

2022

STATISTICS — HONOURS

Paper : CC-8

(Survey Sampling and Indian Official Statistics)

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer **any five** questions from **Question nos. 1 to 8**. (Marks 2×5),
any two from **Question nos. 9 to 11** (Marks 5×2) and
any three from **Question nos. 12 to 16** (Marks 10×3).

1. Distinguish between complete enumeration and sampling with an example. 2
2. Describe the sample space in case of circular systematic sampling from 10 units with sampling interval 3. 2
3. Explain the idea of sampling error in estimating the population mean of a study variable. 2
4. State two advantages of stratified random sampling over simple random sampling in estimating a population parameter. 2
5. What is the probability of obtaining the number 123456789, if nine digits are read from a random-number series? 2
6. Give an example where information on an auxiliary variable may be used through regression method of estimation. 2
7. Explain the meaning of Gross Domestic Product of a country. 2
8. What are the topics of the principal publications of the Government of India? 2
9. Show that the probability of selecting a specified unit of a finite population at a specified draw in simple random with replacement sampling and that in simple random without replacement sampling are equal. 5
10. In case of a two-stage sampling scheme with equal-sized first-stage units, suggest an unbiased estimator of the population mean and justify your answer. 5
11. Briefly describe the role of the Ministry of Statistics and Programme Implementation (MoS&PI) in India. 5

Please Turn Over

12. The variate value of one of the units is known to be y_1 in a finite population of size N . An SRSWOR of size n is selected from the remaining $(N - 1)$ units and the sample mean \bar{y}'_n is used in the estimator T_1 , given by

$$T_1 = y_1 + (N - 1)\bar{y}'_n.$$

Also consider an estimator T , given by

$$T = N\bar{y}_n,$$

based on an SRSWOR of size n taken from the entire population. Show that both T_1 and T are unbiased for the population total, and that T_1 has a smaller variance than T . 2+2+6

13. Consider a population sub-divided into L (>1) homogenous strata.
- Suggest an unbiased estimator of the population mean based on an appropriate sample.
 - Also suggest an unbiased estimator of the variance of the estimator.
 - Derive expressions of optimum sample sizes for the strata such that the variance of the estimator and the total observational cost are minimized. 2+3+5
14. (a) What is a linear systematic sampling? Why and how is a circular systematic sampling used?
- (b) For a systematic sampling obtain an estimator of the population mean. Show that the variance of the estimator can be expressed as

$$\frac{\sigma^2}{n}[1 + (n-1)\rho_c],$$

where σ^2 is the population variance and ρ_c is the correlation coefficient between pairs of sample values in the same sample of size n . 4+6

15. Describe the Ratio-Method in estimating a population total when simple random without replacement sampling is adopted. Also derive an approximate variance function of the estimator. 3+7
16. If a population contains some equal-sized clusters, suggest an unbiased estimator of the population mean per unit of a study variable. Hence justify your answer and obtain the corresponding variance function. 5+5
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