ACCOUNTING FOR DECISION MAKING

Professional 1
December 1999

MARKING SCHEME

Question 1

(a) See spreadsheet for calculations: marks should be awarded as follows:
For each option:

Costs	*2*
Landfill tax	*2*
Savings:	
Heating/sales	*2*
Totals	*2*
Discounting	*2*

N.B. If candidates carry out the discounting using different 'real' discount rates credit should also be given.

The recycling plant has the higher NPV and would therefore be the more financially attractive of the two options for the authority if it had unlimited capital. *1*

Public sector bodies rarely find themselves with unlimited capital. Therefore, before choosing the recycling plant it would be necessary to ask what else would be done with the extra £1.1m capital if the incinerator was chosen instead. In theory, if this alternative use had an NPV of more than £26,910 (the difference between the two NPVs) then it would be more attractive financially to choose the incinerator option. In practice, of course, it is not possible to calculate an NPV for all investment options. However, a decision to choose the incinerator option would, by implication place a (present) value on the alternative use of the £1.1m greater than £26,910. *4*

(15)

NB. Up to 1 mark would be awarded for relevant comments regarding key assumptions/limitation inherent in the NPV analysis.

(b) Environmental impact could be appraised by using some form of cost benefit analysis, and/or desiderata ranking. CBA is used for projects where there is no market price for the output, or where there are objectives other than purely financial ones. It attempts to put costs on factors such as pollution in this example, or savings on journey times, in the example of a proposed new road scheme.

Desiderata ranking entails a multi-disciplinary group deciding on the objectives, or desiderata, of the proposed project, and ranking them according to their importance. Each alternative is then awarded a score by the team, reflecting how well each achieves each objective. The scores are then weighted according to the rankings already decided. The alternative with the highest score may or may not be

the best in financial terms, but it is considered to meet the other objectives most efficiently.

If the useful life of the projects were extended beyond five years, then the recycling option would become less attractive, assuming the revenue from the sale of recycled materials continues to drop in real terms, and the cost of fuel to rise. If the projects had different lifespans, then the annual equivalent value of the cash flows would need to be calculated.

3 marks for description of CBA and/or Desiderata
(Credit should be given for a discussion of how these factors could be valued)
3 marks for identifying the effect of an extension of useful life.

NB. The above is not an exhaustive list: credit should be given for all **relevant** points made.

(6)

(c) The change in income generated must be £26,910 over 5 years, discounted at the cost of capital, which is 8% *1*

The cumulative DF at 8% for 5 years = 3.993.

$\frac{£26,910}{3.993} = £6,739$

2

The change in annual income necessary from recycling would therefore need to be a decrease of at least £6,739 per annum before the decision changed. *1*

(4)
(25)

Analysis consistent with results in (a) should be given credit.

DISCOUNT FACTORS

Year	8%
1	0.926
2	0.857
3	0.794
4	0.735
5	0.681
6	0.630
7	0.583
8	0.540

Option 1

Year	Capital	Running Costs	Total Cost	Tax Savings	Heat Savings	Total Rev	Net Rev	PV
0	1900000		1900000				-1900000	-1900000
1		153000	153000	500000	40000	540000	387000	358362
2		160650	160650	550000	42000	592000	431350	369667
3		168682.5	168682.5	605000	44100	649100	480417.5	381451.5
4		177116.6	177116.6	665500	46305	711805	534688.4	392996
5		185972.5	185972.5	732050	48620.25	780670.3	594697.8	404989.2
NPV								7465.598

Option 2

Year	Capital	Running Costs	Total Cost	Tax Savings	Product Sales	Total Rev	Net Rev	PV
0	3000000		3000000				-3000000	-3000000
1		152000	152000	500000	325000	825000	673000	623198
2		159600	159600	550000	325000	875000	715400	613097.8
3		167580	167580	605000	325000	930000	762420	605361.5
4		175959	175959	665500	325000	990500	814541	598687.6
5		184757	184757	732050	325000	1057050	872293.1	594031.6
NPV								34376.48

Question 2

Report format *1*

(a) No. of hours opened: Mon-Sat 15 x 6 = 90
+ Sunday 10 x 1 = 10
100 per week.

