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Sr. No. of Question Paper : 2077

GC-3

Your Roll No.....

Unique Paper Code : 32371302

Name of the Paper : Survey Sampling & Indian Official Statistics

Name of the Course : B.Sc. (H) Statistics (CBCS)

Semester : III

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on the receipt of this question paper.
2. Attempt **Six** questions in all, selecting **three** from each Section.

SECTION - I

1. (a) Discuss the basic principles of sample survey. What are the main steps involved in a sample survey.
(b) A simple random sample of size $n = n_1 + n_2$ with mean \bar{y}_n is drawn from a finite population of size N by srswor. Further, a simple random sub-sample of size n_1 is drawn from it by srswor with mean \bar{y}_1 , show that

$$(i) v(\bar{y}_1 - \bar{y}_2) = \left(\frac{1}{n_1} + \frac{1}{n_2} \right) S^2$$

$$(ii) v(\bar{y}_1 - \bar{y}) = \left(\frac{1}{n_1} + \frac{1}{n} \right) S^2$$

$$(iii) cov(\bar{y}, \bar{y}_1 - \bar{y}_2) = 0$$

where, S^2 is the population mean square and \bar{y}_2 is the mean of remaining $(n - n_1)$ units. (6½,6)

2. (a) If the coefficient of variations of y and x are equal, then prove that, under first approximation, (The notations have their usual meaning).

$$\text{MSE}_1\left(\frac{R_n}{R_N}\right) = 2\left(\frac{1}{n} - \frac{1}{N}\right)C^2(1-\rho) = 2\text{Bias}_1\left(\frac{R_n}{R_N}\right).$$

- (b) Establish the results which justify the following statement :

- (i) Efficiency of cluster sampling increases as mean square within clusters increases.
 - (ii) If clusters are formed of random samples of elements of population, they will, on an average, be as efficient as the individual elements themselves. (7½,5)
3. (a) A sample of size n is drawn from a population having N units by simple random sampling without replacement. A sub-sample of n_1 units is drawn from the n units by simple random sampling without replacement. Let \bar{y}_1 denote the mean based on n_1 units and \bar{y}_2 be the mean based on $(n - n_1)$ units.

Consider the estimator of the population mean \bar{Y}_N given by :

$$\bar{y}_w = w\bar{y}_1 + (1-w)\bar{y}_2.$$

- (i) Show that $E(\bar{y}_w) = \bar{Y}_N$, and obtain its variance.
- (ii) Find the optimal value of w for which $V(\bar{y}_w)$ is minimum.
- (iii) Find the optimal estimator and its variance.

- (b) 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. (7½,5)
4. (a) Find the variance of an estimator of population mean based on cluster sampling in terms of intra-class correlation coefficient between the elements of a cluster. Hence, prove that the increase in the size of the cluster usually leads to a substantial increase in the sampling variance.
- (b) Describe the method of determining the sample size in case of simple random sampling so as to meet the desired margin of error and confidence coefficient, stating the assumptions made. (7½,5)

SECTION – II

5. (a) State the practical difficulties in adopting Neyman's method of allocation of a sample to different strata. How much would the variance increase, on an average, if the allocation is based on the estimates of strata mean squares? Also, compare it with proportional allocation.
- (b) Prove that, in the presence of a linear trend, the variance of a stratified sample is only $\frac{1}{n}$ th of the variance of a systematic sample and the latter is also approximately $\frac{1}{n}$ th the variance of a random sample. (7½,5)
6. (a) Discuss briefly about the statistical wing, MOS & PI and its functions.
- (b) What is primary and secondary data? Mention two methods each of collecting primary and secondary data.
- (c) What is the background and objectives of COCSSO? (5½,4,3)

7. (a) Show that a systematic sample has the same precision as the corresponding stratified random sample with one unit per stratum if $\rho_{wst} = 0$, the notation has its usual meaning.
- (b) If there are two strata and if ϕ is the ratio of actual $\frac{n_1}{n_2}$ to the Neyman optimum allocation $\frac{n_1}{n_2}$, show that whatever be the values of N_1, N_2, S_1 and S_2 , the ratio $\frac{V(\bar{y}_{st})_{\min}}{V(\bar{y}_{st})}$ is never less than $4\phi(1 + \phi)^{-2}$, where f.p.c.'s are negligible. (6,6½)
8. (a) Mention two recommendations each relating to the functioning of NSSO by the Commission regarding (i) organizational aspects and (ii) survey programme.
- (b) Write short notes on the following :
- (i) Functions of CSO
 - (ii) Determinants of quality of statistics
- (c) Explain the concept of post stratification. Prove that post-stratification, with a large sample, is almost as efficient as stratified sampling with proportional allocation. (3,4,5½)