

(c) Write short notes on economic census and follow-up surveys. 5<sup>1</sup>/<sub>2</sub>,3,4

7. (a) Derive the variance of systematic sampling in terms of intra-class correlation coefficient  $\rho$ . Prove that reduction in this variance over srswor will be 100% if  $\rho$  assumes the minimum possible value. If  $\rho$  assumes the maximum value, what is the relative efficiency of systematic sampling over simple random sampling?

(b) Explain the concept of post-stratification. Prove that post-stratification, with a large sample, is almost as efficient as stratified sampling with proportional allocation. 7,5

8. (a) Compare stratified random sampling under Neyman and proportional allocation with simple random sampling without replacement.

(b) Discuss the main functions of Office of the Registrar General of India.

(c) Discuss briefly about the use of information technology in the Indian Statistical System. 5<sup>1</sup>/<sub>2</sub>,4,3

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This question paper contains 4 printed pages.

Your Roll No. ....

Sl. No. of Ques. Paper: 119 I

Unique Paper Code : 32371302

Name of Paper : Survey Sampling and Indian Official Statistics

Name of Course : B.Sc. (Hons.) Statistics

Semester : III

Duration : 3 hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt six questions in all, selecting three from each Section.

### SECTION I

1. (a) (i) Define simple random sampling. Obtain an estimator of the population mean along with its standard error from a simple random sample selected from a finite population without replacement.

(ii) In SRSWOR, prove that the probability of selecting a specified unit of the population at any given draw is equal to the probability of selecting it at the first draw.

(b) A SRS of size  $n=n_1+n_2$  with mean  $\bar{y}_n$  is drawn from a finite population and a simple random

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sub-sample of size  $n_1$  is drawn from it with mean  $\bar{y}_{n_1}$ . Show that:

$$(i) \quad V(\bar{y}_{n_1} - \bar{y}_{n_2}) = S^2 \left( \frac{1}{n_1} + \frac{1}{n_2} \right)$$

$$(ii) \quad V(\bar{y}_{n_1} - \bar{y}_n) = S^2 \left( \frac{1}{n_1} - \frac{1}{n} \right)$$

$$(iii) \quad \text{Cov}(\bar{y}_{n_1}, \bar{y}_{n_1} - \bar{y}_n) = 0 \quad 6,61/2$$

2. (a) Define two-stage sampling. In two-stage sampling with equal first stage units, prove that the sample mean is an unbiased estimator of population mean. Obtain its variance.
- (b) Describe the method of determining the sample size in case of simple random sampling to meet the desired margin of error and confidence coefficient, stating the assumptions made.
- (c) Describe the principles of validity and optimization. 5,5,21/2
3. (a) Obtain the estimated relative efficiency of cluster sampling with respect to simple random sampling without replacement.
- (b) Define difference estimator and derive from it the regression estimator. Also obtain the variance of regression estimator under first approximation.

5,71/2

4. (a) If the coefficients of variation of  $y$  and  $x$  are equal then show that, under first approximation, relative variance of ratio estimator  $R_n$  is twice the relative bias of it.
- (b) From a simple random sample of size  $n$  drawn from  $N$  units, a simple random sub-sample of  $n_1$  units is duplicated and added to the original sample. Show that the mean based on  $(n+n_1)$  units is an unbiased estimator of the population mean. Also obtain its variance. How does it compare with the variance of the estimator based on  $n$  units only? 61/2,6

#### SECTION II

5. (a) Estimate the gain in efficiency due to stratification for arbitrary allocation over simple random sampling.
- (b) Explain the Yates' end corrections in systematic sampling for a population with a linear trend and hence show that the sample mean obtained after applying the end corrections overlaps the population mean. 71/2,5
6. (a) Describe briefly the role and responsibilities of CSO and NSSO. Name their main divisions.
- (b) Name Government of India's three NAD publications related to the National Income estimates.

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