K21U 1146

Reg. No. : ....

Name : ....

IV Semester B.Sc. Degree CBCSS (OBE) Regular Examination, April 2021
(2019 Admission Only)
COMPLEMENTARY ELECTIVE COURSE IN STATISTICS
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. Define unbiased estimator. Give an example.
3. State Neyman factorisation theorem for a sufficient estimator.
4. Define simple hypothesis. Give an example.
5. Write down the test statistic for testing the mean of a normal population with unknown standard deviation.
6. Write down the assumptions of t-test.

PART – B
(Short essay)

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

7. Let X be a random variable having uniform distribution over [0, 10]. Obtain bound for $P(2 \le X \le 8)$, using Chebyshev's inequality.
8. Explain the weak law of large numbers. Check whether the weak law of large numbers holds for sequence iid random variables.
9. State the central limit theorem for iid random variables.

P.T.O.

10. Explain estimation by the method of moments.

11. If X_1, X_2, X_3 is random sample from a population with mean μ and variance σ^2. Let $T_1 = X_1 + X_3 - X_2$ and $T_2 = 2X_1 + 3X_3 - 4X_2$. Show that T_1 and T_2 are unbiased estimator of μ. Which estimator is better ?

12. Explain the two type of errors occurring in testing of hypothesis.

13. What do you mean by most powerful test ?

14. What is analysis of variance ? Write down the assumptions of one-way analysis of variance.

PART – C
(Essay)

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

15. State and prove weak law of large numbers.

16. Let $X_1, X_2, \ldots, X_n$ be a random sample taken from a population with pdf
$f(x, \theta) = \frac{1}{\theta^p \Gamma(p)} x^{p-1} e^{-\frac{x}{\theta}}, x \geq 0$ and p (>0) is known. Find the MLE of θ.

17. Show that sample mean is a sufficient estimator of the population parameter of the Poisson distribution.

18. If $X \geq 1$ is the critical region for testing $H_0 : \theta = 1$ against $H_1 : \theta = 2$ on the basis of a single observation drawn from the population with pdf $f(x) = \theta e^{-\theta x}$, $0 \leq x \leq \infty; \theta > 0$. If α and β denote the probability of type I error and type II error respectively, show that $1 - \beta = \alpha^2$.

19. Explain paired t-test.

20. For the 2×2 contingency table

a	b
c	d

prove that Chi-square test of independence gives $\chi^2 = \frac{(a+b+c+d)(ad-bc)^2}{(a+c)(b+d)(a+b)(c+d)}$.

PART – D
(Long essay)

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

21. a) Obtain the $100(1-\alpha)\%$ confidence interval for the population mean of the normal population.

    b) If the following is a sample of ten observations from a normal population :

    175, 168, 155, 170, 152, 170, 175, 160, 160, 165

    Find the 95% confidence interval for the population mean.

22. State Neyman-Pearson Lemma. Use the Neyman-Pearson lemma to obtain most power full test for testing $H_0 : \mu = \mu_0$ against $H_1 : \mu = \mu_1, \mu_1 > \mu_0$, in the case of $N(\mu, \sigma^2)$, where σ^2 is known, based on a random sample of size n.

23. In a breeding experiment, the ratio of offsprings in four classes, namely A, B, C and D was expected to be 1 : 3 : 3 : 9. An experiment yielded the data as follows.

Classes	1	2	3	4
No. of offsprings	8	29	37	102

Test whether the given data is in agreement with the hypothetical ratio.

24. The following table shows the lifetimes in hours of samples from three different types of television tubes manufactured by a company.

Sample 1	407	411	409		
Sample 2	404	406	408	405	402
Sample 3	410	408	406	408	

Test whether there is a difference between the three types at 5% level of significance.