

SYLLABUS

UNC: Survey Sampling (SOC1 754)

Spring 2022

Davis Library Room 219

Instructor: Chris Wiesen

Instructor Contact Information

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Office Hours

By appointment

Course Objectives

The objective of this course is to teach the basic ideas of sampling from an applied and theoretical perspective. The course will cover the main techniques used in actual sampling practice—simple random sampling, stratification, systematic selection, cluster sampling, multistage sampling, and unequal selection probability. The course will also cover sampling frames, cost models, sampling error estimation techniques, non-sampling errors and compensation for missing data.

This course is concerned with the design of data collection strategies and the implications of the designs for estimators and their precision. For each sampling design, mean estimators and their standard errors will be derived. Rather than memorizing equations, students will understand what the components of each equation are and why they are appropriate for a certain sampling situation.

This course is designed for students interested in understanding survey sampling methods, applying them in practice and discussing relevant issues with other researchers. Introductory course work in applied statistical methods (at least one semester of basic statistics) is required. Students should be familiar with descriptive statistics, the normal and binomial distributions, random selection, expected values, standard errors and confidence intervals. The mathematical aspects of sampling theory will be covered, and statistical notation and algebraic derivations will be used for key equations, so a comfort level with algebraic arguments as used in introductory applied statistics courses is necessary. Emphasis will be on both understanding the concepts and the implications of derivations and the derivations themselves.

Course Requirements

This course requires both homework and examinations. This is an applied course and the homework assignments are important learning devices. Each student must submit individual homework exercise solutions.

There will be two exams, a midterm and final. The final will be cumulative, covering all material taught in the course. Final grades will be a composite of examination scores, homework and class participation. Students are required to complete the assigned reading prior to each lecture.

Textbook

Elementary Survey Sampling, Sixth Edition by Scheaffer, Mendenhall and Ott (Duxbury). It is available from online book vendors.

Class Schedule

The reading assignments shown below are from *Elementary Survey Sampling, Sixth Edition*.

Section 1

1. INTRODUCTION. Objectives and mechanics of the course; Introduction to sample surveys and survey methodology. Concepts relating to populations. Probability and non-probability sampling. Sampling frames, sampling units, analytical units. Sampling measurements and summary statistics.

Reading: Chapter 1

Section 2

2. ELEMENTS OF THE SAMPLING PROBLEM. Technical Terms. How to Select the Sample: The Design of the Sample Survey. Sources of Errors in Surveys. Designing a Questionnaire. Planning a Survey.

Reading: Chapter 2

Section 3

3. SOME BASIC CONCEPTS OF STATISTICS. Summarizing Information in Populations and Samples: The Infinite Population Case. Summarizing Information in Populations and Samples: The Finite Population Case. Sampling Distributions. Covariance and Correlation. Estimation.

Reading: Chapter 3

Section 4

4. SIMPLE RANDOM SAMPLING. How to Draw a Simple Random Sample. Estimation of a Population Mean and Total. Selecting the Sample Size for Estimating Population Means and Totals. Estimation of a Population Proportion. Comparing Estimates.

Reading: Chapter 4

Section 5

5. STRATIFIED RANDOM SAMPLING. How to Draw a Stratified Random Sample. Estimation of a Population Mean and Total. Selecting the Sample Size for Estimating Population Means and Totals. Allocation of the Sample. Estimation of a Population Proportion. Selecting the Sample Size and Allocating the Sample to Estimate Proportions. Additional Comments on Stratified Sampling. An Optimal Rule for Choosing Strata. Stratification after Selection of the Sample. Double Sampling for Stratification.

Reading: Chapter 5

Section 6

6. RATIO, REGRESSION, AND DIFFERENCE ESTIMATION. Surveys that Require the Use of Ratio Estimators. Ratio Estimation Using Simple Random Sampling. Selecting the Sample Size. Ratio Estimation in Stratified Random Sampling. Regression Estimation. Difference Estimation. Relative Efficiency of Estimators.

Reading: Chapter 6

Section 7

7. SYSTEMATIC SAMPLING. How to Draw a Systematic Sample. Estimation of a Population Mean and Total. Estimation of a Population Proportion. Selecting the Sample Size. Repeated Systematic Sampling. Further Discussion of Variance Estimators.

Reading: Chapter 7

Section 8

8. CLUSTER SAMPLING. How to Draw a Cluster Sample. Estimation of a Population Mean and Total. Equal Cluster Sizes; Comparison to Simple Random Sampling. Selecting the Sample Size for Estimating Population Means and Totals. Estimation of a Population Proportion. Selecting the Sample Size for Estimating Proportions. Cluster Sampling Combined with Stratification. Cluster Sampling with Probabilities Proportional to Size.

Reading: Chapter 8

Section 9

9. TWO-STAGE CLUSTER SAMPLING. How to Draw a Two-Stage Cluster Sample. Unbiased Estimation of a Population Mean and Total. Ratio Estimation of a Population Mean. Estimation of a Population Proportion. Sampling Equal-Sized Clusters. Two-Stage Cluster Sampling with Probabilities Proportional to Size.

Reading: Chapter 9

Section 10

10. ESTIMATING THE POPULATION SIZE. Estimation of a Population Size Using Direct Sampling. Estimation of a Population Size Using Inverse Sampling. Choosing Sample Sizes for Direct and Inverse Sampling. Estimating Population Density and Size from Quadrat Samples. Estimating Population Density and Size from Stocked Quadrats. Adaptive Sampling.

Reading: Chapter 10

Section 11

11. SUPPLEMENTAL TOPICS. Interpenetrating Subsamples. Estimation of Means and Totals over Subpopulations. Random-Response Model. Use of Weights in Sample Surveys. Adjusting for Nonresponse. Imputation. Selecting the Number of Callbacks. The Bootstrap.

Reading: Chapter 11

Section 12

12. Summary of the Designs and Methods. Comparisons among the Designs and Methods.

Reading: Chapter 12