1B4A23225

(Pages : 3)

Reg. No:........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester B.Sc Statistics Degree Examination, April 2023

BST4B04 – Testing of Hypothesis

(2019 Admission onwards)

Time: 2 ½ hours

Max. Marks : 80

PART A

Each question carries 2 marks

1. Define null and alternative hypotheses.
2. Define critical region and critical value.
3. Define uniformly most powerful test.
4. Discuss sequential sampling.
5. A sample of size 16 has 53 as mean and the sum of squares of the deviations taken from mean is 150. Can the sample be regarded as taken from the population with mean 56?
6. Write down the test statistic used for testing equality of means of two populations when the sample sizes are large.
7. In a survey of 70 business firms, it was found that 45 are planning to expand their capacities next year. Does the sample information contradict the hypothesis that 70% of the firms are planning to expand next year?
8. What is the null hypothesis in ANOVA?
9. What is Yates correction?
10. Write the test statistic used for testing goodness of fit.
11. It is claimed that more IAS selections are made from cities rather than rural places. On the basis of the following data do you up hold the claim?

	Selected	Not Selected
From Cities	500	200
From Rural Places	100	30

12. State the assumptions in Chi-square test for variance. Give the critical regions of the test.
13. How does a non-parametric test differ from parametric test?
14. Define sign test for two sample.
15. Find the number of runs in the sequence ABBAAABAABBBAAAB.

Maximum Mark = 25

PART B

Each question carries 5 marks

16. It is desired to test the hypothesis that 25% of the articles produced by a machine are defective against the alternative that 50% are defective. The test suggested is to take a sample of size 5 and reject the hypothesis if the number of defectives is greater than one. (1) What is the critical region? (2) Find level of significance (3) Find power of the test.

17. A factory was producing electric bulbs of average length of life 2000 hours with S.D 300.A new process was introduced with the hope that the length of life of the bulbs would increase.A sample of 50 bulbs produced by the new process was found to have an average length of life 2200 hours, Examine whether the length of life of bulbs has increased.

18. Explain the test procedure for testing equality of two population proportions.

19. 12 rats were given a high protein diet and another set of 7 rats given a low protein diet. The gain in weight in gms observed in the two sets are given below.

High protein diet	13	14	10	11	12	16	10	8	11	12	9	12
Low protein diet	7	11	10	8	10	13	9					

Examine whether the high protein diet is superior to the low protein diet at 5% level of significance.

20. Discuss F test for testing ratio of variances.

21. Two sets of students were given an intelligence test and an arithmetic test. The sets were of size 45 and 39 and the correlation co-efficient between the scores obtained by the students in the two sets are 0.45 and 0.38. Do you think that the correlation between the variables is the same for the populations of students of which the two sets are samples?

22. Length of one month old 20 plants are given below. Test whether the median length is 9.9 using sign test. The observed lengths are 9.3, 8.8, 10.9, 11.5, 8.2, 9.7, 10.3, 8.6, 11.3, 10.7, 13.2, 9, 9.8, 9.3, 9.9, 10.3, 10, 10.1, 9.6, 10.4.

23. Explain Median Test.

Maximum Mark = 35

PART C

Each question carries 10 marks (Answer any TWO Questions)

24. State Neymann Pearson Lemma. Obtain the best critical region for testing p in B(n,p).

25. An IQTest was administered to 5 persons before and after they were trained. The results are as follows.

Candidate	A	B	C	D	E
I.Q before training	110	120	123	132	125
I .Q after training	120	118	125	136	121

Test whether there is any change in I Q after the training programme.

26. Two random samples drawn from two normal populations are given below.

Sample I	20	16	26	27	23	22	18	24	25	19		
Sample II	27	33	42	35	32	34	38	28	41	43	30	37

Test whether the two populations have the same variances.

27. Explain briefly Kolmogorov Smirnov one sample and two sample tests. What are the advantages of this test over Chi-square test of goodness of fit?

$2 \times 10 = 20$

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester B.Sc Mathematics Degree Examination, April 2023

BST4C04 – Statistical Inference and Quality Control

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

SECTION-A

Each question carries 2 Marks.

Maximum Marks that can be scored in this section is 20.

1. Define minimum variance unbiased estimators
2. Show that sample mean is more efficient than sample median as an estimator of the population mean for the normal distribution
3. State Cramer-Rao inequality
4. Explain interval estimation
5. Briefly explain paired t test.
6. A random sample of size 30 from a normal population gives mean 42 and variance 25. Calculate the value of the Chi-square statistic used for testing the significance of population variance.
7. What do you mean by p value?
8. Explain the concept of type I and type II errors.
9. Give the assumptions and hypothesis of two-way ANOVA
10. Briefly explain the advantages and disadvantages of non-parametric methods.
11. Distinguish between chance causes and assignable causes.
12. What is a p chart? Give the control limits for p chart.

SECTION-B

Each question carries 5 Marks.

