C 21558 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2022

Statistics

STA 4C 03—STATISTICAL TECHNIQUES FOR GEOGRAPHY

(2019 Admission onwards)

Time : Two Hours Maximum : 60 Marks

Section A

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

1. Define level of significance and power of the test.
2. Define contingency table.
3. Define small sample test and state its assumptions.
4. Explain Lattice patterns.
5. Define two-way ANOVA.
6. Write the small sample test statistic for testing the difference between means of two independent samples whose variances are equal and unknown.
7. Distinguish between simple and composite hypotheses.
8. What are the assumptions of ANOVA ?
9. Define non-parametric test.
10. Define area patterns.
11. What do you mean by large sample tests ?
12. Explain autocorrelation structure.

(8 × 3 = 24 marks)

Turn over

Section B

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

13. Explain random and systematic point patterns.

14. Explain Chi-square test for independence of attributes.

15. The means of two single large samples of 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population of standard deviation 2.5 inches? (Test at 5% level of significance)

16. Write a short note on sign test.

17. In one sample of 8 observations, the sum of squares of deviations of the sample values from the sample mean was 84.4 and in the other sample of 10 observations it was 102.6. Test whether this is significant at 5 % level.

18. Write a short note on paired t-test for difference of means.

19. The data gives the 11 measurements of an instrument as follows 2.5, 2.3, 2.4, 2.3, 2.5, 2.7, 2.5, 2.6, 2.6, 2.7, 2.5. It is believed that variance of the instrument is not more than 0.16. Carry out the test at 1 % level of significance.

(5 × 5 = 25 marks)

Section C

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

20. Explain Rank Sum Test.

21. A test was given to five students taken at random from the fifth class of three schools of a town. The individuals scores are :

School I	9	7	6	5	8
School II	7	4	5	4	5
School III	6	5	6	7	6

Carry out analysis of variance and state your conclusions at 5 % level significance.

(1 × 11 = 11 marks)

C 21556-A (Pages : 4) Name.....

Reg. No.....

FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2022

Statistics

STA 4C 04—STATISTICAL INFERENCE AND QUALITY CONTROL

(2019 Admission onwards)

(Multiple Choice Questions for SDE Candidates)

Time : 15 Minutes	Total No. of Questions : 15	Maximum : 15 Marks

INSTRUCTIONS TO THE CANDIDATE

1. This Question Paper carries Multiple Choice Questions from 1 to 15.
2. The candidate should check that the question paper supplied to him/her contains all the 15 questions in serial order.
3. Each question is provided with choices (A), (B), (C) and (D) having one correct answer. Choose the correct answer and enter it in the main answer-book.
4. The MCQ question paper will be supplied after the completion of the descriptive examination.

STA 4C 04—STATISTICAL INFERENCE AND QUALITY CONTROL

(Multiple Choice Questions for SDE Candidates)

1. Branch of statistics which study the unknown aspects of a population distribution is _____.

   (A) Estimation. (B) Hypothesis testing.

   (C) Inferential statistics. (D) Descriptive statistics.

2. Which of the following is not an assumption of parametric inference methods ?

   (A) Data is quantitative. (B) Population has a known distribution.

   (C) Sample is sufficiently large. (D) Data is qualitative.

3. An estimator is considered to be best if its distribution is :

   (A) Normal.

   (B) Continuous.

   (C) Discrete.

   (D) Concentrated about the true value of the parameter.

4. Let T_n be an estimator of θ. If $E(T_n) = \theta$, then :

   (A) T_n is a sufficient estimator of θ. (B) T_n is an unbiased estimator of θ.

   (C) T_n is a consistent estimator of θ. (D) T_n is an efficient estimator of θ.

5. For a complete statistic to be useful, they must be :

   (A) Sufficient. (B) Unbiased.

   (C) Consistent. (D) Efficient.

6. Let $X_1, X_2, \ldots, X_n$ be a random sample from Poisson (λ). Then the moment estimator of λ is :

   (A) $\bar{X}$. (B) $\sum X_i$.

