	28	22
Direct labour	30	36	24
Overhead ($9·70 x 2·5/3/2)	24·25	29·10	19·40
Full cost per unit	79·25	93·10	65·40

(b) Full budgeted production cost per unit using activity based costing

Product	**X**	**Y**	**Z**	**Total**
Budgeted annual production (units)	20,000	16,000	22,000	
Batch size	500	800	400	
Number of batches (i.e. set ups)	**40**	**20**	**55**	**115**
Number of purchase orders per batch	4	5	4	
Total number of orders	**160**	**100**	**220**	**480**
Machine hours per unit	1·5	1·25	1·4	
Total machine hours	**30,000**	**20,000**	**30,800**	**80,800**

Cost driver rates:

Cost per machine set up $280,000/115 = $2,434·78
Cost per order $316,000/480 = $658·33
Cost per machine hour ($420,000 + $361,400)/80,800 = $9·67

Allocation of overheads to each product:

Product	**X**	**Y**	**Z**	**Total**
	$	**$**	**$**	
Machine set up costs	97,391	48,696	133,913	280,000
Material ordering costs	105,333	65,833	144,834	316,000
Machine running and facility costs	290,100	193,400	297,836	781,336*
Total	492,824	307,929	576,583	1,377,336
Number of units produced	20,000	16,000	22,000	
Overhead cost per unit	$24·64	$19·25	$26·21	

Total cost per unit:	**$ per unit**	**$ per unit**	**$ per unit**
Direct materials	25	28	22
Direct labour	30	36	24
Overhead	24·64	19·25	26·21
ABC cost per unit	79·64	83·25	72·21

*A difference of $64 arises here as compared to the cost pool total of $781,400 because of rounding differences. This has been ignored.

(c) When activity based costing is used, the cost for product X is very similar to that cost calculated using full absorption costing. This means that the price for product X is likely to remain unchanged because cost plus pricing is being used. Demand for product X is relatively elastic but since no change in price is expected, sales volumes are likely to remain the same if ABC is introduced.

However, the cost for product Y is almost $10 per unit less using ABC. This means that the price of product Y will go down if cost plus pricing is used. Given that demand for product Y is also elastic, like demand for product X, a reduced selling price is likely to give rise to increased sales volumes.

The cost of product Z is nearly $7 per unit more using ABC and the price of product Z will therefore go up if ABC is used. Given that demand for product Z is relatively inelastic, this means that sales volumes would be expected to be largely unchanged despite an increase in price.

2 (a) Optimum production plan

Define the variables

Let x = number of units of Xeno to be produced.
Let y = number of units of Yong to be produced.
Let C = contribution.

State the objective function

$C = 30x + 40y$

State the constraints

Build time: $24x + 20y \leq 1,800,000$
Program time: $16x + 14y \leq 1,680,000$
Test time: $10x + 4y \leq 720,000$

Non-negativity constraints:

$x, y \geq 0$

Sales constraints

$x \leq 85,000$
$y \leq 66,000$

Draw the graph

Build time:

If x = 0, y = 1,800,000/20 = 90,000
If y = 0, x = 1,800,000/24 = 75,000

Program time:

