

Roll No.

Total Pages : 3

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. $7\frac{1}{2}$
- (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. $7\frac{1}{2}$

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 $PAQ = I$. $7\frac{1}{2}$
- (b) Define eigen value and eigen vector of a matrix. Prove that eigen values of an idempotent matrix are either zero or unity. $7\frac{1}{2}$
6. (a) Find the eigen values and eigen vectors of the matrix

$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}. \quad 7\frac{1}{2}$$

- (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

EXAMKIT