∴ cost per opened hour = £3000/100 = £30. *1*

Explanation of inappropriateness of using the above cost in this situation, the reasons why and the use of marginal or relevant costing instead. *2*

Relevant cost:

Swimming Club

Revenue:-	per evening		£40		
Costs:	Caretaker	3 x 5 = 15			½
	Power	3 x 5 = 15	£30		½
Net revenue:-	per week		£10		½
	per annum		x 50	Weeks	½
			£500		

(6)

(b) Option 1: extra costs – per week.

		£	
Caretaker:	5x5	25.0	½
Pool attendant:-	12 x 5	60.0	½
Extra Power	8.5 x 5	42.5	½
Receptionist	8.5 x 5	42.5	½
		170.0	½

Revenue:	60% @ 1.20 =	.72
	40% @ 0.80 =	.32
		1.04

Revenue	Expected value of revenue	
155x1.04 = 161.2	161.2 x .4	64.48
170 x 1.04 = 176.8	176.8 x .3	53.04
210 x 1.04 = 218.4	218.4 x .3	65.52
		183.04

Net weekly revenue = £183.04 - £170 = £13.04
Per annum: £13.04 x 52 = £678.08
Or assuming a 50 wk year,
£13.04 x 50 = £652

Revenue calculation	*1½*
Expected value	*1½*
Net weekly or annual revenue	*1½*

Option 1 therefore has a higher net revenue than the swimming club, using expected value, which represents an average outcome. *1*

However, there is a 40% chance of a loss of £8.80 per week, and a 30% chance of making only £6.80 per week, whereas the swimming club offers a guaranteed income of £10 per week (although for only 50 weeks). *2*

Furthermore, the appraisal of option 1 is dependent on demand forecasts, and on the assumption regarding the split between children and adults, both of which are subject to uncertainty, whereas the income from the swimming club is guaranteed for a year. *1*

The decision will therefore depend on management's attitude to risk: if they are risk averse, they will go for the swimming club. If they are risk neutral or risk seeking they will go for Option 1. *1*

(12)

(c) Option 2:
Current income per afternoon: 50 x 1.20 = 60 *1*
50% increase: 75 x .80 = 60
Therefore, no effect on deficit. *1*

100% increase: 100 x .8 = 80
∴ Increase in income = 20 x 2 afternoons = 40, which is the maximum which could be spent on advertising per week. *1*
(3)

(d) If the swimming club was willing to pay £45 per evening then this would be the most attractive option financially. However, this option would not improve access for the general public, as the manager wishes to do. There will be fewer staffing implications (possible problems of finding staff willing to work unsocial hours) with the swimming club.

Against the swimming club option is the issue of widening public access.

Reliability of forecasting, and cost estimates: hidden costs such as wear and tear.

Possibility of more market research: customer surveys?

Extension of differential pricing: membership schemes, season tickets?

(Not an exhaustive list: credit should be given for all relevant points)

1 mark for each point up to a maximum of 4 *(4)*
(25)

Question 3

(a)

	Gnome	Sundial	Birdbath	Total	
Materials (£)	1.50	1.50	1.00		
Labour (£)	1.00	1.80	.90		
Prime cost (£)	2.50	3.30	1.90		*1*
Overhead (100% prime cost) (£)	2.50	3.30	1.90		*1*
Total cost (£)	5.00	6.60	3.80		
Selling Price (£)	8.00	10.00	9.00		
Profit (£)	3.00	3.40	5.20		*1*
Volume	420	140	120		
Total profit (£)	1260	476	624	2360	*1*
					(4)

(b) Calculate the contribution per limiting factor, i.e. labour hour

Gnome: contribution = 8- 2.50 = 5.50 *1*
Takes 1/6 labour hour, ∴ contribution per labour hour = 5.50 x 6 = £33 *1*

Sundial: contribution = 10 – 3.30 = 6.70 *1*
Takes 1.80 = .3 labour hour, ∴ contribution per labour hour
6 = 6.70 = £22.33 *1*
.3

Birdbath: contribution = 9 – 1.90 = 7.10 *1*
Takes .90 = .15 labour hours, ∴ contribution per labour hour
6 = 7.10 = £47.33 *1*
.15

Therefore, reduce production of sundials which have the lowest contribution per labour hour *1*

