

2023

STATISTICS

Paper : STSHC3066

(Survey Sampling and Indian Official Statistics)

Full Marks : 60

Pass Marks : 24

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

- 1. Choose the correct answer from the following (any five) :** **1×5=5**

(a) Which random sampling means division of layers?

- (i) Simple random sampling**
- (ii) Stratified random sampling**
- (iii) Systematic sampling**
- (iv) Cluster sampling**

(2)

(b) The method of selection of simple random sample is

(i) Lottery method

(ii) Random number table method

(iii) Both (i) and (ii)

(iv) Lahiri method

(c) In simple random sampling without replacement (SRSWOR), sample mean is an unbiased estimate of

(i) population mean

(ii) population variance

(iii) sample variance

(iv) population mean square

(d) The number of possible samples of size n from a population of N units, drawn without replacement is

(i) N^n

(ii) $N!$

(iii) ${}^N C_n$

(iv) n^2

(3)

(e) In simple random sampling without replacement (SRSWOR), the variance of the sample mean is

(i) $\left(\frac{N-n}{N-1} \right) \cdot \frac{s^2}{n}$

(ii) $\frac{(N-n)}{Nn} \cdot s^2$

(iii) $\frac{N-n}{N} \cdot s^2$

(iv) $\frac{(N-n)}{(N-1)} \cdot \frac{s^2}{N}$

(f) In stratified random sampling $V(\bar{y}_{st})$ is minimum for fixed total size of the sample (n), if

(i) $n_i \propto N_i s_i$

(ii) $N_i \propto n_i s_i$

(iii) $n_i \propto N_i s_i^2$

(iv) $N_i \propto n_i s_i^2$

- (g) If the variance of systematic sampling is zero, i.e., $\text{var}(\bar{y}_{\text{sys}}) = 0$, then the minimum value of intra class correlation coefficient (ρ) between the units of the same sample is

(i) $\frac{1}{(n-1)}$

(ii) $-\frac{1}{(n-1)}$

(iii) $\frac{1}{1-n}$

(iv) $-\frac{1}{(1-n)}$

- (h) MoSPI means

- (i) Ministry of statistics and program implementation
- (ii) Ministry of statistics and planning information
- (iii) Ministry of social and public information
- (iv) Ministry of statistics and program information

- (i) CSO is headed by

- (i) Director General
- (ii) Chairman
- (iii) Deputy General
- (iv) Assistant General

- (j) Which of the following is not the division of NSSO?

- (i) Field Data Division (FDD)
- (ii) Survey Design and Research Division (SDRD)
- (iii) Data Processing Division (DPD)
- (iv) Coordination and Publication Division (CPD)

2. Answer any five of the following questions :

2×5=10

- (a) Define population and sample.
- (b) How does sample survey differ from complete census?
- (c) Under what circumstances stratified random sampling is used? Explain.

(6)

- (d) Mention two demerits of systematic sampling.
- (e) Explain cluster sampling.
- (f) Write one merit and one demerit of multistage sampling.
- (g) Explain sampling unit and sampling frame.

3. Answer any *five* of the following questions :
5×5=25

- (a) Describe the basic principle of sample survey.
- (b) Describe different steps involved in planning stage of large scale sample survey.
- (c) Write a brief note about sampling error.
- (d) In stratified random sampling (StRS) with given cost function of the form

$$C = a + \sum_{i=1}^n C_i n_i$$

where a is the overhead cost and c_i is the cost per unit in the i th stratum, prove that

$$n_i \propto \frac{N_i s_i}{\sqrt{C_i}}$$

(symbols have their usual meaning)

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(Continued)

(7)

- (e) Show that in large samples, the ratio estimate will be more efficient than the corresponding sample estimate based on simple arithmetic mean, if

$$\rho \frac{C_y}{C_x} > \frac{1}{2}$$

where ρ is the correlation coefficient between study variate y and auxiliary variate x , where

$$C_y = \frac{s_y}{\bar{Y}_N} \quad \text{and} \quad C_x = \frac{s_x}{\bar{X}_N}$$

- (f) Describe a systematic sampling procedure when the population size (N) is an integral multiple of the sample size (n).
- (g) Explain the concept of linear and circular systematic sampling.
- (h) Write a brief note on double sampling.
- (i) What are the objectives of NSSO (National Sample Survey Office)?

4. Answer any *two* of the following questions :
10×2=20

- (a) If a random sample of size n is drawn without replacement from a finite population of size N with mean \bar{Y}_N and

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(Turn Over)

variance σ^2 , show that the covariance between any two members of the sample is $-\sigma^2 / (N - 1) = (-s^2 / N)$, where s^2 is the population mean square.

- (b) Show that for a simple random sampling without (SRSWOR), the probability of two specified units being selected at any two given draw is

$$\frac{1}{N(N-1)}$$

Also prove that

$$V(\bar{y}_{st})_{Ney} \leq V(\bar{y}_{st})_{Prop} \leq V(\bar{y}_n)_R \quad 3+7=10$$

- (c) Obtain best linear unbiased estimator of population mean in stratified random sampling. Also find the standard error of this estimate. 8+2=10
- (d) What is official statistical system in India? What are the methods used for collection of official statistics? Write a brief note on the role of NSC (National Statistical Commission). 4+3+3=10

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