Roll.No. | 25USTCT1002

SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai - 600 044.
B.Sc.Statistics - END SEMESTER EXAMINATIONS - NOVEMBER 2025
SEMESTER - I
25USTCT1002- Introductory Probability Theory

Total Duration : 2 Hrs.30 Mins. Total Marks : 60

Section B

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. Explain the three approaches to probability giving their merits and demerits.
2. Illustrate the concept of independence of two events with an example. Demonstrate that if A and B are independent events, then: (i) A and $\overline{B}$ are independent. (ii) $\overline{A}$ and B are independent. (iii) $\overline{A}$ and $\overline{B}$ are independent.
3. Define the cumulative distribution function (c.d.f.) of a random variable and prove its fundamental properties.
4. Explain the concept of mathematical expectation for a continuous random variable and derive the Addition Theorem on Expectation.
5. Define the moment generating function (m.g.f.) of a random variable X and illustrate how moments can be derived using the m.g.f.
6. Compute the expected value of (i) the sum and (ii) the product of numbers when ten tickets are drawn with replacement from a bag containing tickets numbered 1 to 100
7. Determine the probability that, when two dice are thrown, the sum of the numbers obtained is (a) greater than 8, and (b) neither 7 nor 11.
8. State and prove Bernoulli's Weak Law of Large Numbers and discuss its importance in probability theory.

Section C

Answer any **THREE** questions $(3 \times 10 = 30$ Marks)

9. State and prove Boole's Inequality for a finite number of events. Also, explain its importance in bounding probabilities.
10. a) State Bayes' theorem.
    b) From a bag A containing 4 red and 5 black balls, two balls were transferred to another bag B containing 6 red and 4 black balls. Then two drawn randomly from bag B. what is the probability that the balls drawn from bag B are blacks?

Contd..

11. In a continuous distribution whose relative frequency density is given by f(x)= k.x(2 - x),$0 \leq x \leq 2$ Find mean, variance ,$\beta 1$, $\beta 2$.

12. L et X and Y be two random variables each taking three values -1, 0 and 1, and having the joint distribution function.

X Y	-1	0	1	Total
-1	0	0.1	0.1	0.2
0	0.2	0.2	0.2	0.6
1	0	0.1	0.1	0.2
Total	0.2	0.4	0.4	1.0

a) Show that X and Y have different expectations
b) Prove that X and Y are uncorrelated
c) Find Var(X) and Var(y)
d) Given that Y = 0, what is the conditional probability distribution of X.
e) Find v(Y/X =-1)

13. Let $X_1, X_2, \ldots..X_n$ be jointly normal with $E(X_i) = 0$ and $E(Xi^2) = 1$ for all i and $cov(X_i, X_j) =$ p if $|j - i| = 1$ and = 0 otherwise. Examine if WLLN holds for the sequence $\{X_n\}$

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