

# QQQ – Decision 2 – Chapter 8 – Decision Analysis (Version 2)

**Total Marks: 26**

(26 = Platinum, 23 = Gold, 21 = Silver, 18 = Bronze)

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1. The table below shows the transport options, usual travel times, possible delay times and corresponding probabilities of delay for a journey. All times are in minutes.

| Transport option | Usual travel time | Possible delay time | Probability of delay |
|------------------|-------------------|---------------------|----------------------|
| Car              | 52                | 10                  | 0.10                 |
|                  |                   | 25                  | 0.02                 |
| Train            | 45                | 15                  | 0.05                 |
|                  |                   | 25                  | 0.03                 |
| Coach            | 55                | 5                   | 0.05                 |
|                  |                   | 15                  | 0.01                 |

- (a) Draw a decision tree to model the transport options and the possible outcomes. **(5)**
- (b) State the minimum expected travel time and the corresponding transport option indicated by the decision tree. **(2)**

**(Total 7 marks)**

2. Jenny can choose one of three options, A, B or C, when playing a game. The profit, in pounds, associated with each outcome and their corresponding probabilities are shown on the decision tree in Figure 1.

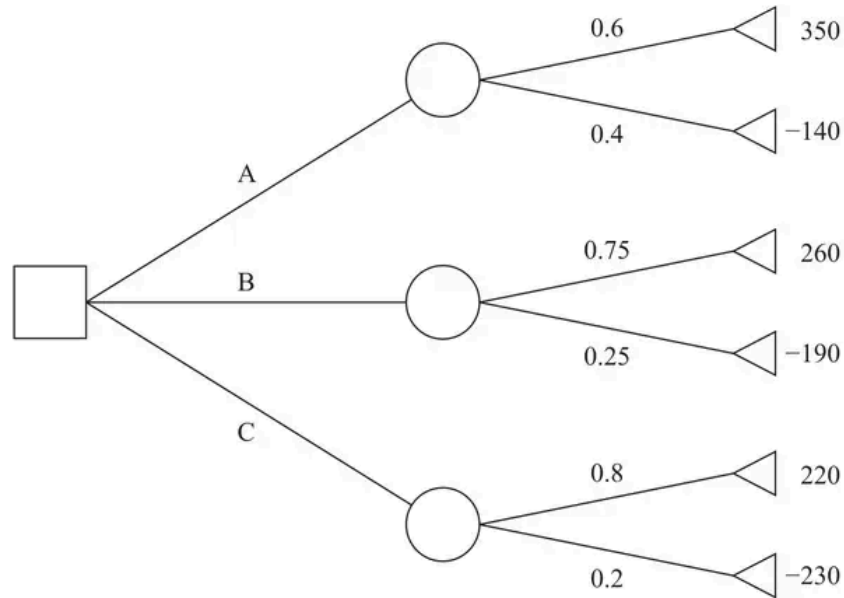


**Figure 1**

- (a) Calculate the optimal EMV to determine Jenny's best course of action. You must make your working clear. **(3)**

For a profit of £ $x$ , Jenny's utility is given by  $1 - e^{-\frac{x}{400}}$

- (b) Using expected utility as the criterion for the best course of action, determine what Jenny should do now to maximise her profit. You must make your working clear. **(4)**

**(Total 7 marks)**

**3.** Aisha is deciding whether or not to play a game.

The game involves rolling three fair six-sided dice, which have faces numbered from 1 to 6

If the total score on the three dice is 16 or more then she wins a prize. If the total score is 15 or less then she loses and will have to pay the person running the game £3

**(a)** Given that the prize is £15

- (i)** draw a decision tree to model Aisha's possible decisions and the possible outcomes
- (ii)** determine Aisha's optimal EMV and state the optimal strategy indicated by the decision tree. **(6)**

The utility function of the game to Aisha is  $u(m) = 1 - e^{-\frac{m}{500}}$  where  $m$  is the amount of money that Aisha has available. Given that Aisha has exactly £3 and that the prize is now £ $x$

**(b)** find the expected utility to Aisha of playing the game in the form

$$\frac{a}{b} \left( 1 - e^{-\frac{(x+c)}{500}} \right)$$

where  $a$ ,  $b$  and  $c$  are integers to be found. **(2)**

Aisha decides to use the expected utilities to determine whether she should play the game or not.

**(c)** Find the minimum prize for which Aisha would consider playing the game. **(4)**

**(Total 12 marks)**