   (C) $\frac{1}{X}$. (D) All of the above.

7. Suppose $X \sim B(10, p)$. Then which of the following is a simple hypothesis about its parameter ?

(A) $H : n = 8, p \neq \frac{1}{4}$.

(B) $H : n = 10, p = \frac{1}{4}$.

(C) $H : n = 8, p < \frac{2}{3}$.

(D) $H : p = \frac{1}{4}$.

8. The statistic based on whose value the null hypothesis is rejected or accepted is called :

(A) The test statistic.

(B) The test criterion.

(C) Both (A) and (B).

(D) Neither (A) nor (B).

9. To test the mean of a normal population when σ is unknown and n is large, the test statistic used is :

(A) $\frac{\bar{X} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$.

(B) $\frac{\mu_0 - \bar{X}}{\frac{\sigma}{\sqrt{n}}}$.

(C) $\frac{\bar{X} - \mu_0}{\frac{S}{\sqrt{n}}}$.

(D) $\frac{\mu_0 - \bar{X}}{\frac{S}{\sqrt{n}}}$.

10. In two-way ANOVA, the total variation is partitioned into :

(A) 2 components.

(B) 3 components.

(C) 4 components.

(D) Can't be partitioned.

11. When is mean sum of squares due to treatment becomes an unbiased estimator of σ^2 :

(A) Always.

(B) Under H_0.

(C) Under H_1.

(D) Never.

12. Kruskal-Wallis Test is used for testing the equality of :

(A) Several population means. (B) Several population variances.

(C) Several population medians. (D) None of these.

13. Variations in the quality characteristic of a product is due to :

(A) Chance causes. (B) Assignable causes.

(C) Both (A) and (B). (D) Neither (A) nor (B).

14. Which among the following is not a control charts for attributes ?

(A) R chart. (B) *p* chart.

(C) *d* chart. (D) *c* chart.

15. Control chart for fraction defective is called :

(A) $\bar{X}$ chart. (B) *p* chart.

(C) *d* chart. (D) *c* chart.

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

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 $N\left(\mu, \sigma^2\right)$ 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)

C 21555 (Pages : 3) Name.....

Reg. No.....

FOURTH SEMESTER (CBCSS-UG) DEGREE EXAMINATION, APRIL 2022

Statistics

STA 4B 04—TESTING OF HYPOTHESIS

(2019 Admission onwards)

Time : Two Hours and a Half Maximum : 80 Marks

Use of Calculator and Statistical table are permitted.

Section A (Short Answer Type Questions)

Answer at least **ten** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 30.

1. Define simple and composite hypotheses.
2. Define Type II error and power of a test.
3. Define test statistic and critical region.
4. Calculate the size of the test where a single observation, $x > 1$ is the rejection region for null hypothesis, $H_0 : \theta = 2$ for the population with pdf $f(x) = \theta e^{-\theta x}, x \geq 0, \theta > 0$.
5. Define UMPT.
6. Define sequential sampling.
7. Calculate the value of the test statistic to test the null hypothesis regarding the mean of a population as 32 using a random sample of size 225 with sample mean 30 and sample variance 25.
8. What are the test statistics and its probability distribution in large sample test of the proportion of a population ?
9. Write the test statistic in a large sample test of equality of proportions of two populations.
10. Identify the degrees of freedom of Chi-square statistic in a test of independence with a 6 × 4 contingency table.
11. Differentiate parametric and non-parametric tests.
12. What is meant by a two tailed statistical test ?
13. Identify the number of runs in the sequence ABBAAABAABBBAAAB.
14. Point out any two merits and demerits of a non-parametric test.
15. What is a run test ?

(10 × 3 = 30 marks)

Turn over

Section B (Paragraph Questions)

Answer at least **five** *questions.*
Each question carries 6 *marks.*
All questions can be attended.
Overall Ceiling 30.

16. A random sample of size 16 is drawn from a normal population $N(\mu, 25)$. To test $H_0 : \mu = 6$ against $H_1 : \mu = 9$. The critical region suggested is $\bar{x} > 8.$, where $\bar{x}$ the sample is mean. Find significance level and power of the test.

