C 41249 **(Pages : 2)** **Name.....**

Reg. No.....

FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2023

Statistics

STA 4C 04—STATISTICAL INFERENCE AND QUALITY CONTROL

(2019 Admission onwards)

Time : Two Hours Maximum : 60 Marks

Use of calculator and Statistical table are permitted.

Part A (Short Answer Type Questions)

Each question carries 2 *marks.*
Maximum marks that can be scored from this Part is 20.

1. Define consistent estimator.
2. Define complete statistic.
3. Define interval estimation.
4. Define significance level of a test. Power of a test is given as 0.80. Identify the probability of type II error of the test.
5. Define a Uniformly Most Powerful Test.
6. Sample proportion of an attribute is noted as 74 out of 240. Calculate the value of test statistic to test whether the population proportion is 0.25.
7. What are the test statistic used and its distribution in a small sample test of the mean of a normal population when population variance is unknown ?
8. Point out the situation where two way ANOVA is used.
9. Define a non-parametric lest and give any two of its advantages.
10. Define a one sample sign test and the null hypothesis concerned.
11. Define Statistical Quality Control.
12. When a process variation is said to be :
    (i) Under control or
    (ii) Out of control ?

Turn over

Part B (Short Essay/Paragraph Type Questions)

Each question carries 5 *marks*
Maximum marks that can be scored from this part is 30.

13. Obtain the MLE of the parameter θ, using random sample $x_1, x_2, ..., x_n$ taken from the normal population $N\left(0, \sigma^2\right)$.

14. Define confidence co-efficient. Derive a $(1-\alpha)100\,\%$ confidence interval for the variance of a normal population $N\left(\mu, \sigma^2\right)$ based on a random sample of size *n*, when the population mean is known.

15. In a coin tossing experiment, let p be the probability of getting a head. A coin is tossed 12 times to test the hypothesis $H_0 : p = 0.5$ against the alternative $H_1 : p = 0.7$, where *p* is the probability of getting head when the coin is tossed. Reject H_0, if more than 8 heads tossed out of the 12 tosses. Find significance level and power of the test.

16. Explain the large sample test of equality of proportions of two populations.

17. Explain Mann-Whiteny U test.

18. Explain the causes of variation in quality of a product.

19. Write a short note on np-chart.

Part C (Essay Type Questions)

Answer any **one** *question*
The question carries 10 *marks.*
Maximum marks that can be scored from this part is 10.

20. (i) Define (a) Unbiasedness ; (b) Efficiency ; and (c) Cramer-Rao Lower Bound.

    (ii) For a random sample of size *n*, taken from a normal population, show that the sample mean is an unbiased estimator of the population mean but the sample variance is a biased estimator of the population variance.

21. (i) Explain Chi-square test of independence of attributes.

    (ii) For a 2 × 2 contingency table for two attributes with cell frequencies for $(1, 1)^{th}$, $(1, 2)^{th}$, $(2, 1)^{th}$ and $(2, 2)^{th}$ cells respectively *a*, *b*, *c* and *d*, prove that the Chi-square statistic is

$$\frac{(a+b+c+d)(ad-bc)^2}{(a+b)(c+d)(b+d)(a+c)}.$$

(1 × 10 = 10 marks)