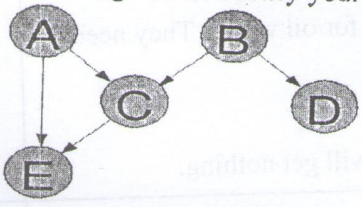
K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)
Subject Code: CEDLC5054 Subject Name: Probabilistic Graphical Models
Date: 05/12/2023

Nov – Dec 2023
(B. Tech) Program: B. Tech. (Computer Engineering)
Examination: TY Semester: V
Course Code: CEDLC5054 and Course Name: Probabilistic Graphical Models
Duration: 2.5 Hours **Max. Marks: 60**

Instructions:
(1) All questions are compulsory.
(2) Draw neat diagrams wherever applicable.
(3) Assume suitable data, if necessary.

		Max. Marks	CO	BT level
Q 1	**Solve any six questions out of eight:**	**12**		
i)	Let X, Y and Z be binary variables. Compute the selected entries (marked by a '?') in the factor $\psi(X,Y,Z)=\phi 1\ (X,Y)\cdot\phi 2\ (Y,Z)$	2	CO3	Ap
ii)	List any four applications of Hidden Markov Models.	2	CO4	U
iii)	Explain Gibb's Distribution with suitable examples.	2	CO3	U
iv)	Explain the concept of Reducible and Irreducible Markov Network.	2	CO5	U
v)	Explain the different types of variables and their probable values used in developing Bayesian network for a given scenario.	2	CO2	U
vi)	Assume that the variable E is observed. A, B, C, and D are not observed. Which pairs of variables other than E are independent in the given graphical model, given E? Justify your answer. 	2	CO3	Ap

X	Y	$\phi_1(X,Y)$
1	1	0.8
1	2	0.5
2	1	0.5
2	2	0.6

×

Y	Z	$\phi_2(Y,Z)$
1	1	0.2
1	2	0.2
2	1	0.9
2	2	1.0

=

X	Y	Z	$\psi(X,Y,Z)$
1	1	1	?
1	1	2	
1	2	1	?
1	2	2	
2	1	1	
2	1	2	
2	2	1	
2	2	2	?

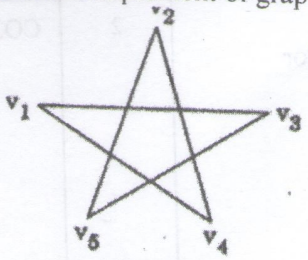
Nov-Dec 2023
Sem-V COMP **Subject: Probabilistic Graphical Models (CEDLC5054)**

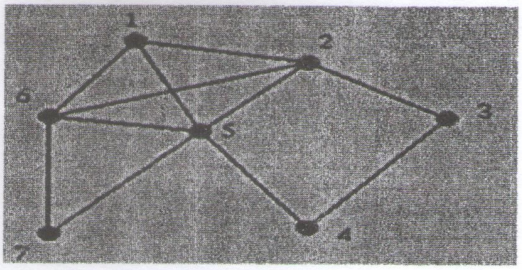
Q.2

5) Explain how Expected Value is used for taking decisions. Explain any example with Decision Network. (4M – CO5)

6) Explain Markov Model for Portfolio Optimization – (4 M- CO6)

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)
Subject Code: CEDLC5054 Subject Name: Probabilistic Graphical Models
Date: 05/12/23

vii)	List and explain advantages of probabilistic graphical modeling.	2	CO1	U
viii)	Explain properties of independent variables.	2	CO1	U
Q.2	**Solve any four questions out of six.**	**16**		
i)	Differentiate between Bayesian Networks and Markov Networks.		CO2	Ap
ii)	Explain Monty Hall Problem with Bayesian network.		CO2	U
iii)	Explain Complete Graph and Complement of Graph. Draw Complement of graph for the graph mentioned below:  		CO1	Ap
iv)	Explain inference concepts in Bayesian Networks. Discuss the concept with any one suitable example.		CO2	U
Q.3	**Solve any two questions out of three.**	**16**		
i)	Compare Conditional Probability and Joint Probability concepts with suitable examples.		CO2	U
ii)	Explain the working of Page Ranking Algorithms with an example. Write an application of the same.		CO6	U
iii)	a. Differentiate between the concepts of Expected Utility (EU) and Expected Value (EV). b. Calculate the Expected payoff for following scenario using decision tree: **Scenario:** Suppose the oil company needs to drill for oil wells. They need to decide to drill or not on the given site. 1. Drilling cost = $200 2. If oil found, it's worth of $900 3. If the well is dry, the company will get nothing.		CO5	Ap
Q.4	**Solve any two questions out of three.**	**16**		
i)	Explain the terms: a. Complete Graph b. Clique		CO2	Ap

	c. Maximal Clique d. Non-Maximal Clique Write the maximal and non-maximal cliques from the graph given below: 			
ii)	Explain D-separation in a BN structure. Draw graphs considering all different scenarios of D-Separation.		CO2	Ap
iii)	There is a Mouse moving around a maze. The maze is a closed space containing nine rooms numbered from 1 to 9 and there are doorways connecting the rooms. There are doors leading to adjacent rooms, i.e. there are doors: 1. from 1 to 2, 4 2. from 2 to 1, 3, 5 3. from 3 to 2, 6 4. from 4 to 1, 5, 7 5. from 5 to 2, 4, 6, 8 6. from 6 to 3, 5, 9 7. from 7 to 4, 8 8. from 8 to 5, 7, 9 9. from 9 to 6,8 a. Generate Transition Matrix based on the above information. b. What is the probability of the mouse starting from room 2 and reaching room 2 again in two transitions?		CO3	Ap

****