# 2005 Paper 8 Question 2

**Artificial Intelligence II**

(*a*) A given probabilistic inference problem involves a query random variable (RV) $Q$, evidence RVs $\mathbf{E} = (E_1, \ldots, E_n)$ and unobserved RVs $\mathbf{U} = (U_1, \ldots, U_m)$. Assuming that RVs are discrete, state the equation allowing the inference $\Pr(Q|\mathbf{E} = (e_1, \ldots, e_n))$ to be computed using the full joint distribution of the RVs and explain why in practice such a method might fail. [5 marks]

(*b*) Give a general definition of a *Bayesian network* (BN), and explain how a BN represents a joint probability distribution. [4 marks]

(*c*) Define *conditional independence* and explain how BNs make use of this concept to reduce the effect of the difficulties mentioned in your answer to part (*a*). Describe the way in which conditional independence is employed by the *naïve Bayes* algorithm. [6 marks]

(*d*) Describe *two* further issues relevant to the application of BNs in a practical context and describe briefly how these issues can be addressed. [5 marks]