

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2026

B.Tech-VIII Semester (CSE/IT)

COURSE CODE (CREDITS): 19B1WCI832 (3)

MAX. MARKS: 15

COURSE NAME: PROBABILISTIC GRAPHICAL MODELS

COURSE INSTRUCTOR: Prof. Vivek Kumar Sehgal

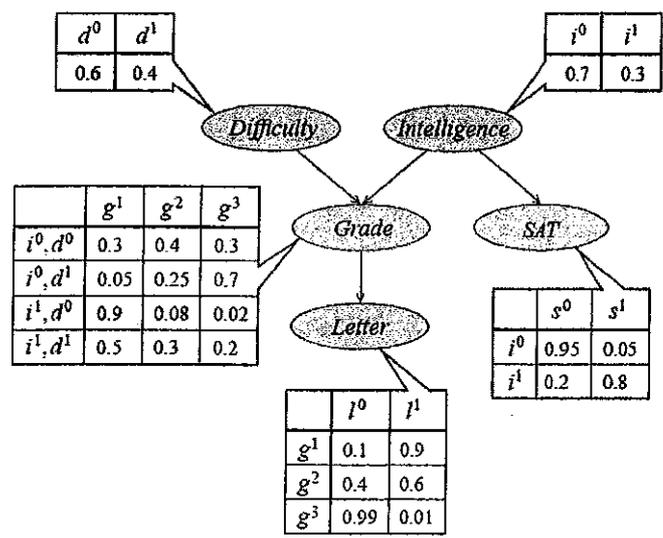
MAX. TIME: 1 Hour

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of calculators is allowed

Q.No	Question	CO	Marks																																																				
Q1	What are Probabilistic Graphical Models? Name and briefly explain the two main types of PGMs with diagram and one example each.	CO-1	3																																																				
Q2	For given joint distribution, calculate: i. Reduced Conditioning Distribution on g^1 ii. Renormalization of $P(I, Dg^1)$ iii. Marginalization of I	CO-1	3																																																				
<table border="1"> <thead> <tr> <th>I</th> <th>D</th> <th>G</th> <th>Prob.</th> </tr> </thead> <tbody> <tr> <td>i^0</td> <td>d^0</td> <td>g^1</td> <td>0.126</td> </tr> <tr> <td>i^0</td> <td>d^0</td> <td>g^2</td> <td>0.168</td> </tr> <tr> <td>i^0</td> <td>d^0</td> <td>g^3</td> <td>0.126</td> </tr> <tr> <td>i^0</td> <td>d^1</td> <td>g^1</td> <td>0.009</td> </tr> <tr> <td>i^0</td> <td>d^1</td> <td>g^2</td> <td>0.045</td> </tr> <tr> <td>i^0</td> <td>d^1</td> <td>g^3</td> <td>0.126</td> </tr> <tr> <td>i^1</td> <td>d^0</td> <td>g^1</td> <td>0.252</td> </tr> <tr> <td>i^1</td> <td>d^0</td> <td>g^2</td> <td>0.0224</td> </tr> <tr> <td>i^1</td> <td>d^0</td> <td>g^3</td> <td>0.0056</td> </tr> <tr> <td>i^1</td> <td>d^1</td> <td>g^1</td> <td>0.06</td> </tr> <tr> <td>i^1</td> <td>d^1</td> <td>g^2</td> <td>0.036</td> </tr> <tr> <td>i^1</td> <td>d^1</td> <td>g^3</td> <td>0.024</td> </tr> </tbody> </table>				I	D	G	Prob.	i^0	d^0	g^1	0.126	i^0	d^0	g^2	0.168	i^0	d^0	g^3	0.126	i^0	d^1	g^1	0.009	i^0	d^1	g^2	0.045	i^0	d^1	g^3	0.126	i^1	d^0	g^1	0.252	i^1	d^0	g^2	0.0224	i^1	d^0	g^3	0.0056	i^1	d^1	g^1	0.06	i^1	d^1	g^2	0.036	i^1	d^1	g^3	0.024
I	D			G	Prob.																																																		
i^0	d^0			g^1	0.126																																																		
i^0	d^0			g^2	0.168																																																		
i^0	d^0			g^3	0.126																																																		
i^0	d^1			g^1	0.009																																																		
i^0	d^1			g^2	0.045																																																		
i^0	d^1			g^3	0.126																																																		
i^1	d^0			g^1	0.252																																																		
i^1	d^0			g^2	0.0224																																																		
i^1	d^0			g^3	0.0056																																																		
i^1	d^1			g^1	0.06																																																		
i^1	d^1	g^2	0.036																																																				
i^1	d^1	g^3	0.024																																																				
Q3	What is the role of conditional probability distribution on Bayesian probabilistic graphical model? Calculate the following conditional probability distributions.	CO-1	3																																																				