17. A coin is tossed 400 times and it turns up head 216 times. Test whether the coin is unbiased at 5% level of significance.

18. Explain paired *t*-test.

19. Write a short note on one way ANOVA.

20. Explain Chi-square test of variance of a normal population.

21. Explain the small sample F- test of equality of variances of two normal populations.

22. Explain Kruskal Wallis test for one-way classification of data.

23. Explain Wilcoxon Signed Rank Test.

(5 × 6 = 30 marks)

Section C (Essay Type Questions)

Answer any **two** *questions.*
Each question carries 10 *marks.*

24. What is a large sample test ? How the mean of a population is tested based on large sample? Explain the procedure when the sample size is small where the sample is collected from a normal population.

25. (i) Explain the large sample test of equality of means of two populations.

    (ii) A random sample of sizes 6400 and 1600 taken from two different populations produces the sample averages 67.85, 68.55 and sample SDs 2.56, 2.52 respectively. Do the data indicate that the second population mean is greater than that of the first at 5% level of significance ?

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

(ii) In an opinion poll regarding the academic excellence with internet resources, the number of responses from boys and girls are recorded as follows :

	Favourable	Unfavourable	Indifferent
Boys	40	30	30
Girls	42	28	30

Test whether the responses are independent of gender at 5% level of significance.

27. Explain (i) Mann Whitney U test ; (ii) Median test.

(2 × 10 = 20 marks)

C 21318 (Pages : 4) Name.....

Reg. No.....

FOURTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION, APRIL 2022

Statistics

SG 4C 04—TESTING OF HYPOTHESIS

(2014—2018 Admissions)

Time : Three Hours Maximum : 80 Marks

Use of Calculator and Statistical tables are permitted.

Part A

Answer **all** *questions.*
Each question carries 1 *mark.*

1. Probability of type I error is called ————.
2. The hypothesis $H_0 : \theta\theta_0$ is a ———— hypothesis.
3. Degrees of freedom of Chi-square in case of contingency table of order (4 × 3) are ————.
4. The distribution involved in testing the correlation co-efficient is ————.
5. ANOVA is a statistical method of comparing the ———— of several populations.
6. A hypothesis contrary to null hypothesis is known as ————.
7. Run test is a test of ————.
8. The classical method used to separate the assignable causes and chance causes of variation is ————.
9. The range of the variance ratio F is ————.
10. Most of the non-parametric methods utilize measurements on ———— scale.

(10 × 1 = 10 marks)

Part B

Answer **all** *questions in* **one sentence.**
Each one carries 2 *marks.*

11. Define simple hypothesis with an example.
12. Define null hypothesis and alternative hypothesis.

Turn over

13. Define two types of errors in testing of hypotheses.

14. Write the applications of χ^2 test.

15. Define degrees of freedom and size of a test.

16. Write down the test statistic used in ANOVA. Explain its calculation.

17. Define the term Run.

(7 × 2 = 14 marks)

Part C

Answer any **three** *questions.*
Each one carries 4 *marks.*

18. Explain Chi-square test of goodness of fit.

19. Explain the uses of standard error in statistical inference.

20. A random sample of 625 pairs of observations gives a correlation coefficient of 0.2. Test the significance of r.

21. Explain one-way ANOVA model.

22. Explain the advantages and disadvantages of non-parametric methods over parametric methods.

(3 × 4 = 12 marks)

Part D

Answer any **four** *questions.*
Each one carries 6 *marks.*

23. Define power of test. Explain the role of critical region in testing of hypothesis.

24. The yield of wheat from 18 randomly selected test plots are the following. 48, 48.5, 49, 49, 50, 52, 57, 54, 53.5, 52, 49.5, 53, 52.5, 51, 47, 52, 51.5, 53. Use sign test at 5% level to test the hypothesis that the median of the yield distribution is 50 units.

