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Your Roll No.....

Sr. No. of Question Paper : 143

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Unique Paper Code : 2372573601

Name of the Paper : DSC: Survey Sampling

Name of the Course : B.A./B.Sc. (P)

Semester : VI (NEP)

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. 1 is compulsory.
3. Attempt any **Five** questions from the remaining.
4. Use of a non-programmable scientific calculator is allowed.

1. (a) Attempt any three (2 marks each):

- (i) Name two publications of the Ministry of Statistics and Programme Implementation.
- (ii) What are the limitations of sampling?
- (iii) Explain systematic sampling with an example.
- (iv) What is the main advantage of stratified sampling over simple random sampling?

- (b) Attempt any three (3 marks each):

- (i) Explain Sampling and non-sampling errors.
- (ii) For which value of n , the variance of the sample mean in SRSWOR is exactly half of the variance of the sample mean in SRSWR of the same size?
- (iii) Describe the advantages of a sample survey in comparison with a census survey. Write the circumstances under which census surveys are preferred to sample surveys.
- (iv) A researcher wants to conduct a survey study on the number of hours per week for students in a university with two strata:

Stratum	Population	Standard deviation	Mean hours
Science	300	6	15
Arts	200	12	10

Draw a sample of 80 students under Neyman and Proportional allocation.

2. (a) What are the main steps involved in conducting a sample survey? Discuss them briefly.

- (b) If $(X_i, Y_i), i = 1, 2, \dots, N$ are the pairs of variates defined for every unit of the population of size N and $\bar{x}_n$ and $\bar{y}_n$ are the corresponding means of a simple random sampling without replacement of size n , then prove that:

$$\text{cov}(\bar{x}_n, \bar{y}_n) = \frac{N-n}{Nn} \cdot \frac{1}{N-1} \sum_{i=1}^N (X_i - \bar{X}_N)(Y_i - \bar{Y}_N) = \frac{N-n}{n(N-1)} \text{cov}(X, Y).$$

(6, 9)

Also evaluate $E(\bar{x}_n \bar{y}_n)$.

P.T.O.

3. (a) With two strata, a sampler would like to have $n_1 = n_2$ for administrative convenience, instead of using the values given by the Neyman allocation. If $V(\bar{y}_{st})$ and $V(\bar{y}_{st})_{opt}$ denote the variances given by the $n_1 = n_2$ and the Neyman allocations, respectively, show that the fractional increase in variance is $\frac{V(\bar{y}_{st}) - V(\bar{y}_{st})_{opt}}{V(\bar{y}_{st})_{opt}} = \left(\frac{r-1}{r+1}\right)^2$.

Where $r = \frac{n_1}{n_2}$ as given by Neyman allocation.

(b) Describe the method of determining the sample size in the case of simple random sampling to meet the desired margin of error and confidence coefficient.

(9, 6)

4. (a) For a population with a linear trend, show that $V(\bar{y}_{st}) \leq V(\bar{y}_{sys}) \leq V(\bar{y})_{SRS}$. (Notations have their usual meaning).

(b) How does sampling without replacement differ from that with replacement? Which of them gives a lower value of the standard deviation of the sample mean?

(9, 6)

5. (a) Show that systematic sampling variance as

$$V(\bar{y}_{sys}) = \frac{k-1}{nk} S_{wst}^2 [1 + (n-1)\rho_{wst}]$$

(b) Define simple random sampling without replacement from a finite population. Derive the unbiased estimator of the population mean and find its sampling variance.

(7, 8)

6. (a) Discuss briefly the present Statistical system in India.
 (b) Write about the National Statistical Commission in India.
 (c) State the objectives of NSSO.

(5,5,5)

7. (a) Write short notes on any three of the following:
 (i) Basic Principles of Sample Survey
 (ii) Non-probability sampling
 (iii) Economic Census
 (iv) Circular systematic sampling.

(b) Consider a population of three units with values 112, 116, and 120. For a sample of size two, determine the variance of the sample mean when sampling with replacement and when sampling without replacement. Compare the two results and explain how the method of sampling affects the variance.

(9, 6)