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PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2023
(Fourth Semester)

Branch – **STATISTICS**

STATISTICAL INFERENCE – I

Time: Three Hours Maximum: 50 Marks

SECTION-A (5 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (5 x 1 = 5)

1. If an estimator T_n of population mean is
   (i) sufficient (ii) efficient (iii) consistent (iv) unbiased

2. Rao-Blackwell theorem enables us to obtain minimum variance unbiased estimator through:
   (i) unbiased estimators (ii) complete statistics
   (iii) efficient statistics (iv) sufficient statistics

3. Method of minimum Chi-square for the estimation of parameters utilizes:
   (i) Chi-square distribution function (ii) Pearson's Chi-square statistic
   (iii) contingency table (iv) All the above

4. The most pragmatic approach for determining (1-α) per cent confidence interval is to find out:
   (i) zero width confidence interval
   (ii) equal tail confidence coefficient interval
   (iii) a confidence interval such that the combined area of both the tails is equal to α
   (iv) none of the above

5. To test the randomness of a sample, the appropriate test is
   (i) run test (ii) sign test (iii) median test (iv) U test

SECTION - B (15 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 3 = 15)

6. (a) Discuss the concept of efficiency and sufficiency.

   OR

   (b) $x1,x2,\ldots\ldots xn$ is a random sample from a normal population $N(\mu, 1)$.
   Show that $t=\frac{1}{n}\sum xi^2$ is an unbiased estimator of μ^2+1.

7. (a) A random sample $(X_1, X_2, X_3, X_4, X_5)$ of size 5 is drawn from a normal population with unknown mean μ. Consider the following estimators to estimate μ
   (i) $t_1=\frac{X1+X2+X3+X4+X5}{5}$ (ii) $t_2=\frac{X1+X2}{2}+X_3$

   (OR)

   (b) Let $X_1, X_2, \ldots X_n$ be a random sample from a population with pdf $f(x,\theta)=\theta x^{\theta-1}$; $0<x<1$, $\theta>0$ show that $t_1=\prod_{i=1}^{n} xi$ is sufficient for θ.

Cont...

8. (a) Explain the methods of Minimum Chi-square estimation.

OR

(b) Explain the method of moments.

9. (a) Explain about the Bayes' estimator.

OR

(b) Distinguish between the prior and posterior distribution.

10. (a) Write down the concept of order statistics.

OR

(b) Explain Sign test.

SECTION -C (30 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 6 = 30)

11. (a) State and prove Cramer Rao Inequality.

OR

(b) Explain the concept of consistent estimator and also show that in sampling from a $N(\mu,\sigma^2)$ population, the sample mean is a consistent estimator of μ.

12. (a) State and prove Rao Blackwell theorem.

OR

(b) State and prove Neyman – Fisher factorization theorem.

13. (a) Explain the Properties of Maximum Likelihood Estimators.

(OR)

(b) In a random sampling from normal population $N(\mu,\sigma^2)$, find the maximum likelihood estimators for (i) μ when σ^2 is known (ii) σ^2 when μ is known.

14. (a) Define prior and posterior distributions with suitable notations. Define Bayes Risk of an estimator and obtain two different expressions for it.

OR

(b) Obtain $100(1-\alpha)\%$ confidence limits for the difference of means in sampling from two normal populations.

15. (a) Describe Wilcoxon's Signed Rank Test.

OR

(b) Describe Median test.

Z-Z-Z END