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Reg. No. | | | | | | | | |

IV Semester B.Sc. Degree Examination, September/October - 2022

STATISTICS

Statistical Inference - II

(CBCS 2020 Freshers & 2021-22 And Onwards)

Paper : P-4

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates:

i. Answer any **Ten** questions from Section A and any **Five** questions from Section B.

ii. Scientific calculators are allowed.

SECTION - A

(20 Marks)

I. Answer any **Ten** subdivisions from the following questions. **(10×2=20)**

1. a. Classify the following hypothesis as simple and composite accordingly.

   i. $H: P \leq P_0$ in B(N,P) (N is known).

   ii. $H: \theta = \theta_0$ in G(θ) geometric distribution.

   iii. $H: \alpha = \alpha_0, \beta = \beta_0$ in $V(\alpha, \beta)$ Gamma distribution.

   iv. $H: \mu = \mu_0$ in $N(\mu, \sigma^2)$.

   b. What is P-value? If the P - value of a test is 0.0231. What is the inference drawn given the size of the test is 0.05.

   c. Explain normal test of significance.

   d. Write the test statistic for paired t-test with appropriate degrees of freedom.

   e. How Yate's correction is adopted in chi-square test for independence of attributes in (2×2) contingency table?

   f. Define Fisher's z-transformation and mention its utility.

   g. What are non - parameters tests? State the assumptions involved.

[P.T.O.

h. Define a run. Find the number of runs from the following sequence SSBBBBSSBSBSSSBBB.

i. Write the test statistic for testing sign test for two sample.

j. Write down the statistic for Wilcoxon's signed rank test based on paired observation.

k. Define Wilcoxon rank sum T statistic.

l. What is meant by Wald's sequential test?

SECTION - B

(50 Marks)

II. Answer any **Five** of the following questions. **(5×10=50)**

2. a. Define the terms :

   i. Parameter space.

   ii. Type - I and Type - II errors.

   iii. Critical region.

   iv. Critical value.

   b. Let P be the probability that a coin will fall head in a toss. In order to test $H_0 : P = \frac{1}{2}$ against $H_1 : P = \frac{2}{3}$, the coin is tossed 5 times and hypothesis H_0 is rejected if mor than 3 heads are obtained. Compute size and power of the test. **(5+5)**

3. a. Define test function. Consider the following test function

$$\phi(x_1, x_2, x_3) = \begin{cases} 1, if\ x_1 + x_2 + x_3 > 5 \\ 0.5, if\ x_1 + x_2 + x_3 = 5 \\ 0,\ if\ x_1 + x_2 + x_3 < 5 \end{cases}$$

   What is your decision if the sample observation observations are.

   i. $x_1 = 2, x_2 = 1, x_3 = 2.$

   ii. $x_1 = 3, x_2 = 3, x_3 = 4.$

   iii. $x_1 = 0, x_2 = 1, x_3 = 1.$

   b. Find MP test of level α for testing $H_0 : \mu = \mu_0$ against $H_1 : \mu = \mu_1 (\mu_1 = \mu_0)$ in normal $N\left(\mu, \sigma_0^2\right)$ distribution. Also write the expression for the power of the test. **(3+7)**

4. a. Explain the small sample test procedure for testing $H_0 : \mu = \mu_0$ against various alternatives, when σ^2 is unknown.

b. Describe the large sample test procedure for testing the significance of difference between two population means. (5+5)

5. a. Describe the large sample test procedure for testing $H_0 : P = P_0$ against $H_1 : P > P_0$, where P is the population proportion.

b. Describe chi - square test for testing $H_0 : \sigma^2 = \sigma_0^2$ against $H_1 : \sigma^2 \neq \sigma_0^2$, where σ^2 is the population variance of $N(\mu, \sigma^2)$ distribution, μ is known. (5+5)

6. a. Describe the test procedure for testing $H_0 : \rho_1 = \rho_2$ against $H_1 : \rho_1 \neq \rho_2$, where ρ_1 and ρ_2 are two independent correlation co-efficients (use z transformation).

b. Explain the chi-square test for goodness of fit. (5+5)

7. a. Explain the test procedure of testing $H_0 : \beta = 0$ where β is the population regression co-efficient.

b. Describe chi-square test for independence of attributes for (m×n) contingency table. (5+5)

8. a. Explain median test.

