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QP – 177

III Semester B.Sc. Examination, March/April 2022
(F+R) (CBCS) (2018-19 and Onwards)
STATISTICS (Paper – III)
Statistical Inference – I

Time : 3 Hours Max. Marks : 70

Instructions : *i) Answer **any ten** subdivisions in Section – **A** and **five** questions from Section – **B**.*
*ii) Scientific calculators are **allowed**.*

SECTION – A **(10×2=20)**

I. Answer **any ten** sub-divisions from the following :

1) a) What is sampling distribution ?

b) Define standard error and mention its uses.

c) Given T is an estimator of a parameter θ, then prove that MSE (T) $\geq$ V(T).

d) Define consistency and mention the sufficient conditions for consistency.

e) Write a note on Fisher's information in terms of expectation.

f) State the Cramer-Rao inequality.

g) State the properties of moment estimator.

h) What is interval estimation ? Explain.

i) Write down the confidence interval for μ of $N(\mu, \sigma^2)$.

j) Write confidence interval for population correlation coefficient ρ with confidence coefficient $(1 - \alpha)$.

k) What is meant by Monte Carlo method of simulation ?

l) Mention the disadvantages of simulation.

P.T.O.

SECTION – B (5×10=50)

II. Answer **any five** questions from the following :

2) a) Obtain sampling distribution of sample mean $\bar{x}$, when the random sample of size 'n' is drawn from $N(\mu, \sigma_0^2)$ distribution.

b) Derive the moment generating function of chi-square distribution and hence establish additive property. **(4+6)**

3) a) Obtain the expression for even ordered moments of t-distribution with 'n' degrees of freedom.

b) If $F \sim F(n_1, n_2)$ distribution, then prove that $\frac{1}{F} \sim F(n_2, n_1)$ distribution. **(5+5)**

4) a) Show that sample mean $\bar{x}$ is the unbiased estimator for the population mean μ of $N(\mu, \sigma^2)$.

b) Show that the Caushy population $f(x,\mu) = \frac{1}{\pi[1+(x-\mu)^2]}, -\infty \le x \le \infty$ the sample mean is not a consistent estimator, but sample median is a consistent estimator. **(4+6)**

5) a) Define efficiency. If x_1, x_2, x_3 are three independent observations from a population with mean μ and variance σ^2, if $T_1 = x_1 + x_2 - x_3$ and $T_2 = 2x_1 + 3x_2 - 4x_3$ are two estimates of μ, then

i) Which one is unbiased ?

ii) Which one is more efficient ?

b) Show that $\sum_{i=1}^{n} x_i$ is sufficient estimator of p of B (1, p). **(6+4)**

6) a) Define sufficiency and state the theorem used to obtain sufficient estimator.

b) Derive the Minimum Variance Bound Estimator (MVBE) of μ in $N(\mu, \sigma_0^2)$ distribution and find its variance. **(4+6)**

7. a) Find the maximum likelihood estimator for the parameter 'θ' in the distribution with pdf $f(x, \theta) = \theta e^{-\theta x}$, $x \geq 0$, $\theta > 0$.

   b) Estimate p in a sampling from binomial population $f(x, n, p) = {}^{n}C_{x}\, p^{x} q^{n-x}$, $x = 0, 1 \ldots n$ by method of moments. **(5+5)**

8. a) Obtain $100(1 - \alpha)\%$ C.I. for the mean μ of a normal population $N(\mu, \sigma^2)$.

   b) Construct confidence interval for the ratio of two variances. **(5+5)**

9. a) Explain the method of generating random samples from $N(\mu, \sigma^2)$ population.

   b) Explain the method of generating random samples from exponential distribution. **(5+5)**
