

Introduction and Objectives

This module will introduce you to a set of advanced business analytic techniques. We define advanced business analytics as a set of tools and techniques to assist in key business decisions. While the emphasis is on understanding and implementing results, you should always keep in mind the broader context of decision making, including the analysis of risk described in the Ask an Actuary reading.

Overall Objectives

After completing this module, you will be able to:

- Use the computing environment R to analyze data.
- Explain the differences between ordinary least squares and generalized linear models (GLM).
- Use software to estimate the parameters of a GLM.
- Select an appropriate GLM for a given data set, including variable selection and diagnostics.
- Use GLMs to perform classification ratemaking.
- Explain how the generalized linear mixed model incorporates credibility.
- Use various models, including GLMs, to estimate variability in reserve estimates.
- Understand how Bayesian and bootstrap methods are used in estimating variability in reserve estimates.
- Understand how clustering methods can be used in setting predictor variables.

Module Sections

- Section 1: Module Overview (you are here now)
- Section 2: Ordinary Least Squares
- Section 3: The Generalized Linear Model
- Section 4: Classification Ratemaking
- Section 5: Cluster Analysis
- Section 6: Credibility in the Generalized Linear Model
- Section 7: Reserve Variability
- Section 8: Further Topics in Reserve Variability

Section 2 Objectives

After completing this section, you will be able to:

- Install and run the R package on your computer.
- Fit an OLS regression model to data using R.

Section 3 Objectives

After completing this section, you will be able to:

- Understand the advantages of GLM over OLS.
- Identify the main components of a GLM.
- Select an appropriate model within GLM.

- Estimate the parameters of a GLM model.
- Interpret model output and assess the quality of a model.
- Apply general modeling procedures.

Section 4 Objectives

After completing this section, you will be able to:

- Understand how the minimum bias method can be replicated by an appropriate GLM.
- Use a GLM to select an appropriate model for the observed pure premiums.
- Use a GLM to assess the value of a given classification variable.

Section 5 Objectives

After completing this section, you will be able to:

- Understand the basic concept of cluster analysis.
- Understand the k -means clustering algorithm.
- Apply the k -means clustering algorithm to a given problem.

Section 6 Objectives

After completing this section, you will be able to:

- Apply the Bühlmann-Straub formula to a one-dimensional problem.
- Understand how the linear mixed model provides an equivalent solution.
- Apply the generalized linear mixed model to a data set.

Section 7 Objectives

After completing this section, you will be able to:

- Implement the chain ladder (CL) method in R.
- Use a generalized linear model (GLM) to model claim development and estimate ultimate claims.
- Use the nonparametric Mack method to estimate ultimate claims.
- Use both the GLM and the Mack method to quantify the uncertainty in reserve estimates.

Section 8 Objectives

After completing this section, you will be able to:

- Estimate reserve variability using Bayesian methods.
- Estimate reserve variability using the bootstrap method.
- Describe the differences between, and limitations of, these methods.