



COMSATS University, Islamabad
Department of Computer Science
Terminal Examination Fall-2022

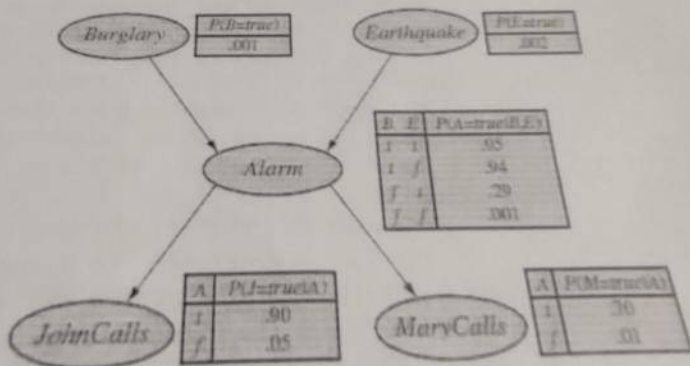
— CLO 5: Compare various planning strategies for different applications under uncertainty —

Question 05: (5 + 5 + 5 = 15 marks)

- a) Consider the following data set. Apply Naive Bayes approach to determine the probability of Alarm has sounded and neither the burglary nor the earthquake occurred, but John and Mary both did not call?

- a) Consider the following data set. Apply Naive Bayes approach to determine the probability of Alarm has not sounded and both the burglary and the earthquake occurred, but John and Mary both called?

$$P(H|X) = P(X|H) P(H) / P(X)$$



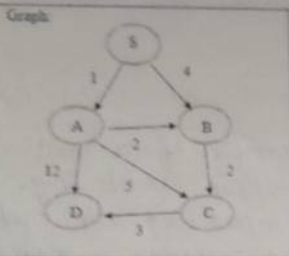
A typical Bayesian network, showing both the topology and the conditional probability tables (CPTs). In the CPTs, the letters B, E, A, J, and M stand for Burglary, Earthquake, Alarm, JohnCalls, and MaryCalls, respectively.

b) Using A* search from S to D, what will be the highest cost?

c) Using A* search from S to G, what will be the intermediate cost for the path S-A-C?

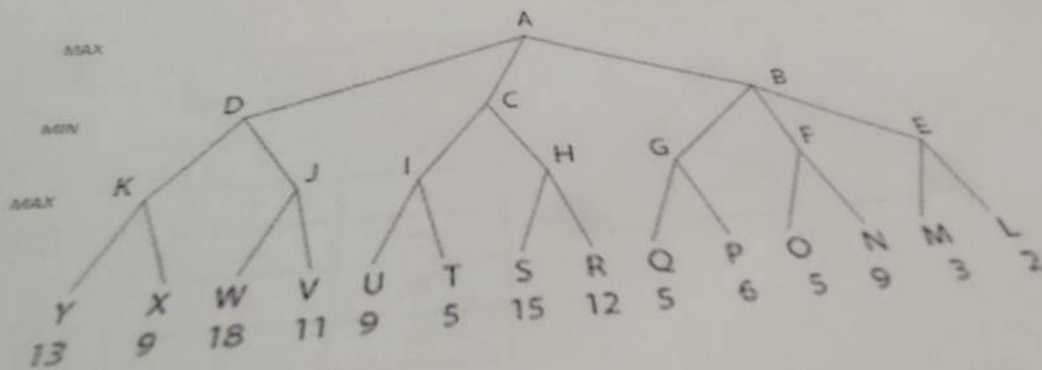
d) Using A* search from S to G, what will be the intermediate cost for starting the search path at S?

Consider the following graph



e) Using GBFS from S to C, what will be the final path?

Consider the following graph for alpha-beta pruning and answer the following questions



Final Value at node B will be

Frank bought something.

"Susan bought everything that Frank bought."

"If Frank bought everything, so did Susan."

"Everyone bought something."

$\forall x. (\text{bought}(x, \text{Frank}))$

$\forall x. \text{bought}(\text{Frank}, x) \rightarrow \forall x. \text{bought}(\text{Susan}, x)$

$\forall x \exists y. \text{bought}(x, y)$

b) With the help of the following table, prove that the logical equivalency mentioned below always holds.

$$\neg(\alpha \Rightarrow (\beta \wedge \gamma)) \equiv (\alpha \wedge \neg\beta) \vee (\alpha \wedge \neg\gamma)$$

- $(\alpha \wedge \beta) \equiv (\beta \wedge \alpha)$ commutativity of $\wedge$
- $(\alpha \vee \beta) \equiv (\beta \vee \alpha)$ commutativity of $\vee$
- $((\alpha \wedge \beta) \wedge \gamma) \equiv (\alpha \wedge (\beta \wedge \gamma))$ associativity of $\wedge$
- $((\alpha \vee \beta) \vee \gamma) \equiv (\alpha \vee (\beta \vee \gamma))$ associativity of $\vee$
- $\neg(\neg\alpha) \equiv \alpha$ double-negation elimination
- $(\alpha \Rightarrow \beta) \equiv (\neg\beta \Rightarrow \neg\alpha)$ contraposition
- $(\alpha \Rightarrow \beta) \equiv (\neg\alpha \vee \beta)$ implication elimination
- $(\alpha \Leftrightarrow \beta) \equiv ((\alpha \Rightarrow \beta) \wedge (\beta \Rightarrow \alpha))$ biconditional elimination
- $\neg(\alpha \wedge \beta) \equiv (\neg\alpha \vee \neg\beta)$ De Morgan
- $\neg(\alpha \vee \beta) \equiv (\neg\alpha \wedge \neg\beta)$ De Morgan
- $(\alpha \wedge (\beta \vee \gamma)) \equiv ((\alpha \wedge \beta) \vee (\alpha \wedge \gamma))$ distributivity of $\wedge$ over $\vee$
- $(\alpha \vee (\beta \wedge \gamma)) \equiv ((\alpha \vee \beta) \wedge (\alpha \vee \gamma))$ distributivity of $\vee$ over $\wedge$