8. (a) Write Procedure of Kolmogorov–Smirinov Non Parametric Test. 20

(b) Write the procedure for Mann-Whitney U–test and what is its equivalent parametric test ? 20

(c) Describe the Nature of Nonparametric tests and give a brief information on their merits and limitations. 20

SECTION–III

9. (a) Define Malanobis D^2 statistic and write about the applications of this distribution. 15

(b) What are the merits and limitations of Hotling's T^2 Statistic in Multivariate data analysis ? 15

(c) Give a brief note on the importance of Discriminant Analysis. 10

(d) Give the method of fitting a polynomial regression of order k by the method of least squares. 20

10. (a) Find coefficients of Partial Correlation $r_{12.3}$ and $r_{13.2}$ when the simple correlations are $r_{12} = 0.57$, $r_{13} = 0.82$, $r_{23} = 0.63$. 20

(b) Prove that for a tri-variate population $1\text{-}R^2_{1.23} = (1 - r^2_{12})(1 - r^2_{13.2})$. 20

(c) Find $R_{1.23}$, $b_{12.3}$ for $r_{12} = 0.7$, $r_{13} = 0.35$, $r_{23} = 0.65$, '$\sigma_1 = 2$, $\sigma_2 = 3$, $\sigma_3 = 1$. 20

11. (a) State the Mathematical Model and its assumptions for analysis of variance in one way classification of data. 20

(b) Describe the Gauss = Markoff setup behind the ANOVA for 2 way classification of data. 20

(c) Compare the concepts of Simple Correlation and Simple Regression. 20

12. (a) Define Bivariate Normal Population and state its properties. 20

(b) Explain the procedure for testing the significance of regression coefficients in a linear regression. 20

(c) Give the advantages and disadvantages in fitting of Orthogonal Polynomials. 20

Total No. of Printed Pages : 4 **Roll No. ....**

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Statistics–I

(23)

Time : Three Hours Maximum Marks : 300

INSTRUCTIONS

(i) Answers must be written in English.

(ii) The number of marks carried by each question is indicated at the end of the question.

(iii) The answer to each question or part thereof should begin on a fresh page.

(iv) Your answers should be precise and coherent.

(v) The part/parts of the same question must be answered together and should not be interposed between answers to other questions.

(vi) Candidates should attempt any **five** questions choosing at most **two** from each section.

(vii) If you encounter any typographical error, please read it as it appears in the text book.

(viii) Candidates are in their own interest advised to go through the General Instructions on the back side of the title page of the Answer Script for strict adherence.

(ix) No continuation sheets shall be provided to any candidate under any circumstances.

(x) Candidates shall put a cross (X) on blank pages of Answer Script.

(xi) No blank page be left in between answer to various questions.

SECTION–I

1. (a) The odds in favour of winning a game by player A are 2 to 3 and the odds against winning the game by player B are 3 to 4. If both players are making their efforts independently find the probabilities of :

   (A) Both will win the game

   (B) None will win the game

   (C) Only one will win the game

   (D) At least one will the game. 20

   (b) Name the methods of estimation and explain the method of least squares to estimate the parameters of a polynomial of 2^{nd} degree. 10

   (c) Explain the terms Statistical Hypothesis and Sample Space. 10

   (d) Distinguish the difference between one way and two way classified data. 20

2. (a) Let the p.d.f. of a random variable X is $f(x) = k(x^2 - 2x + 3)$, $0 \le X \le 2$; $f(x) = k(1 - 2x)$, $2 \le X \le 3$; $f(x) = K(x - 2)$, $3 \le X \le 4$; $f(x) = 0$, otherwise; Let the event $A = 1/2 \le X \le 5/2$, $B = 1 \le X \le 4$; then find P(A/B) and P(B/A) while finding k value. 30

   (b) State and prove Cauchy–Schwartz Inequality. 15

   (c) State and prove Baye's Theorem. 15

3. (a) Show that the Pearson's coefficient beta-2 is greater than or equal to 1. 10

   (b) Define Karl Pearson's Coefficient of Correlation and show that it is invariant of change of origin and scale. 20

   (c) Find the correlation coefficient between X, Y when their joint probability density function is $f(X, Y) = ax^2(y + 1)$; for $0 \le X \le 2$; $1 \le Y \le 3$; $f(x, y) = 0$, Otherwise. 30

4. (a) Write a Joint Probability distribution for the outcomes of X, Y; where X is the number of heads when two fair coins are tossed simultaneously, and Y is the outcome on a throw of a fair die. 20

   (b) Given the probabilities, $P(X = 1, Y = -1) = 1/6$; $P(X = 0, Y = -1) = 1/12$; $P(X = -1, Y = -1) = 1/12$; $P(X = 1, Y = 0) = 3/12$; $P(X = -1, Y = 0) = 1/12$; $P(X = 0, Y = 0) = 1/6$; $P(X = 1, Y = 1) = 1/12$; and remaining probabilities are equal to zero. Find the Marginal Probability distributions of X, Y and also calculate the Means of X and Y. 30

   (c) Define Central Limit Theorem, state its importance. 10

SECTION–II

5. (a) Define consistent, unbiased and sufficient estimators with suitable examples. 15

   (b) Show that Consistent Estimators need not be unbiased. 15

   (c) State and prove Rao Blackwell Theorem. 15

   (d) Find the sufficient estimator of 'p' when an independent random sample of size 'k' is drawn from a binomial population with parameters 'n' and 'p' using Neymann Factorization Theorem. 15

6. (a) State the properties of method of Moments. 10

   (b) What are confidence intervals ? How do you estimate them for the mean and variance of Normal distribution ? 20

   (c) Use the Method of Maximum Likelihood estimation for estimating the parameters 'μ' and 'σ^2' when an independent random sample of size n is drawn from two Normal populations $N(\mu, 1)$ and $N(0, \sigma^2)$. 30

7. (a) Write brief notes on Type-I error, Type-II errors, Most powerful Critical Region and Uniformly Most Powerful Critical Region. 20

   (b) Find the probabilities of Type-I and Type-II errors for a critical region $W = \{x_1, x_2 : x_1 + x_2 \ge 9.5\}$ under $H0 : \theta = 2$ against $H1 : \theta = 1$ when the parent population of the sample with size 2 is drawn from a population with pdf $f(x) = (1/\theta)e^{-x/\theta}$, $\theta > 0$; $f(x) = 0$ otherwise. $(\chi_4^2 = 9.488)$ 20

   (c) Find the Best Critical Region for Mean when an independent random sample of size 'n' is drawn from a Poisson Population under $H_0 : \theta = \theta_0$ against $H_1 : \theta = \theta_1$. 20