STATISTICS 350-3
LINEAR MODELS IN APPLIED STATISTICS II

Spring 2003
DAY COURSE

Instructor: Dr. J. GRAHAM (TLX 10534)

Prerequisites:

STAT 330 and MATH 251.

Textbook:

Supplementary Text - *Applied Linear Regression* by Sanford Weisberg, Wiley

Calendar Description:

Theory and application of linear regression. Normal distribution theory. Hypothesis tests and confidence intervals. Model selection. Model diagnostics. Introduction to weighted least squares and generalized linear models.

Outline:

1. Linear models. Matrix notation, examples of linear and non-linear models. Fitting linear models to data. Least squares. Geometrical interpretation of least squares.
2. Theoretical development of the behaviour of least squares: Matrix expectation, mean and variance of random vectors, singular and non-singular distributions, factorization theorem. Means, variances and covariances of least squares estimators. Standardized residuals, standardized coefficients. Expected value of residual sum of squares.
3. Normal, t, Chi-squared and F distributions. Multivariate normal distribution. Joint density, independence property, orthogonal transformations.
4. Significance tests and confidence intervals for linear models with independent homoscedastic normal errors. Distributions of estimates, fitted values, residuals, residual sum of squares. Inference about variance, inferences for a linear function of the regression coefficients. Prediction.
5. General Linear Hypotheses. Linear models and vector spaces. Singular and non-singular cases, changing basis vectors. Additional Sum of Squares Principle. Analysis of Covariance: fitting families of straight lines, checking equal slopes, checking equal variances. Regression with replicate observations, pure error sum of squares, test for lack of fit, near replicates.
6. Inference for variances, pooled variance estimate, likelihood ratio test for equality of variances, Bartlett's test. Lack of robustness to assumptions.
7. Model selection: adding terms, dropping terms, aims of model, requirements of model, iterative procedures, difficulties with lack of orthogonality. Automatic variable selection procedures: all possible subsets, best subset regression, forward, backward and stepwise regression. Warnings and recommendations.
8. Weighted least squares, connection to ordinary least squares. Introduction to generalized linear models: transformation of response versus transformation of means, logistic or Poisson regression introduced.

Grading

A grading scheme will be announced by the instructor at the beginning of the semester

Students should be aware that they have certain rights to confidentiality concerning the return of course papers and the posting of marks. Please pay careful attention to the options discussed in class at the beginning of the semester.

Revised November 2002