LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

U.G. DEGREE EXAMINATION –**ALLIED**

FOURTH SEMESTER – **APRIL 2025**

17UST4AL01 – MATHEMATICAL STATISTICS

Date: 06-05-2025 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 PM

SECTION A

Answer ANY FOUR of the following **4 x 10 = 40 Marks**

1. Define the following
   a) Discrete and Continuous Random variables.
   b) Define 'Probability mass function'.
2. a) Differentiate 'Correlation Coefficient' and 'Regression Equation'.
   b) State the properties of Normal distribution.
3. Let X be a random variable with the following probability mass function (pmf):
   P (X = 1) = 0.2, P (X = 2) = 0.5, and P (X = 3) = 0.3. Find the expected value E(X).
4. Derive the mean and variance of the Binomial distribution.
5. Suppose that a market research firm is hired to estimate the percent of adults living in a large city who have cell phones. Five hundred randomly selected adult residents in this city are surveyed to determine whether they have cell phones. Of the 500 people surveyed, 421 responded yes – they own cell phones. Construct a 95% confidence interval for the proportion of adult residents of this city who have 2 cell phones.
6. a) Define Point and Interval estimation.
   b) Define Null and Alternative hypothesis.
7. Ten coins are thrown simultaneously. Find the probability of getting atleast seven heads.
8. Obtain two-regression lines from the following data, n = 20, $\Sigma x = 80$, $\Sigma y = 40$, $\Sigma x2 = 1680$, $\Sigma y2 = 320$, $\Sigma xy = 480$.

SECTION B

Answer ANY THREE of the following **3 x 20 = 60 Marks**

9. a) Derive the mean and variance of the Negative Binomial distribution.
   b) Explain paired t test with an example.
10. a) The number of customers arriving at a grocery store is a Poisson random variable. On average 10 customers arrive per hour. Let X be the number of customers arriving from 10:00am to 11:30am. What is $P(10<X\leq15)$?

b) A continuous random variable X has a pdf $f(x) = 3x^2$; $0 \leq x \leq 1$. Find a and b such that, (i) $P(x \leq a) = P(x > a)$ (ii) $P(x > b) = 0.05$.

11. State and prove Chebyshev's inequality.

12. a) Find the correlation coefficient between production and sales of a factory from the data given below:

Production (in tons)	6	14	12	15	9	6	7	9	6	8
Sales	4	10	6	9	6	9	8	12	9	7

b) Random sample drawn from two places gave the following data relating to the heights of adult males. Test whether the two groups have same height.

	Place A	Place B
Mean Height (inches)	68.50	68.58
SD of heights	2.5	3.0
Sample size	1200	1500

13. a) Derive the mean and variance of Beta distribution of first kind.

b) Let X be normally distributed with mean 8 and standard deviation 4.

Evaluate: i) $P(5 \leq X \leq 10)$ ii) $P(X \leq 5)$ iii) $P(X \geq 15)$.

14. a) A sample of 900 items has mean 3.4 and standard deviation 2.61. Can the sample be regarded as drawn from a population with mean 3.25 at 5% level of significance?

b) Derive the mean of Rectangular Distribution over the range [a, b].

$$\$\$\$\$\$\$\$\$\$\$\$\$\$$$