Geog 560	Jim Burt

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Advanced Quantitative Analysis   425 Science Hall
Fall 2012   263-4460
MW 2:30-3:45   jeburt@wisc.edu
Office Hours: M 4-5, W 9:45-10:45

Description: This is a second course in statistical methods, covering techniques widely used in geographic research (both human and physical geography). Topics covered include multiple regression and its extensions, nonlinear least squares models, principal components, clustering and related methods, time series analysis (time and frequency domain), and computer-intensive methods (e.g., bootstrapping). The formal prerequisite is a course in univariate methods, similar to Geography 360 or Statistics 301.

Readings: The primary texts are Kutner et al., *Applied Linear Regression Models* (Irwin, 2004 or 2003) and S. Sharma, *Applied Multivariate Techniques* (Wiley, 1996). We will also use J.E. Burt, G.M. Barber, and D.L. Rigby, *Elementary Statistics for Geographers, 3rd Ed.* (Guilford, 2009). Depending on your background, other texts may be helpful. For multiple regression, I recommend N.R. Draper and H. Smith, *Applied Regression Analysis* (Wiley, 1998), or W. Mendenhall and T. Sincich, *A Second Course in Statistics* (Prentice-Hall, 1996), or T.P. Ryan, *Modern Regression Methods, 2nd Ed.* (Wiley, 2009), or Hill et al., *Undergraduate Econometrics* (Wiley, 1997). For other multivariate techniques, consider J. Tacq, *Multivariate Analysis: Techniques in Social Science Research* (Sage, 1997) or R. A. Johnson and D. W. Wichern, *Applied Multivariate Statistical Analysis* (Prentice-Hall, 1998). Additional readings will be available on reserve in the Geography Library.

Grading: Course grades will be based on two exams (33% each) and a set of short exercises (33%). The exercises will use PC software and data available in Geography computing facilities. Beyond general familiarity with Windows, no specific computer knowledge is presumed.

Topic Outline
I. Review
        A. Hypothesis Testing and Confidence Intervals
        B. Bivariate Regression and Correlation

II. Multiple Regression
        A. Estimation and Hypothesis Testing
        B. Problems and Diagnostics (influential observations, multicollinearity, etc.)

III. Extensions of Multivariate Regression
        A. Polynomials, Trend Surfaces, Transformations
        B. General Linear Adaptive Models
        C. Geographically Weighted Regression

IV. Nonlinear Models

V. Logit and Related Models

VI. Computer-Intensive Methods
        A. Jackknifing
        B. Bootstrapping

VII. Other Multivariate Methods

A. Discriminant Analysis
B. Principal Components Analysis
C. Cluster Analysis

VIII. Spatial Data
A. 2-D Sampling Theorem
B. Density Estimation

IX. Methods for Temporal Data
A. Filtering and Filter Design
B. Time Series Models

Other books:

F. P. Agterberg, *Geomathematics: Mathematical Background and Geo-science Applications*, Elsevier, 1974.

J-P. Chiles and P. Delfiner, *Geostatistics*, Wiley, 1999.

R. D. Cook and S. Weisberg, *Applied Regression Including Computing and Graphics*, Wiley, 1999.

J.C. Davis, *Statistics and Data Analysis in Geology*, Wiley, 2003.

E. H. Isaaks and R. M. Srivastava, *Applied Geostatistics*, Oxford University Press, 1989.

P. Goovaerts, *Geostatistics for Natural Resources Evaluation*, Oxford University Press, 1997.

D. B. Percival and A. T. Walden, *Spectral Analysis for Physical Applications*, Cambridge Univ. Press, 1993.

B. Vidakovic, *Statistical Modeling by Wavelets*, Wiley, 1999.

D. S. Wilks, *Statistical Methods in Atmospheric Sciences*, Academic Press, 1995.