

Statistics 423 (3 – 1T)

Statistical Analysis of Sample Surveys

(see Course Descriptions under the year applicable: <http://www.ucalgary.ca/pubs/calendar/>)

Syllabus

<u>Topics</u>	<u>Number of hours</u>
A review of foundational statistical concepts to include the following: the central limit theorem, t, chi-square, and F distributions. Single-parameter hypothesis testing emphasizing P-values.	3
Populations and samples. Non-sampling and sampling errors. Designing a questionnaire.	3
Simple random sampling and the statistics associated with parameter estimation in a simple random sampling regime. Estimation of population mean, proportion, and total. Variance estimates of such statistics.	5
Stratified random sampling. Variance estimates of stratified sampling statistics used in the estimation of the population mean, proportion, and total. Sampling weights.	6
Ratio estimation from both simple and stratified random sampling. Bias and variance of statistics used in a ratio estimation regime. Applications to the estimation of the population mean.	4
Regression estimation from a simple random sample, both with and without the constant term. Bias and variance of statistics used in the estimation of the population mean and total. Comparison with ratio estimation and univariate estimation from a srs.	4
Systematic and cluster sampling. Bias and variance of statistics used in systematic and cluster sampling. Multi-stage cluster sampling (optional).	5
Estimation of population size through direct sampling and indirect sampling. Maximum likelihood estimation of the population size. Estimation of population density.	3
Types of nonresponse. Addressing nonresponse issues and adjusting for non-response.	3
TOTAL HOURS	36

Statistics 423: Sampling Theory of Surveys

Course Outcomes

By the end of this course, students will be able to

1. Differentiate between 'good' and 'bad' survey questions and design appropriate questionnaires/surveys to quantify relevant response variables/outcomes.
2. Describe the different scales of measurement for measuring relevant survey variables and how they are summarized visually (e.g., histogram, scatterplot).
3. Appreciate the difference between 'non-scientific' and 'scientific' surveys and explain the limitations of inference from the former.
4. Select and administer either a simple random, a stratified random, cluster (single and multi-stage), and a systematic (1-in-k) sampling designs for a given level of confidence and sampling tolerance.
5. Distinguish among different sampling designs and the consequent design-based estimation of the population mean, population proportion, or population total.
6. Incorporate the use of auxiliary variables in ratio and regression estimation of relevant parameters.
7. Document various types of survey non-response and missing data, and the different ways of handling them (e.g., call-backs, imputation, weighting adjustments).
8. Employment of a statistical package/software (e.g., R, SAS) for selecting a sample using a given sampling design and for carrying out estimation of relevant parameters based on the sample.
9. Summarize in written and oral form the design, statistical analysis and conclusions of a survey.
