Fall 2015

MATH 5353. APPLIED LINEAR MODELS

Instructor: D.L. Hawkins, Ph.D. (817-272-3261 or hawkins@uta.edu)
Time: TTh 2:00-3:20pm (but this is negotiable)

Prerequisites: Linear regression analysis, math stat

Texts: 1. Linear Mixed Models for Longitudinal Data by Verbeke and Molenberghs
       2. Multivariate Statistical Methods by Morrison
       3. Analysis of Longitudinal Data by Diggle, Liang and Zeger

Course Coverage

1. Preliminaries
   a. Expectation algebra
   b. Multivariate normal distribution theory

2. Univariate Linear Model
   a. Basic inference in the model with \((\sigma^2)\text{ I}\) covariance structure
      (point and interval estimation, hypothesis testing, with distributional properties “proved” using the material in 1b; power calculations)
   b. Parameterizations for linear models (cell mean, center point and reference cell models for various experimental designs)
   c. Models for covariate adjustment
   d. Model with linear restrictions
   e. Model with \((\sigma^2)\text{ V}\) covariance structure
   f. Connections with ANOVA

3. Multivariate Linear Model
   a. Basic observational settings: multivariate responses, repeated measures
   b. Expressed as a univariate linear model (for distribution theory)
   c. Point and interval estimation, including simultaneous
   d. Hypothesis testing (the four criteria for the general linear hypothesis) with power calculations, simultaneous testing
   e. Inference about the covariance matrix (correlation analysis, partial correlation, testing for special structure, etc)
   f. Applications to multivariate response data, repeated measures designs

4. The Univariate Mixed Model
   a. Basic observational settings -- examples
Random and mixed models
Block designs
Time-dependent covariates
Longitudinal data
b. Estimation (fixed and random effects - BLUPS)
c. Testing (including simultaneous, power calculation)
d. Applications
  Repeated measures analysis
  Within-subjects designs
  Random effects models – variance component estimation by REML
  RCB design with missing data
  Longitudinal data analysis using the Diggle, Liang, Zeger model

This course prepares students to handle a wide variety of problems involving gaussian responses. It is a key step in the preparation of students wishing to work as practicing statisticians.

The theory covered in the course will be at the operational level – i.e. I will hand out and discuss the statistical theory which drives the methodology, but students will not be tested on this material. The emphasis will be on applying the methods to real problems, the choice of methods being informed by a working knowledge of statistical theory.

As such, the course should be accessible to any student having a good working knowledge of linear regression analysis. The SAS package will be used extensively, particularly the GLM and MIXED procedures. Grades will be based on homework and projects.