b. Discuss Mann-Whitney-Wilcoxon U test for the equality of two p.d.f.s. (5+5)

9. a. Describe sequential probability Ratio Test (SPRT).

b. Derive the SPRT for testing $H_0 : \mu = \mu_0$ Vs $H_1 : \mu = \mu_1 (\mu_1 > \mu_0)$ in $N(\mu, \sigma^2)$ distribution (σ^2 is known). (5+5)

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IV Semester B.Sc. Degree Examination, September/October - 2022

STATISTICS

Statistical Inference - II

(CBCS Scheme 2019-20 and Onwards Repeaters)

Paper : IV

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates:

i. Answer any **Ten** questions from Section A and any **Five** questions from Section B.

ii. Scientific calculators are allowed.

SECTION - A

I. Answer any **ten** subdivisions from the following questions. **(10×2=20)**

1. a. What are simple and composite hypothesis?

b. State Neyman - Pearson Lemma.

c. Explain paired t-test.

d. Write the test statistic for testing for a population proportion.

e. What is meant by degrees of freedom of a test statistic? Calculate it in testing the independence of attributes using (r×c) contingency table.

f. State the applications of Fisher's z-transformation.

g. What are non - parameters test? Mention its advantages.

h. Define a run. Calculate the number of runs and the length of each run in the following binary data.
101100011110001011000111111000.

i. Define Wilcoxon rank sum T statistic and Mann - Whitney U statistic.

j. Explain Median test.

k. Explain Spearman's rank correlation test procedure.

l. What is meant by strength of SPRT? Write down the expression's for stopping bounds.

SECTION - B

II. Answer any **five** of the following questions. **(5×10=50)**

2. a. Define critical region and acceptance region. Interpret the following test function

$$\phi(x_1, x_2, x_3) = \begin{cases} 1, if\ x_1 + x_2 + x_3 > 5 \\ 0.5, if\ x_1 + x_2 + x_3 = 5 \\ 0,\ if\ x_1 + x_2 + x_3 < 5 \end{cases}$$

When :

i. $x_1 = 3, x_2 = 0, x_3 = 2$.

ii. $x_1 = 3, x_2 = 3, x_3 = 4$.

iii. $x_1 = 0, x_2 = 1, x_3 = 2$.

[P.T.O.

b. In testing $H_0:\theta=1$ against $H_1:\theta=2$ based on a single observation (X) from $U(0,\theta)$ show that the critical regions $C_1=\{x<1/4\}$ and $C_2=\{x>3/4\}$ are of same size. Which of there is more powerful? **(5+5)**

3. a. Express probabilities of type I, type II error and power of the test in terms of test function.

   b. State Neyman - Pearsons Lemma. Using it obtain MP test of the size α based on random sample of size n from exponential distribution with mean θ for testing $H_0:\theta=\theta_0$ against $H_1:\theta=\theta_1(>\theta_0)$ write the expression for maximum power attained. **(3+7)**

4. a. Explain large sample test for testing single population mean.

   b. Explain F-test for testing equality of two Normal population variances. **(5+5)**

5. a. Describe chi - square test for testing $H_0:\sigma^2=\sigma_0^2$ against $H_1:\sigma^2\neq\sigma_0^2$, where σ^2 is the population variance of $N(\mu,\sigma^2)$ distribution.

   b. Describe the large sample test procedure for testing $H_0:P=P_0$ against $H_1:P>P_0$ where P is the population proportion. **(5+5)**

6. a. Decribe the test procedure for testing H_0 : $\rho_1\neq\rho_2$ against H_1: $\rho_1\neq\rho_2$, where ρ_1 and ρ_2 are two independent correlation co-efficient.

   b. Explain t-test for testing the significance of regression co-efficient. **(5+5)**

7. a. Describe chi-square test for independence of atrtributes.

   b. State the conditions for the validity of chi-square test for goodness of fit. Also describe the chi-square test for goodness of fit. **(5+5)**

8. a. Describe Wald - Wolfowitz run test of randomness for single sample.

   b. Describe sign test for two independent samples. **(5+5)**

9. a. What is meant by sequential test? Mentionn its advantages.

   b. Develop SPRT for testing $H_0:P=P_0$ against $H_1:P=P_1(>P_0)$ where P is the parameter of Bernoulli distribution. **(4+6)**