	<p>i. $P(d^0, i^1, g^3, s^1, l^1)$ ii. $P(d^0, i^1, g^2, s^1, l^0)$ iii. $P(d^1, i^0, g^1, s^0, l^1)$</p>  <p>Difficulty CPT:</p> <table border="1"> <tr><td></td><td>d^0</td><td>d^1</td></tr> <tr><td></td><td>0.6</td><td>0.4</td></tr> </table> <p>Intelligence CPT:</p> <table border="1"> <tr><td></td><td>i^0</td><td>i^1</td></tr> <tr><td></td><td>0.7</td><td>0.3</td></tr> </table> <p>Grade CPT:</p> <table border="1"> <tr><td></td><td>g^1</td><td>g^2</td><td>g^3</td></tr> <tr><td>i^0, d^0</td><td>0.3</td><td>0.4</td><td>0.3</td></tr> <tr><td>i^0, d^1</td><td>0.05</td><td>0.25</td><td>0.7</td></tr> <tr><td>i^1, d^0</td><td>0.9</td><td>0.08</td><td>0.02</td></tr> <tr><td>i^1, d^1</td><td>0.5</td><td>0.3</td><td>0.2</td></tr> </table> <p>SAT CPT:</p> <table border="1"> <tr><td></td><td>s^0</td><td>s^1</td></tr> <tr><td>i^0</td><td>0.95</td><td>0.05</td></tr> <tr><td>i^1</td><td>0.2</td><td>0.8</td></tr> </table> <p>Letter CPT:</p> <table border="1"> <tr><td></td><td>l^0</td><td>l^1</td></tr> <tr><td>g^1</td><td>0.1</td><td>0.9</td></tr> <tr><td>g^2</td><td>0.4</td><td>0.6</td></tr> <tr><td>g^3</td><td>0.99</td><td>0.01</td></tr> </table>		d^0	d^1		0.6	0.4		i^0	i^1		0.7	0.3		g^1	g^2	g^3	i^0, d^0	0.3	0.4	0.3	i^0, d^1	0.05	0.25	0.7	i^1, d^0	0.9	0.08	0.02	i^1, d^1	0.5	0.3	0.2		s^0	s^1	i^0	0.95	0.05	i^1	0.2	0.8		l^0	l^1	g^1	0.1	0.9	g^2	0.4	0.6	g^3	0.99	0.01		
	d^0	d^1																																																						
	0.6	0.4																																																						
	i^0	i^1																																																						
	0.7	0.3																																																						
	g^1	g^2	g^3																																																					
i^0, d^0	0.3	0.4	0.3																																																					
i^0, d^1	0.05	0.25	0.7																																																					
i^1, d^0	0.9	0.08	0.02																																																					
i^1, d^1	0.5	0.3	0.2																																																					
	s^0	s^1																																																						
i^0	0.95	0.05																																																						
i^1	0.2	0.8																																																						
	l^0	l^1																																																						
g^1	0.1	0.9																																																						
g^2	0.4	0.6																																																						
g^3	0.99	0.01																																																						
<p>Q4</p>	<p>How are the flow conditions are influenced in Bayesian Networks? For following patterns explain when</p> <p>i. X CAN influence Y ii. X CANNOT influence Y $X \rightarrow Y$ $X \leftarrow Y$ $X \rightarrow W \rightarrow Y$ $X \leftarrow W \leftarrow Y$ $X \leftarrow W \rightarrow Y$ $X \rightarrow W \leftarrow Y$</p> <p>iii. From Q3, identify the observable components for complete influence D-G-I-S</p>	<p>CO-1.2</p>	<p>3</p>																																																					
<p>Q5</p>	<p>What you mean by Conditional Independencies? What are the conditions to satisfy random variables X, Y, Z, $p = (X \perp Y Z)(P(X, Y, Z) \propto \phi_1(X, Z)\phi_2(Y, Z))$?</p>	<p>CO-2</p>	<p>3</p>																																																					