25. In a certain experiment to compare two types of pig foods A and B, the following results of increase in weights were observed in pigs :

Pig number		1	2	3	4	5	6	7	8	Total
Increase	Food A	49	53	51	52	47	50	52	53	407
in weight in lb	Food B	52	55	52	53	50	54	54	53	423

(i) Assuming that the two samples of pigs are independent, can we conclude that food B is better than food A ?

26. Complete the following one-way ANOVA table :

Source	Df	SS	MS	F
Between groups	—		196.60	—
Error	16	103.2	—	
Total	19	—		

27. The ratio of offspring in four classes in an experiment was expected to be 1:3:3:9. The experiment yielded data as follows :

Classes	AA	Aa	aA	aa
No. of offsprings	8	29	37	102

Test whether the given data is in agreement with the hypothetical ratio.

28. Explain the test for difference of proportions.

(4 × 6 = 24 marks)

Part E

Answer any **two** *questions.*
Each one carries 10 *marks.*

29. (i) A die is thrown 60 times and following number of times faces were obtained, test whether the die is unbiased (goodness of fit) $\left(\chi^2_{0.05,5} = 11.07\right)$:

Faces	1	2	3	4	5	6
No. of offsprings	14	7	5	8	10	16

(ii) Explain paired *t*-test.

30. Perform a two-way ANOVA on the data given below :

Plots of land	Treatment			
	A	B	C	D
I	38	40	41	39
II	45	42	49	36
III	40	38	42	42

Turn over

31. Explain Kolmogorov-Smirnov goodness of fit test.

32. (i) Explain the test for equality of population variances.

(ii) Pumpkins were grown under two experimental conditions. Two random samples of 11 and 9 pumpkins show the sample standard deviations of their weights as 0.8 and 0.5 respectively. Assuming that the weight distributions are normal, test the hypothesis that the true variances are equal, against the alternative that they are not at 10% level.

(2 × 10 = 20 marks)

C 21317-A (Pages : 4) Name.....

Reg. No.....

FOURTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
APRIL 2022

Statistics

STS 4C 04—APPLIED STATISTICS

(2014—2018 Admissions)

(Multiple Choice Questions for SDE Candidates)

Time : 15 Minutes	Total No. of Questions : 20	Maximum : 20 Marks

INSTRUCTIONS TO THE CANDIDATE

1. This Question Paper carries Multiple Choice Questions from 1 to 20.
2. The candidate should check that the question paper supplied to him/her contains all the 20 questions in serial order.
3. Each question is provided with choices (A), (B), (C) and (D) having one correct answer. Choose the correct answer and enter it in the main answer-book.
4. The MCQ question paper will be supplied after the completion of the descriptive examination.

STS 4C 04—APPLIED STATISTICS

(Multiple Choice Questions for SDE Candidates)

1. First step in a statistical enquiry is :

   (A) Planning the enquiry. (B) Collection of data.

   (C) Forecasting. (D) Organisation.

2. Enumerators are persons :

   (A) Who conducts the investigation.

   (B) Who gathers the information from informants.

   (C) Who gives the information.

   (D) None of the above.

3. Random sampling is also termed as :

   (A) Probability sampling. (B) Chance sampling.

   (C) both (A) and (B). (D) None of these.

4. Cluster sampling is a method of :

   (A) Random sampling. (B) Non-random sampling.

   (C) Any sampling. (D) None of these.

5. The variance due to two treatments in an experiment is 480 and the error variance is 60.0 with 14 df. Test for equality of treatment effects reveals that (Given $F_{[0.05, (1, 14)]} = 4.60$)

   (A) Treatments are equally effective. (B) Treatments differ significantly.

   (C) No conclusion. (D) None of the above.

6. The analysis of variance technique is based on the assumption :

   (A) Populations from which the samples have been drawn are normal.

   (B) The populations have the same variance.

   (C) The random errors are normally distributed.

   (D) All the above.

7. Index numbers are expressed :

(A) In percentages. (B) In ratios.

(C) In terms of absolute value. (D) All the above.

