3/26

0502E1454

Candidate's Seat No :_____

MSc Sem.-1 Examination

404

Statistics

Time : 2-30 Hours] **February-2025** **[Max. Marks : 70**

Note: Attempt all questions.

Q. 1

(i) Explain fixed confidence interval method for the determination of sample size. [7]

(ii) Define PPS sampling. Explain the Lahiri's method of drawing a varying probability sample. [7]

OR

(i) Explain fixed relative standard error method for the determination of sample size. [7]

(ii) Explain the method of determination of sample size when E(L) is specified. [7]

Q. 2

(i) Suggest an unbiased estimator of population mean under ppswr. Obtain its variance and unbiased estimator of this variance. [7]

(ii) Define Horwitz - Thompson (HT) estimator for population total. Derive its variance and estimator of variance suggested by HT. [7]

OR

(i) Explain Sen-Midzuno method. [7]

(ii) In usual notations show that gain G due to ppswr sampling as compared to srs is given by

$$G = \frac{1}{n^2}\sum_{i=1}^{n}\frac{y_i^2}{p_i}\left(N - \frac{1}{p_i}\right)$$ [7]

Q. 3

(i) In usual notations show that $E = \frac{1}{1+(M-1)\rho_c}$ in cluster sampling. [7]

(ii) Suggest an unbiased estimator of population total in two- stage sampling. Obtain its variance using SRSWOR at both the stages. Also, obtain an unbiased estimator of this variance. [7]

OR

(i) Suggest an unbiased estimator of population total in two- stage sampling. Obtain its variance using SRSWR at both the stages. Also, obtain an unbiased estimator of this variance. [7]

(P.T.O)

(ii) Suggest an unbiased estimator of population mean when a sample of n clusters of equal size is selected with srswr. Derive its variance and also obtain unbiased estimator of this variance. [7]

Q. 4

(i) Obtain the expressions for bias and variance of the ratio estimator in case of simple random sampling with replacement. [7]

(ii) Define ratio estimator. Obtain the expressions for its bias and variance in case of ppswr. [7]

OR

(i) Obtain the expressions for bias and variance of the ratio estimator in case of systematic sampling. [7]

(ii) Discuss almost unbiased ratio estimators. [7]

Q. 5 Answer any seven: [14]

(i) Give one advantage of PPS sampling.
(ii) Give one disadvantage of cumulative total method.
(iii) The ratio of the standard error of the estimator to the expected value of the estimator is known as
(A) variance (B) relative standard error (C) error (D) none of the above
(iv) Give one disadvantage of Horwitz - Thompson (HT) estimator.

(v) In usual notations $\sum_{j(\neq i)=1}^{N} \pi_{ij}$ is equal to

(A) $(n-1)\pi_i$ (B) $(n+1)\pi_i$ (C) $(n+2)\pi_i$ (D) none of the above

(vi) In usual notations, for $n=2$ Des Raj estimator for population total Y is given by

(A) $\hat{Y}_D = \frac{1}{2}\left\{\frac{y_1}{p_1}(1+p_1)+\frac{y_2}{p_2}(1+p_1)\right\}$ (B) $\hat{Y}_D = \frac{1}{2}\left\{\frac{y_1}{p_1}(1-p_1)+\frac{y_2}{p_2}(1-p_1)\right\}$

(C) $\hat{Y}_D = \frac{1}{2}\left\{\frac{y_1}{p_1}(1+p_1)+\frac{y_2}{p_2}(1-p_1)\right\}$ (D) $\hat{Y}_D = \frac{1}{4}\left\{\frac{y_1}{p_1}(1+p_1)+\frac{y_2}{p_2}(1-p_1)\right\}$

(vii) Give one advantage of cluster sampling.

(viii) In usual notations ρ_C is equal to

(A) $1-\frac{M\sigma_w^2}{(M-1)\sigma^2}$ (B) $2+\frac{M\sigma_w^2}{(M-1)\sigma^2}$ (C) $1-\frac{3M\sigma_w^2}{(M-1)\sigma^2}$ (D) $1-\frac{4M\sigma_w^2}{(M-1)\sigma^2}$

(ix) In usual notations ρ_C lies in the range

(A) $\{-1/(M-1)\}$ to 2 (B) $\{-2/(M-1)\}$ to 1
(C) $\{-3/(M-1)\}$ to 1 (D) $\{-1/(M-1)\}$ to 1

(x) The ratio estimators are generally
(A) unbiased (B) biased (C) consistent (D) both (B) and (C)

(xi) Define separate regression estimator.

(xii) In case data on an auxiliary variate for individual sampling units are not available, instead , aggregate value for all units of auxiliary variate is available, then one can rely on:

(A) pps sampling scheme
(B) stratified sampling scheme
(C) ratio method of estimation
(D) none of the above

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