5 SEM TDC STS M 3 (N/O)

2 0 1 8

(November)

STATISTICS

(Major)

Course : 503

(Sample Survey)

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

(New Course)

Full Marks : 80
Pass Marks : 24

Time : 3 hours

1. Select the correct one out of the given
   alternatives :   1×8=8

   (a) In sampling the people in a city, the
       sampling unit height be

       (i) an individual person

       (ii) the members of a family

       (iii) all persons living in the same city
             block

       (iv) All of the above

(*Turn Over*)

(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) In SRSWOR, the probability of any one sample of size n being drawn out of N units is

   (i) $\dfrac{1}{N}$

   (ii) $\dfrac{n}{N}$

   (iii) $\dfrac{1}{n}$

   (iv) $\dfrac{1}{{}^{N}C_{n}}$

(d) A population is perfectly homogeneous in respect of a characteristic under study. What size of a sample would you prefer?

   (i) A large sample

   (ii) A small sample

   (iii) A sample of one unit

   (iv) None of the above

(e) Regarding the number of strata, which statement is true?

    (i) Lesser the number of strata better it is.

    (ii) More the number of strata, worse it is.

    (iii) More the number of strata, better it is.

    (iv) None of the above

(f) Systematic sampling means

    (i) selection of n middle units

    (ii) selection of n largest units

    (iii) selection of every n th unit

    (iv) None of the above

(g) 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

(h) A population is divided into clusters and it is found that all items within a cluster are alike. Which of the following procedures would you adopt?

   (i) Simple random sampling

   (ii) Cluster sampling

   (iii) Systematic sampling

   (iv) Stratified sampling

2. Answer the following questions in brief :

$$2 \times 9 = 18$$

(a) What is meant by sampling error?

(b) What is lottery method for selecting a simple random sample?

(c) Mention two factors that are responsible for size of a sample.

(d) How can one estimate population total?

(e) How are the variances of $\bar{y}_{st}$ under random sampling, proportional allocation and Neyman allocation related to each other?

(f) What is optimum allocation in stratified random sampling?

(g) What is meant by stratifying factor (SF)? Mention two commonly used stratifying factors.

        (Continued)

(h) State the circumstances when systematic sampling is optimum.

(i) What are the main differences between cluster sampling and stratified random sampling?

3. Discuss briefly the principal steps involved in a sample survey. Enumerate the advantages of a sample survey over complete enumeration.

$$6+5=11$$

4. *(a)* *(i)* Explain simple random sampling with replacement and without replacement.

(ii) Show that in SRSWOR, the sample mean is an unbiased estimator of the population mean, i.e.,

$$E(\bar{y}_n) = \bar{Y}_N$$

(iii) Show that in SRSWOR, the variance of the sample mean is given by

$$Var(\bar{y}_n) = \frac{S^2}{n} \cdot \frac{N-n}{N} \qquad 4+3+4=11$$

Or

(b) *(i)* Explain simple random sampling for proportions.

(Turn Over)

(ii) Show that sample proportion p is an unbiased estimator of the population proportion P, i.e., $E(p) = P$.

(iii) Show that in SRSWOR, the variance of p is given by

$$Var(p) = \frac{N-n}{N-1} \frac{PQ}{n} \qquad 4+3+4=11$$

5. What is stratified random sampling? How do you estimate the population mean from a stratified random sample? What are the advantages of stratified random sampling over simple random sampling? $\qquad$ 4+4+5=13

6. (a) Define systematic sampling. Obtain the variance of the estimated mean. $\qquad$ 4+4=8

Or

(b) If the population consists of a linear trend, then prove that

$$Var(\overline{y}_{st}) \leq Var(\overline{y}_{sys}) \leq Var(\overline{y}_n)_R \qquad 8$$

7. Write short notes on the following : $\qquad$ 5½×2=11

(a) Probability and non-probability sampling

Or

SRS of India

(b) Cluster sampling

(7)

1. Select the correct alternative from the following : 1×8=8

   (a) The discrepancies between sample estimate and population parameter is termed as

      (i) human error

      (ii) formula error

      (iii) sampling error

      (iv) non-sampling error

   (b) A selection procedure of a sample having non-involvement of probability is known as

      (i) purposive sampling

      (ii) judgement sampling

      (iii) subjective sampling

      (iv) All of the above

(Turn Over)

(c) The number of all possible samples with replacement of size two from a population of 4 units is

 (i) 2

 (ii) 4

 (iii) 8

 (iv) 12

(d) In SRSWOR, the variance of the sample mean is given by

 (i) $\dfrac{N-n}{N}\dfrac{S^2}{n}$

 (ii) $(1-f)\dfrac{S^2}{n}$

 (iii) $\dfrac{N-n}{N-1}\dfrac{\sigma^2}{n}$

 (iv) All of the above

(e) Stratified sampling comes under the category of

 (i) restricted sampling

 (ii) unrestricted sampling

 (iii) purposive sampling

 (iv) subjective sampling

(f) Under proportional allocation, one get

    (i) an optimum sample

    (ii) a self-weighting sample

    (iii) Both (i) and (ii)

    (iv) Neither (i) nor (ii)

(g) 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

(h) A population is divided into clusters and it has been found that all items within a cluster are alike. Which of the following sampling procedures would you adopt?

    (i) Simple random sampling

    (ii) Stratified random sampling

    (iii) Systematic random sampling

    (iv) Cluster sampling

(*Turn Over*)

2. Answer the following questions in brief :

$2 \times 8 = 16$

(a) Define parameter and statistic.

(b) Explain with example, what is a sampling frame.

(c) Explain with example, simple random sampling with and without replacement.

(d) What is lottery system for selecting a random sample?

(e) What is meant by stratifying factor? Explain how to select stratifying factors.

(f) What is proportional allocation in stratified random sampling?

(g) Is systematic sampling a probability sampling? Justify.

(h) Write a comparative note on simple random sampling and stratified random sampling.

3. Discuss the basic principles of sample survey. Enumerate the advantages of sample survey over complete enumeration. $5+5=10$

4. Answer any *two* of the following :   6×2=12

(a) What do you understand by simple random sample? Show that the probability of selecting a specified unit of the population at any given draw is equal to the probability of its being selected at the first draw in simple random sampling without replacement (SRSWOR).

(b) Draw all possible samples of size two by using SRSWOR technique from the population [7, 12, 15, 20] and verify that the sample mean is an unbiased estimate of population.

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

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

then show that

$$V(p) = \frac{N-n}{N-1} \frac{PQ}{n}$$

5. What is stratified random sampling? How would you estimate the population mean from a stratified random sample? Write a comparative note on stratified random sampling and cluster sampling.   3+4+4=11

6. *(a)* What is systematic sampling? If the population consists of a linear trend $y_i = i;\ i = 1, 2, \cdots k$, then prove that

$$V(\bar{y}_{st}) \leq V(\bar{y}_{sys}) \leq V(\bar{y}_n)_R \qquad\qquad 3+8=11$$

Or

(b) Describe cluster sampling. In what situation, the cluster sampling be preferred? What sampling design is used to select clusters from the population? $\qquad\qquad 6+3+2=11$

7. Write short notes on the following : $\qquad 6\times2=12$

(a) Methods of allocation in stratified random sampling

(b) Sampling and non-sampling errors

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