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Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, NOVEMBER 2022

Fourth Semester

Complementary Course—STATISTICAL INFERENCE

(Common for B.Sc. Mathematics Model I Physics Model I and Computer Applications)

(2013 to 2016 Admissions)

Time : Three Hours Maximum Marks : 80

Part A (Short Answer Questions)

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

1. Define the term 'statistic'.
2. Define efficiency of an estimator.
3. What are the sufficient conditions for consistency ?
4. What is an MLE ?
5. Define a most efficient estimator.
6. Define null hypothesis.
7. What is size of the test ?
8. What are the assumptions of '*t*' test ?
9. Define an F statistic.
10. Which test is used for testing the equality of variances of two normal distributions ?

(10 × 1 = 10)

Part B (Brief Answer Questions)

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

11. Distinguish between a point estimate and an interval estimate.
12. Show that sample mean is more efficient than sample median as an estimator of μ in $N(\mu,\sigma)$.
13. State Fisher-Neymann factorization criteria for sufficiency.

Turn over

14. If t is unbiased for θ, show that t^2 is not unbiased for θ^2.

15. Obtain method of moment estimator of λ when $X \to P(\lambda)$.

16. State Crammer Rao inequality.

17. State the 95% interval estimate of $\mu_1 - \mu_2$ when $X_1 \to N(\mu_1, \sigma_1)$ and $X_2 \to N(\mu_2, \sigma_2)$ when σ_1 and σ_2 are known.

18. Distinguish between simple and composite hypothesis

19. Define (i) Type I error ; (ii) Type II error.

20. What is a test statistic ?

21. Write the format of one-way ANOVA table

22. What are the assumptions of F test ?

(8 × 2 = 16)

Part C (Descriptive/Short Essay type questions)

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

23. Explain the desirable properties of a good estimator with a suitable example

24. Show that the sample mean $\bar{x}$ is an unbiased estimator of $\frac{1}{\theta}$ for the distribution :

$f(x,\theta) = \theta(1-\theta)^{x-1}, x = 1,2,\ldots\ldots\ldots\ldots, 0 < \theta < 1.$

25. In $N(\mu,1)$, show that sample mean is a sufficient estimator of μ.

26. Find the MLE for the parameter θ in the probability function $f(x,\theta) = \theta e^{-ex}, x \geq 0, \theta > 0.$

27. The diameters of 200 ball bearing made by a machine during a week were found to have a mean 0.824 and 0.042. Find 99% confidence interval for the mean diameter of the ball bearings.

28. Distinguish between parametric and nonparametric tests of hypothesis.

29. Suppose $X \to B(1,p)$, To test $H_0 : p = \frac{1}{4}$ against $H_2 : p = \frac{3}{4}$. We take a sample of 4 observations and reject H_0 if we get 4 successes. Compute α and β ?

30. Explain the large sample test for testing the equality of two population means.

31. Four coins are tossed 80 times, The distribution of the number of heads is given below :

No. of heads	0	1	2	3	4
Frequency	4	20	32	18	6

Test whether the coins are unbiased.

(6 × 4 = 24)

Part D (Long Essays)

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

32. For a random sampling from $N(\mu,\sigma^2)$, Find the MLE for :

(a) μ when σ^2 is known.

(b) σ^2 when μ is known.

33. The following sample of 11 observations is drawn from a normal population :

12.5, 11.5, 120, 11.5, 12.5, 13.5, 12.5, 13.0, 13.0, 13.5, 12.5. Test $H_0 : \sigma^2 = 4$ against $H_1 : \sigma^2 = 4$.

34. The following are samples from two independent normal distributions. Test the hypothesis that they have the same mean assuming that the variances are equal (Take $\alpha = 0.05$) :

Sample I	14	18	12	9	16	24	20	21	19	17
Sample II	20	24	18	16	26	25	18			

Turn over

35. Set a table of ANOVA for the following data :

Plots	Variety			
	A	B	C	D
1	200	230	250	300
2	190	270	300	270
3	240	150	145	180

Test whether the varieties are different.

(2 × 15 = 30)