Maximum Marks that can be scored in this section is 30.

13. Explain how the Median test is used to compare two populations.
14. Obtain the m.l.e. of θ for the distribution having p.d.f

$$f(x:\theta) = \theta x^{\theta-1}, x > 0, 0 \leq \theta \leq 1.$$

15. In a sample of 532 individuals selected at random from a population, 89 have been found to have Rh- negative blood. Find an interval estimate of the proportion of individuals in the population with Rh- negative blood with 95% confidence.

16. Define sufficiency of an estimate. Verify whether $\bar{x}$ is a sufficient estimator of p when samples of size n are taken from a binomial population with parameter N and p (N given).

17. Let p be the probability that a coin will fall head in a single toss. In order to test $H_0: p = \frac{1}{2}$ against $H_1: p = \frac{3}{4}$, the coin is tossed 5 times and H_0 is rejected if more than 3 heads are obtained. Find the probability of type I error and power of the test.

18. Certain diet was fed to 15 mice and the following increases in weights have been noted: 2.1, 3.2, -1.0, 1.2, -1.3, 1.5, 1.7, 2.5, -3.0, 4.0, 4.2, 1.7, -1.6, 1.2, -1.0. Examine whether the diet has any effect on the increases in weight of mice.

19. Given the sample values from normal populations: Sample I: 1, 12, 4, 3, 9, 10, 6, 8, 6, 5 and Sample II: 1, 10, 2, 8, 2, 3, 6, 8. Examine whether the variances of the two samples differ significantly.

SECTION-C

(Answer *any one* Question and carries 10 marks)

20. a. Briefly explain the term 'Analysis of Variance' and state the assumptions involved in it.

b. The following figures relate to the production in kilograms of three varieties A, B and C of wheat sown in 12 plots:

A: 14, 16, 18

B: 14, 13, 15, 22

C: 18, 16, 16, 19, 20

Is there any significant difference in the production of three varieties?

21. a. Explain how $\bar{X}$ and R charts are used to control the quality of products in the industry.

b. Construct the control chart for the mean and range for the sample of size 5 being taken every hour. Verify whether the process is under control.

Sample Number	Sample values				
1	42	65	75	78	87
2	42	45	68	72	90
3	19	24	80	81	81
4	16	54	69	77	84
5	42	51	57	59	78
6	51	74	75	78	60

(for $n = 5$, $A_2 = 0.58$, $D_3 = 0$, $D_4 = 2.115$)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester B.Sc Statistics Degree Examination, April 2023

BAS4C04 – Probability Models and Risk Theory

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

PART-A (Short Answer)
Each question carries *two* marks. Maximum *20* Marks

1. What is meant by saddle point?
2. Define zero-sum two-person game.
3. If X~ Pareto distribution with parameters $\lambda = 400$ and $\alpha = 3$ and N~Poi(50), find E[S].
4. What is compound binomial distribution?
5. Define Reinsurance.
6. Define poisson process.
7. What is meant by proportional reinsurance?
8. What is ruin theory in risk theory?
9. Define Non-proportional reinsurance.
10. Define surplus process.
11. What do you mean by a dominant strategy?
12. What is meant by the aggregate claim process?

Maximum Marks = 20

PART-B (Paragraph)
Each question carries *five marks*. Maximum *30* Marks

13. An insurer knows from past experience that the number of claims received per month has a poisson distribution with mean 15 and that claim amounts have an exponential distribution with mean 500. The insurer uses a security loading of 30%. Calculate the insurer's adjustment coefficient.

14. Determine the minimax strategy for players A and B from the following pay-off matrix.

Player A

Player B	I	II	III
1	6	2	2
2	4	3	5
3	-3	1	0

15. Differentiate between Proportional and Non Proportional reinsurance arrangements.

16. Write down a formula for the MGF of a compound Poisson distribution with individual claim size distribution *Gamma* (α, β) and poisson parameter λ.

17. The probability of a claim arising on any given policy in a portfolio of 1,000 one-year term assurance policies is 0.004. Claim amounts have a *Gamma* (5 , 0.002) distribution. Calculate the mean and variance of the aggregate claim amount.

18. Determine an expression for the MGF of the aggregate claim amount random variable if the number of claims has a *Bin*(100, 0.01) distribution and individual claim sizes have a *Gamma*(10, 0.2) distribution.

19. The random variable S has a compound Poisson distribution with Poisson parameter 4. The individual claim amounts are either 1, with probability 0.3, or 3, with probability 0.7. Calculate the probability that $S = 4$.

Maximum Marks = 30

PART-C (Essay)

Each question carries *ten* marks. Maximum *10* Marks

20. a) Discuss the main assumptions of individual risk model.

b) Determine the mean, variance and MGF for compound binomial distribution.

21. a) Explain probability of ruin in discrete time.

b) What is the surplus process ruin theory?

Maximum Marks = 10