D 140863 **(Pages : 3)** **Name..................................**

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

FOURTH SEMESTER (CBCSS—U.G.) DEGREE EXAMINATION APRIL 2026

Statistics

STA4C04—STATISTICAL INFERENCE AND QUALITY CONTROL

(2019 Syllabus)

Time : Two Hours Maximum : 60 Marks

Use of calculator and statistical table are permitted.

Section A (Short Answer Type Questions)

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

1. Give an example of an estimator which is consistent but not unbiased.
2. Give Fisher-Neyman criterion on sufficiency.
3. Differentiate between point estimate and interval estimate.
4. Construct the large sample confidence interval for the mean of Normal population with known standard distribution.
5. Let X follows a uniform distribution in $[0, \theta]$, obtain m.l.e of θ.
6. Define significance level and power of a test.
7. Write the test statistic for testing the mean of a population has specific value in large sample test when the population SD (1) σ is known (2) σ is unknown.
8. Explain simple hypothesis with an example
9. What are the advantages of Non-Parametric tests over Parametric tests ?
10. "Write a short note on two way ANOVA.
11. What is a modified control chart ?
12. Distinguish between warning limits, and action limits on a control chart.

(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. Define Efficiency ? Compare the Efficiency of $T_1 = \frac{(x_1 + x_2 + x_3)}{3}$ and $T_2 = \frac{(x_1 + x_2 + x_3 + x_4 + x_5)}{5}$ in estimating the parameter of a Poisson distribution ?

14. A random sample of size 11 from a normal population is found to have variance 12.3. Find a 95 % confidence interval for the population variance ?

15. Describe the procedure for testing equality of variances of two normal populations.

16. Explain test for independence of attributes.

17. Explain advantages and disadvantages of non parametric tests.

18. 50 children were given special diet for a certain period and control group of 50 other children were given normal diet. Their average gain in weight were found to be 7.2 lbs and 5.7 lbs respectively and common standard deviation for gain in weight was 2 lbs. Assuming normality of the distributions would you conclude that the special diet really promoted weight ?

19. What do you mean by ARL of a control chart ?

(Ceiling 30 marks)

Part C (Short Essay Type Questions)

Answer any **one** *question.*

The questions carries 10 *marks.*

20. (a) Derive the 95 % confidence interval for the variance of a normal population.

    (b) 150 heads and 250 tails resulted from 400 tosses of a coin. Find 90 % confidence interval for the proportion of head.

21. The following table gives the yield of three varieties. Perform anone way analysis of variance on this data.

Varities	*Yield*				
1	30	27	42		
2	51	47	37	48	42
3	44	35	41	36	

(1 × 10 = 10 marks)

D 120597 **(Pages : 3)** **Name.......................................**

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

FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION APRIL 2025

Statistics

STA 4C 04—STATISTICAL INFERENCE AND QUALITY CONTROL

(2019—2023 Admissions)

Time : Two Hours Maximum : 60 Marks

Use of Calculator and Statistical table are permitted.

Section A (Short Answer Type Questions)

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

1. Distinguish between an estimator and an estimate.
2. Define Unbiasedness.
3. What do you mean by confidence level ?
4. Give the confidence interval for μ where samples are taken from Normal population with unknown variance ?
5. Give any three unbiased estimate for the mean of a Poisson distribution.
6. Define Type I and Type II error.
7. Give the test statistic in the case of small sample test to test whether the mean of a normal population has a specified value, (1) when population SD is known ; and (2) when population SD is unknown.
8. Explain composite hypothesis with an example.
9. Define ordinary sign test.
10. State the assumptions to be followed in one- way ANOVA.
11. What do you mean by Statistical Quality Control ?
12. Define tolerance limits.

(Ceiling 20 marks)

Turn over

Section B (Short Essay/Paragraph Type Questions)

All questions can be attended.
Each questions carries 5 marks.
Overall Ceiling 30 marks.

13. If the random variable X has p.d.f $f(x) = (\beta + 1)x^{\beta}, 0 \le x \le 1, \beta > 0$, obtain the m.l.e of β.

14. A random sample of size 15 from a normal population gives $\bar{x} = 3.2$ and $S^2 = 4.24$. Determine 90 % confidence limits for σ^2.

15. Explain the large sample test for the mean of a normal distribution has a specified value $(H_0 : \mu = \mu_0)$?

16. Explain the procedure of Kruskal - Wallis test.

17. The mean life of 100 fluorescent light tubes produced by a company is computed to be 1570 hours with standard deviation of 120 hours. The company claims that the average life of the tubes produced by the company is 1600 hours. Using the level of significance of 0.05, is the claim acceptable ?

18. The mean yield of wheat from a district A was 210 kg with sd 10 kg per acre from a sample of 100 plots. In another district B, the mean yield was 200 kg with sd 12kg from a sample of 150 plots. Test whether there is any significant difference between the mean yield of the crops in the two districts

19. Distinguish between control chart for individual values and control chart for averages.

(Ceiling 30 marks)

Part C (Short Essay Type Questions)

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

20. a) Give the Important properties of maximum likelihood estimates.

    b) If 1.2, 2.6, 1.4, 3.6, 2.4, 2.5, 3.1, 3.9, 4.4, 4.9 are the sample observation from $N(\mu, \sigma^2)$ population, obtain the m.l.e's of μ and σ^2.

21. a) Write a short note on chi square test of independence.

b) Given the following data relating to social status and state of intelligence. Test whether intelligence is related to social status :

	Dull	**Average**	**Brilliant**	**Total**
Lower middle	22	35	23	80
Middle	38	70	32	140
Upper middle	60	20	20	100
Total	120	125	75	320

(1 × 10 = 10 marks)

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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 × 3 = 24 marks)

Turn over

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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)