

Seat No. : _____

JA2-104
January-2016
M.Sc., Sem.-I
404 : Statistics
(Sampling Theory)

Time : 3 Hours]

[Max. Marks : 70

- Instructions :** (i) Attempt **all** the questions.
(ii) **All** questions carry equal marks.

1. (a) Explain Stein's method for the determination of sample size.

OR

Explain cost aspect method for the determination of sample size.

- (b) Explain the cumulative total method of drawing a varying probability sample.

OR

Explain the Lahiri's method of drawing a varying probability sample.

2. (a) Suggest an unbiased estimator of population total under PPSWR. Obtain its variance and unbiased estimator of this variance.

OR

Show that linearity of regression is not a sufficient condition for pps sampling to be better than srs.

- (b) Show that stratified PPSWR sampling is always more efficient than unstratified pps sampling when the allocation is proportional to X_s .

OR

What do you understand by an ordered estimator ? Discuss Des Raj's estimator.

3. (a) Suggest an unbiased estimator of population mean when a sample of n clusters of unequal size is selected with SRSWOR. Derive its variance as a function of intraclass correlation coefficient ρ_C and also obtain unbiased estimator of this variance.

OR

In usual notations show that $E = \frac{1}{1 + (M - 1)\rho_C}$ in cluster sampling.

- (b) Suppose n fsu's are selected with PPSWR and from each selected fsu, m ssu's are selected with SRSWOR. Give an unbiased estimator of the population total Y and derive its sampling variance. Also, obtain an unbiased estimator of this variance.

OR

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.

4. (a) Obtain the expressions for bias and variance of the ratio estimator in case of systematic sampling.

OR

Define ratio estimator. Obtain the expressions for its bias and variance in case of PPSWR.

- (b) Discuss separate and combined regression estimators.

OR

Discuss unbiased ratio type estimators.

5. Answer the following :

- (i) How many distinct samples of size n can be drawn with replacement from the population (u_1, u_2, \dots, u_n) of n units ?

- (a) n^n (b) $\binom{2n-1}{n}$ (c) 1 (d) none of the above

- (ii) Define relative standard error.
- (iii) In usual notations the rse of the sample mean in case of srswor is given by
- (a) $C(\bar{y}) = \sqrt{\frac{N-n}{N-1}} \frac{C}{\sqrt{n}}$ (b) $C(\bar{y}) = \frac{C}{\sqrt{2n-1}}$
- (c) $C(\bar{y}) = \frac{C}{n}$ (d) none of the above
- (iv) In Sen-Midzuno method of selecting a sample of size n units out of N units, we select first unit with pps and the remaining $(n-1)$ units from $(N-1)$ units of the population by
- (a) stratified sampling (b) simple random sampling, wor
- (c) systematic sampling (d) none of the above
- (v) In Sen-Midzuno method π_{ij} is given by _____.
- (vi) In Horwitz-Thompson estimator the variance term may assume negative values for some samples.
- (a) True (b) False
- (vii) 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
- (viii) When the sampling frame of elements may not be readily available, we can use cluster sampling.
- (a) True (b) False
- (ix) From the point of view of statistical efficiency, cluster sampling is generally less efficient than simple random sampling.
- (a) True (b) False

- (x) Define two stage sampling.
- (xi) The ratio estimators are generally biased and consistent.
- (a) True (b) False
- (xii) The separate regression estimator is likely to be more efficient than the combined regression estimator.
- (a) True (b) False
- (xiii) 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
- (xiv) If the regression of y on x is perfectly linear then the variance of regression estimate is :
- (a) zero (b) one
- (c) between zero and one (d) greater than 1
-