2   Artificial Intelligence II (SBH)

(a) Denoting the *utility* of a state s of the world by $U(s)$, and given that we have *evidence E* regarding the world and probability distribution $\Pr(s|A = a, E)$ modelling the effect of taking specific actions, define the *expected utility* associated with taking an action. [2 marks]

(b) Evil Robot is, despite his undoubted evilness, very shy where romance is concerned. He has fallen for a beautiful vacuum cleaner, called SN05718, and is wondering whether to ask her to accompany him for a change of oil. He rates the utility of going alone as -10 and the utility of being accompanied as $+100$. Being shy, he feels that if he asks her then she will accept with probability 0.1, but if he does not then there is a small chance of 0.01 that she will in fact ask him. What is the expected utility of this situation? [3 marks]

(c) If in the scenario described in part (b) we discover that it is possible to obtain further evidence E' in addition to E regarding the world, derive an expression for the *value of perfect information* associated with finding the value of E'. [5 marks]

(d) Evil Robot has a plan to acquire SN05718's diary to find out whether or not she likes him. He believes that the likelihood of her liking him is 0.3. Also, if she likes him and he asks her to accompany him he thinks she will accept with probability 0.7, whereas if he does not ask she will in any case accompany him with probability 0.4. On the other hand, if she does not like him then the corresponding probabilities are 0.05 and 0.01. It will cost Evil Robot 15 to get someone to steal the diary. Compute whether or not he should. [10 marks]