K24U 0751

Reg. No. : .....

Name : .....

IV Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, April 2024
(2019 to 2022 Admissions)
COMPLEMENTARY ELECTIVE COURSE IN STATISTICS FOR MATHEMATICS/COMPUTER SCIENCE
4C04STA : Statistical Inference

Time : 3 Hours Max. Marks : 40

Instruction : ***Use*** *of calculators and statistical tables are* ***permitted***.

PART – A **(Short answer)**

Answer **all 6** questions. **(6×1=6)**

1. Define convergence in probability.
2. State Bernoulli's law of large numbers.
3. When do you say an estimator is consistent ?
4. Write an example of an estimator that is sufficient and unbiased.
5. Define null and alternative hypotheses.
6. Write the assumptions of Student's t test.

PART – B **(Short essay)**

Answer **any 6** questions. **(6×2=12)**

7. Explain weak law of large numbers.
8. Find the least value of $P\{|X - 5| < 3\}$ using Chebyshev's inequality if X is a random variable with a mean of 5 and a variance of 3.

P.T.O.

9. Why do we say that "the Cramer-Rao inequality provides a lower bound to the variance of an unbiased estimator" ?

10. Consider a random sample of observations 2.5, 4.1, –1.2, –2.6 drawn from a Normal population with population variance 4. Obtain the 99% confidence interval for the population mean.

11. State Neyman-Pearson lemma.

12. Define :
    i) Critical region and
    ii) Most powerful critical region.

13. Distinguish between type I error and type II error.

14. Write the test statistic and critical region for the large sample test for testing the equality of population proportions of two independent populations.

PART – C (Essay)

Answer **any 4** questions. **(4×3=12)**

15. State and prove Chebyshev's inequality.

16. For the geometric distribution, $f(x, \theta) = \theta (1-\theta)^{x-1}$, $x = 1, 2,...; 0 < \theta < 1$; show that the sample mean $\bar{X}$ is an unbiased estimator of $\frac{1}{\theta}$.

17. Derive the $100(1-\alpha)\%$ confidence interval for the proportion of success of a Binomial population.

18. Explain the steps involved in large sample test for testing the significance of an assumed population proportion.

19. Illustrate the procedure for testing the significance of an assumed population variance of a normal population.

20. A random sample of 6400 men from Country A has a mean height of 172 cm with a standard deviation of 6.5 cm, while a sample of heights of 2500 men from Country B has a mean of 175 cm with a standard deviation of 6.4 cm. Do the data indicate that the men from Country B are taller than those from Country A ? Use $\alpha = 0.05$.

PART – D (Long Essay)

Answer **any 2** questions. **(2×5=10)**

21. i) Explain the method of moments estimation technique.
    ii) Consider the binomial distribution with pmf $f(x) = {}^nC_x p^x (1-p)^{n-x}$, $x = 0, 1, \ldots, n$. Estimate p by the method of moments.

22. To test the hypothesis $H_0 : \theta = 2$ against $H_1 : \theta = 5$ based on a random variable with pdf $f(x) = \frac{1}{\theta} e^{-\frac{x}{\theta}}$, $x > 0$. Compute the level of significance and power of the test if the critical region is $X > 3$.

23. Describe the Student's t tests for testing the equality of population means of two normal populations when the populations are
    i) independent and
    ii) not independent

24. The following table gives the length of lives of electric bulbs produced by 3 companies. Examine whether the durability of the bulb produced by the different companies differ at 5% level of significance.

Company	Durability in hours				
I	1550	1560	1600	1630	1650
II	1530	1590	1650	1700	
III	1410	1500	1550	1570	1590