Chapter 10: Comparing Monetary Returns over Time

Extra questions

1. A project costing £150,000 has the following expected benefits:

Year	1	2	3	4	5
Benefits	£70,000	£70,000	£80,000	£60,000	£40,000

(a) If the company used the payback method, when does the project pay for itself?
(b) If the company were to employ a discount rate of 10%, what would be the NPV of the project?

2. Find the amount of interest earned on an investment of £1,200 over 5 years if interest is at 8% and (a) simple interest, (b) compound interest, is used.

3. A newly appointed manager decides to invest a series of inheritances to offset against possible future unemployment and eventually, retirement. Initially she puts aside £25,000. For the first 2 years she is able to get an annual interest rate (compounded) of 4%. At the beginning of the fourth year she invests a further £10,000. In the third and fourth year she gets an interest rate is then 5%, and in year 6 of 10% and year 7 of 8%. In year 8 she invests £45,000 and the interest rate drops to 7%, as it does for year 9. In the final year she gets an interest rate of 5%. How much money will she have as a lump sum at the end of year 10? (Assume in each case that she invests the money on January 1st each year.)

4. A company is considering investing in a project to expand the facilities for customers. There are two different ways of doing this and they have each been costed. Projected net cash flow into the company has also been estimated.

	Year	**Project 1**	**Project 2**
Cost	0	£120,000.00	£115,000.00
Expected Contributions			
	1	£50,000.00	£40,000.00
	2	£50,000.00	£45,000.00
	3	£50,000.00	£50,000.00
	4	£40,000.00	£50,000.00
	5	£40,000.00	£45,000.00
	6	£30,000.00	£30,000.00

(a) If the company used the payback method, when does each project pay for itself?
(b) If the company were to employ a discount rate of 12%, what would be the NPV of each project?

5. A new process is likely to save money for a company if it can be successfully implemented. The firm's accountants have estimated the likely savings if the implementation is fully successful, it is partially successful, and if it fails. The production department claim the probability of these three scenarios is 0.6, 0.3 and 0.1 respectively. The management accountants assess the probabilities as 0.3, 0.5 and 0.2

respectively. Using the figures below together with an interest rate of 10% and the NPV method, assess the expected savings over the five year period under each set of assumptions. What would you recommend to the company?

		Savings		
Probability		0.6	0.3	0.1
Year		Fully Successful	Partially Successful	Fails
	1	£15000	£5000	-£10000
	2	£20000	£8000	-£10000
	3	£25000	£10000	-£8000
	4	£25000	£10000	-£8000
	5	£25000	£11000	-£7000

N.B. Negative figures are costs

6. What factors might you take into account if you were asked to set an interest rate to be used by your company in Net present Value calculations?

7. A car costs £15,000 and depreciates by 20 per cent per year. What will it be worth after 3 years?

Extra answers

1. (a) if we add up the benefits we have £70,000 at the end of year 1, £140,000 at the end of year 2 and £220,000 at the end of year 3. So payback is in year 3. If we were to further assume that the money comes to the company evenly through the year, then to get to £150,000 from the end of year 2 we need £10,000 – this is an eighth of the benefits from year 3, so we could say that the payback period is two and 8/12 years, or $2^{2}/_{3}$ years .
   (b) to find the NPV we can use a spreadsheet such as:

			10%
Year	**Costs**	**Expected Revenues**	**Discount Factor**	**NPV**
0	£ 150,000.00		1	-£150,000.00
1		£ 70,000.00	0.909090909	£ 63,636.36
2		£ 70,000.00	0.826446281	£ 57,851.24
3		£ 80,000.00	0.751314801	£ 60,105.18
4		£ 60,000.00	0.683013455	£ 40,980.81
5		£ 40,000.00	0.620921323	£ 24,836.85
				£ 97,410.45

2. (a) Simple interest gives the same amount each year. This will be £1,200*0.08 = £96. You get this for 5 years, so the total is £96 * 5 = £480
   (b) with compound interest you get interest on the interest. Our formula is $A_0(1+r)^n$ and we have A_0 = £1,200, r = 0.08 and n = 5
   So 1,200 (1.08)^5 = £563.19

3. You could use a spreadsheet to work out the interest year by year:

Year	Amount	Additions	Interest	Total
1		£ 25,000.00		4 £ 26,000.00
2	£ 26,000.00			4 £ 27,040.00
3	£ 27,040.00			5 £ 28,392.00
4	£ 28,392.00	£ 10,000.00		5 £ 40,311.60
5	£ 40,311.60			7 £ 43,133.41
6	£ 43,133.41			10 £ 47,446.75
7	£ 47,446.75			8 £ 51,242.49
8	£ 51,242.49	£ 45,000.00		7 £ 102,979.47
9	£ 102,979.47			7 £ 110,188.03
10	£ 110,188.03			5 £ 115,697.43

4. (a) for payback we need to find the cumulative benefits and identify when they pass the cost of the project. For both projects this will be during year 3:

	Year	**Project 1**	**Project 2**	**Cumulative 1**	**Cumulative 2**
Cost	0	£ 120,000.00	£115,000.00		
	1	£ 50,000.00	£ 40,000.00	£ 50,000.00	£ 40,000.00
	2	£ 50,000.00	£ 45,000.00	£ 100,000.00	£ 85,000.00
	3	£ 50,000.00	£ 50,000.00	£ 150,000.00	£ 135,000.00
	4	£ 40,000.00	£ 50,000.00	£ 190,000.00	£ 185,000.00
	5	£ 40,000.00	£ 45,000.00	£ 230,000.00	£ 230,000.00
	6	£ 30,000.00	£ 30,000.00	£ 260,000.00	£ 260,000.00

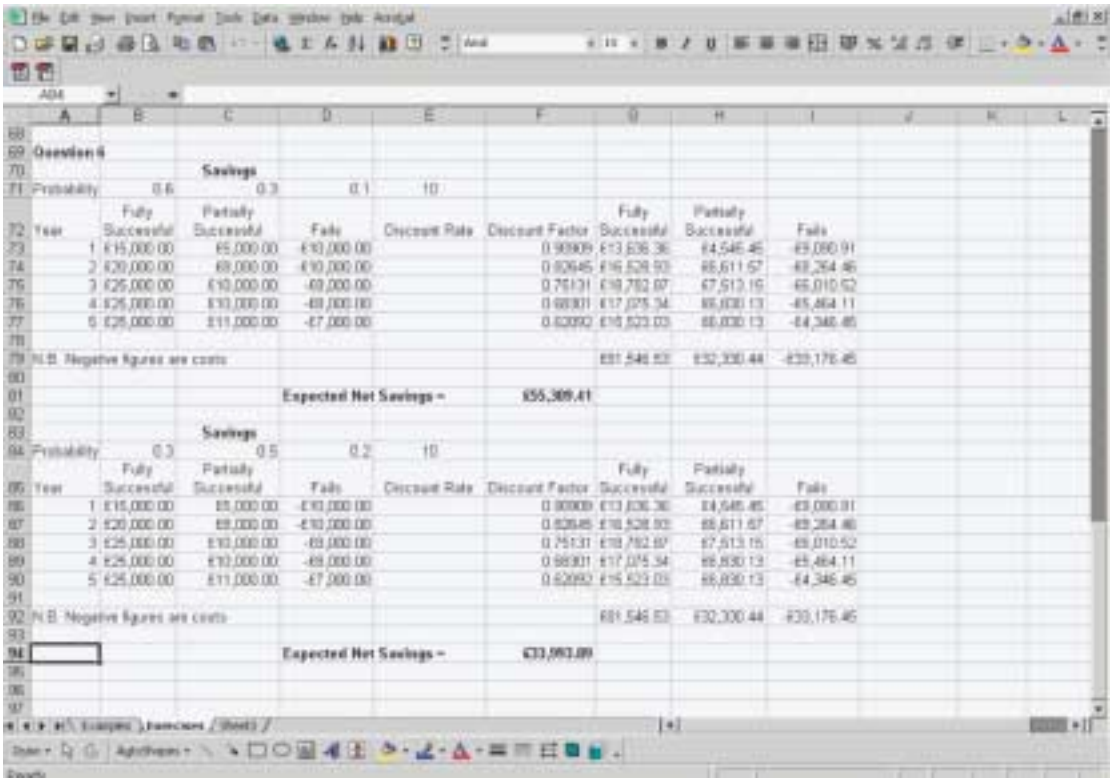
   For the first project we are £20,000 short at the beginning of the year, and in year 3 we get £50,000 – so we reach to total at (2/5) of the way through the year

(nearly 5 months). For the second project we are £40,000 short at the beginning of the year, and earn £50,000 in the year – so we reach the total at (4/5) of the way through the year (not quite 10 months). Therefore Project 1 is better using the payback method.
(b) this part is approached in much the same way as the last question, except that we apply the discount factor to each set of projected cash flows. This gives:

Discount Factor	PV1	PV2
	£120,000.00	£ 115,000.00
0.8929	£ 44,642.86	£ 35,714.29
0.7972	£ 44,642.86	£ 40,178.57
0.7118	£ 44,642.86	£ 44,642.86
0.6355	£ 35,714.29	£ 44,642.86
0.5674	£ 35,714.29	£ 40,178.57
0.5066	£ 26,785.71	£ 26,785.71
	NPV = £112,142.86	**£ 117,142.86**

Since NPV2 is larger than NPV1, Project 2 is seen as the better project.

5. We can use the NPV calculations on savings in just the same way that we use them on Net Income. Our spreadsheet is shown here:



Note that we have done the sums twice, for clarity, but in practice you would just change the probability figures to move from the Production Department's view, to that of the management accountants.

Since both assessments lead to positive expected savings, the company would be recommended to go ahead.

6. In answering this question you can rehearse the arguments about selecting r, but you can also bring in other relevant factors.

In relation to r you might include knowing the industry the company is in, knowing the discount rate recommended by the trade body (if it exists), knowing the rate used by competitors, knowing the current Bank of England discount rate on Treasury Bonds, knowing the most recent economic forecasts, knowing if the project is more or less risky than other projects, knowing the discount rate used last time.

Other factors might include knowing about the predictions, are they optimistic or conservative? The assumption of success of the project. The reliability of any forecasts.

7. Depreciation is often used in accounting departments to gradually lower the value of some asset. We just take a given percentage away from the value each year. This will give us:

Year		Value	r =20%
Start	£	15,000.00	
1	£	12,000.00	
2	£	9,600.00	
3	£	7,680.00	