[Total No. of Questions - 9] [Total No. of Printed Pages - 3]

May-25-0301

MA-301 (Probability & Statistics)

(Common for B.Tech. all Branch)

B.Tech. 3rd (CBCS)

Time : 3 Hours **Max. Marks : 60**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, selecting one question each from sections A, B, C, D and Section E is compulsory.

SECTION - A

1. (a) A bag contains 5 red, 3 blue, and 2 green balls. Two balls are drawn randomly. Find the probability that both are red. (5)

   (b) State and prove Bayes' theorem. (5)

2. (a) Prove Chebyshev's inequality and explain its applications. (5)

   (b) If the mean and variance of a distribution are 50 and 25, use Chebyshev's inequality to estimate the probability that a randomly selected value lies between 40 and 60. (5)

SECTION - B

3. A factory produces light bulbs, and the probability of a bulb being defective is 0.1. A sample of 15 bulbs is selected.

   (a) Find the probability that exactly 2 bulbs are defective.

   (b) Find the probability that no more than 3 bulbs are defective. (2×5=10)

4. A random variable X follows an exponential distribution with parameter $\lambda=2$.

   Calculate the following:

   (a) The probability that X is less than 3.

   (b) The probability that X is greater than 5.

   (c) The mean and variance of X. (3+3+4=10)

SECTION - C

5. A sample of 64 individuals is selected from a population with a mean height of 170 cm and a standard deviation of 10 cm.

   (a) What is the standard error of the mean?

   (b) What is the probability that the sample mean is greater than 172 cm?

   (c) Construct the 99% confidence interval for the population mean height. (3+3+4=10)

6. Derive the sampling distribution of the sample mean for a random sample taken from a normal population. Discuss its key properties. Define standard error and explain its significance. (10)

SECTION - D

7. A sample of 64 students has a mean score of 75, and the population standard deviation is 8. Test the hypothesis that the mean score of all students is 78 using a one-tailed z-test at a 5% significance level.

   (a) Formulate the hypotheses.

   (b) Find the test statistic and the p-value.

   (c) Make a decision based on the p-value. (3+3+4=10)

8. Calculate the correlation coefficient between the following pairs of variables (X, Y):

X:	2	4	6	8	10
Y:	5	7	9	11	13

(10)

SECTION - E (Compulsory)

9. (i) What is the difference between classical and axiomatic probability?

(ii) Differentiate between population parameters and sample statistic.

(iii) Define standard error and explain its significance.

(iv) Explain the exponential distribution. Derive the mean and variance for an exponential random variable.

(v) What do you understand by the term Probability Mass Function (PMF)? Give an example.

(vi) Define the variance and standard deviation of a random variable.

(vii) What is the difference between a point estimate and an interval estimate?

(viii) Differentiate between null hypothesis (HO) and alternative hypothesis (HI).

(ix) Explain the difference between correlation and regression.

(x) What is difference between Probability Mass Function and Probability Density Function? Describe the applications of PMF in Binomial and Poisson distribution. (10×2=20)