8. Index numbers are also known as :

(A) Economic barometers. (B) Signs and guide posts.

(C) Both (A) and (B). (D) Neither (A) nor (B).

9. The first and fore most step in the construction of index numbers is :

(A) Choice of base period.

(B) Choice of weights.

(C) To delineate the purpose of index numbers.

(D) All the above.

10. Laspeyre's index formula uses the weight of the :

(A) Base year.

(B) Current year.

(C) Average of the weights of a number of years.

(D) None of the above.

11. Paasche's quantity index formula for n items is :

(A) $\left(\sum p_1 q_1 / \sum p_0 q_1\right) \times 100$. (B) $\left(\sum p_1 q_1 / \sum p_0 q_0\right) \times 100$.

(C) $\left(\sum p_0 q_1 / \sum p_1 q_1\right) \times 100$. (D) $\left(\sum p_1 q_1 / \sum p_1 q_0\right) \times 100$.

12. Marshall and Edgeworth price index number formula utilises the weights as :

(A) Quantities of the base year.

(B) Quantities of the given year.

(C) Combined quantities of base and given year.

(D) Any of the above.

13. The condition for the time reversal test to hold good with usual notations is :

(A) $p_{01} \times p_{10} = 1$. (B) $p_{10} \times p_{01} = 0$.

(C) $p_{01} \times p_{10} = 1$. (D) $p_{01} + p_{10} \quad 1$.

14. Data for index numbers should be collected from :

(A) The retailers. (B) The wholesale dealers.

(C) The selected group of persons. (D) None of the above.

15. Chance or random variation in the manufactured product is :

(A) Controllable. (B) Not controllable.

(C) Both (A) and (B). (D) None of the above.

16. Variation due to assignable causes in the product occurs due to :

(A) Faulty process. (B) Carelessness of operators.

(C) Poor quality of raw material. (D) All the above.

17. The control limits for R-chart with a known specified range R′ and usual constant factors are :

(A) $U.C.L._{R'} = (d_2 - 3d_3)\,\sigma_{R'}$, $C.L_{R'} = d_1\sigma_{R'}$ and $L.C.L._{R'} = (d_2 - 3d_3)\,\sigma_{R'}$.

(B) $U.C.L._{R'} = D_2 - R'$, $C.L_{R'} = d_2\sigma_{R'}$ and $L.C.L._{R'} = D_1 - \sigma_{R'}$.

(C) Either (A) or (B).

(D) Neither (A) nor (B).

18. The trial control limits for R-chart with usual constant factors are :

(A) $U.C.L. = D_4R$, $C.L. = R$ and $L.C.L. = D_3R$.

(B) $U.C.L. = D_4\bar{R}$, $C.L. = \bar{R}$ and $L.C.L. = D_3\bar{R}$.

(C) $U.C.L. = D_4\bar{R}$, $C.L. = \bar{R}$ and $L.C.L. = D_4\bar{R}$.

(D) All the above.

19. 2-sigma trial control limits for c-chart for equal size samples are given as :

(A) $U.C.L. = \bar{C} + 3\sqrt{\bar{C}}$, $C.L. = \bar{C}$ and $L.C.L. = \bar{C} - 3\sqrt{\bar{C}}$.

(B) $U.C.L. = \bar{C} + \sqrt{2\bar{C}}$, $C.L. = 2\bar{C}$ and $L.C.L. = \bar{C} - \sqrt{2\bar{C}}$.

(C) $U.C.L. = \bar{C} + 2\sqrt{\bar{C}}$, $C.L. = \bar{C}$ and $L.C.L. = \bar{C} - 2\sqrt{\bar{C}}$.

(D) $U.C.L. = \bar{C} + 2\sqrt{\bar{C}}$, $C.L. = C$ and $L.C.L. = \bar{C} - 2\sqrt{\bar{C}}$.

20. If μ and σ are the process mean and S.D., then the control limits $\mu \pm 3\sigma$ are known as :

(A) Modified control limits. (B) Natural control limits.

(C) Specified control limits. (D) None of the above.

