2011 Paper 8 Question 8

Artificial Intelligence II

(a) Give a definition of *expected utility* and explain why the concept is useful in the context of decision-making. [2 marks]

(b) Give a definition of the *value of perfect information* and explain why the concept is useful in the context of decision-making. [4 marks]

(c) A talented, but nervous, student has to sit a difficult and important examination. There are only two possible outcomes: `pass` or `fail` and the student attaches to these utilities of $U(\texttt{pass}) = 10^6$ and $U(\texttt{fail}) = -10^8$. Lacking in confidence, his beliefs are that $\Pr(\texttt{pass}|\texttt{revise}) = 0.55$ and $\Pr(\texttt{pass}|\neg\texttt{revise}) = 0.2$. Calculate the expected utility of the situation described. [4 marks]

(d) The student finds what he believes might be a copy of this year's examination paper, discarded by a careless examiner. He believes that

$$\Pr(\texttt{pass}|\texttt{revise}, \texttt{thisYearsPaper}) = 0.75$$

However, should he be wrong then

$$\Pr(\texttt{pass}|\texttt{revise}, \neg\texttt{thisYearsPaper}) = 0.1$$

as he will waste time learning to answer the wrong questions, because he will revise from the wrong paper. Not revising implies

$$\Pr(\texttt{pass}|\neg\texttt{revise}, \texttt{thisYearsPaper}) = 0.7$$

However, should he be wrong then

$$\Pr(\texttt{pass}|\neg\texttt{revise}, \neg\texttt{thisYearsPaper}) = 0.08$$

He considers bribing somebody to tell him whether he has this year's paper or not; however, he thinks it is unlikely that he in fact has this year's paper, and therefore believes that

$$\Pr(\texttt{thisYearsPaper}) = 0.7$$

Compute the value of perfect information associated with finding out whether the paper is the right one. [10 marks]