

## More Problems – Decision theory – CA200

### Question 1

A purchasing agent must decide to accept or reject an incoming shipment of machine parts. The agent wishes to do either of the following:

- $a_1$ : Accept the shipment
- $a_2$ : Reject the shipment

The fraction of defective parts in the shipment is either 0.1 or 0.5 with a prior likelihood of each occurring being 0.5. The costs associated with the possible decisions are €1000 if a 0.1 shipment is rejected and €1500 if a 0.5 shipment is accepted. No costs are incurred if a 0.1 shipment is accepted or a 0.5 shipment is rejected. It is possible to test one part from a shipment as a cost of €10.

- (i) What is the optimal decision without sampling?
- (ii) Calculate the Expected Value of Perfect Information.
- (iii) Determine the optimal strategy, that is, what action to take in response to sample outcomes. Show the results of workings on a decision tree.

### Question 2

A manufacturing company must decide whether it should purchase a component part from a supplier or manufacture the component in its plant in Cork. If demand is high, it would be advantageous to manufacture the component, but if demand is low, the high manufacturing cost would favour purchasing the component. The projected profit (in €'000) for each option is given in the following table:

<u>Decision alternatives</u>	<u>Demand</u>		
	<u>Low(S<sub>1</sub>)</u>	<u>Medium(S<sub>2</sub>)</u>	<u>High(S<sub>3</sub>)</u>
Manufacture component	- 20	40	100
Purchase component	10	45	70

The probabilities of demand being low, medium or high are estimated to be 0.35, 0.35 and 0.30 respectively.

- (i) On the basis of the above information, what decision would you recommend?
- (ii) A test market study of potential demand for the product could be carried out at a cost of €5,000, and would be expected to report either favourable ( $O_1$ ) or unfavourable ( $O_2$ ) demand conditions, the relevant conditional probabilities being as follows:

$$\begin{array}{ll}
 P(O_1 | S_1) = 0.10 & P(O_2 | S_1) = 0.90 \\
 P(O_1 | S_2) = 0.40 & P(O_2 | S_2) = 0.60 \\
 P(O_1 | S_3) = 0.60 & P(O_2 | S_3) = 0.40
 \end{array}$$

Would it be worthwhile for the company to pay for this test market study?