

2023
B.A./B.Sc.
Third Semester
 CORE – 6
STATISTICS
Course Code: STC 3.21
 (Survey Sampling & Indian Official Statistics)

Total Mark: 70
 Time: 3 hours

Pass Mark: 28

Answer five questions, taking one from each unit.

UNIT-I

1. (a) Which one of the following is not true for probability sampling? 1
 (i) Each unit has an equal chance of being included into the sample.
 (ii) The sample is selected with a definite purpose in view.
 (iii) Sampling units have different probabilities of being selected.
 (iv) All units have different probabilities of being selected.
 (b) Explain about different types of sample survey. 6
 (c) Discuss about simple random sampling for attributes. Show that in simple random sampling of attributes

$$V(p) = \frac{N-n}{N-1} \cdot \frac{PQ}{n} \quad 3+4=6$$

2. (a) Which one of the following is not true for sample survey? 1
 (i) All units of the population are taken into consideration.
 (ii) The units are drawn in a scientific manner.
 (iii) An appropriate sampling technique is used.
 (iv) The size of units selected in the sample is adequate.
 (b) Distinguish between simple random sampling with replacement (SRSWR) and simple random sampling without replacement (SRSWOR). Show that $V(\bar{x}_n)_{WOR} < V(\bar{x}_n)_{WR}$. 3+4=7
 (c) Show that in simple random sampling of attributes, the sample proportion ' p ' is an unbiased estimate of the population proportion ' P ' and obtain its variance. 4+2=6

UNIT-II

3. (a) In proportional allocation, size of the sample from each stratum depends on 1
- (i) total sample size
 - (ii) size of the stratum
 - (iii) population size
 - (iv) product of the stratum size and variability
- (b) Show that in stratified random sampling $V(\bar{x}_{st})$ is minimum for fixed total size of the sample 'n' if $n_i \propto N_i S_i$. 6
- (c) Explain in short why systematic sampling is called mixed sampling. Show that systematic sampling is more efficient as compared to simple random sampling if within systematic sample variation is more as compared to the overall variation of the population i.e. $S_{w\text{sy}}^2 > S^2$. 3+4=7
4. (a) To determine the quality of the manufactured product, an inspection of every 15th item is made, then the sampling plan is
- (i) Simple random sampling
 - (ii) Systematic sampling
 - (iii) Stratified random sampling
 - (iv) Cluster sampling
- (b) Give the concept of stratified random sampling. Discuss about the advantages and disadvantages of stratified sampling. 2+4=6
- (c) Show that if the population consists of a linear trend, then
- $$V(\bar{x}_{st}) < V(\bar{x}_{\text{sys}}) < V(\bar{x}_n)_{\text{Ran}} \quad 6$$

UNIT-III

5. (a) Linear regression estimators make use of _____ information for increasing precision. 1
- (b) Briefly explain the comparison of ratio estimators with mean per unit. 3
- (c) Prove that in SRS the large samples variance of the regression estimator is given by:
- $$V(\bar{y}_d) = V(\bar{y}) + \beta^2 V(\bar{x}) + 2\beta \text{Cov}(\bar{y}, \bar{x}) \quad 4$$

(d) Define cluster sampling. Explain the efficiency of cluster sampling.

1+5=6

6. (a) The smallest unit into which the population can be divided is called an _____.

1

(b) Define ratio method of estimation and state its properties.

6

(c) Show that the first approximation to the relative bias of ratio estimator in simple random sampling without replacement is given by:

$$\frac{B(\hat{R})}{R} \cong \frac{(1-f)}{n} (C_x^2 - \rho C_x C_y) \text{ where } C_x = \frac{S_x}{\bar{X}}, C_y = \frac{S_y}{\bar{Y}} \text{ are the}$$

coefficient of variation of x and y respectively.

7

UNIT-IV

7. (a) In two stage sampling s_w^2 , the sample variance within the selected first stage units (fsu's) is given by:

1

$$(i) s_w^2 = \sum_{i=1}^N \frac{s_{w_i}^2}{n}$$

$$(ii) s_w^2 = \sum_{i=1}^N \frac{s_{w_i}^2}{N}$$

$$(iii) s_w^2 = \sum_{i=1}^N \frac{(y_{ij} - \bar{y}_i)^2}{N}$$

$$(iv) s_w^2 = \sum_{i=1}^N \frac{(y_{ij} - \bar{y}_i)^2}{N-1}$$

(b) Explain two stage sampling. Mention advantages of two stage sampling.

4+3=7

(c) In PPS sampling with replacement, find an unbiased estimator of the population mean and also its variance.

6

8. (a) In PPS sampling with replacement an unbiased estimator of the population total i.e. Y is given by:

1

$$(i) \hat{Y}_{pps} = \frac{1}{n} \sum_{i=1}^n \frac{y_i}{p_i}$$

$$(ii) \hat{Y}_{pps} = \frac{1}{nN} \sum_{i=1}^n \frac{y_i}{p_i}$$

$$(iii) \hat{Y}_{pps} = \frac{1}{N} \sum_{i=1}^N \frac{y_i}{p_i}$$

$$(iv) \hat{Y}_{pps} = \frac{1}{N} \sum_{i=1}^N \frac{Y_i}{p_i}$$

- (b) Write down the advantages and disadvantages of multistage sampling. 6
- (c) Explain the cumulative total method and Lahiri's method of selecting a sample in PPS sampling with replacement. 7

UNIT-V

9. (a) Ministry of Statistics and Programme Implementation started in: 1
 (i) 1999 (ii) 1998 (iii) 1997 (iv) 1996
- (b) What is the full form of NSSO? Discuss the importance and functions of NSSO. 1+6=7
- (c) Write short notes on the following: 3×2=6
 (i) Gross domestic product (GDP)
 (ii) Net national product (NNP)
10. (a) Central Statistical Office in India was formed in 1
 (i) 2 May 1951 (ii) 5 May 1951
 (iii) 2 May 1956 (iv) 2 May 1949
- (b) What are the methods of collection of Indian official statistics? Explain them by mentioning their reliability and limitations. 3+4=7
- (c) Write short notes on the following: 3×2=6
 (i) Indian agricultural statistics
 (ii) National Statistical Commission