2008 Paper 9 Question 5

Artificial Intelligence II

A friend of mine likes to climb on the roofs of Cambridge. To make a good start to the coming week, he climbs on a Sunday with probability 0.98. Being concerned for his own safety, he is less likely to climb today if he climbed yesterday, so

$$\Pr(\texttt{climb\_today}|\texttt{climb\_yesterday}) = 0.4$$

If he did not climb yesterday then he is very unlikely to climb today, so

$$\Pr(\texttt{climb\_today}|\neg\texttt{climb\_yesterday}) = 0.1$$

Unfortunately, he is not a very good climber, and is quite likely to injure himself if he goes climbing, so

$$\Pr(\texttt{injury}|\texttt{climb\_today}) = 0.8$$

whereas

$$\Pr(\texttt{injury}|\neg\texttt{climb\_today}) = 0.1$$

(a) Explain how my friend's behaviour can be formulated as a *Hidden Markov Model*. What assumptions are required? [4 marks]

(b) You learn that on Monday and Tuesday evening he obtains an injury, but on Wednesday evening he does not. Use the *filtering* algorithm to compute the probability that he climbed on Wednesday. [8 marks]

(c) Over the course of the week, you also learn that he does not obtain an injury on Thursday or Friday. Use the *smoothing* algorithm to compute the probability that he climbed on Thursday. [8 marks]