

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – STATISTICS

THIRD SEMESTER – APRIL 2010

ST 3504/ST 3502/ST 4500 - BASIC SAMPLING THEORY

Date & Time: 26/04/2010 / 1:00 - 4:00

Dept. No.

Max. : 100 Marks

PART – A

Answer ALL the questions.

(10 x 2 = 20 marks)

1. Explain any one method of non-probability sampling.
2. Distinguish between parameter and statistic.
3. Mention the methods of selecting a random sample.
4. Define unbiased estimator of a parameter.
5. Explain sampling with replacement and sampling without replacement.
6. Explain stratified random sampling.
7. Explain Balanced systematic sampling
8. Explain Lahiri's method of pps selection.
9. What do you mean by pps sampling?
10. What are the advantages of stratified sampling scheme?

PART – B

Answer any FIVE questions

(5 x 8 = 40 marks)

11. In a population with $N = 6$, the values of y_i are 8,3,1,11,4 and 7 . Calculate the sample mean \bar{y} for all possible samples of size 2. Verify that \bar{y} is an unbiased estimator of \bar{Y} .
12. For a simple random sample find $V(\bar{y})$.
13. Prove that the mean of a systematic sample is more precise than the mean of a simple random sample if and only if $S_{wsy}^2 > S^2$.
14. If in every stratum the sample estimate is unbiased, then prove that $\bar{y}_{st} = \sum_{K=1}^L N_k \bar{y}_K$ is an unbiased estimate of the population mean \bar{Y} .
15. Describe the advantages of carrying out a sample survey in preference to a complete enumeration survey. Under what circumstances can complete enumeration be recommended in preference to a sample survey.
16. Explain random sampling and non-random sampling. What are their relative advantages and disadvantages?

(P.T.O.)

17. By giving an example, explain the procedure of selecting a modified systematic sample.

18. Explain cumulative total method of pps selection.

PART – C

Answer any TWO questions

(2 x 20 = 40 marks)

19. a) Prove that for a SRS $s^2 = \frac{1}{n-1} \sum_{i=1}^n (y_i - \bar{y})^2$ is an unbiased estimator of

$$S^2 = \frac{1}{N-1} \sum_{i=1}^N (y_i - \bar{y})^2 .$$

b) Write down the advantages and disadvantages of simple random sampling and stratified random sampling.

20. a) Derive the variance of Hansen-Hurwitz estimator for population total.

b) Explain proportional allocation and optimal allocation in stratified random sampling.

21. a) Obtain the sample size under Neyman's allocation and optimal allocation under fixed cost and fixed variance.

b) Show that $V(\bar{y})_{opt} \leq V(\bar{y})_N \leq V(\bar{y})_p$ under fixed cost.

22. a) Obtain the relative efficiency of systematic sample as compared to simple random sampling without replacement.

b) If a sample of n units is drawn with probabilities Z_i and with replacement then prove that

$$\hat{y}_{ppes} = \frac{1}{n} \sum_{i=1}^n \frac{y_i}{z_i} \text{ is an unbiased estimate of } y \text{ with variance } V(\hat{y}_{ppes}) = \frac{1}{n} \sum_{i=1}^N z_i \left(\frac{y_i}{z_i} - y \right)^2$$

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