

NRT/KS/19/2152

Bachelor of Science (B.Sc.) Semester—V Examination
SURVEY SAMPLING TECHNIQUES
Optional Paper—2
(Statistics)

Time : Three Hours]

[Maximum Marks : 50

N.B. :— All questions are compulsory and carry equal marks.

1. (A) What was the purpose of establishing N.S.S.O. ? State its divisions. Describe their functions and important aspects. 10

OR

- (E) Explain the following terms with respect to sampling :

- (i) Sampling unit
- (ii) Frame
- (iii) Probability sampling
- (iv) Judgement sampling
- (v) Sampling error.

Why is sample survey superior to census survey ? 10

2. (A) In case of simple random sampling show that specified unit of population of size N can be included in the sample of size n with probability $\frac{n}{N}$.

(B) In case of SRSWOR, show that sample mean is an unbiased estimator of population mean.

(C) Derive an expression for variance of sample mean in SRSWR.

(D) Show that SRSWOR provides a more efficient estimator of population mean as compared to SRSWR. 2.5×4=10

OR

(E) In sampling for attributes, show that sample proportion is an unbiased estimator of population proportion when SRSWOR is used. Derive an expression for its variance. Also obtain an unbiased estimator for this variance. 10

3. (A) Explain stratified sampling procedure. Derive an expression for the number of units to be selected from each stratum under optimum allocation with fixed cost. Also obtain an expression for variance of unbiased estimator of population mean under this allocation. 10

OR

(E) Compare stratified sampling under proportional and Neyman allocation over SRSWOR. Prove that :

(a) Greater the difference in strata means, greater is the gain in precision of stratified random sampling under proportional allocation over unstratified random sampling.

(b) Larger the strata differ in standard deviations, greater is the gain in precision of stratified sampling with Neyman allocation over proportional allocation. 10

4. (A) Explain the procedure of cluster sampling. Obtain an unbiased estimator of population mean under this sampling procedure. Derive an expression for its variance.

(B) Describe a procedure of systematic sampling. Show that systematic sample mean is an unbiased estimator of population mean. Derive its variance. Can it be estimated on the basis of systematic sample ? 5+5

OR

(E) If the population has a linear trend, then in usual notations, show that :

$$V(\bar{y}_w)_{st} \leq V(\bar{y}_i)_{sy} \leq V(\bar{y}_n)_R. \quad 10$$

5. Answer any **TEN** questions from the following :

- (A) Define mean square error of an estimator.
- (B) What are non-sampling errors ?
- (C) State any two requirements of a good questionnaire.
- (D) What is the probability of selecting a specified unit in a sample of size 'n' when SRSWOR is used ?
- (E) From the population of size three $A : \{y_1, y_2, y_3\}$, a SRSWOR of size two is selected. An estimator 'e' is defined as follows :

$$e(y_1, y_2) = \frac{1}{3}y_1 + \frac{1}{4}y_2, e(y_2, y_3) = \frac{3}{4}y_2 + \frac{1}{3}y_3, e(y_1, y_3) = \frac{2}{3}y_1 + \frac{1}{2}y_3$$

Is 'e' an unbiased estimator of population mean ?

- (F) Justify the statement : A SRSWOR provides a more efficient estimator of population mean than SRSWR.
- (G) Derive an expression for size of the sample to be selected from i^{th} stratum in stratified sampling with proportional allocation.
- (H) Show that, in case of stratified sampling the population mean is the weighted arithmetic mean of strata means.
- (I) Give a practical situation where cluster sampling can be used.
- (J) Give one advantage of cluster sampling over SRSWOR.
- (K) Fill in the blanks :

To improve efficiency of the sampling method, the strata should be formed of _____ units while clusters should be formed of _____ units.

- (L) State one advantage of stratified sampling over SRS. 1×10=10