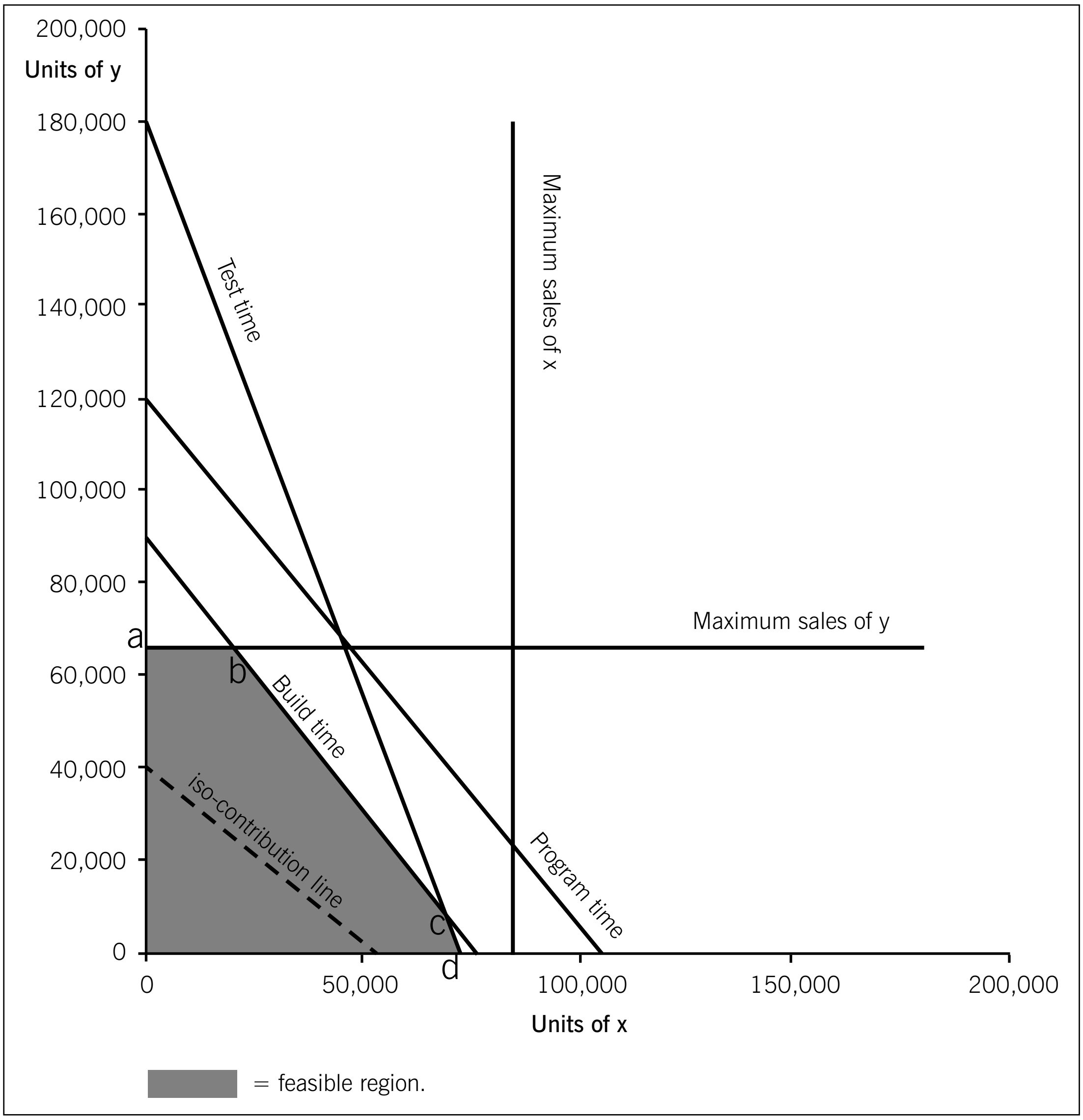
If x = 0, y = 1,680,000/14 = 120,000
If y = 0, x = 1,680,000/16 = 105,000

Test time:

If x = 0, y = 720,000/4 = 180,000
If y = 0, x = 720,000/10 = 72,000

Solve using the iso-contribution line

If y = 40,000, C = 40,000 x $40 = $1,600,000
If C = $1,600,000 and y = 0, x = $1,600,000/$30 = 53,333·33



Moving the iso-contribution line out to the furthest point on the feasible region, the optimum production point is b. This is the intersection of the build time constraint and the sales constraint for y. Solving the simultaneous equations for these two constraints:

y = 66,000
24x + 20y = 1,800,000
24x + (20 x 66,000) = 1,800,000
24x + 1,320,000 = 1,800,000
24x = 480,000
x = 20,000

C = (20,000 x $30) + (66,000 x $40)
= $600,000 + $2,640,000 = $3,240,000

Fixed costs = 3 x $650,000 = $1,950,000.
Therefore profit = $1,290,000.

(b) Slack resources

Test time used = (20,000 x 10)/60 + (66,000 x 4)/60 = 7,733 hours.
Therefore slack hours = 12,000 – 7,733= 4,267 hours.

