

Geog 560
Advanced Quantitative Analysis
Fall 2006
TR 9:30-10:45

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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, permutation methods). 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 and G.M. Barber, *Elementary Statistics for Geographers* (Guilford, 1996). 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* (Wiley, 1997), 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 (50%), short exercises (25%), and a group project/presentation (25%). The exercises will use PC software and data available in Geography computing facilities. The project calls for original analysis using data obtained by the group (real or simulated).

Topic Outline

I. Review of 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
- D. Alternatives to LS (robust regression, MAD)

IV. Nonlinear Models

V. Logit and Related Models

VI. Computer-Intensive Methods

- A. Permutation Methods
- B. Jackknifing, 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
- C. Spectral Analysis (windowed methods, MEM, multi-taper method)

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.