32.5 = 108.3, round up to 109 sundials, will result in lost contribution
.3 of 109 x 6.70 = £730.30 *2*

(lose a mark if not rounded up) *(9)*

(c) Total overheads:

2.50 x 420	1050
3.30 x 140	462
1.90 x 120	228
	1740

2

Overhead	**Amount (£)**	**Total driver**	**Driver rate (£)**
Moulding	522	90 Set ups	5.80
Firing	696	1740 Kiln hours	.40
Finishing	348	30 Finishing hours	11.60
Packing	174	870 Sheets	.20

2

Overhead	**Gnome**	**Sundial**	**Birdbath**	**Total**	
Moulding (£)	232	145	145		*1*
Firing (£)	320	180	196		*1*
Finishing (£)	116	116	116		*1*
Packing (£)	60	54	60		*1*
Total overhead (£)	728	495	517	1740	
÷volume	420	140	120		
Unit overhead (£)	1.73	3.54	4.31		*1*
Prime cost (£)	2.50	3.30	1.90		
Total cost (£)	4.23	6.84	6.21		
Selling price (£)	8.00	10.00	9.00		
Profit (£)	3.77	3.16	2.79		*1*

Using the current method of overhead absorption, Birdbath is the most profitable, gnome least profitable. Using ABC, the situation is reversed.

The reasons are that the gnome is high volume, the birdbath low volume. The birdbath has a low prime cost, and was therefore charged with a small proportion of the overheads in (a), whereas it is in fact a relatively large consumer of resources. This is reflected in the product cost calculated in (c). *2*

(12)
(25)

Question 4 (a)

Overhead distribution (£m)	**Test**	**Test**	**Test**	**Facilities**		**Personnel &**	
Division / department	**Division A**	**Division B**	**Division C**	**Management**	**Finance**	**Chief Exec.**	**Totals**
Direct costs	3.21000	2.45000	2.30000	1.30000	0.44000	0.30000	10.00000
Distribution of Fac. Mgmnt	0.49480	0.34191	0.37619	-1.30000	0.03336	0.05374	0.00000
	3.70480	2.79191	2.67619	0.00000	0.47336	0.35374	10.00000
Distribution of Personnel / CE	0.11245	0.06325	0.15461	0.00000	0.02343	-0.35374	0.00000
	3.81725	2.85516	2.83080	0.00000	0.49679	0.00000	10.00000
Distribution of Finance	0.20034	0.15291	0.14354		-0.49679	0.00000	0.00000
Full fixed cost	4.01759	3.00807	2.97434	0.00000	0.00000	0.00000	10.00000
Less contribution from block contract		-0.94600					
Fixed cost after block contract	4.01759	2.06207	2.97434				
Fixed cost per test (excl. block contract) (£)	877.97	1,138.64	434.78				
Add variable cost per test	35.00	45.00	55.00				
Full cost per test (excl. block contract) (£)	912.97	1,183.64	489.78				
Add Profit Margin (£) (Full cost/0.95)	48.05	62.30	25.78				
Unit Price (£)	961.02	1,245.94	515.56	Markers should allow for effect of roundings in earlier calculations)			
Unit price (to the nearest £1)	961	1,246	516				

Notes: Personnel and Chief Executive (P/CE) costs have been distributed before Finance because the charge from P/CE to Finance is larger than the charge that would be from Finance to P/CE if Finance had been distributed first. Facilities Management is recharged first as the value of its recharge to the other two overhead departments is higher than the recharge that would have been due from other Finance or P/CE to the other two overhead departments.

		£
Contribution from block contract:	contract fee	1,000,000
	Less variable costs ((1,200 x £45)	54,000

946,000

(b) **Report**

To Chief Executive
From Trainee Accountant
Re. Pricing of Tests

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1 You have asked me to investigate pricing options for the three types of tests which we offer.

2 The attached table shows the calculation of unit costs and the prices required for each division to achieve a 5% profit margin, which are as follows

	Full cost per test	**Price to achieve 5% profit margin**
	£	**£**
Test Division A	913	961
Test Division B (after contract)	1,184	1,246
Test Division C	490	516

It is clear from these figures that none of our current prices will cover full cost, let alone achieve the profit target.

