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BTECH**(SEM V) THEORY EXAMINATION 2023-24****MATHEMATICAL FOUNDATION AI, ML AND DATA SCIENCE****TIME: 3 HRS****M.MARKS: 100**

Note: Attempt all Sections. If you require any missing data, then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2x10 = 20**

Qno	Questions	CO
(a)	Explain the reading and interpretation of bar graphs.	1
(b)	Using Chebyshev's inequality, calculate the percentage of observations that would fall outside 3 standard deviations of the mean. (i) 11% (ii) 89% (iii) 90%	1
(c)	Discuss the need of sampling.	2
(d)	Explain the use of chi square test in hypothesis testing.	2
(e)	Briefly explain Gibbs sampling.	3
(f)	Interpret the need of random number generator.	3
(g)	Discuss vector space.	4
(h)	Explain linear independence.	4
(i)	Differentiate between symmetric matrix and anti symmetric matrix.	5
(j)	Discuss eigen value and eigen vectors.	5

SECTION B

2. Attempt any *three* of the following: **10x3 = 30**

(a)	The following table shows the number of Maruti car sold by five dealers in a particular month:	1												
	<table border="1"> <thead> <tr> <th>Dealer</th> <th>Saya</th> <th>Bagga Links</th> <th>DD motors</th> <th>Bhasin Motors</th> <th>Competent</th> </tr> </thead> <tbody> <tr> <td>Cars Sold</td> <td>60</td> <td>40</td> <td>20</td> <td>15</td> <td>10</td> </tr> </tbody> </table>	Dealer	Saya	Bagga Links	DD motors	Bhasin Motors	Competent	Cars Sold	60	40	20	15	10	
Dealer	Saya	Bagga Links	DD motors	Bhasin Motors	Competent									
Cars Sold	60	40	20	15	10									
	Represent the above information by a bargraph.													
(b)	Discuss Central limit theorem with applications.	2												
(c)	Explain Metropolis Hastings algorithm.	3												
(d)	Explain the proof of Cauchy-schwarz Inequality.	4												
(e)	Explain orthogonal diagonalization with the help of an example.	5												

SECTION C

3. Attempt any *one* part of the following: **10x1 = 10**

(a)	Three persons A,B,C have applied for a job in a private company. The chance of their selections is in the ration of 1:2:4. The probabilities that A,B and C can introduce changes to improve the profits of the company are 0.8, 0.5 and 0.3 respectively. If the change does not take place, find th1 probability that it is due to the appointment of C.	1
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(b)	Determine the mean and variance of the random variable X having the following probability distribution.										1	
	X=x	1	2	3	4	5	6	7	8	9	10	
	P(x)	0.15	0.10	0.10	0.01	0.08	0.01	0.05	0.02	0.28	0.20	

4. Attempt any one part of the following: 10 x 1 = 10

(a)	Calculate the ANOVA coefficient for the following data:				2
	Plant	Number	Average Span	S	
	Hibiscus	5	12	2	
	Marigold	5	16	1	
	Rose	5	20	4	
(b)	Discuss the steps involved in dimensionality reduction using PCA.				2

5. Attempt any one part of the following: 10 x 1 = 10

(a)	Explain the Joint distributions mentioned below:		3
	(i) Discrete Joint Distributions.		
	(ii) Continuous Joint distributions.		
	(iii) Multinomial Distribution.		
(b)	The breakdown of ages of all visitors to a convention is given in the table below. Fabine wants to take a stratified sample of the visitors at the convention She choses a sample size of 80. Calculate how many people she will need to sample from each age group.		3
	Age	Number of people	
	5-15	132	
	16-25	678	
	26-40	543	
	41-60	289	
	61+	108	

6. Attempt any one part of the following: 10 x 1 = 10

(a)	Explain the Gram Schmidt Process.	4
(b)	Explain how to find a basis of vector space.	4

7. Attempt any one part of the following: 10 x 1 = 10

(a)	Diagonalize the matrix	5									
	<table border="1"> <tr> <td>3</td> <td>0</td> <td>0</td> </tr> <tr> <td>-3</td> <td>4</td> <td>9</td> </tr> <tr> <td>0</td> <td>0</td> <td>3</td> </tr> </table>	3	0	0	-3	4	9	0	0	3	
3	0	0									
-3	4	9									
0	0	3									
(b)	Show that the transformation $T: V_2(\mathbf{R}) \rightarrow V_2(\mathbf{R})$ defined by $T(a, b) = (a + b, a) \forall a, b \in \mathbf{R}$ is a linear transformation.	5									