1905N523

Candidate's Seat No :________

BSc Sem.-4 Examination
CC-204
Statistics
May-2025

Time : 2-30 Hours] **[Max. Marks : 70**

Instructions
1. Figures to the right indicate full marks of the question/sub-question.
2. Notations used in this question paper carry their usual meaning.
3. Use of scientific calculator is allowed.
4. Statistical & logarithmic tables and graph papers will be provided on request.

Q-1 a) Derive moment generating function of negative binomial distribution and obtain first two raw moments. (07)

b) If X follows negative binomial distribution, then in usual notations, show that (07)

$$\mu_{r+1} = q\left(\frac{d\mu_r}{dq} + \frac{r \cdot k}{p^2}\mu_{r-1}\right), r = 1,2,3, \ldots.$$

OR

a) State probability mass function of geometric distribution. Hence or otherwise, state and prove memoryless property of geometric distribution. (07)

b) Define Hypergeometric distribution and give its applications. Also, derive mean and variance of Hypergeometric distribution (07)

Q-2 a) Derive distribution function of two parameter Cauchy distribution. Hence, find the median of two parameter Cauchy distribution. (07)

b) Define Laplace distribution.
Hence or otherwise, obtain characteristic function of Laplace distribution. (07)

OR

a) Define lognormal distribution. Derive an expression for mean and variance of Lognormal distribution. (07)

b) Define two parameter Weibull distribution. In usual notations, obtain mean and median of two parameter Weibull distribution. (07)

Q-3 a) State probability density function of Normal distribution with parameters μ and σ^2. Derive second and third quartiles of N (μ, σ^2). (07)

(P.T.O)

N523-2

b) If $X \sim N(\mu_1, \sigma_1^2)$ and $Y \sim N(\mu_2, \sigma_2^2)$ are independently distributed normal variates, and if $Z = X + Y$, then derive the probability distribution of Z. (07)

OR

a) With respect to Bivariate Normal distribution, define marginal and conditional distributions. (07)
If X and Y have bivariate normal distribution with parameters (3,1, 16, 25, 0.6), Determine the following probabilities
(i) $P[6 < Y < 11]$, ii) $P[6 < Y < 11 / X = 1]$

b) State and prove, two random variable (X, Y) following Bivariate Normal Distribution, are independent if and only if $\rho = 0$. (07)

Q-4 a) In usual notations, state and prove weak law of large number. (07)

b) State and prove general form of Chebyshev's inequality. (07)

OR

a) Examine whether the law of the large numbers holds for the sequence $\{x_k\}$, k=1,2,... of independent random variables defined as: (07)

$$P[X_k - 1] - P[X_k - -1] - \frac{1}{k}, P[X_k - 0] - 1 - \frac{2}{k}$$

b) In usual notations, state and prove Lindberg Levi's central Limit Theorem. (07)

Q-5 Answer the following questions (14)

1 Define convergence in probability.

2 State applications of geometric distribution.

un

3 State the relation between mean and variance of geometric distribution.

4 State moment generating function of geometric distribution.

un

5 State one application of geometric distribution.

6 State a condition under which, geometric distribution is a special case of negative binomial distribution.

7 Give applications of Weibull distribution.

8 State value of a mode of Cauchy distribution. Is it same as median?

9 Give reason, why normal distribution is treated as symmetric distribution?

10 State mean of conditional distribution of X given Y, when random variables (X, Y) follows bivariate normal distribution.

11 State moment generating function of $N(\mu, \sigma^2)$.

12 State Liapounoff's form of Central Limit Theorem.

13 State inversion theorem on characteristic function.

14 State bernoulli's law of large numbers.