3 The local market for test A is not competitive. The national average price is £1,200. This suggests that there would be no real problem in charging a price of £961 thus allowing Division A to achieve the 5% profit margin. A higher price of £1,200 or even more could be feasible.

4 We have a block contract for 1,200 tests of type B, at a contract price of £1 million. On past year's performance we could expect further sales of 1,811 tests. However, this is based on our current price of £880 per test. If we were to increase the price to £1,245 in order to cover full cost and profit margin, demand would almost certainly drop, bearing in mind that the national average price is only £1,000. One cause of this problem seems to be the price agreed for the block contract. This is contributing £788.33 (£1,000,000 – (1,200 x £45) ÷ 1,200) per test against a fixed cost per unit of £999.03 (£3,008,070 ÷ 3,011). As a result, if the division is to achieve its 5% profit margin, the remaining 1,811 tests must not only recover their own costs but also subsidise the block contract and achieve the whole of the division's profit target. This explains the high price required. If the required price of £1,245 were to be charged we would probably lose a large part of our market to competitors, who are charging over £200 less.

5 The market for test C is highly competitive. The only way we can hope to avoid a serious drop in demand is to keep our prices close to the prevailing market price. Market research indicates sales of 7,000 tests at a unit price of £350, dropping to 6,500 at £380. The relative financial merits of these two price options can be assessed as follows:

	£
7,000 units sold at £350	2,450,000
less variable costs of 7,000 x £55	385,000
Net contribution	2,065,000

	£
6,500 units sold at £380	2,470,000
less variable costs of 6,500 x £55	357,500
Net contribution	2,112,500

This suggests we should leave the price at £380, provided we are confident that the market research is reliable.

6 I think it is clear from the above analysis that it is not feasible to require each division to achieve its own 5% profit margin. We should therefore consider a degree of cross subsidy. The table below shows the effect of setting prices at current market rates.

	Test Division A	Test Division B	Test Division C	Totals
Selling price (£)	1,200	1,000	380	
Forecast sales (units)	4,576	1,811	6,500	
Forecast sales income	5,491,200	1,811,000	2,470,000	9,772,200
Add block contract income		1,000,000		
Total forecast income	5,491,200	2,811,000	2,470,000	10,772,200
Less variable cost	160,160	135,495	357,500	653,155
Net contribution	5,331,040	2,675,505	2,112,500	10,119,045
Less fixed costs				10,000,000
Net profit				119,045
Net profit margin				1.11%

7 Increasing the price of test A by £100 would enable us to achieve more than the 5% profit margin, as shown below, without risking a drop in demand since there is little local competition for test A.

	Test Division A	Test Division B	Test Division C	Totals
Selling price (£)	1,300	1,000	380	
Forecast sales (units)	4,576	1,811	6,500	
Forecast sales income	5,948,800	1,811,000	2,470,000	10,229,800
Add block contract income		1,000,000		
Total forecast income	5,948,800	2,811,000	2,470,000	11,229,800
Less variable cost	160,160	135,495	357,500	653,155
Net contribution	5,788,640	2,675,505	2,112,500	10,576,645
Less fixed costs				10,000,000
Net profit				576,645
Net profit margin				5.13%

8 I recommend that we charge the following prices:

	£
Test Division A	1,300
Test Division B (except contract)	1,000
Test Division C	380

These prices represent significant increases for tests A and B. We need to give some thought to the best way to introduce them. At the very least we need to ensure our customers are made aware of the reason for them and that they are still not significantly above current market prices. Perhaps a more sensible approach would be to phase in the increases over two or three years, accepting the need for profit margins below our target in the first couple of years; this would represent the cost of reversing what has become a serious financial position.

9 I also recommend that we seek to re-negotiate our price for the block contract for test B at the next opportunity: although it is reasonable to accept a lower unit price for such as large contract, the current discount of over 20% of full cost is rather high.

