



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – STATISTICS

SECOND SEMESTER – JUNE 2015

ST 2816 - SAMPLING THEORY

Date : 03/07/2015
Time : 10:00-01:00

Dept. No.

Max. : 100 Marks

SECTION – A

Answer ALL the questions.

(10 x 2 = 20 marks)

1. Explain the two types of Probability Sampling Designs.
2. Find the mean and variance of the inclusion indicator, for any sampling design.
3. In SRSWOR design, show that $E_p(s_y^2) = S_y^2$.
4. Under what condition PPSWR reduces to SRSWR?
5. Define Midzuno Sampling Design. Show that this design is a valid probability sampling design.
6. Describe the Linear Systematic Sampling Scheme and write its probability sampling design.
7. When do we recommend stratified random sampling?
8. Explain the cumulative total method and prove that it is a PPS selection method.
9. Compute the probability of selecting a linear systematic sample consisting of 3rd and 4th population units, when $N = 12$ and $n = 4$.
10. Show that \hat{Y}_{LR} is more efficient than \hat{Y}_R unless $\beta = R$.

SECTION - B

Answer any FIVE questions.

(5 x 8 = 40 marks)

11. State the unit drawing mechanism for implementing SRSWOR design and prove that this mechanism implements the design.
12. Illustrate that an estimator can be unbiased under one design but biased under another design.
13. Establish that Lahiri's method of selection is a PPS selection method.
14. If there is a linear trend in the population, then prove that the usual expansion estimator in CSS is unbiased for the population total.
15. State the reason for using Desraj ordered estimator instead of Horwitz – Thompson estimator under PPSWOR sampling scheme. Show that Desraj ordered estimator is unbiased for population total.
16. For population with linear trend, verify whether or not \hat{Y}_{LSS} is more efficient than \hat{Y}_{SRS} .
17. Explain Warner's randomized response technique for estimating the population proportion of the units possessing the undesirable characteristic A.
18. Derive the formula for ' n_h ' under Cost Optimum Allocation.

SECTION – C

Answer any TWO questions.

(2 x 20 = 40 marks)

19(a) Deduce \hat{Y}_{HT} and $V(\hat{Y}_{HT})$ using the formula for π_i and π_{ij} under SRSWOR design. **(10)**

(b) Obtain the expressions for \hat{Y}_{st} , $V(\hat{Y}_{st})$ and $v(\hat{Y}_{st})$ when samples are drawn independently from different strata using (i) SRSWOR and (ii) PPSWR designs. **(10)**

20(a) Write the unit drawing mechanism for Midzuno Sampling Design and verify whether or not this mechanism implements the design. **(10)**

(b) Prove that Hansen – Hurwitz estimator \hat{Y}_{dhh} under double sampling is unbiased for Y and derive $V(\hat{Y}_{dhh})$. **(10)**

21. Derive the approximate expressions for the bias and MSE of \hat{Y}_R and deduce their formulae under (i) SRSWOR, (ii) PPSWOR and (iii) Midzuno Sampling designs. **(20)**

22(a) Find the estimated variance of \hat{Y}_{TS} , the estimator for population total under Two – Stage sampling. **(10)**

(b) Obtain Hartley – Ross unbiased ratio type estimator for population total. **(10)**
