Course Syllabus and References

Overview of Modelling

**Lecture 0**: Overview of experiments and studies; Goals of modelling; General form of statistical models; Types of response variables and classes of models

**References: General Statistics, Modelling, and Software Guides**


George, D. and Mallery, P. (2001). *SPSS for Windows Step by Step: A Simple Guide and Reference, 10.0 Update (3rd ed.)*. Boston: Allyn and Bacon. (Provides a substantial and straightforward introduction to statistics and various data analysis methods and clearly explains how to implement those methods in SPSS. The first 16 chapters cover basic methods and require no knowledge of statistics but some grounding in mathematics; the last 12 chapters present more advanced methods.)

Moore, D. and McCabe, G. (1998). *Introduction to the Practice of Statistics (3rd ed.)*. Freeman. (A straightforward and example filled introduction to probability and statistics/data analysis, requiring only a basic grounding in mathematics.)


**Linear Models**

*Lecture 1 [Overview of Linear Regression]*: General concept; Basic model setup and assumptions; Least squares estimation

*Lecture 2 [More Details of Linear Regression]*: Residuals; $R^2$, total variance, and conditional variance; Coefficients and their properties; Predicted values and their properties; Checking assumptions and goodness of fit (overall diagnostic plots and statistics); Outliers and influential points (case statistics); Comparing models

*Lecture 3 [Problems with Linear Regression and Extensions/Alternatives]*: Transforming and adding variables; Generalized (weighted) least squares regression; Robust regression; Resistant regression; Multicollinearity and solutions; Non-parametric regression

**References: Linear Models**


Rawlings, J. (1988). *Applied Regression Analysis: A Research Tool*. Pacific Grove, CA: Wadsworth and Brooks. (A more mathematically advanced, traditional text on regression. Covers regression basics and diagnostics, transformation of variables, and collinearity. Focuses on applications: does a very good job of presenting examples and describing how to interpret results and diagnostics. Understanding the presentation of methods requires a good background in mathematics (i.e., knowledge of matrix algebra) and basic knowledge of statistics; however, the presentation of applications is very accessible.)

**ANOVA**

*Lecture 4*: One-way ANOVA and Kruskal-Wallis; Two-way ANOVA; Multiple comparisons and contrasts; Analysis of Covariance; Repeated measures ANOVA (MANOVA)

**References: ANOVA**


**Generalized Linear Models**

*Lecture 5 [The GLM Framework]*: Motivation; Basic GLM setup and assumptions; Coefficients and their properties; Scale parameter and overdispersion; Goodness of fit and comparing models; Residuals, case statistics, and diagnostic plots
**Lecture 6 [Frequently used GLMs]:** Logistic regression; Poisson/Log-linear models; Gamma model; Multiple Logistic Regression and Proportional Odds Model

**References: GLM**


**Multivariate Response Modelling (esp. Longitudinal Data)**

**Lecture 7:** Fixed effects; Random effects

**Lecture 8:** Generalized linear mixed models; Generalized estimating equations

**References: Longitudinal/Multivariate Data Modelling**

