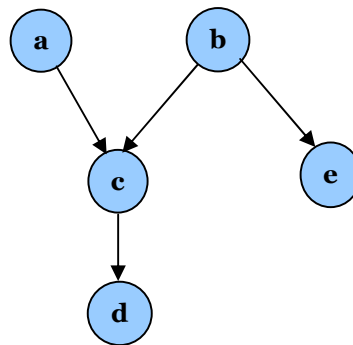


Statistical Pattern Recognition
Department of Computer Engineering
Quiz #10 (Graphical Models) – Spring 2011

Q. Consider a Bayesian Network with the below structure :



Further assume that each variable takes only 2 values {1, 0}.

- a) Prove that **a** and **e** are independent.
- b) Find $P(c=1|e=1)$ based on the probability distribution of the nodes given their parents.

Solution :

a) We have $P(a|e) = P(a)$. Therefore, **e** and **a** are independent.

$$\begin{aligned} b) P(c=1|e=1) &= P(c=1, b=1|e=1) + P(c=1, b=0|e=1) \\ &= P(c=1|b=1, e=1)P(b=1|e=1) + P(c=1|b=0, e=1)P(b=0|e=1) \\ &= P(c=1|b=1)P(b=1|e=1) + P(c=1|b=0)P(b=0|e=1) \end{aligned}$$

$$\begin{aligned} P(b=1|e=1) &= P(e=1|b=1)P(b=1)/P(e=1) \\ &= P(e=1|b=1)P(b=1)/\{P(e=1|b=1)P(b=1) + P(e=1|b=0)P(b=0)\} \end{aligned}$$

$$\begin{aligned} P(b=0|e=1) &= P(e=1|b=0)P(b=0)/P(e=1) \\ &= P(e=1|b=0)P(b=0)/\{P(e=1|b=1)P(b=1) + P(e=1|b=0)P(b=0)\} \end{aligned}$$