SN – 360

III Semester B.Sc. Examination, Nov./Dec. 2017
(CBCS) (F + R) (2015-16 and Onwards)
STATISTICS – III
Sampling Theory and Estimation

Time : 3 Hours Max. Marks : 70

Instructions : *1) Answer **five** subdivisions from Section – **A**, **five** subdivisions from Section – **B** and **five** questions from Section – **C**.*
*2) Answer Section – **A** in **first two** pages of answer **book only**.*
*3) **Scientific** calculator is **allowed**.*

SECTION – A **10**

I. Answer **any five** sub-divisions from the following : **(5×2=10)**

1) a) Define population, finite population and infinite population.

b) For SRSWOR, prove that $E(\overline{y}) = \overline{Y}$.

c) In stratified random sampling, obtain an unbiased estimator of population mean $\overline{Y}$.

d) What is systematic sampling ? Explain.

e) Define a sufficient estimator and give an example.

f) Define efficient estimator and most efficient estimator.

g) Define minimum variance bound estimator.

h) Obtain moment estimator of μ of Normal N (μ, 1).

SECTION – B **15**

II. Answer **any five** sub-divisions from the following : **(5×3=15)**

2) a) What is sample survey ? Mention its limitations.

b) Explain the method of selecting a random sample using random numbers.

c) In SRSWOR, prove that

$$E\left[\hat{A}\right] = A \text{ where } \hat{A} = Np$$

P.T.O.

d) If $X_1, X_2, ..., X_n$ is a random sample from exponential distribution with mean θ, then verify whether $\overline{X}$ is an unbiased estimator of θ.

e) Obtain the efficiency of sample mean over sample median in estimating mean of normal population.

f) Define the terms :

i) Standard error

ii) Mean square error.

g) Obtain moment estimator of θ of uniform distribution U (0, θ).

h) Explain the general method of obtaining the confidence interval for the population parameter.

SECTION – C 45

III. Answer **any five** questions from the following : (5×9=45)

3) a) Explain sampling and non-sampling errors.

b) Obtain the sampling distribution of $\frac{1}{\sigma^2}\sum_{i=1}^{n}(x_i - \overline{x})^2$. (4+5)

4) a) In SRSWOR, prove that the probability of selecting i^{th} unit in the r^{th} draw is equal to the probability of its selection in the 1^{st} draw.

b) Derive an expression for sample size under SRSWOR for estimating population mean $\overline{Y}$. (5+4)

5) What is allocation of sample size in stratified random sampling ? With usual notations obtain an expression for $V(\overline{y}_{st})$ under proportional allocation and Neymann allocation. 9

6) Distinguish between linear and circular systematic sampling. Also prove that $V(\overline{y}_{sys}) = \frac{N-1}{N}S^2 - \frac{N-K}{N}S^2_{wsy}$. 9

7) a) If $X_1, X_2, ..., X_n$ is a random sample from normal $N(\mu, \sigma^2)$, μ is known then verify whether $s^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \mu)^2$ is consistent estimator for σ^2.

b) For a random sample of size n from Poisson distribution $P(\lambda)$, verify whether $\sum x_i$ is sufficient estimator of λ. **(5+4)**

8) a) State Crammer-Rao inequality. Obtain MVB estimator of P of Bernoulli distribution B(1, P), based on a random sample of size n.

b) Obtain an estimator of the parameter σ^2 of normal $N(\mu, \sigma^2)$ using maximum likelihood method (μ is known). **(4+5)**

9) a) Obtain $(1 - \alpha)$ 100% confidence interval for the parameter P of Bernoulli population B(1, P) based on a random sample of size n.

b) If $X_{11}, X_{12}, \ldots, X_{1n_1}$ is a random sample of size n_1 from $N(\mu_1, \sigma_1^2)$ and $X_{21}, X_{22}, \ldots, X_{2n_2}$ is another random sample of size n_2 from $N(\mu_2, \sigma_2^2)$. Obtain $(1 - \alpha)$ 100% confidence interval for σ_1^2 / σ_2^2. **(4+5)**
