SC

SEAT No._____

[60/61]

No. of Printed pages: 2

SARDAR PATEL UNIVERSITY
M.Sc. (Statistics) 2nd Semester Examination
2018
Tuesday, 30th October
10:00 a.m. to 1:00 p.m.
Course No. PS02CSTA04/ PS02CSTA24
(Theory of Sample Surveys)

Note: Figures to the right indicate marks. (Total marks: 70)

1 Write the correct answer (each question carries one mark). **08**

(a) For the given sampling design:

$$p(s) = \begin{cases} 0.15 & s = \{1,2,4\} \\ 0.20 & s = \{1,3,4\} \\ 0.30 & s = \{2,3,4\} \\ 0.35 & s = \{3,4\} \\ 0 & o.w. \end{cases}$$

The joint inclusion probability for units 3 and 4 is

(A) 0.15 (B) 0.30 (C) 0.35 (D) 0.85

(b) In PPS sampling , the units are selected with probability proportional to

(A) the size of the population (B) the size of the sample
(C) the size of the unit (D) none of the above

(c) YG variance estimator of the HT-estimator can be used for any

(A) varying probability sampling (B) fixed-size sampling
(C) πps sampling (D) non- πps sampling

(d) A ratio estimator is preferable under SRSWOR if

(A) $y_i / x_i \approx$ constant $\forall$i (B) $y_i x_i \approx$ constant $\forall$i
(C) $x_i / y_i \approx$ constant $\forall$i (D) none

(e) The relationship between y and x is a straight line not passing through origin suggests use of

(A) ratio estimator (B) product estimator
(C) difference estimator (D) regression estimator

(f) Cluster Sampling is appropriate when

(A) a list of elementary unit is not available,
(B) a list of groups of units is available,
(C) to increase precision of an estimator with fixed cost of surveys
(D) all of the above.

(g) For the clusters of unequal but known sizes the useful estimator(s) under SRSWOR is

(A) a mean of cluster means,
(B) a ratio-to size estimator,
(C) a weighted mean of cluster means with weights M_i,
(D) all of the above.

(h) A two-phase sampling is useful when

[P.T.O.]

(A) complete auxiliary information is not available
(B) population size is very large
(C) a list of elementary unit is not available
(D) none

2 Answer any SEVEN of the following (each question carries two marks) **14**

(a) Distinguish between with replacement sampling and without replacement sampling.
(b) For a sample of size n = 2, define Des Raj estimator and show that it is unbiased.
(c) The HT-estimator is preferable for πps (or IPPS) sampling design. Justify.
(d) Define Olkin's multivariate ratio estimator for two auxiliary variables and obtain its optimal weights.
(e) Discuss Hartley-Ross estimator of the population mean.
(f) Show that the efficiency of cluster sampling as compared to SRSWOR can be approximated as $[1+(M-1)\rho]^{-1}$.
(g) Define Two-stage sampling and discuss its merits with respect to single-stage sampling design.
(h) Distinguish between two-stage sampling and two-phase sampling.
(i) Distinguish between sampling errors and non-sampling errors.

3 (a) Discuss two methods of selection to obtain a PPSWR sample and show that the selection probabilities are achieved. **06**

(b) Define PPS sampling and suggest an unbiased estimator of the population total under this sampling. Derive its variance and variance estimator. **06**

OR

(b) Define Horvitz-Thompson (H.T) estimator of population total. Obtain its expected value, variance and estimator of variance given by H.T. **06**

4 (a) Write critical note on the ratio estimator of the population mean. **06**

(b) Discuss the sampling design under which the usual ratio estimator turns out to be unbiased. Obtain the variance and variance estimator of the ration estimator under this scheme. **06**

OR

(b) Define the regression estimator of the population mean. Derive its bias and MSE. **06**

5 (a) Describe cluster sampling. Derive an unbiased estimator of the population mean when clusters are of equal sizes. Also derive its variance and variance estimator. **06**

(b) Obtain the optimum values of M and n in cluster sampling. **06**

OR

(b) Suppose that the finite population consists of N FSUs and each FSU contains M SSUs. Suppose that SRSWOR is used at both the stages. In usual notations, show that $\bar{y}_{nm}$ is unbiased for the population mean per unit. Further obtain its variance. **06**

6 (a) Discuss the PPS sampling in two-phase sampling. **06**

(b) Discuss the ratio estimator in two-phase sampling. **06**

OR

(b) Discuss Warner's randomized response technique. **06**

= ∞ = ∞ = ∞ =