Program time used = (20,000 x 16)/60 + (66,000 x 14)/60 = 20,733 hours.
Therefore slack hours = 28,000 – 20,733 = 7,267 hours.

The slack values for test time and program time mean that there are 4,267 and 7,267 hours of each respective department's time unutilised under the optimum production plan. If possible, this time could be used by the organisation elsewhere or subcontracted out to another company.

3 (a) Ratios

(i) ROCE = operating profit/capital employed x 100%

		$'000	ROCE
W Co	Design division	6,000/23,540	25·49%
	Gearbox division	3,875/32,320	11·99%
C Co		7,010/82,975	8·45%

(ii) Asset turnover = sales/capital employed x 100%

		$'000	Asset turnover
W Co	Design division	14,300/23,540	0·61
	Gearbox division	25,535/32,320	0·79
C Co		15,560/82,975	0·19

(iii) Operating profit margin = operating profit/sales x 100%

		$'000	Operating profit
W Co	Design division	6,000/14,300	41·96%
	Gearbox division	3,875/25,535	15·18%
C Co		7,010/15,560	45·05%

Both companies and both divisions within W Co are clearly profitable. In terms of what the different ratios tell us, ROCE tells us the return which a company is making from its capital. The Design division of W Co is making the highest return at over 25%, more than twice that of the Gearbox division and nearly three times that of C Co. This is because the nature of a design business is such that profits are largely derived from the people making the designs rather than from the assets. Certain assets will obviously be necessary in order to produce the designs but it is the employees who are mostly responsible for generating profit.

The Gearbox division and C Co's ROCE are fairly similar compared to the Design division, although when comparing the two in isolation, the Gearbox division's ROCE is actually over three percentage points higher than C Co's (11·99% compared to 8·45%). This is because C Co has a substantially larger asset base than the Gearbox division.

From the asset turnover ratio, it can be seen that the Gearbox division's assets generate a very high proportion of sales per $ of assets (79%) compared to C Co (19%). This is partly because the Gearbox division buys its components in from C Co and therefore does not need to have the large asset base which C Co has in order to make the components. When the unit profitability of those sales is considered by looking at the operating profit margin, C Co's unit profitability is much higher than the Gearbox division (45% operating profit margin as compared to 15%). The Design division, like the Gearbox division, is also using its assets well to generate sales (asset turnover of 61%) but then, like C Co, its unit profitability is high too (42% operating profit margin.) This is why, when the two ratios (operating profit margin and asset turnover) are combined to make ROCE, the Design division comes out top overall – because it has both high unit profitability and generates sales at a high level compared to its asset base.

It should be noted that any comparisons between such different types of business are of limited use. It would be more useful to have prior year figures for comparison and/or industry averages for similar businesses. This would make performance review much more meaningful.

(b) Transfer prices

From C Co's perspective
C Co transfers components to the Gearbox division at the same price as it sells components to the external market. However, if C Co were not making internal sales then, given that it already satisfies 60% of external demand, it would not be able to sell all of its current production to the external market. External sales are $8,010,000, therefore unsatisfied external demand is ([$8,010,000/0·6] – $8,010,000) = $5,340,000.

From C Co's perspective, of the current internal sales of $7,550,000, $5,340,000 could be sold externally if they were not sold to the Gearbox division. Therefore, in order for C Co not to be any worse off from selling internally, these sales should be made at the current price of $5,340,000, less any reduction in costs which C Co saves from not having to sell outside the group (perhaps lower administrative and distribution costs).

As regards the remaining internal sales of $2,210,000 ($7,550,000 – $5,340,000), C Co effectively has spare capacity to meet these sales. Therefore, the minimum transfer price should be the marginal cost of producing these goods. Given that variable costs represent 40% of revenue, this means that the marginal cost for these sales is $884,000. This is therefore the minimum price which C Co should charge for these sales.

In total, therefore, C Co will want to charge at least $6,224,000 for its sales to the Gearbox division.

From the Gearbox division's perspective
The Gearbox division will not want to pay more for the components than it could purchase them for externally. Given that it can purchase them all for 95% of the current price, this means a maximum purchase price of $7,172,500.

Overall
Taking into account all of the above, the transfer price for the sales should be somewhere between $6,224,000 and $7,172,500.

