D 103085 **(Pages : 3)** **Name.......................................**

Reg. No..................................

FOURTH SEMESTER (CBCSS–UG) DEGREE EXAMINATION
APRIL 2024

Statistics

STA4C04—STATISTICAL INFERENCE AND QUALITY CONTROL

(2019 Admission onwards)

Time : Two Hours Maximum : 60 Marks

Use of calculator and statistical table are permitted.

Section A (Short Answer Type Questions)

Each question carries 2 marks.
All questions can be attended.
Overall Ceiling 20 marks.

1. What is a likelihood function ?
2. Define consistency.
3. Construct the large sample confidence interval for the proportion of a binomial population.
4. If t is consistent for an unknown parameter θ whether t^2 is consistent for θ^2 ?
5. The mean and SD of sample of size 60 are 145 and 40. Construct 95% confidence interval for the population mean.
6. Write a note on Standard Error.
7. Write down the test statistic for testing the equality of means of two populations when the population SDs (1) σ_1 and σ_2 are known (2) σ_1 and σ_2 are unknown for a large sample.
8. Distinguish between null and alternative hypothesis.
9. What adjustment has to be made for ties in Kruskal - Wallis Statistic ?
10. Define median test.
11. Which are the control charts for variables ?
12. Describe U charts.

(Ceiling 20 marks)

Turn over

Section B (Short Essay/Paragraph Type Questions)

Each questions carries 5 marks.

All questions can be attended.
Overall Ceiling 30 marks

13. Find the m.l.e for the parameter θ given the p.d.f $f(x) = \theta^{e-\theta x}, x \geq 0, \theta > 0$.

14. If 8.6, 7.9, 8.3, 6.4, 8.4, 9.8, 7.2, 7.8, 7.5 are the observed values of a random sample of size 9 from $N \sim (\mu, \sigma^2)$, construct 90 % confidence limits for μ.

15. Describe the procedure for testing of homogeneity.

16. How will you test the equality of two proportion of items in the same class on the basis of two independent samples drawn from two populations?

17. Explain one way ANOVA test procedure with ANOVA table.

18. A stenographer claims that she can take dictations at the rate of more than 120 words per minute. Of the 12 tests given to her she could perform an average of 135 words with a standard deviation of 40. Is her claim valid $(\alpha = 0.01)$.

19. Explain the applicability of an R chart.

(Ceiling 30 marks)

Part C (Short Essay Type Questions)

Answer any **one** *question.*
The question carries 10 *marks.*

20. Find the maximum likelihood estimators for random sampling from a normal population $N \sim (\mu, \sigma^2)$ for :

    (a) Population mean μ when population variance σ^2 is known.

    (b) Population variance σ^2 when population mean μ is known.

    (c) The simultaneous estimation of both the population mean and variance.

21. A group of 10 children were tested to find out how many digits they could repeat from memory after hearing them once. They were given practise at this test during the next week and were then tested.

a) Is the difference of the performance of the 10 children at the two tests significant ?

b) Whether practise has improved the ability of remembrance ?

Child	A	B	C	D	E	F	G	H	I	J
Test I	6	5	4	7	8	6	7	5	6	8
Test II	7	7	6	7	9	6	8	6	6	10

(1 × 10 = 10 marks)

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 $N(0, \sigma^2)$.

14. Define confidence co-efficient. Derive a $(1-\alpha)100\%$ confidence interval for the variance of a normal population $N(\mu, \sigma^2)$ 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)

C 21556 **(Pages : 2)** **Name.......................................**

Reg. No..................................

FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION APRIL 2022

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.

Section A (Short Answer Type Questions)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. Distinguish between parameter and statistic.
2. Define Cramer-Rao Lower Bound (CRLB).
3. Define a moment estimator and point out any *two* of its properties.
4. Define null and alternative hypothesis.
5. Define size of a test.
6. State Neyman-Pearson Lemma
7. What are the test statistic used and its distribution in large sample test of equality of means of two populations when population variances are known ?
8. State the assumptions underlying in ANOVA.
9. Define run test and state the null hypothesis.
10. Write the importance of Kruskal Wallis test.
11. Define random cause and preventable cause acting on the quality of a product.
12. Define control chart.

($8 \times 3 = 24$ marks)

Turn over

Section B (Short Essay/Paragraph Type Questions)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. State Fisher-Neyman factorization theorem. Prove that sample mean is a sufficient estimator of population mean when a random sample of size n is taken from a Poisson population.

14. Define confidence co-efficient. Derive a 95 % confidence interval for the mean of a normal population $N(\mu, \sigma^2)$ based on a random sample of size n, with sample mean $\bar{x}$ when population variance is unknown.

15. Find the probabilities of type I and type II errors if $x \geq 1$ is the critical region for testing $H_0 : \theta = 2$ against $H_1 : \theta = 1$ based on a single observation from the population with p.d.f. $f(x, \theta) = \theta e^{-\theta x}, x \geq 0$.

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

17. The following are the average rain fall in mms over 40 consecutive days in a moderate rainy season 12, 15,18, 20, 26, 24, 28, 32, 38, 48, 30, 28, 20, 36, 38, 40, 46, 50, 42, 40, 30, 22, 18, 16, 28, 30, 36, 44, 40, 52, 48, 38, 40, 26, 38, 42, 48, 38, 32, 30. Use one sample sign test to test whether the median rain fall is 40 mms against it is less than 40 at 5 % level of significance.

18. Explain x-bar control chart and the control limits for x-bar when process mean and SD are known.

19. Write a short note on p-chart.

(5 × 5 = 25 marks)

Section C (Essay type Questions)

Answer any **one** *question.*
The question carries 11 *marks.*

20. Explain the method of Maximum Likelihood Estimation. Obtain the MLEs of mean and variance of a normal population based on a sample of size n taken from that population. Also verify whether these MLEs are unbiased for the respective parameters.

21. Explain Chi-square test of goodness of fit. The theory predicts the proportion of beans in the four groups A, B, C, and D should be 9 : 3 : 3 : 1. In an experiment among 1600 beans, the members in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory at 5 % level of significance ?

(1 × 11 = 11 marks)