E 2309 (Pages : 4) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, AUGUST 2021

Fourth Semester

Complementary Course—STATISTICAL INFERENCE

[Common for B.Sc. Mathematics Model I Physics Model I and B.Sc. 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. Distinguish between an estimate and estimator.
2. Define an unbiased estimator.
3. Give an example of a consistent estimator which is not unbiased.
4. State Cramer Rao inequality.
5. Write the expression for 98 % confidence interval of the proportion of success of a population.
6. Define statistical hypothesis.
7. Define critical region.
8. Who is the propounder of Chi-square test ?
9. What is the relationship between t and F ?
10. What is the standard error for testing the mean of a population when σ is known ?

$(10 \times 1 = 10)$

Part B (Brief Answer Questions)

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

11. Distinguish between parameter and an estimator.
12. What do you mean by statistical estimation ?

Turn over

13. State Neymann factorisation criteria for sufficiency.

14. Give an example of an estimator which is unbiased consistent, efficient and sufficient.

15. Give the conditions for getting a MLE when the r.v. X has, the p.d.f. $f\left(f(x, \mathrm{B})\right)$.

16. What is the advantage of interval estimate over point estimate ?

17. Given $\bar{x} = 1.0, n = 16, \sigma^2 = 1.0,$ obtain 90 % confidence interval for the population mean μ for $\mathrm{N}\left(\mu, \sigma^2\right)$.

18. What about the test when the test is found to be significant ?

19. Explain Neymann Pearson approach of testing hypothesis.

20. Define p-value and significance level.

21. Define Power of test.

22. Name the test for testing the equality of two normal population means using two dependent samples taken from it ?

$(8 \times 2 = 16)$

Part C (Descriptive/Short Essay Questions)

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

23. Obtain an unbiased estimator of σ^2 for a normal distribution with mean μ and variance σ^2.

24. Let $x_1, x_2, \ldots\ldots x_n$ be a random sample drawn from a distribution with p.d.f.

$$f(x, 0) = 0\, x^{0-1}, 0 < x < 1, \theta > 0.$$
$$= 0 \text{ elsewhere.}$$

Prove that $x_1, x_2, \ldots\ldots x_n$ is a sufficient statistic for θ.

25. Obtain the 95 % confidence interval for the mean of the normal population, when n is small and σ unknown.

26. What is an MLE ? What are its properties ?

27. Two random samples of sizes 10 and 12 from normal populations having the same variance gave $\bar{x}_1 = 20, s_1^2 = 25$ and $\bar{x}_2 = 25, s_2^2 = 36$. Find 90% confidence limits for $\mu_1 - \mu_2$.

28. Explain the test procedure for testing a null hypothesis against an alternate hypothesis.

29. It is decided to reject $H_0 : \theta = 1$ against a $H_1 : \theta = 2$, if a randomly selected observation X exceeds 0.9, find the significance level and power given that $f(x, \theta) = \frac{1}{\theta}, 0 \le x \le \theta$.

30. For the following table showing the number of plants having certain character, test the hypothesis that the flower colour is independent of flatness of the leaves :

Leaves / Flowers	Flat leaves	Curled leaves
White flowers	99	36
Red flowers	20	5

31. What are the assumptions of ANOVA ?

(6 × 4 = 24)

Part D (Long Essays)

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

32. Distinguish between point estimation and interval estimation. Construct 100 $(1 - \delta)$ % confidence interval for the difference of proportion of successes of two populations.

33. Explain the terms :

(i) Type I and Type II errors.

(ii) Level of significance and *p*-value.

(iii) Power of test.

(iv) Test statistic.

34. Fit a PD to the following data and test the goodness of fit :

x	:	0	1	2	3	4
f	:	47	36	24	10	1

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

Brand			
A	B	C	D
20	25	24	23
19	23	20	20
21	21	22	20

(2 × 15 = 30)