

COURSE CODE (CREDITS): 19B1WCI832 (3)

MAX. MARKS: 25

COURSE NAME: Probabilistic Graphical Models

COURSE INSTRUCTORS: Dr. Nancy Singla

MAX. TIME: 1 Hour 30 Minutes

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make suitable numeric assumptions wherever required for solving problems.

Q1. Consider the Markov chain having states 0, 1, 2, 3 and 4. The state transition probability matrix P for the markov chain is as follows:

[5]

(CO2)

$$P = \begin{pmatrix} \frac{1}{2} & \frac{1}{2} & 0 & 0 & 0 \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & \frac{1}{2} & \frac{1}{2} & 0 \\ 0 & 0 & \frac{1}{2} & \frac{1}{2} & 0 \\ \frac{1}{4} & \frac{1}{4} & 0 & 0 & \frac{1}{2} \end{pmatrix}$$

Define and determine the recurrent and transient states.

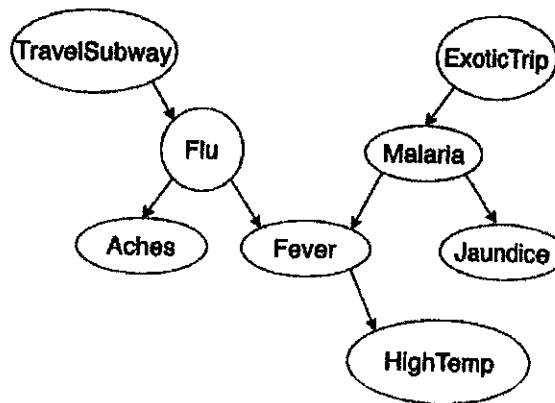
Q2. (a) Describe the conditions under which an evidence set E d-separates nodes A and B.

[3+6]

(b) Consider the Bayesian Network describing the following scenario:

(CO4)

If I travel on the subway, I may get the flu. If I take a trip to an exotic destination, I may catch malaria. Flu and malaria will have different symptoms. Flu and malaria will both cause fever. Flu will also cause aches. Malaria will also cause jaundice. Having a fever will also cause me to have high temperature.



(i) Are TravelSubway and HighTemp conditionally independent given Flu?

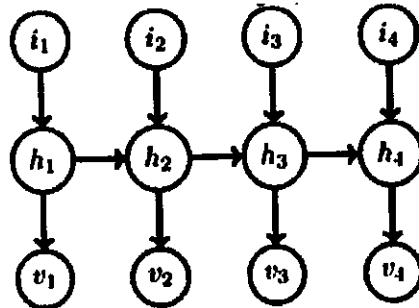
(ii) Are Aches and HighTemp independent?

(iii) Are Flu and ExoticTrip conditionally independent given HighTemp?

- Q3. (a) What is the significance of Factor graphs in the graphical models?
 (b) Draw the factor graph for the following Input-Output HMM.

[2+3]

(CO2)



- Q4. Given a portion of the Holmes scenario below, calculate $P(B|A)$ using the variable elimination algorithm

[6]

(CO3)

