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BT-4/M-22 **44227**

MATHEMATICS FOR MACHINE LEARNING

Course No. : BS-CS-AIML-202M

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *five* questions in all by selecting at least *one* question from each unit. All questions carry equal marks.

UNIT–I

1. (a) Explain the history of Data Science. 7½

(b) Explain the history of Machine Learning. 7½

2. (a) Explain the types of Data. 7½

(b) Explain the application of Machine Learning in the modern context. 7½

UNIT–II

3. (a) An urn contains 10 black and 10 white balls. Find the probability of drawing two balls of the same colour. 7½

(b) An urn I contains 3 white and 4 red balls and an urn II contains 5 white and 6 red balls. One ball is drawn at random from one of the urns and is found to be white. Find the probability that it was drawn from urn I. 7½

4. (a) Assuming that 20% of the population of a city are literate, so that the chances of an individual being literate is 1/5, and assuming that 100 investigators each take 10 individuals to see whether they are literate, how many investigators would you expect to report 3 or less were literate. 7½

(b) The 9 items of a sample have the following values 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these values differ significantly from the assumed mean 47.5 ? The tabular value of t at 5% level for 8 d.f. is 2.31. 7½

UNIT–III

5. (a) If $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, determine two non-singular matrices P and Q such that PAQ = 1. 7½

(b) Define eigen value and eigen vector of a matrix. Prove that eigen values of an idempotent matrix are either zero or unity. 7½

6. (a) Find the eigen values and eigen vectors of the matrix

$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}.$$ 7½

(b) State Cayley-Hamilton theorem. By using this theorem compute A^{-1} for the matrix. 7½

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

UNIT–IV

7. Diagonalise the matrix $A = \begin{bmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{bmatrix}$. 15

8. Compute the singular value decomposition (SVD) of the matrix $A = \begin{bmatrix} 1 & 0 & 1 \\ -2 & 1 & 0 \end{bmatrix}$. 15