

Total No. of Printed Pages—11

3. SEM TDC STSH (CBCS) C 6 (N/O)

2023

(Nov/Dec)

STATISTICS

(Core)

Paper : C-6

(**Survey Sampling and Indian Official Statistics**)

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

(New Course)

Full Marks : 55

Pass Marks : 22

Time : 3 hours

1. Choose the correct answer of each question
from given alternatives : 1×5=5

(a) The difference between sample estimate
and population parameter is known as

(i) sampling error

(ii) non-sampling error

(iii) formula error

(iv) human error

(b) The standard error of the mean of the sample of size n , which is drawn from the population with variance σ^2 is

(i) σ^2 / n

(ii) σ / n

(iii) σ^2 / n^2

(iv) σ / \sqrt{n}

(c) In stratified random sampling, optimum allocation of sample size in each stratum is done to

(i) minimize the variance for fixed sample size

(ii) maximize the precision for fixed cost

(iii) minimize the total cost for fixed desired precision

(iv) All of the above

(d) Linear regression estimate is used when the lines of regression pass through the

(i) origin

(ii) any arbitrary point

(iii) point on the X -axis

(iv) point on the Y -axis

(c) In SRSWOR for attribute, with usual notation

$$(i) \text{ var } (p) = \frac{N-n}{N-1} \cdot \frac{PQ}{n}$$

$$(ii) \text{ var } (p) = \frac{N-n}{N} \cdot \frac{pq}{n-1}$$

$$(iii) \text{ var } (p) = \frac{N-n}{n-1} \cdot \frac{PQ}{n}$$

$$(iv) \text{ var } (p) = \frac{N-n}{N-1} \cdot \frac{PQ}{N}$$

2. Answer the following :

2×5=10

- (a) What do you mean by non-sampling errors?
- (b) Define simple random sampling with replacement and without replacement from a finite population.
- (c) In what way, linear regression estimate differs from ratio estimate?
- (d) How to draw a stratified random sample?
- (e) Name two statistical offices of Government of India.

3. Answer any one of the following :

- (a) (i) What is a sample survey? In what respects, it is superior to a census survey? 6
- (ii) Discuss briefly the basic principles of a sample survey. 6

(b) Consider a population of 6 units with values 1, 2, 3, 4, 5, 6. Write down all possible samples of 2 (without replacement) from the population and verify that sample mean is an unbiased estimate of the population mean. Calculate the sampling variances of sample mean by 'with replacement' and 'without replacement' methods and compare these two. 12

(c) In a population of N units, the number of units possessing a certain characteristic is A and in a simple random sample of size n from it, the number of units possessing that characteristic is a . If

$$P = \frac{A}{N}, p = \frac{a}{n}; Q = 1 - P \text{ and } q = 1 - p$$

prove that p is an unbiased estimate of

$$P \text{ and } \text{var}(p) = \frac{N-n}{N-1} \cdot \frac{PQ}{n}$$

Also prove that an unbiased estimate of $\text{var}(p)$ is

$$v(p) = \frac{N-n}{N-1} \cdot \frac{pq}{N} \quad 12$$

4. (a) A population of N units is divided into k strata, there being N_i units in the i th stratum. n_i units are drawn at random without replacement from the i th stratum, the samples from different strata are independent. State the best linear unbiased estimator for the population mean and obtain its variance. Considering a linear cost function $C = a_0 + \sum_{i=1}^k C_i n_i$, a_0 being the overhead cost and C_i the cost per unit for the i th stratum. Obtain the optimum values of n_i ($i = 1, 2, \dots, k$), such that for the given cost the variance is minimized.

11

Or

- (b) What is stratified random sampling? When will you use stratified random sampling? Describe the methods used to fix the number of units to be selected from each stratum. Obtain $V(\bar{y}_{st})$ and obtain the results for the particular cases when—

(i) $\frac{n_h}{N_h}$ is negligible;

(ii) $n_h = \frac{nN_h}{N}$;

- (iii) the sampling is proportional and variance in all strata have the same value.

11

5. (a) What is a ratio estimate? Show that the usual ratio estimate is biased and obtain the magnitude of the bias.

4+3+3=10

Or

- (b) (i) Prove that in systematic sampling positive intraclass correlation coefficient between units of the same systematic sample inflates the variance of the systematic sample mean.

5

- (ii) Write a note on cluster sampling.

5

6. (a) Explain the role and importance of National Sample Survey Organization in providing data on Indian economy.

7

Or

- (b) Write a brief note on present official statistical system in India. What is the role of Ministry of Statistics and Programme Implementation of Government of India?

(7)

(Old Course)

Full Marks : 50

Pass Marks : 20

Time : 2 hours

1. Choose the correct answer from the following alternatives in each question : 1×5=5

(a) Sampling is inevitable in the situation

(i) blood test of a person

(ii) when the population is infinite

(iii) testing of life of dry battery cells

(iv) All of the above

(b) The number of all possible samples of size 2 from a population of size 10 without replacement is

(i) 5

(ii) 45

(iii) 100

(iv) None of the above

- (c) Stratified sampling comes under the category of
- (i) unrestricted sampling
 - (ii) subjective sampling
 - (iii) purposive sampling
 - (iv) restricted sampling
- (d) The greatest drawback of systematic sampling is that
- (i) one requires a large sample
 - (ii) data are not easily accessible
 - (iii) no single reliable formula for standard error of mean is available
 - (iv) None of the above
- (e) In cluster sampling, it is desirable to have
- (i) as great a heterogeneity as possible within cluster
 - (ii) as small a difference as possible between clusters
 - (iii) Both (i) and (ii)
 - (iv) None of the above

2. Answer the following in brief : 2×5=10

- (a) What is meant by sampling error?
- (b) What is lottery method for selecting a simple random sample?
- (c) What is proportional allocation in stratified random sampling?
- (d) Name two Government of India's principal publications containing statistical data on various factors of population.
- (e) What are the points that should be born in mind when we use cluster sampling?

3. (a) Distinguish between sample survey and complete enumeration. Describe briefly the advantages of carrying out a sample survey in preference to a complete enumeration. Under what circumstances can complete enumeration be recommended in preference to a sample survey? 2+5+3=10

Or

- (b) What do you mean by simple random sampling with replacement and without replacement from a finite population? Prove that in simple random sampling without replacement the sample mean

is an unbiased estimate of the population mean. Under what circumstances can we consider simple random sampling without replacement more efficient than simple random sampling with replacement and how?

$$4+3+3=10$$

4. (a) Describe the procedure of stratified random sampling. Mention two commonly used stratifying factors. Describe the methods used to fix the number of units to be selected from each stratum. Prove that for stratified random sampling

$$\bar{y}_{st} = \frac{1}{N} \sum_{i=1}^k N_i \bar{y}_{ni}$$

is an unbiased estimator of the population mean \bar{y}_N .

$$3+1+3+3=10$$

Or

- (b) Explain the method of systematic sampling. Discuss its advantage and disadvantage. Obtain the variance of the estimated mean.

$$3+3+4=10$$

5. (a) What do you mean by ratio estimate? With usual notation, derive the approximate variance of the ratio estimates \hat{R} and \hat{Y}_R .

$$2+5+2=9$$

Or

- (b) Describe cluster sampling. A simple random sample of n clusters is drawn without replacement from a population of N clusters, each containing k elements. Give an unbiased estimate of the mean square between elements of the population. 3+6=9

6. (a) What is CSO? Write an explanatory note on objective and activities of CSO. 2+4=6

Or

- (b) What is meant by NSSO? Mention some functions of NSSO. Under what ministry does NSSO function? 6
