STAT 750 - Multivariate Analysis - Fall 2009

Course Syllabus

**Time and Place:** TuTh 11:00 AM - 12:15 PM, MTH 2300

**Prerequisites:** STAT 420 or STAT 700 or consent of the instructor

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After an introduction where basic properties of multivariate distributions (mainly, multinomial, normal and related distributions) are presented, statistical inference (estimation, confidence sets, hypothesis testing, regression analysis, principal components, discriminant analysis and a couple of topics more if time permits) from samples from multivariate populations will be presented in detail.

The material will be presented in a mathematically rigorous form with an emphasis on statistical interpretation of the results. All mathematical prerequisites will be discussed though some proofs will be left to the students to complete.

I could not find an appropriate textbook for the class. Some material will be taken from *Multivariate Statistical Analysis* by T. W. Anderson and from *Multivariate Analysis* by K. V. Mardia, J. T. Kent and J. M. Bibby, ISBN 0-12-471252-5. I am planning to prepare handouts when the presented material is not easily available. Given this, attendance becomes more important than in classes with textbooks. Two midterms and the final will be take home exams; accordingly, the problems in the exams will be of a higher level of difficulty compared to ones given in in-class exams.
Course Outline

Multivariate distributions

1. Basic properties.
2. Multinomial distribution.

Point estimation of parameters

1. Reduction of data through sufficiency
2. Matrix of Fisher information
3. Cramér-Rao inequality
4. Maximum likelihood estimator
4. Estimating equations

Hypothesis testing

1. The likelihood ratio test
2. Simultaneous confidence intervals
3. Testing the general linear hypothesis

Regression analysis

1. General setup of linear regression
2. Least squares and generalized least squares estimators
3. Residuals
4. Multiple and partial correlation coefficients
5. Application in econometrics

Principal component analysis

1. Population and sample principal components
2. Estimation and hypothesis testing
Factor analysis

1. The factor model. Examples
2. Estimation of parameters
3. Goodness-of-fit test

Discriminant analysis

1. Case of known populations
2. Analysis when parameters are estimated
3. Bayesian approach

Elements of multivariate analysis of variance (MANOVA)