

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2024)

CLASS: BTECH
BRANCH: AI & ML

SEMESTER : IV
SESSION : SP/2024

SUBJECT: AI203 MATHEMATICS FOR DATA SCIENCE

TIME: 02 Hours

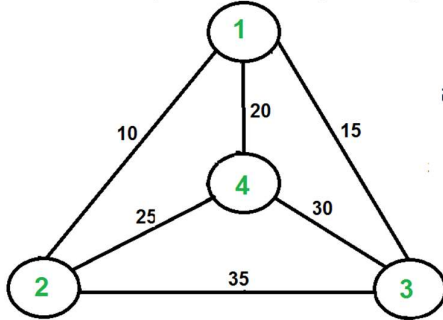
FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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- Q.1(a) Alex and Leo are a couple, and they organize a party together with 4 other couples. [3] CO BL
There are a number of greetings but, naturally, nobody says hello to their own partner. 1 4
At the end of the party Alex asks everyone how many people did they greet, receiving nine different answers. How many people did Alex greet and how many people did Leo greet?

- Q.1(b) Generate all possible tours (covering all vertices) and their cost in given graph. [2] 1 2



- Q.2(a) Find all eigenvalues and eigenvectors of given matrix. [5] 1 3

$$A = \begin{bmatrix} -2 & 1 \\ 12 & -3 \end{bmatrix}$$

- Q.3(a) For given data [5] 2 4

- Two states : 'Low' and 'High' atmospheric pressure.
- Two observations : 'Rain' and 'Dry'.
- Transition probabilities: $P(\text{'Low'}|\text{'Low'})=0.3$,
 $P(\text{'High'}|\text{'Low'})=0.7$, $P(\text{'Low'}|\text{'High'})=0.2$,
 $P(\text{'High'}|\text{'High'})=0.8$
- Observation probabilities : $P(\text{'Rain'}|\text{'Low'})=0.6$,
 $P(\text{'Dry'}|\text{'Low'})=0.4$, $P(\text{'Rain'}|\text{'High'})=0.4$,
 $P(\text{'Dry'}|\text{'High'})=0.3$.
- Initial probabilities: say $P(\text{'Low'})=0.4$, $P(\text{'High'})=0.6$.

Draw the Hidden markov model. And calculate probability for sequence of observations {Dry, Rain}.

Q.4(a) Find Covariance matrix of given data

[5]

4

X	Y	Z
75	10.5	45
65	12.8	65
22	7.3	74
15	2.1	76
18	9.2	56

Q.5(a) Write steps of Principle Component Analysis with their importance.

[2] 3 2

Q.5(b) Find transformed dataset for given data, eigen values and their corresponding eigen vectors. Calculate percentage of reduction using PC1 and PC2 components.

[3] 3 5

Standardized Data

x1	x2	x3	x4
1.04	0.71	-0.47	1.08
-0.73	-1.43	-0.99	-0.27
-0.97	0.04	0.13	0.44
0.66	0.67	1.33	-1.25

Eigen values and their corresponding eigen vectors

$$\lambda_1 = 1.6698239685 \quad v_1 = [0.51 \quad 0.6 \quad 0.58 \quad -0.23]$$

$$\lambda_2 = 0.3151205250 \quad v_2 = [-0.73 \quad 0.37 \quad 0.41 \quad 0.40]$$

$$\lambda_3 = 1.0144883673 \quad v_3 = [0.38 \quad 0.33 \quad -0.38 \quad 0.78]$$

$$\lambda_4 = 0.0005671392 \quad v_4 = [0.25 \quad -0.63 \quad 0.60 \quad 0.43]$$

.....22/02/2024.....M