

Quantitative Research Methods II, UST804: Applied Multivariate Data Analysis

Fall Semester, 2005

Levin College of Urban Affairs, Cleveland State University

Instructor: Bill Bowen, Office UB219 Phone, 687-9226 Office Hours: by appointment

Course Description: This course introduces the student to a range of multivariate methods used for analyzing large, complex and complicated data sets with a lot of variables, such as are used throughout empirical research on urban areas. It also includes a brief introduction to mathematical programming and non-parametric statistics.

The informal prerequisites for the course include competence at college algebra and elementary statistics, as well as ability to use a computer language or software package(s) with the necessary multivariate statistics capabilities. The emphasis is on solving problems to obtain specific and accurate numerical answers.

Course Objectives:

- 1) To introduce the student to the concepts behind *why* the following multivariate analytic methods are and should be used in Urban Studies and/or Public Affairs: principal components analysis, factor analysis, discriminant analysis, regression analysis, logistic regression analysis, cluster analysis, multivariate analysis of variance, multivariate generalizations of common univariate inference, and canonical correlation analysis.
- 2) To introduce the student to *how* to use the preceding multivariate methods.
- 3) To introduce the student to *when* or under what conditions to use each of the preceding multivariate methods.
- 4) To introduce the student to what outcomes or products logically can or cannot be obtained when using each of these multivariate methods.
- 5) To introduce the student to the method of mathematical programming and its extension to Data Envelopment Analysis.
- 6) To introduce the student to non-parametric statistics.

Texts:

Johnson, Dallas E. (1998). *Applied Multivariate Methods for Data Analysts*. Pacific Grove, California: Duxbury Press.

George, Darren and Paul Mallery (2005). SPSS For Windows: Step By Step. Fifth Edition. Boston: Pearson Publishers.

Course Method: Students are expected to prepare for and attend all classes, participate actively in discussions, and ask clarifying questions. Each week the student is expected to complete the week's homework assignment, which will be given on Thursday and due the next Thursday. Also, for each analytic technique, students are expected to find a relevant peer-reviewed research article, and to prepare a 10-minute presentation on it, with emphasis on the use of the method. Each presentations is to first as objectively as possible present the problematique for which the analysis was conducted, describe the use of the technique, describe the conclusions, and finally assess and critique the use of the technique for that particular problematique.

Grades: Class participation, 20%: Homework, 60%: Final Exam, 20%.

Tentative Schedule:

I. Multivariate Statistical Methods

- Week 1. Overview of Multivariate Data Analysis
Introduction to Matrix Operations
- Week 2. Matrix Operations, Sample Correlations, and Multivariate Data Plots
- Week 3. Eigenvalues and Eigenvectors
- Week 4. Principal Components Analysis
- Week 5. Factor Analysis
- Week 6. Discriminant Analysis
- Week 7. Logistic Regression
- Week 8. Cluster Analysis
- Week 9. Mean Vectors and Variance-Covariance Matrices
- Week 10. Multivariate Analysis of Variance

II. Other Useful Types of Multivariate Analysis

- Week 11. Multidimensional Scaling (supplemental readings)

Week 12. Mathematical (Linear) Programming (supplemental readings)

Week 13. Data Envelopment Analysis (supplemental readings)

Week 14. Non-parametric statistics (supplemental readings)