Seat No. : _______________

SI-125

September-2020

B.Sc., Sem.-VI

CC-307 : Statistics
(New Course)

Time : 2 Hours] **[Max. Marks : 50**

Instructions : (1) **All** Questions in **Section I** carry equal marks.
(2) Attempt any **THREE** questions in **Section I**.
(3) Question No. 9 in **Section II** is **COMPULSORY**.

Section – I

1. (A) State and prove Neyman-Pearson Lemma. **7**

(B) A random sample of size 5 is drawn from Binomial population with probability of success = P. Suppose we want to test $H_0 : P = \frac{1}{2}$ Vs $H_1 : P = \frac{3}{4}$. Obtain most powerful test (critical region) for $\alpha = \frac{6}{32}$. **7**

2. (A) Define the following terms : **7**
   (i) Level of significance
   (ii) Power of the test
   (iii) Type I and type II errors
   (iv) Most Powerful test

(B) Let $x_1, x_2, \ldots, x_n$ be a random sample of size 'n' from $N(\mu,\sigma^2)$. Test for μ when σ is known. Obtain the Best Critical Regions for testing
$H_0 : \mu = \mu_0$ Vs $H_1 : \mu = \mu_1$ $(\mu_1 < \mu_2)$ **7**

3. (A) Give detail procedure for test for significance of single sample proportion. **7**

(B) Explain the test for the significance of observed value of correlation coefficient when hypothetical value of correlation coefficient = 0. **7**

4. (A) Write in detail for the test of homogeneity of k correlation coefficients. **7**

(B) Give detail procedure for the test of significance of the difference between two sample means. **7**

5. (A) Discuss in detail any 2 applications of t-test. **7**

(B) Write the test to test the homogeneity and independence in a contingency table. **7**

6. (A) State paired t - test for difference of means with the method and test statistics. **7**

(B) Discuss in detail any 2 applications of F-test. **7**

7. (A) Describe Median test in detail. **7**

(B) Write the difference between parametric and non-parametric tests. **7**

8. (A) Write the advantages and disadvantages of non-parametric test. **7**

(B) Write detailed account of Mann-Whitney U test. **7**

Section – II

9. Answer in short (Any **Four**) : **8**

(A) Define null hypothesis.

(B) Give an example of simple hypothesis.

(C) Define power function.

(D) What is critical region ?

(E) Write the test statistic used to test the significance for single sample proportion.

(F) Describe two tailed critical region on Standard Normal probability curve. Write the null hypothesis to test equality of two population variances.

(G) What is the test statistic used to test the significance of an observed correlation coefficient ?

(H) t-test is used to test the homogeneity of variance. (True/ False)

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Section – I

1. (A) Define Cauchy distribution. Obtain the distribution function and hence quartiles of Cauchy distribution. **7**

   (B) Define Laplace distribution. Obtain the cumulant generating function of laplace distribution. Hence determine first four cumulants. **7**

2. (A) Let a random variable X has log-normal distribution with mean r, and variance σ^2 then obtain r^{th} moment of the random variable. **7**

   (B) Define log normal distribution. Let $X_1, X_2 \ldots, X_n$ are iid $LN(\mu, \sigma^2)$ distribution then, show that $G = (\prod_{i=1}^{n} x_i)^{\frac{1}{n}}$ has $LN(\mu, \frac{\sigma^2}{n})$ **7**

3. (A) In case of bivariate normal distribution, show that regression can be viewed as a conditional expectation. **7**

   (B) Let $(X, Y) \sim BVND(\mu_1, \mu_2, \sigma_1^2, \sigma_2^2, \rho)$, obtain the marginal distributions of X and Y **7**

4. (A) Derive moment generating function of bivariate normal distribution. **7**

   (B) Let $f(x, y) = Ke^{-\frac{x^2 - 2\rho xy + y^2}{2(1-\rho^2)}}$, *for* $-\infty < x < \infty, -\infty < y < \infty$ and $-1 < \rho < 1$, find the value of *K*. **7**

5. (A) In usual notations, state and prove Chebyschev's inequality. **7**

(B) If a r.v. having p.m.f. $P(X)=\begin{cases}2^{-x}, & x=1,2,3,4,...\\ 0, & \text{Otherwise}\end{cases}$, Determine the probability $P[|x-E(x)|\leq 2]$ and compare it with its actual probability. **7**

6. (A) In usual notation state and prove Bernoulli's law of large numbers. **7**

(B) A dice is rolled 200 times. Find the lower bound for the probability of getting 80 to 120 odd numbers. **7**

7. (A) State and prove Lindberg Levy form of central limit theorem. **7**

(B) Let $X \sim P(\lambda)$ show that for large value of n, $\frac{X-\lambda}{\sqrt{\lambda}}$ is standard normal variate. **7**

8. (A) State uses of central limit theorem and state Liapounff's form of central limit thorem. **7**

(B) Let $X \sim \chi^2$ variate with n d.f. Show that for $n \to \infty \frac{X-n}{\sqrt{2n}}$ is SNV. **7**

Section – II

9. Attempt any **Four** : **8**

(A) State pdf of Cauchy distribution.

(B) State pdf of log normal distribution.

(C) Let X be a random variable having standard Cauchy distribution. What is the distribution of $1/X$?

(D) State mean and variance of Laplace distribution.

(E) State characteristics function of Laplace distribution.

(F) State the relation between normal and log normal distribution.

(G) Let $(X, Y) \sim BVND(\mu_1, \mu_2, \sigma_1^2, \sigma_2^2, \rho)$, State conditional distribution of X|Y.

(H) Let $X \sim B(72,1/3)$, compute approximately $P(22<X<28)$ using CLT.