STATISTICS 992
THEORY OF LINEAR MODELS
Spring Semester, 2003

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Time: 11:00 - 11:50 MWF, Room 1289 CSSC

Prerequisite: Statistics 310 or 609 or equiv.; Statistics 849 or equiv. desirable; otherwise some basic knowledge of regression analysis and matrix theory would be helpful

Texts: The required 'textbook' is:
Reinsel, Notes on Linear Models: Regression and Analysis of Variance

Additional (not required) reference books are:
Seber, Linear Regression Analysis
Scheffe, The Analysis of Variance
Hocking, The Analysis of Linear Models
Hocking, Methods and Applications of Linear Models
Diggle, Liang, and Zeger, Analysis of Longitudinal Data

This 'special topics' course is designed to cover some of the fundamental theory of the linear model, with consideration of the general linear model as well as particular instances within the analysis of variance framework. It could tend to serve as a supplement or complement to previous knowledge gained in the study of theory and analysis of linear models, or as an introduction to the subject from a somewhat theoretical perspective. Although a certain emphasis will be placed on the theory, analysis of data using linear regression and analysis of variance techniques will be included as part of the course. Analyses of data will be conducted by students using existing computer programs (R, Splus, SAS, Minitab).

Topics to be covered include a brief review of multivariate normal and quadratic forms distribution theory, least squares (LS) estimation and associated distribution theory for both full-rank and less than full-rank settings, best linear unbiased estimation (BLUE) and the Gauss–Markov Theorem, hypothesis testing and confidence regions procedures including derivations of F-tests from the likelihood ratio (LR) principle, associated sums of squares decompositions and the analysis of variance, simultaneous confidence interval methods, generalized least squares (GLS) estimation, model diagnostics, analysis of residuals, outliers, influence measures, model and variable selection methods, lack-of-fit test, basic analysis of variance (ANOVA) situations including one-way and two-way layouts and (complete and incomplete) block designs, random and mixed effects models, restricted maximum likelihood (REML) estimation of variance components, best linear unbiased prediction (BLUP) of random effects, analysis of covariance, generalized linear models, split plot designs and repeated measures and some multivariate linear model methods, and brief considerations for more general longitudinal data situations. There may be some further or different topics covered, but due to time constraints, probably not all of the latter topics mentioned will be able to be covered in the course.

Course Credit, Requirements, and Assignments: Students can register in the course for either 1, 2, or 3 credits, but should consult with the instructor first if they consider to register for less than 3 credits. There will be some written assignments required, approximately six. These will mainly consist of problems of the 'algebra and theoretical derivations' type, although there would also likely be a few small data analysis-computer type assignments during the semester. There will be no midterm exam for the course, but a take-home final exam might be a possibility.