

Examination Second Half 2021 under cluster __ (Lead College: _____)

Examinations Commencing from----- 2022 to ----- 2022

Program: Computer Engineering

Curriculum Scheme: Rev2019

Examination: TE Semester V

Course Code: CSDLO5011 and Course Name: Probabilistic Graphical Models

Time: 2 hour 30 minutes

Max. Marks: 80

Q.1	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Bayesian network consists of
Option A:	Directed Acyclic Graph
Option B:	Table of conditional probabilities
Option C:	Dependency between Variables
Option D:	All of the above
2.	Which algorithm is used for solving temporal probabilistic reasoning?
Option A:	Hill Climbing Algorithm
Option B:	Hidden Markov Model
Option C:	Depth-first search
Option D:	Breadth-first search
3.	An HMM is a temporal probabilistic model in which the state of the process is described by a
Option A:	Single discrete random variable
Option B:	Single random variable
Option C:	Single continuous random variable
Option D:	Multiple random variable
4.	Which amongst the following is a Non-Temporal Model?
Option A:	Linear Dynamic Systems
Option B:	Static Bayesian Network
Option C:	Kalman Filters
Option D:	Hidden Markov Model
5.	Find the incorrect statement. Bayesian (BN) versus Markov Network (MN)
Option A:	In BN, we use conditional probability as factors. In MN also, we use conditional probability
Option B:	In MN, we want to capture the affinity by a real number. In BN the factors are probability between 0 and 1
Option C:	MN is restricted to discrete state space while BN can be both discrete and

	continuous
Option D:	Unlike BN which have directed edges and clear directions of causality, MN have undirected edges and only encode associations
6.	The weighted average of all possible outcomes of a project, with the probabilities of the outcomes used as weights, is known as the:
Option A:	Variance
Option B:	Standard deviation
Option C:	Expected value
Option D:	Coefficient of variation
7.	Learning a graphical model involves
Option A:	Only Structural Learning
Option B:	Only Parameter Learning
Option C:	Both Structural and Parameter Learning
Option D:	None of the above
8.	If the various probabilities are given as: $P(B1)=P(B2)=P(B3)=P(B4)=1/4$ and $P(D/B1)=0.05$, $P(D/B2)=0.4$, $P(D/B3)=0.1$, $P(D/B4)=0.1$. Find $P(B2/D)$.
Option A:	13/80
Option B:	13/8
Option C:	8/13
Option D:	0
9.	Causal Chains(For example Smoking Causes Cancer, which in turn causes dyspnea) gives rise to
Option A:	Conditional Independence
Option B:	Conditional Dependence
Option C:	Gibbs Distribution
Option D:	Joint Distribution
10.	The probability transition matrix for a given markov chain is as follows The initial distribution given is $(1/3, 1/3, 1/3)$ Find the probability of $P(X_2=2, X_1=1 X_0=2)$ P is 3×3 matrix $P = \begin{bmatrix} 0.7 & 0.3 & 0 \\ 0.1 & 0.5 & 0.4 \\ 0.15 & 0.15 & 0.7 \end{bmatrix}$
Option A:	0.15
Option B:	0.02
Option C:	0.6
Option D:	0.06

Please use either of the 3 option given below while setting up the subjective/descriptive questions

Option 1

Q.2	Solve any Four out of Six [5 marks each]
A	Differentiate between marginal and joint distributions with an example.
B	What is a Directed Acyclic Graph.
C	Explain factor graph in HMM with the help of an example.
D	Explain three goals of learning.
E	Explain Gibbs Distribution.
F	Differentiate between Rule based CPD and Tree based CPD.

Q. 3	Solve any Two Questions out of Three [10 marks each]																									
A	Explain Application of Bayesian Networks for Classification, Forecasting, Decision Making																									
B	What is HMM model? Give basic formulation of HMM? From the HMM given below, decode the sequence {Happy, Grumpy} <pre>graph TD; Start((Start)) -- 0.2 --> S((S)); Start -- 0.8 --> R((R)); S -- 0.8 --> S; S -- 0.2 --> R; R -- 0.4 --> S; R -- 0.6 --> R; S -.-> 0.8 H1((H)); S -.-> 0.2 G1((G)); R -.-> 0.4 H2((H)); R -.-> 0.6 G2((G));</pre>																									
C	For the joint probability distribution table given below: <table><tr><th colspan="2" rowspan="2"></th><th colspan="3">X</th></tr><tr><th>0</th><th>1</th><th>2</th></tr><tr><th rowspan="4">Y</th><th>0</th><td>1/120</td><td>0</td><td>0</td></tr><tr><th>1</th><td>1/8</td><td>1/10</td><td>0</td></tr><tr><th>2</th><td>1/4</td><td>1/4</td><td>1/24</td></tr><tr><th>3</th><td>1/8</td><td>1/20</td><td>1/20</td></tr></table> a. What is the marginal distribution of X?			X			0	1	2	Y	0	1/120	0	0	1	1/8	1/10	0	2	1/4	1/4	1/24	3	1/8	1/20	1/20
				X																						
		0	1	2																						
Y	0	1/120	0	0																						
	1	1/8	1/10	0																						
	2	1/4	1/4	1/24																						
	3	1/8	1/20	1/20																						

b.	What is the marginal distribution of Y?
c.	What is the conditional distribution of Y given $X = 2$?
d.	What is the conditional distribution of X given $Y = 1$?

Q. 4	Solve any Four out of Six [5 marks each]
A	Explain the concept of D Separation.
B	Explain any two goals of the learning.
C	Explain maximum likelihood explanation with the help of an example.
D	Explain Gibbs parameterization with the help of an example.
E	Explain Utility. Explain Maximum Expected Utility with the help of an example
F	Explain Reduced Markov models