QP CODE: 25003368

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Reg No : ....

Name : ....

B.Sc DEGREE (CBCS) SPECIAL REAPPEARANCE EXAMINATIONS, FEBRUARY 2025

Fifth Semester

B.Sc Statistics Model I

CORE COURSE - ST5CRT05 - STATISTICAL ESTIMATION THEORY

2022 Admission Only

A3E9F2D9

Time: 3 Hours Max. Marks : 80

Part A

*Answer any **ten** questions.*

*Each question carries **2** marks.*

1. Discuss the nature of chi square probability curve.
2. Define student's t statistic and write it's pdf.
3. Obtain the limiting distribution of t distribution.
4. A random sample of size 16 from a normal population with mean 14 is found to have variance 5 . Find the probability that the mean of the sample is negative.
5. State the sufficient conditions for the consistency of an estimator.
6. What is the importance of Factorization theorem?
7. Distinguish between MVB and MVU estimators.
8. What are the different methods of estimation ?
9. Obtain the moment estimate of if the p.d.f. of the population is $f(x,\theta) = \theta x^{\theta-1}$; $0 < x < 1$; $\theta > 0$.
10. Estimate the parameters of binomial distribution if the mean and variance of a sample are 6 and 3/2.
11. Define confidence interval and confidence limits.
12. Explain the construction of large sample confidence interval for the proportion of a binomial population.

(10×2=20)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. Define (i) Parameter, (ii) Statistic (iii) sampling distribution (iv) Standard error . Give one example for each.

14. Prove that if $n_1 = n_2$ the median of F distribution is at F = 1 and that the quartiles Q_1 and Q_3 satisfy the condition $Q_1 Q_3 = 1$.

15. Define UBE. Let X be distributed in the Poisson form with parameter θ . Show that only UBE of $e^{-(k+1)\theta}$ $k > 0$ is $T(x) = (-k)^x$.

16. Prove that in sampling from $N(\mu, \sigma^2)$ the sample mean and sample median are consistent estimators of μ .

17. A random sample $(X_1, X_2, X_3, X_4, X_5)$ of size 5 is drawn from a normal distribution with unknown mean μ . Consider the following estimators to estimate μ .
(i) $T_1 = \frac{(X_1+X_2+X_3+X_4+X_5)}{5}$ (ii) $T_1 = \frac{(X_1+X_2)}{2} + X_3$
(iii) $T_3 = \frac{(2X_1+X_2+\lambda X_3)}{3}$ where λ is such that T_3 is UB .Then (a) Find λ (b) Are T_1 and T_2 UB ? (c) State giving reasons the estimator which is best among T_1, T_2 and T_3 .

18. Find the m.l.es of the parameters μ and σ^2 of the normal distribution $N(\mu, \sigma^2)$.

19. Obtain the MVUE of ' μ ' based on a random sample of size n taken from $N(\mu, \sigma^2)$ population.

20. If a sample 13 ,26 ,14 ,36 ,20 ,25 ,35 ,39 ,44 ,54, 39 is taken from $N(\mu, \sigma^2)$ population , obtain the 95% confidence interval of the mean μ .

21. The weight of students studying in plus two standard is assumed to be distributed with S.D. 1.5 . A sample of 100 students have their mean weight 47.5 kg . Find the 95% and 99% confidence interval for mean weight of students.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **15** marks.*

22. Obtain the distribution of sample correlation coefficient, r in a random sample taken from an uncorrelated bivariate normal population. Also obtain the distribution of the statistic, $t = \frac{r}{\sqrt{1-r^2}}\sqrt{n-2}$.

23. State and prove Rao-Blackwell theorem.

24. (a) Explain the method of maximum likelihood estimation.

(b) If 1.2 ,2.6 ,1.4 ,3.6 ,2.4 ,2.5 ,3.1 ,3.9 ,4.4 ,4.9 are the sample oservations taken from a population with p.d.f. $f(x,\theta)=\frac{1}{\theta}e^{\frac{-x}{\theta}}$; $0<x<\infty$; $0<\theta<\infty.$

Obtain the m.l.e. of θ

25. (a) Explain the construction of large sample confidence interval for the difference of means of two populations.

(b) Two random samples taken from two populations resulted the following information.

size	mean	S.D.
160	34	2.5
250	45	2.6

Construct a 99% confidence interval for the difference of means of the populations.

(2×15=30)