M 10383

Name .....

Reg. No. 1531

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, MAY 2005
(2004 ADMISSION)

STATISTICS

PAPER 2.2 - Sampling Theory

Time : 3 Hours

Max. Marks: 60

Answer any FIVE questions without omitting any unit.

All questions carry EQUAL marks.

Unit - 1

1. a) Discuss the advantages of sampling and complete enumeration methods.

   b) A simple random sample of size 3 is drawn from a population of size N with replacement. Show that the mean $\bar{y}$ based on different units in the sample is unbiased for the population mean and its variance is $\frac{(2N-1)(N-1)S^2}{6N^2}$ **(7+8=15 marks)**

2. a) From a finite population a simple random sample has to be drawn. How do you determine the sample size and under what assumption ?

   b) Show that the sample proportion under SRSWOR is unbiased for the population proportion and derive its sampling variance. Obtain $(1-\alpha)\%$ confidence limits for the population proportion. **(7+8=15 marks)**

Unit - 2

3. a) When does stratification produce large gain in precision ? Compare the precision of stratified random sampling with proportional and optimum allocation and simple random sampling without replacement.

   b) Describe Quota sampling. **(11+4=15 marks)**

4. a) Explain (i) the systematic sampling in two dimensions, and (ii) circular systematic sampling. Show that in circular systematic sampling the sample mean is an unbiased estimator of the population mean and the variance of the estimator in given by $\frac{1}{N}\sum_{i=1}^{N}(\bar{y}_i - \bar{y})^2$ with usual notation.

   b) Show that in systematic sampling from population with linear trend, such that $y_h = \mu + h\theta$, $h = 1, 2, \ldots, N$ with μ and θ constants.

   $\bar{y} = \mu + \frac{N+1}{2}\theta$ and $S^2 = \frac{N(N+1)}{12}\theta^2$.

   Show also that the efficiency of systematic sampling from population with periodic trend depends upon the choice of the interval between the successive units to be included in the sample. **(8+7=15 marks)**

Turn Over

Unit - 3

5. a) Explain sampling with varying probabilities. Describe Midzuno scheme of sampling.

   b) What is Desraj's order estimator? Obtain the variance of Desraj's ordered estimator.

(8+7=15 marks)

6. a) Obtain the Horvitz-Thompson estimator. Derive the variance of the estimator and obtain the unbiased estimator of the variance expression.

   b) What is Murthy's unordered estimator ? Obtain the variance of the estimator. **(8+7=15 marks)**

Unit - 4

7. a) What is a ratio estimator ? Determine the bias in it. Show that

$$V(\hat{\bar{y}}_R) = \frac{N-n}{N}\,\frac{y^n}{n}\,(C_{yy} + C_{xx} - 2C_{yx})$$

   b) Discuss in detail about the construction of unbiased ratio type estimator and obtain its variance.

(7+8=15 marks)

8. a) What is a regression estimator ? Discuss about its bias and mean square error.

   b) Discuss about the efficiency of separate and combined regression estimators used in stratified sampling. (8+7=15 marks)

Unit - 5

9. a) Describe cluster sampling. Suggest two estimators of population under cluster sampling, when clusters are of unequal size. Obtain their sampling variances and discuss the relative advantages and disadvantages.

   b) Explain briefly double sampling.

(11+4=15 marks)

10. a) Explain the estimation procedure of the population mean in two stage sampling with equal first stage units. Arrive at the estimators unbiased form, giving also its variance.

    b) Briefly write about multistage sampling and the situation in which it can be used.

(10+5=15 marks)
