PAPER NO-7: SURVEY SAMPLING

1. Basic Concepts of Survey
   - 1.1 Concept of population and survey
   - 1.2 Need for sampling
   - 1.3 Probability sampling design
   - 1.4 Complete enumeration V/s Survey sampling
   - 1.5 Principles of sample theory
   - 1.6 Principal steps in sample surveys
   - 1.7 Sampling and Non-Sampling errors
2. Simple Random Sampling (SRS) with and without replacement
   - 2.1 Definition and procedures of selecting a sample
   - 2.2 Properties of simple random sample, Estimation of mean
   - 2.3 Sampling variance of sample mean
   - 2.4 Classes of linear estimators and minimum variance
   - 2.5 Optimality of sample mean, Determination of sample size
3. Stratified Random Sampling
   - 3.1 Estimation of population mean and its variance
   - 3.2 Choice of sample sizes in different strata
   - 3.3 Practical difficulties in adopting Neyman allocation
   - 3.4 Estimation of gain in Precision due to stratification
   - 3.5 Estimator based on post- stratification and its performance
   - 3.6 Method of collapsed strata
   - 3.7 Comparison of Stratified sampling with proportional and Neyman allocation with SRS in terms of precision
4. Systematic Sampling
   - 4.1 Linear systematic sampling, Sample mean and its variance (N=nk)
   - 4.2 Comparison of systematic sampling vis-à-vis simple and stratified sampling in the presence of a linear trend, End corrections
   - 4.3 Comparison of systematic sampling with stratified and simple random sampling
   - 4.4 Circular systematic sampling
5. Ratio Method of Estimation
   - 5.1 Description of the techniques
   - 5.2 Upper bound to the bias of the ratio estimator
   - 5.3 First approximation to the expected value and variance of the Ratio estimator
   - 5.4 Concept of super population and Optimality of ratio estimator
6. Regression Method of Estimation
   - 6.1 Difference and regression estimators
   - 6.2 First approximation to the expected value and variance of the regression estimator
   - 6.3 Comparison of ratio and regression estimators with SRS
   - 6.4 Optimality of regression estimators
7. Cluster Sampling (Equal clusters only)
   - 7.1 Estimation of population mean and its variance
   - 7.2 Comparison (with and without randomly formed clusters) with SRS
   - 7.3 Relative efficiency of cluster sampling with SRS in terms of intra class correlation
8. Sub-Sampling (Two stage only with equal first stage units)
   - 8.1 Estimator, Derivation of variance and its estimator
   - 8.2 Comparison of two stage and one stage sampling
9. Non Sampling Errors
   - 9.1 Incomplete samples
   - 9.2 Hansen and Hurwitz Technique

WEEK-WISE DETAILS

Week 1: Basic Concepts of Survey

- Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C. (1984): *Sampling Theory of Surveys with Applications,* Iowa State University Press and Indian Society of Agricultural Statistics. pp. 1-3, 6-9
- Singh, D. and Chaudhary, F.S. (2009): *Sample Survey Designs,* New Age International Publishers. pp. 7-13, 15-17

Week 2-3: Simple Random Sampling (SRS) with and without replacement

- Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C. (1984): *Sampling Theory of Surveys with Applications,* Iowa State University Press and Indian Society of Agricultural Statistics. pp. 21-30, 38-42
- Gupta, S.C. and Kapoor, V.K. (2007): *Fundamentals of Applied Statistics,* Sultan Chand and Sons. pp. 7.26-7.36

Week 4-5: Stratified Random Sampling

- Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C. (1984): *Sampling Theory of Surveys with Applications,* Iowa State University Press and Indian Society of Agricultural Statistics. pp. 105-112, 123-126, 128-130, 133-135, 169-170
- Cochran, W.G. (2011): *Sampling Techniques,* John Wiley and Sons. pp. 99-101
- Gupta, S.C. and Kapoor, V.K. (2007): *Fundamentals of Applied Statistics,* Sultan Chand and Sons. pp. 7.63-7.65

Week 6: Systematic Sampling

- Cochran, W.G. (2011): *Sampling Techniques,* John Wiley and Sons. pp. 205-217

Week 7-8: Ratio Method of Estimation

- Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C. (1984): *Sampling Theory of Surveys with Applications,* Iowa State University Press and Indian Society of Agricultural Statistics. pp. 184-190, 192-194
- Cochran, W.G. (2011): *Sampling Techniques,* John Wiley and Sons. pp. 158-159

Week 8-9: Regression Method of Estimation

- Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C. (1984): *Sampling Theory of Surveys with Applications,* Iowa State University Press and Indian Society of Agricultural Statistics. pp. 236-241
- Cochran, W.G. (2011): *Sampling Techniques,* John Wiley and Sons. pp. 199-200

Week 10: Cluster Sampling (Equal clusters only)

- Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C. (1984): *Sampling Theory of Surveys with Applications,* Iowa State University Press and Indian Society of Agricultural Statistics. pp. 270-276

Week 11: Sub-Sampling (Two stage only with equal first stage units)

- Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C. (1984): *Sampling Theory of Surveys with Applications,* Iowa State University Press and Indian Society of Agricultural Statistics. pp. 304-308, 314-316

Week 12: Non Samplig Errors

- Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C. (1984): *Sampling Theory of Surveys with Applications,* Iowa State University Press and Indian Society of Agricultural Statistics. pp. 484-488

Practical/ Lab work

LIST OF PRACTICALS

1. To select a SRS with and without replacement.
2. For a population of size 5, estimate population mean, population mean square and population variance. Enumerate all possible samples of size 2 by wr and wor and establish all properties relative to SRS.
3. For srswor, estimate mean, standard error, the sample size
4. Stratified Sampling: allocation of sample to strata by proportional and Neyman's methods Compare the efficiencies of above two methods relative to SRS
5. Estimation of gain in precision in stratified sampling.
6. Comparison of systematic sampling with stratified sampling and SRS in the presence of a linear trend.
7. Ratio and Regression estimation: Calculate the population mean or total of the population. Calculate mean squares. Compare the efficiencies of ratio and regression estimators relative to SRS.
8. Cluster sampling: estimation of mean or total, standard error of the estimate, estimate of intra-class correlation coefficient, calculate efficiency as compared to SRS.
9. Two stage sampling: estimation of mean or total, standard error of the estimate, efficiency as compared to SRS