



Term Evaluation (Odd) Semester Examination September 2025

Roll no.....

Name of the Course: MCA AI & DS

Semester: 1st

Name of the Paper: Probability and Statistics

Paper Code: TMD 101

Time: 1.5 hour

Maximum Marks: 50

Note:

- (i) Answer all the questions by choosing any one of the sub-questions.
- (ii) Each question carries 10 marks.

Q1.

(10 Marks) CO1

a. What do you mean by data analysis? Give a brief introduction to the components of data science.

OR

b. A die is thrown twice. Let the event A be "the sum of the numbers is 7" and event B be "at least one number is even."

- (i) Write down the sample space.
- (ii) Find $P(A)$, $P(B)$, and $P(A \cap B)$.
- (iii) Check whether A and B are independent.

Q2.

(10 Marks) CO1

a. Define the following.

- (i) Moment
- (ii) Standard deviation
- (iii) Variance
- (iv) Expectation

OR

b. What is a Binomial distribution? Write its probability mass function (PMF). Show that the mean of a Binomial distribution is np and the variance is npq .

Q3.

(10 Marks) CO1 & CO2

a. Define random variables. Write the probability function and probability distribution of a random variable. Illustrate your answer with an example of a coin toss or die throw.

OR

b. Define mathematical expectation. Derive and prove the following two properties.

- (i) $E(X+Y)=E(X)+E(Y)$
- (ii) If X and Y are independent, then $E(XY)=E(X)E(Y)$.

Q4.

(10 Marks) CO2

a. The length of a species of fish is normally distributed with mean of 5.3 cm and standard deviation of 2.5. A fish is selected at random, what is the probability that its length is

- (i) Less than 4.5 cm
- (ii) Greater than 6.4 cm
- (iii) Between 3.6cm and 5.9 cm
- (iv) Between 2.8cm and 4.9cm



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From Z-table

$P(Z < -0.32) = 0.3745$, $P(Z < 0.44) = 0.6700$, $P(Z < -0.68) = 0.2483$, $P(Z < 0.24) = 0.5948$,
 $P(Z < -1.0) = 0.1587$, $P(Z < -0.16) = 0.4364$

OR

b. For the table given as follow

x	-3	-2	-1	0	1	2	3
$P(x)$	0.05	0.10	0.30	0	0.30	0.15	0.10

Compute (i) $E(X)$ (ii) $E(X^2)$ (iii) Variance

Q5.

(10 Marks) CO2

a. Define covariance and find a covariance matrix for the following dataset.

$$X = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \quad Y = \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix}$$

OR

b. Let the random variable X has the distribution:

$P(X=0) = P(X=2) = p$; $P(X=1) = 1-2p$ for $0 \leq p \leq \frac{1}{2}$
For what values of p is the $\text{Var}(X)$ a maximum.