C 21317 (Pages : 4) Name.....

Reg. No.....

FOURTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
APRIL 2022

Statistics

STS 4C 04—APPLIED STATISTICS

(2014—2018 Admissions)

Time : Three Hours Maximum : 80 Marks

Use of Calculator and Statistical table are permitted.

Part A

Answer **all** *questions in* **one word.**

Each question carries 1 *mark.*

1. Data obtained by conducting a survey is called ———— data.
2. The errors other than sampling errors are termed as ————.
3. Another name of population is ————.
4. Equality of several population means can be tested by ————.
5. A time series consist of at the most ———— components.
6. The moving average method eliminates ————.
7. Index numbers are known as ————.
8. In the computation of index numbers, the most preferred type of average is ————.
9. 3σ - limits were proposed by ————.
10. For the subgroups of size n, the upper and lower control limits for rejection of a lot are termed as ————.

(10 × 1 = 10 marks)

Part B

Answer **all** *questions in* **one sentence.**

Each question carries 2 *marks.*

11. Define secondary data.
12. Define Sample.

13. What is the use of ANOVA technique ?

14. What is a time series ?

15. Give the idea of seasonal variation.

16. Discuss factor reversal test.

17. When a population process is said to be in a state of statistical control ?

(7 × 2 = 14 marks)

Part C

Answer any **three** *questions.*
Each question carries 4 *marks.*

18. Describe any *two* methods of selecting a sample.

19. Discuss the moving average method for ascertaining the trend.

20. Explain the simple average method for measuring seasonal variation.

21. Define Fisher's index number. Why it is considered as ideal index number ?

22. How can the Shewart control charts be interpreted to draw meaningful conclusions ?

(3 × 4 = 12 marks)

Part D

Answer any **four** *questions.*
Each question carries 6 *marks.*

23. Explain the technique of analysis of variance for a two-way classification data.

24. Explain the principle steps in a sample survey.

25. Calculate the Paasche's index number from the following data :

Commodity	Price		Quantity	
	Base Year	Current Year	Base Year	Current Year
A	0.80	0.70	10	11
B	0.85	0.90	8	9
C	1.30	0.80	5	5.5

26. Apply the method of semi-averages for determining the trend :

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000
Value	10	12	15	20	18	25	24	28	34

27. Fit a straightline trend to the following data by the least square method :

Year	1961	1962	1963	1964	1965	1966	1967
Value	60	72	75	65	80	85	95

28. What is the rationale behind setting of control limits ?

(4 × 6 = 24 marks)

Part E

Answer any **two** *questions.*
Each question carries 10 *marks.*

29. Explain the characteristics, uses and limitations of index numbers.

30. Compute Fisher's ideal index from the following data and show that it satisfies the time reversal test.

Commodity	Price		Quantity	
	Base Year	Current Year	Base Year	Current Year
A	5	8	10	1
B	6	24	18	3
C	8	11	8	1
D	3	12	6	4

31. The following are the figures of defectives in 22 lot containing 2000 rubber belts.

425, 430, 216, 341, 225, 322, 280, 306, 337, 305, 356, 402, 216, 264,126, 409, 193, 326, 280, 389, 451, 420.

Draw control chart for fraction defective and comment on the state of control of the process.

32. A set of data involving four tropical feed stuffs A, B, C, D tried on 20 chicks is given below. All the 20 chicks were treated alike in all respects except the feeding treatments and each feeding treatment is given to 5 chicks. Analyze the data :

A	55	49	42	21	52
B	61	112	30	89	63
C	42	97	81	95	92
D	169	137	169	85	154

(2 × 10 = 20 marks)

C 21316 (Pages : 3) Name.....

Reg. No.....

FOURTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION, APRIL 2022

Statistics

STS 4B 04—TESTING OF HYPOTHESIS

(2014—2018 Admissions)

Time : Three Hours Maximum : 80 Marks

Part A (One Word Questions)

Answer **all** *questions.*
Each question carries 1 *mark.*

1. Accepting a false null hypothesis is known as ————.
2. The number of unspecified parameters in a composite hypothesis is known as ————.
3. The critical region which has the maximum power for a fixed level is called ————.
4. Degrees of freedom of Chi-square in case of contingency table of order (5 × 4) are ————.
5. The hypothesis $H_0 : \theta = \theta_0$ is a ———— hypothesis.
6. Student's-*t* is valid in case the variable X follows ———— distribution.
7. The smallest significance level at which the null hypothesis can be rejected is known as ————.
8. Equality of two population variances can be tested by ————.
9. The number of runs in the sequence ABBAAABAABBBAAAB is ————.
10. An alternative to *t*-test in non-parametric case is ————.

(10 × 1 = 10 marks)

Part B

Answer **all** *questions in* **one sentence.**
Each question carries 2 *marks.*

11. Define composite hypothesis with an example.
12. Define type I error.
13. Describe power function and power curve.

14. When do you call a test uniformly most powerful ?

15. What is Yate's correction ?

16. Give the uses of Neymann-Pearson lemma.

17. How do you perform ordinary sign test ?

(7 × 2 = 14 marks)

Part C

Answer any **three** *questions.*
Each question carries 4 *marks.*

18. Distinguish between parametric and non-parametric hypothesis with examples.

19. A random variable X has an exponential distribution with parameter 'θ'. To test $H_0 : \theta = 2$ against $H_1 : \theta = 1$ a random sample of size 2 is selected and the critical region is observed that $X_1 + X_2 \geq 9.5$. Find the level of significance and power of the test. Also draw the power curve.

20. Explain the test for significance of correlation coefficient.

21. Point out the difference between one-tailed and two-tailed tests.

22. Describe Mann-Whitney U-test.

(3 × 4 = 12 marks)

Part D

Answer any **four** *questions.*
Each question carries 6 *marks.*

23. Find the best critical region to test $H_0 : \mu = \mu_0$ against $H_1 : \mu = \mu_1$ based on a random sample of size 'n' from $N(\mu, \sigma^2)$, σ^2 is known.

24. Explain the Chi-square test for independence of attributes.

25. Show that in a 2 × 2 contingency table where the frequencies are :

a	b
c	d

and $N = a + b + c + d$, the χ^2 calculated from independent frequencies is :

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

26. Samples of size 100 each are taken from two brands of electric bulbs. The sample from brand A gave an average lifetime of 1500 hours with a standard deviation of 50 hours. The sample from brand B gave an average lifetime of 1550 hours with a standard deviation of 60 hours. Assuming normality of the distributions examine whether the two brands have the same lifetime distribution.

27. Explain the procedure of testing the significance of difference of proportions.

28. The yield of wheat from 18 randomly selected test plots are 48, 48.5, 49, 49, 50, 52, 57, 54, 53.5, 52, 49.5, 53, 52.5, 51, 47, 52, 51.5, 53. Use sign test at 5% level to test the hypothesis that the median of the yield distribution is 50 units.

(4 × 6 = 24 marks)

Part E

Answer any **two** *questions.*
Each question carries 10 *marks.*

29. (i) Explain the test based on F-distribution.

(ii) Two independent samples of items had the following values.

Sample I :	20	16	26	27	23	22	18	24	25	19		
Sample II :	26	33	42	35	32	34	38	28	41	43	40	37

Find the estimates of population variances and test whether the variances are same.

30. Describe large sample tests. Explain the method of testing the population proportion using large sample.

31. Fit a Poisson distribution for the following data and test the goodness of fit :

X	0	1	2	3	4	5	6
$f(x)$	275	72	30	7	5	2	1

32. 12 sets of identical twins were given a psychological test to measure the amount of aggressiveness in each person and the data are given below :

First twin	86	71	77	68	91	72	77	91	70	71	88	87
Second twin :	88	77	76	64	96	72	65	90	65	80	81	72

Examine whether the first born twin tends to be more aggressive than the second born twin using : (a) median test ; (b) U-test ; and (c) run test.

(2 × 10 = 20 marks)