

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



B.Sc. DEGREE EXAMINATION – STATISTICS

THIRD SEMESTER – APRIL 2022

UST 3501 – SAMPLING THEORY

Date: 16-06-2022

Dept. No.

Max. : 100 Marks

Time: 01:00-04:00

SECTION - A

Answer ALL questions. Each carries TWO marks. (10 x 2 = 20 marks)

1. Define (i) parameter and (ii) statistic. Give an example for both.
2. Describe the lottery method of obtaining a random sample.
3. In SRSWOR, show that sample mean is unbiased for population mean.
4. Obtain an unbiased estimate of $\text{Var}(\bar{y}_{st})$.
5. Explain proportional allocation and hence deduce $\text{Var}(\bar{y}_{st})_{prop}$.
6. In SRSWOR, find the probability of obtaining a sample of size 'n' from a population of size 'N'.
7. Mention the Limitations of Sampling.
8. Describe the method of drawing a random sample by Random Number Tables Method.
9. What is meant by Stratifying Factor? Mention some of the Stratifying Factors.
10. Mention the merits of systematic sampling.

SECTION – B

Answer any FIVE questions. Each carries EIGHT marks. (5 x 8 = 40 marks)

11. Explain in detail the three important principles of sampling.
12. Discuss in detail the sources of non-sampling errors.
13. In SRS of attributes, find $E(p)$, $\text{Var}(p)$, $v(p)$, $\text{Var}(\hat{A})$, and $v(\hat{A})$.
14. Show that s^2 is unbiased for S^2 , in SRSWOR.
15. State the advantages and disadvantages of Stratified Random Sampling.
16. Obtain $\text{Var}(\bar{y}_{sys})$ and compare it with $\text{Var}(\bar{y}_n)$ and draw your conclusion.
17. Find the approximate bias and mean square error of the Ratio Estimator.
18. Prove that $\text{Var}(\bar{y}_{st})$ is minimum for fixed total sample size 'n' if $n_i \propto N_i S_i$
and hence deduce $\text{Var}(\bar{y}_{st})_{Ney}$.

SECTION – C

Answer any TWO questions. Each carries TWENTY marks. (2 x 20 = 40 marks)

19. Discuss in detail the principal steps involved in the planning and execution of a sample survey? (20)
- 20(a) If the population consists of a linear trend, $Y_i = i$; ($i = 1, 2, \dots, N$), then prove that
$$\text{Var}(\bar{y}_{st}) \leq \text{Var}(\bar{y}_{sys}) \leq \text{Var}(\bar{y}_n)_R$$
 (12)
- (b) Explain the terms (i) Unbiasedness (ii) Variance (iii) Mean Square Error (iv) Bias. (8)

21(a) Find the formula for sample size 'n' in sampling for proportions, with a desired degree of precision. (10)

(b) Write a brief note on the three types of sampling under which the sampling procedures are broadly classified. (10)

22(a) Write a note on the use of 'Auxiliary Information' in Ratio and Regression estimation. (10)

(b) In Stratified Random Sampling with given cost function

$C = a + \sum_{i=1}^k C_i n_i$, prove that $\text{Var}(\bar{y}_{st})$ is minimum if $n_i \propto \frac{N_i S_i}{\sqrt{C_i}}$. (10)

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