(a)

Accurate distribution of overhead departments (Fac. Management, CE/P and Finance)	*3*
Correct order of closing (1 for Fac. Mngmnt first and 1 for CE/P second)	*2*
Correct treatment of contract	*1*
Consistent full unit costs (allow for rounding)	*3*
Consistent price to achieve 5% margin per division	*2*
Total for part (a)	*(11)*

(b)

Recognise that prices required to achieve 5% margin per division are not viable	*1*
Recognise that a price rise to £1,200 or above for test A is feasible	*1*
Explain how the block contract is seriously distorting the price for test B	*2*
Identify which price for test C generates the best contribution	*2*
Propose a viable pricing structure and calculate the resulting profit margin*	*4*
Suggest ways of cushioning the impact of large price increases	*2*
Recommend reducing the discount for the block contract	*1*
Report format	*1*
Total for part (b)	*(14)*

* Any combination of prices which achieves an approximate margin of 5% is acceptable provided it seems viable in the light of the market information provided. A spreadsheet is available for markers to test the profit margin calculation for any set of prices and demand levels.

Candidates may use trial and error to find a suitable price for test A, which is acceptable. However, the price required for a 5% margin can be calculated mathematically as follows:

Total contribution less fixed costs = 5% of total income

Let X be the price for test A

$4576\ (X-35) + 2,675,505 + 2,112,500 - 10,000,000 = (4576X + 2,811,000 + 2,470,000) \times 5\%$

$4576X - 5,372,155 = 228.2X + 264,050$

$437.2X = 5,636,205$

X = 1,296.5

Question 5

(a) Annual full cost figures should be adjusted to today's prices before they are used to estimate variable and fixed cost. This can be done by multiplying the cost by the current price index over the index in the year in question. For example, the 1995 cost at today's prices is

$$£206 \times \frac{183}{158} = £239$$

The result for the five years is as follows:

Full cost at current prices (£000)	239	233	233	237	229
Number of Students	102	88	90	110	79

The next step is to estimate variable and fixed costs using linear regression:

x	y	x^2	xy
102	239	10,404	24,378
88	233	7,744	20,504
90	233	8,100	20,970
110	237	12,100	26,070
79	229	6,241	18,091
469	1,171	44,589	110,013

Using the linear regression formula, the variable cost per student (£000) is

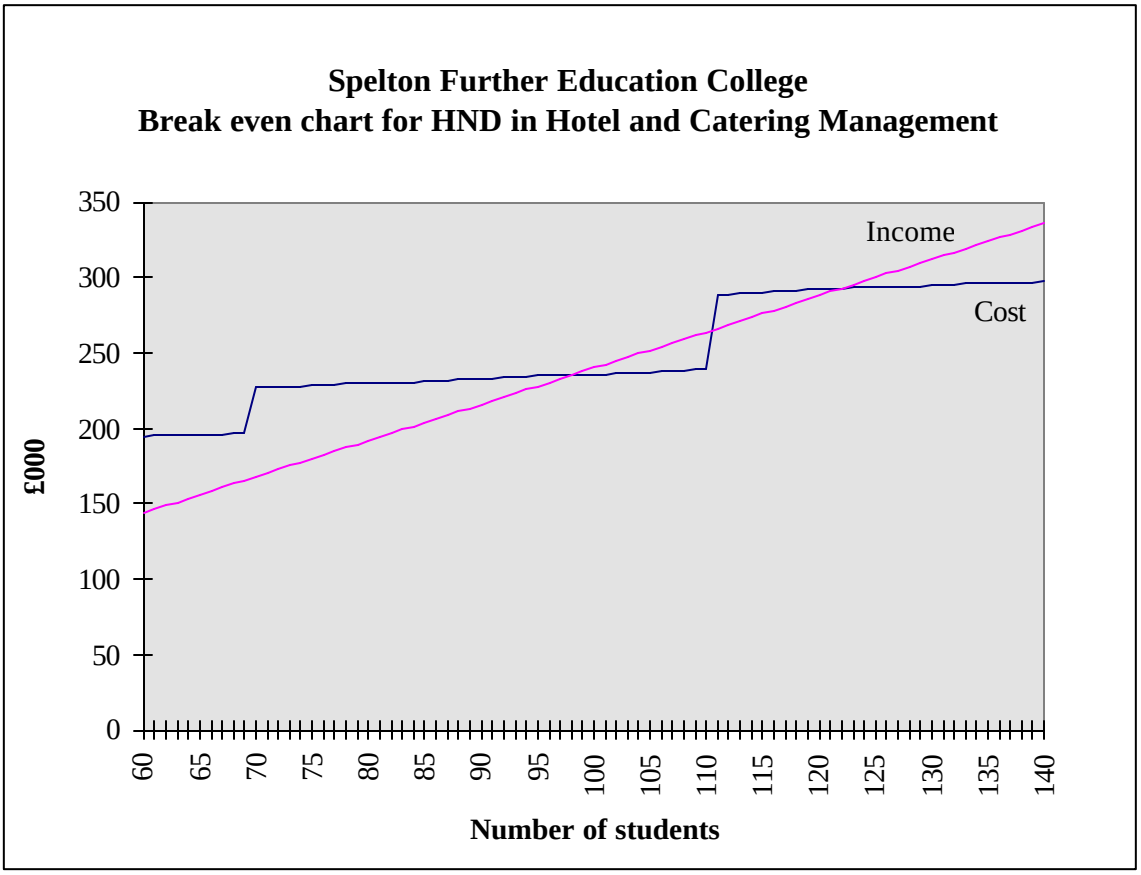
$$\frac{(5 \times 110{,}013) - (469 \times 1{,}171)}{(5 \times 44{,}589) - (469^2)} = 0.29 \quad \text{(i.e. £290 per student)}$$