4 (a) Profit outcomes

Unit contribution	Sales price per unit	
	$30	**$35**
Up to 100,000 units	$18	$23
Above 100,000 units	$19	$24

Sales price $30

Sales volume	Unit contribution $	Total contribution $'000	Fixed costs $'000	Advertising costs $'000	Profit $'000
120,000	19	2,280	450	900	930
110,000	19	2,090	450	900	740
140,000	19	2,660	450	900	1,310

Sales price $35

Sales volume	Unit contribution $	Total contribution $'000	Fixed costs $'000	Advertising costs $'000	Profit $'000
108,000	24	2,592	450	970	1,172
100,000	23	2,300	450	970	880
94,000	23	2,162	450	970	742

(b) Expected values

Sales price $30

Sales volume	Profit $'000	Probability	EV of profit $'000
120,000	930	0·4	372
110,000	740	0·5	370
140,000	1,310	0·1	131
			873

Sales price $35

Sales volume	Profit $'000	Probability	EV of profit $'000
108,000	1,172	0·3	351·6
100,000	880	0·3	264
94,000	742	0·4	296·8
			912·4

If the criterion of expected value is used to make a decision as to which price to charge, then the price charged should be $35 per unit since the expected value of this option is the greatest.

(c) Maximin decision rule

Under this rule, the decision-maker selects the alternative which offers the most attractive worst outcome, i.e. the alternative which maximises the minimum profit. In the case of Gam Co, this would be the price of $35 as the lowest profit here is $742,000 as compared to a lowest profit of $740,000 at a price of $30.

(d) Reasons for uncertainty arising in the budgeting process

Uncertainty arises largely because of changes in the external environment over which a company will sometimes have little control. Reasons include:

- Customers may decide to buy more or less goods or services than originally forecast. For example, if a major customer goes into liquidation, this has a huge effect on a company and could also cause them to go into liquidation.
- Competitors may strengthen or emerge and take some business away from a company. On the other hand, a competitor's position may weaken leading to increased business for a particular company.
- Technological advances may take place which lead a company's products or services to become out-dated and therefore less desirable.
- The workforce may not perform as well as expected, perhaps because of time off due to illness or maybe simply because of lack of motivation.
- Materials may increase in price because of global changes in commodity prices.
- Inflation can cause the price of all inputs to increase or decrease.

– If a company imports or exports goods or services, changes in exchange rates can cause prices to change.
– Machines may fail to meet production schedules because of breakdown.
– Social/political unrest could affect productivity, e.g. the workforce goes on strike.

Note: *This list is not exhaustive, nor would candidates be expected to make all the points raised in order to score full marks.*

5 (a) Variances

(i) The sales mix contribution variance

Calculated as (actual sales quantity – actual sales quantity in budgeted proportions) x standard contribution per unit.

Standard contributions per valet:
Full = $50 x 44·6% = $22·30 per valet
Mini = $30 x 55% = $16·50 per valet
Actual sales quantity in budgeted proportions (ASQBP):
Full: 7,980 x (3,600/5,600) = 5,130
Mini: 7,980 x (2,000/5,600) = 2,850

Valet type	AQAM	AQBM	Difference	Standard contribution	Variance
				$	$
Full	4,000	5,130	(1,130)	22·30	25,199 A
Mini	3,980	2,850	1,130	16·50	18,645 F
					6,554 A

(ii) The sales quantity contribution variance

Calculated as (actual sales quantity in budgeted proportions – budgeted sales quantity) x standard contribution per unit.

Valet type	AQBM	BQBM	Difference	Standard contribution	Variance
				$	$
Full	5,130	3,600	1,530	22·30	34,119 F
Mini	2,850	2,000	850	16·50	14,025 F
					48,144 F

(b) Description

The sales mix contribution variance
This variance measures the effect on profit of changing the mix of actual sales from the standard mix.

The sales quantity contribution variance
This variance measures the effect on profit of selling a different total quantity from the budgeted total quantity.

