

Solve the problem neatly on paper. Write your Name and Roll number clearly on top of the paper. Take photograph of the paper(s) and convert to a SINGLE pdf file. Upload the file in MS Teams.

1.a. We want to compute $P(Y \mid X_1, X_2)$, and we have no conditional independence information. Which of the following sets of values are sufficient for the calculation? [5]

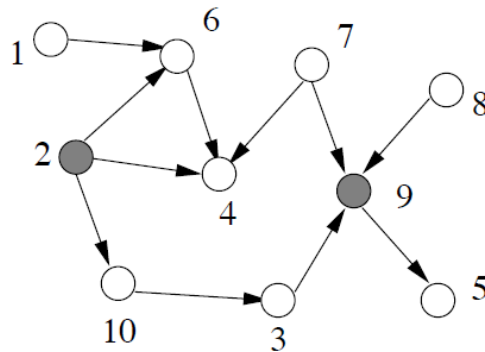
i. $P(X_1, X_2), P(Y), P(X_1 \mid Y), P(X_2 \mid Y)$

ii. $P(X_1, X_2), P(Y), P(X_1, X_2 \mid Y)$

iii. $P(X_1 \mid Y), P(X_2 \mid Y), P(Y)$

b. Suppose we know $X_1 \perp\!\!\!\perp X_2 \mid Y$ (i.e., X_1 is conditionally independent of X_2 given Y). Which of the above three sets are sufficient now? [5]

2. A Bayesian network is given below.



a. Which pair of nodes (i, j) are independent given nothing? [5]

b. Suppose we observe $\{2, 9\}$, shown shaded in the graph. What is the largest set of nodes X for which the statement $1 \perp\!\!\!\perp X \mid \{2, 9\}$ holds? [5]