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Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2021

First Degree Programme under CBCSS

Statistics

Core Course VIII

ST 1544 : SAMPLE SURVEY METHODS

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Define a statistical population.
2. Define probability sampling.
3. Give the expression of 100(1- α)% confidence interval of population mean for moderate sample size.
4. Define 'inflation factor' in sampling theory.
5. When will the design of a stratified sampling be preffered to that of SN?
6. Define 'stratum weight' in stratified sampling.
7. Define systematic sampling.
8. Give one advantage of systematic sampling.

9. Define ratio estimator of population total.

10. Define linear regression estimator of population mean.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. What is sampling error?

12. Define mean square error of an estimator.

13. Define a sampling design.

14. Define a statistic, and give an example.

15. What is finite population correction?

16. What is an unbiased estimator?

17. What is the probability of selecting a random sample of size 'n' from 'N' units, without replacement?

18. Define the estimator of population mean in stratified sampling.

19. Explain proportional allocation.

20. Give an example where stratified sampling is suitable.

21. Give the difference between systematic and stratified sampling.

22. Give a systematic sample by Lahiri's method if 'N' = 23 and 'n' = 5.

23. Show that $\bar{y}_{sy}$ is unbiased for population mean when $N = nk$.

24. When will the ratio and regression estimates of population mean be the same?

25. Give an example of a ratio estimator for population mean.

26. Show that in simple random sampling the linear regression estimate $\bar{y}_{tr} = \bar{y} + b_0(\bar{X} - \bar{x})$ is unbiased.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

27. Describe two differences between standard sample survey theory and classical sampling theory.

28. Give three uses of sample surveys.

29. Explain how the accuracy of an estimator is evaluated through confidence intervals.

30. Show that sample mean is unbiased in SRSWR.

31. Show that $V(\bar{y}_{WOR}) = \frac{N-n}{N}\frac{S^2}{n}$ in SRSWOR.

32. Compare the efficiency of sample mean under SRSWR and SRSWOR.

33. Obtain the expression of $V_{prop}(\bar{y}_{st})$ in stratified sampling.

34. Establish an unbiased estimate of $V(\bar{y}_{st})$ in stratified sampling.

35. Give the systematic samples when 'k' samples each of size 'n' are to be taken from $N = nk$ units denoted as $y_1, y_2, \ldots y_k, y_{k+1}, y_{k+2}, \ldots y_{2k}, \ldots\ldots y_{(n-1)k+1}, y_{(n-1)k+2}, \ldots y_{nk}$.

36. Obtain the expression of the variance of a systematic sample of size 'n' for estimating population mean when linear trend is there and $N = nk$.

37. Show that the leading term in the bias of ratio estimate is

$$E(\hat{R} - R) = \frac{1-f}{n\overline{X}^2}(R S_x^2 - \rho S_y S_x).$$

38. Give the expression of $100(1-\alpha)\%$ confidence interval of population total using ratio estimator using large samples, and explain the terms contained therein.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. Explain in detail the principal steps in a sample survey.

40. Show that sample variance is unbiased for σ^2 in SRSWR.

41. Explain how the value of sample size is decided in stratified sampling when cost is to be minimised for a specified variance.

42. Show that $V(\overline{y}_{st}) = \frac{(\sum W_h S_h)^2}{n} - \frac{\sum W_h S_h^2}{N}$ under Neyman allocation.

43. Show that systematic sampling is more precise than simple random sampling if the variance within the systematic samples is larger than the population variance.

44. Show that in simple random sampling the linear regression estimate $\overline{y}_{lr} = \overline{y} + b_0(\overline{X} - \overline{x})$ has minimum variance when $b_0 = \frac{S_{yx}}{S_{x^2}}$, and $V_{min}(\overline{y}_{lr}) = \frac{1-f}{n} S_y^2 (1-\rho^2)$.

(2 × 15 = 30 Marks)