(c) Sales performance of the business

The sales performance of the business has been very good over the last year, as shown by the favourable sales quantity variance of $48,144. Overall, total sales revenue is 33% higher than budgeted (($319,400 – $240,000)/$240,000). This is because of a higher total number of valets being performed. When you look at where the difference in sales quantity actually is, you can see from the data provided in the question that it is the number of mini valets which is substantially higher. This number is 99% ((3,980 – 2,000)/2,000) higher than budgeted, whereas the number of full valets is only 11% ((4,000 – 3,600)/3,600) higher. Even 11% is still positive, however.

The fact that the number of mini valets is so much higher combined with the fact that they generate a lower contribution per unit than the full valet led to an adverse sales mix variance of $6,554 in the year. This cannot be looked at in isolation as a sign of poor performance; it is simply reflective of the changes which have occurred in Strappia. We are told that disposable incomes in Strappia have decreased by 30% over the last year. This means that people have less money to spend on non-essential expenditure such as car valeting. Consequently, they are opting for the cheaper mini valet rather than the more expensive full valet. At the same time, we are also told that people are keeping their cars for an average of five years now as opposed to three years. This may be leading them to take more care of them and get them valeted regularly because they know that the car has to be kept for a longer period. Thus, the total quantity of valets is higher than budgeted, particularly the mini valets.

Also, there is now one less competitor for Valet Co than there was a year ago, so Valet Co may have gained some of the old competitor's business. Together, all of these factors would explain the higher number of total valets being performed and in particular, of the less expensive type of valet.

Note: *Other valid points will be given full credit.*

			Marks
1	**(a)**	**Full absorption cost**	
		Overhead absorption rate	1·5
		Cost for X incl labour and materials	0·5
		Cost for Y incl labour and materials	0·5
		Cost for Z incl labour and materials	0·5
			3
	(b)	**Activity based cost**	
		Correct cost driver rates	4·5
		Overhead unit cost for X	1
		Overhead unit cost for Y	1
		Overhead unit cost for Z	1
		Adding labour and materials costs	2
		Total cost for X	0·5
		Total cost for Y	0·5
		Total cost for Z	0·5
			11
	(c)	**Discussion**	
		Effect on price	3
		Effect on sales volume	3
			6
		Total marks	**20**
2	**(a)**	**Optimum production plan**	
		Stating the objective function	0·5
		Defining constraint for built time	0·5
		Defining constraint for program time	0·5
		Defining constraint for test time	0·5
		Non-negativity constraints	0·5
		Sales constraint x	0·5
		Sales constraint y	0·5
		Iso-contribution line worked out	1
		The graph:	
		Labels	0·5
		Build time line	0·5
		Program time line	0·5
		Test time line	0·5
		Demand for x line	0·5
		Demand for y line	0·5
		Iso-contribution line	0·5
		Feasible region identified and labelled/shaded	1
		Optimum point identified	1
		Equations solved at optimum point	3
		Total contribution	0·5
		Total profit	0·5
			14
	(b)	**Slack values**	
		Test time calculation	1·5
		Program time calculation	1·5
		Defining and identifying slack resources	1·5
		Discussing implication of slack resources	1·5
			6
		Total marks	**20**

			Marks
3	**(a)**	Ratios	
		Calculating ROCE	1·5
		Calculating asset turnover	1·5
		Calculating operating profit margin	1·5
		Per valid comment	1
			10
	(b)	Transfer pricing	
		Each valid comment/calculation	1 or 2
			10
		Total marks	**20**
4	**(a)**	Profit outcomes	
		Unit contribution up to 100,000 units	1
		Unit contribution above 100,000 units	1
		Each line of table for price of $30 (3 in total)	1
		Each line of table for price of $35 (3 in total)	1
			8
	(b)	Expected values	
		Expected value for $30	1
		Expected value for $35	1
		Recommendation	1
			3
	(c)	Maximin	
		Explanation	2
		Decision	1
			3
	(d)	Uncertainty	
		Each point made	1
			6
		Total marks	**20**
5	**(a)**	Calculations	
		Sales mix contribution variance	4
		Sales quantity contribution variance	4
			8
	(b)	Description	
		One mark per description	2
	(c)	Discussion on sales performance	
		Calculations – each one, max 2	0·5
		Maximum for each point made	2
			10
		Total marks	**20**