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Reg. No. : ....

Name : ....

Fourth Semester B.Sc. Degree Examination, July 2019

First Degree Programme Under CBCSS

Complementary Course for Mathematics

ST 1431.1 – STATISTICAL INFERENCE

(2013 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

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

1. Define point estimation.
2. What do you mean by completeness of an estimate?
3. Define minimum variance unbiased estimate.
4. What is the interval estimate of the population mean when population variance is known?
5. What is a hypothesis?
6. Define critical region of a test.
7. Distinguish between null and alternative hypothesis.
8. Distinguish between type I and type II errors.
9. Discuss any two applications of chi square test.
10. Explain briefly local control in experimental design.

(10 × 1 = 10 Marks)

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SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. Define consistency. State and prove the sufficient conditions for consistency.

12. When would you say that an estimate is more efficient than another?

13. Find by the method of moments, an estimate for the Poisson parameter λ.

14. Explain the method of maximum likelihood estimation.

15. Define sufficiency.

16. Derive the confidence interval for the variance of a normal distribution.

17. If $X_1, X_2, ..., X_n$ is a random sample from a normal population with mean μ and variance l, show that $t = \frac{1}{n}\sum_{i=1}^{n} \chi_i^2$ is an unbiased estimate of $\mu^2 + 1$.

18. State the Neyman-Pearson theorem in funding the maximum powerful critical region.

19. A population has pdf $f(x) = \frac{1}{4}$, $\theta - 2 \leq X \leq \theta + 2$. To test H_o: $\theta = 5$ against $H_1 = \theta = 8$, based on a sample of size 1, it is suggested to reject the hypothesis if $\chi \geq 6$. Find the significance level and power of the test.

20. Explain paired t test.

21. Explain the test procedure in testing the equality of variances of two normal populations.

22. Explain briefly randomization and replication in the design of experiments.

(8 × 2 = 16 Marks)

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SECTION – C

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

23. State Fisher-Neyman factorization theorem. Use it to show that sample mean is sufficient for estimating the parameter μ in (μ, σ) where σ is known.

24. If the random variable X has pdf $f(x) = (\beta + 1)\ \chi^{\beta},\ 0 \le \chi \le 1,\ \beta > 0$. Obtain the maximum likelihood estimate of β.

25. A random sample of size 10 from a normal population with S.D 5 gave the following observations : 65, 72, 71, 85, 73, 76, 67, 70, 74, 76. Calculate the 95% confidence interval for the population mean.

26. Explain testing of equality of proportions of items in the same class on the basic of two independent samples drawn from two populations.

27. The following data gives marks obtained by a sample of 10 students before and after a period of training. Assuming normality test whether the training was of any use.

Student no :	1	2	3	4	5	6	7	8	9	10
Before :	91	95	81	83	76	79	101	85	88	81
After :	88	89	97	88	92	92	90	99	97	87

28. A machine puts out 16 imperfect articles in a sample of 500. After the machine was overhauled it puts out 3 imperfect articles in a batch of 100. Has the machine improved in its performance?

29. Explain the chi-square test of goodness of fit.

30. Show that if t is a consistent estimator of θ, then t^2 is also a consistent estimator of θ^2.

31. What are the important assumptions underlying the analysis of variance techniques?

(6 × 4 = 24 Marks)

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SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. (a) Discuss the desirable properties of a good estimator.

(b) Derive the confidence interval for the difference of means of two normal populations.

(c) A random sample of 20 bullets produced by a machine shows an average diameter of 3.5 mm and a S.D of 0.2 mm. Assuming that the diameter measurement follows $N(\mu, \sigma)$, obtain a 95% internal estimate for the mean and 99% interval estimate for the true variance.

33. (a) Estimate the parameters of a normal population by the method of moments.

(b) State Cramer-Rao Lower Bound for the variance of an unbiased estimator of a parameter θ.

(c) Explain method of minimum variance estimation show that the minimum variance unbiased estimator for the parameter μ is the sample mean when sample is drawn from $N(\mu, \sigma)$, σ known.

34. (a) Explain chi-square test of independence of qualitative characteristics.

(b) A die was thrown 180 times. The following results were obtained.

No. turning up :	1	2	3	4	5	6
Frequency :	25	35	40	22	32	26

Test whether the die is unbiased

35. (a) Explain analysis of variance.

(b) Derive the ANOVA table foe one way classification.

(2 × 15 = 30 Marks)

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