

F5 June 2011 Question 1

- 1 Cement Co is a company specialising in the manufacture of cement, a product used in the building industry. The company has found that when weather conditions are good, the demand for cement increases since more building work is able to take place. Last year, the weather was so good, and the demand for cement was so great, that Cement Co was unable to meet demand. Cement Co is now trying to work out the level of cement production for the coming year in order to maximise profits. The company doesn't want to miss out on the opportunity to earn large profits by running out of cement again. However, it doesn't want to be left with large quantities of the product unsold at the end of the year, since it deteriorates quickly and then has to be disposed of. The company has received the following estimates about the probable weather conditions and corresponding demand levels for the coming year:

Weather	Probability	Demand
Good	25%	350,000 bags
Average	45%	280,000 bags
Poor	30%	200,000 bags

Each bag of cement sells for \$9 and costs \$4 to make. If cement is unsold at the end of the year, it has to be disposed of at a cost of \$0.50 per bag.

Cement Co has decided to produce at one of the three levels of production to match forecast demand. It now has to decide which level of cement production to select.

Required:

- (a) Construct a pay off table to show all the possible profit outcomes. (8 marks)

- (b) Decide the level of cement production the company should choose, based on the following decision rules:

(i) Maximin (1 mark)

(ii) Maximax (1 mark)

(iii) Expected value (4 marks)

You must justify your decision under each rule, showing all necessary calculations.

- (c) Describe the 'maximin' and 'expected value' decision rules, explaining when they might be used and the attitudes of the decision makers who might use them. (6 marks)

(20 marks)

1 Cement Co

(a) Pay off table

			Prob.*	SUPPLY (no. of bags)		
				350,000	280,000	200,000
DEMAND	Weather			\$'000	\$'000	\$'000
	Good	\$'000	0.25	1,750 (1)	1,400	1,000
	Average	\$'000	0.45	1,085 (2)	1,400	1,000
	Poor	\$'000	0.3	325	640	1,000

* The probability column is only shown so as to help in part (b) (iii)'s calculations.

Profit per bag sold in coming year = \$9 – \$4 = \$5

Loss per bag disposed of = \$4 + \$0.50 = \$4.50

(1) 350,000 x \$5 = \$1,750,000

(2) [280,000 x \$5] – [70,000 x \$(4.50)] = \$1,085,000 etc

(b) (i) Maximin – identify the worst outcome for each level of supply and choose the highest of these worst outcomes.

	SUPPLY (no. of bags)		
	350,000	280,000	200,000
	\$'000	\$'000	\$'000
Worst	325	640	1000

The highest of these is \$1,000,000 therefore choose to supply only 200,000 bags to meet poor conditions.

(ii) Maximax – identify the best outcome for each level of supply and choose the highest of these best outcomes.

	SUPPLY (no. of bags)		
	350,000	280,000	200,000
	\$'000	\$'000	\$'000
Best	1,750	1,400	1,000

The highest of these is \$1,750,000 therefore choose to supply 350,000 bags to meet good conditions.

(iii) Expected value – use the probabilities provided in order to calculate the expected value of each of the supply levels.

Good (0.25 x \$1,750,000) + (0.45 x \$1,085,000) + (0.30 x \$325,000) = \$1,023,250

Average (0.7 x \$1,400,000) + (0.3 x \$640,000) = \$1,172,000

Poor 1 x \$1,000,000 = \$1,000,000

The expected value of producing 280,000 bags when conditions are average is the highest at \$1,172,000, therefore this supply level should be chosen.

(c) Maximin and expected value decision rules

The 'maximin' decision rule looks at the worst possible outcome at each supply level and then selects the lowest one of these. It is used when the outcome cannot be assessed with any level of certainty. The decision maker therefore chooses the outcome which is guaranteed to minimise his losses. In the process, he loses out on the opportunity of making big profits. It is often seen as the pessimistic approach to decision-making (assuming that the worst outcome will occur) and is used by decision makers who are risk averse. It can be used for one-off or repeated decisions.

The 'expected value' rule calculates the average return that will be made if a decision is repeated again and again. It does this by weighting each of the possible outcomes with their relative probability of occurring. It is the weighted arithmetic mean of the possible outcomes.

Since the expected value shows the long run average outcome of a decision which is repeated time and time again, it is a useful decision rule for a risk neutral decision maker. This is because a risk neutral person neither seeks risk or avoids it; they are happy to accept an average outcome. The problem often is, however, that this rule is often used for decisions that only occur once. In this situation, the actual outcome is unlikely to be close to the long run average. For example, with Cement Co, the closest actual outcome to the expected value of \$1,172,000 is the outcome of \$1,085,000. This is not too far away from the expected value but many of the others are really different.

		Marks
1	(a) Pay off table	
	Calculation of profit	1
	Calculation of loss	1
	Supply column – 350,000	2
	Supply column – 280,000	2
	Supply column – 200,000	2
		8
	(b) Decision criterion	
	(i) Maximin	
	Selecting highest of the low	1
	(ii) Maximax	
	Selecting highest of the high	1
	(iii) Expected value	
	Calculating EV when good	1
	Calculating EV average	1
	Calculating EV when poor	1
	Selecting highest	1
		4
	(c) Maximin and EV	
	Describe maximin	1
	Risk averse/pessimistic	1
	One-off/repeated decisions	1
	Describe EV	2
	Risk neutral	1
	Repeated decisions	1
		6
	Maximum marks	
	Total marks	20