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

Name.....................................

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MAY 2024

Fourth Semester

Complementary Course—STATISTICAL INFERENCE

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

[2013–2016 Admissions]

Time : Three Hours | Maximum Marks : 80

Part A (Short Answer Questions)

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

1. Define a consistent estimator.
2. What is a point estimate ?
3. Define a likelihood function.
4. Obtain the method moment estimator of λ of a PD.
5. Write the expression for the 95 % confidence interval for the variance of a normal distribution.
6. What do you mean by testing of hypothesis ?
7. What is a p-value ?
8. Define power of test.
9. Define a random sample.
10. Who developed ANOVA ?

(10 × 1 = 10)

Part B (Brief Answer Questions)

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

11. In $N(\mu, \sigma)$, show that sample mean is an unbiased estimator of population mean.
12. Give an example of an estimator which is unbiased but not consistent.
13. Define a sufficient estimator.
14. What is an MLE ?

Turn over

15. Write a note on method of minimum variance.
16. Write the expression for 100 (1 – α) % confidence interval of p, the population proportion of success.
17. Define (i) Null hypothesis ; (ii) Alternate hypothesis.
18. What is mean by critical region ?
19. How will you distinguish a large sample test from a small sample test ?
20. What are the applications of Chi square test ?
21. What is meant by testing the mean of a population ?
22. What are the assumptions of 't' test ?

(8 × 2 = 16)

Part C (Descriptive/Short Essay Type Questions)

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

23. Given three random observations x_1, x_2 and x_3 from $N(\mu, 1)$ population, a person constructs the following estimator of μ if in a sample of 25 observtions there are 10 ones and 4 two's :

$$T_1 = \frac{2x_1 + 3x_2 + x_3}{6}, T_2 = \frac{x_1 + 2x_2 + 3x_3}{7}, T_3 = \frac{x_1 + x_2}{2}.$$

Find the most efficient estimator of. Which one would you choose and why ?

24. Show that $\frac{T(T-1)}{n(n-1)}$ is an unbiased estimator for θ^2, for the sample $x_1, x_2 \ldots, x_n$ drawn on X which takes values 1 or 0 with respective probabilities θ and $1-\theta$ where $T = \sum_{1=1}^{n} X_1$.

25. Given the probability distribution :

X	:	0	1	2
P(X = x)	:	$1-\theta-\theta^2$	θ	θ^2, $0 < \theta < 1$

26. Explain the concept of interval estimation. How does this differ from point estimation ?
27. In a sample of 500 families owning television sets it was found that 160 owned colour sets. Find a 95 % confidence interval for the actual proportion of families with colour sets.
28. If $X \geq 1$ is the critical region for testing $H_0 : \theta = 2$ against $H_1 : \theta = 1$ on the basis of single obwervation from $f(x, \theta) = \theta e^{-\theta x}, x \geq 0$. Obtain the values of Type I and Type II errors.

29. Explain Neymann Pearson approach of testing Hypothesis.

30. In a sample of 600 men, 450 are smokers and in a sample of 900 women 450 are smokers. Do the data indicate that men and women are significantly different with regard to smoking.

31. Explain the Chi-sqare test of goodness of fit.

(6 × 4 = 24)

Part D (Long Essays)

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

32. Obtain MLE of θ in the pdf $f(x,\theta) = (1+\theta)x^{\theta}, 0 < x < 1$ based on a sample of n independent observations. Examine whether this estimate is sufficient for θ.

33. In a rat feeding experiment the following results were obtained :

High Protein x	:	13	14	10	11	12	16	10	8	11	12	9	2
Low Protein y	:	7	11	10	8	10	13	9					

Test the equality of variance of the gain in weight due to the two diets.

34. Calculate the value of the Chi square and the degrees of freedom in a simple contingency table with observed cell frequencies :

a	b
c	d

35. Perform a one-way ANOVA for the following data :—

Sample		
A	B	C
5	8	7
6	10	3
8	11	5
9	12	4
7	4	1

(2 × 15 = 30)