Text book

Required: Johnson & Wichern “Applied Multivariate Statistical Analysis”
Other sources may be required and will be posted on the webCT site page.

Course Web Site and E-mail

We will use the webCT system on Rutgers. To access the course web site go to http://webct.rutgers.edu. Click on the login link and when prompted use your university netID and password. Your university netID is usually the same as your eden or pegasus user id. Once you have logged in you will see a list of courses you are eligible to navigate, in particular you should see the Operations Management course link. Click on it and you are in the course web site.

To reach me by e-mail use webCT and click on the Mail link. Write my name, alizadeh, for receiver. You can also send other students in the class e-mail in this way.

Caution about sending e-mail: You should only use e-mail to contact me on private and personal issues. If you have a question regarding homeworks, text, or you wish to point out problems such as broken links, typos, etc. you should post your question/comment on the discussions section of the homepage. You are also most certainly welcome to answer questions and provide comment and advice to your fellow students on that page if you wish to do so. E-mails that should have been posted on the discussion page may not be replied.
Office hours and online hours

I will be in my office on Thursdays from around 11 AM to 1:00 PM. Drop by if you wish to see me.

I will try to monitor the discussions page and the e-mail of the class two or three times a week, but I will definitely monitor that page on Tuesdays from 1:30-2:30 and during office hours.

Prerequisites

• School of Business PhD standing
• Introductory statistics course

Course Overview:

We will study fundamental statistical concepts from hypothesis testing and confidence regions to regression and analysis of variance, in the context of multivariate models.

Homeworks, Exams and Grading Policy

1. **Homeworks:** There will be one final exam accounting for 50% of your grade.

2. There will be several homework assignments and projects. Some of these assignments will include problem solving; others may involve modeling real applications, and some may involve computer projects. Homeworks will make up 50% of your grade.

List of topics

**Introduction to data analysis and matrix algebra**

Review of vector and matrix algebra, notions of mean, variance, covariance, correlation coefficient, statistical distance, vectors of random variables; all in the context of multivariate data and in the language of matrices and vectors. Broad introduction to MATLAB/Octave, R (S-Plus) and statistical capabilities of Excel.

**Chapters:** 1, 2, and Supplement 2A. **Three weeks**
Sampling Theory, Multivariate Normal Distribution

Samples and statistics, population and parameters, biased and unbiased statistics, sample mean, sample variance, sample covariance, and related statistics as matrix operations.

Multivariate normal distribution, mean vector and covariance matrix, marginal and conditional distributions, maximum likelihood estimation, distributions of sample mean and sample covariance, $\chi^2$ and Wishart distributions, tests of normality.

**Chapters** 3 and 4. Two weeks

Inferences about parameters and hypothesis testing

Notion of confidence regions, hypothesis testing, small samples with $t$ and $T^2$ and $F$ distributions, the Expectation Maximization (EM) algorithm and its applications.

**Chapter** 5 and Supplement 5A. Two weeks

Comparison of several multivariate means

Paired comparison of means for single and multivariate means, comparing means from different populations, one way and two way ANOVA, multivariate ANOVA, some topics on design of experiments.

**Chapter** 6. Two weeks

Multivariate regression

Relations with linear dependence on unknown parameters, Multiple regression analysis, multivariate regression analysis, numeric and categorical variables, prediction, collinearity and other pitfalls, applications of regression in Finance: CAPM model, beta and alpha of equities.

**Chapter** 7 and Supplement 7A. Three weeks

Principal component and factor analysis

principal components with singular value decomposition, determination of unobservable factors

**Chapters:** 8 and (if time allows) parts of 9. Two weeks