This gives a fixed cost (£000) of

$$\frac{1{,}171}{5} - \frac{0.29 \times 469}{5} = 206.998 \quad \text{(i.e. £206,998 per year)}$$

(The effect of roundings needs to be taken into account throughout the above analysis).

(b)


Spelton Further Education College
Break even chart for HND in Hotel and Catering Management
£000
350
300
250
200
150
100
50
0
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
Number of students
Income
Cost

(c) Report

To: Course Manager, HND Hotel and Catering Management
From: Trainee Accountant
Subject: Course Viability in 2000/2001

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1 I have estimated that at current prices the variable cost per student is £290 and the fixed cost is £207,000. The fixed cost will change if student numbers drop below 70 or rise above 110.

2 The attached break even chart shows that if recruitment exceeds 98 then income will exceed cost. However, there will be a jump in fixed costs if numbers exceed 110, meaning that if numbers are between 111 and 121 (inclusive) the course will not cover its cost. Above 121 it again becomes profitable.

3 I would suggest that if numbers reach 110, it would be sensible to delay enrolment of any further applicants until you are confident that you will have at least 12 more students.

4 The figures I have used have been derived from data relating to the first five years of the course, using a technique called linear regression. The technique is only valid if there is a strong correlation between cost and student numbers. This appears to be the case from inspection of the figures; it could be tested by finding the correlation coefficient. If this turned out to be close to 1 or -1 then a high correlation is present. (Examiner's note: the correlation coefficient in this case is 0.9 - not required for full marks.)

5 The use of a break even chart to illustrate the viability of the course, depends on the assumption that fixed costs will remain the same, at least for student numbers within the expected range (60 - 140), apart from the known changes for part time tutors. Before placing reliance on the break even figures you should satisfy yourself that there are no other elements of semi fixed costs which could change within the given range of student numbers.

6 The costs and income figures I have used are all based on this year's values. No doubt both costs and income per student will increase next year as a

result of inflation. This in itself will not invalidate my analysis provided all elements of cost and income are increased by the same level of inflation.

(a) Adjust full cost figures to constant prices *2*

Estimate fixed and variable costs. If a valid method (eg High-Low) other than regression is used, the maximum mark should be reduced to 4; if the result is significantly different from the regression result, a further mark should be deducted even if the method has been correctly applied. For example, the high low method gives a variable cost of £258.06 $\frac{(237,000 - 229,000)}{110 - 79}$
and fixed cost of £208,613 which would limit the maximum mark to 3. *6*

Total for part (a) *(8)*

(b) Total cost line consistent with results in part (a) *4*

Accurate income line. *1*

Well presented with units marked on the x and y axes, break even point(s) shown and cost and income lines labelled. *2*

Total for part (b) *(7)*

(c) State the break even points. *1*

Explain the significance of the break even points. *2*

Explain the assumption of no other changes in fixed costs. *2*

Comment on the relevance of inflation. *2*

Mention assumptions of correlation and linearity. *2*

Credit can be given for other valid comments in the report, provided the total for part (c) does not exceed 10.

Good report format. *1*

(10)

(25)