

## **An Introduction to Model-Based Survey Sampling with Applications**

Professor Ray Chambers and Associate Professor Robert Clark published a new book “An Introduction to Model-Based Survey Sampling with Applications” in January 2012.

This book discusses aspects of survey sampling that are usually covered relatively briefly in a standard statistics course. Survey sampling is a major field of application of statistics and it is one of the most satisfying and useful fields of statistics where both the target of inference is solid and observable and the range of models and associated methods used in modern statistics can be applied.

The book covers a wide range of issues in model-based survey sampling including -

- model-based design of survey samples;
- efficient model-based linear estimation of population totals;
- prediction of non-linear population quantities, including ratios, medians and quantiles;
- prediction of solutions to population-based estimating equations;
- prediction variance estimation for complex statistics;

The first part of the book introduces the reader to the use of models for sample design and finite population inference, through -

- motivating a model-based approach to survey sampling;
- examining design and inference under the homogenous population model;
- extending this model to stratified populations;
- discussing linear regression models for populations with a single auxiliary variable;
- considering two level hierarchical populations made up of units grouped into homogeneous clusters, with sampling carried out in two stages; and
- integrating these results via the general linear population model.

The second part of the book examines the concept of robustness, which is crucial to model-based survey sampling, and considers the properties of estimators based on incorrectly specified models. This includes –

- examining robust sample designs that guarantee unbiased predictors of population totals under a wide variety of alternative models;
- exploring the problem of robustifying prediction variance estimators to model misspecification;
- considering how survey sampling methods can be made robust to outliers; and
- evaluating how flexible modeling methods like non-parametric regression can be used in survey sampling.

The third part of this book then applies the theory developed in the first two parts to a number of problem areas of interest in modern survey sampling. These are

- issues in design and estimation for multipurpose surveys;
- prediction for domains;
- small area estimation methods;
- efficient prediction of population distribution functions;
- the use of transformations in survey inference.

The book is ideal for both undergraduate and graduate level students with a good grounding in statistics, including the theory of linear regression, and a working knowledge of differential calculus and linear algebra, particularly matrix theory.