16:960:563:01 Index 01673 – Regression Analysis (Spring/2014)
SEC 203, Busch Campus, Thursday 7, 8 (6:40-9:30 pm) (wait 20 minutes)

Instructor: Jack Mardekian, PhD Pfizer Inc

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Office hours: Before and after class or by appointment. (TA will be assigned - hopefully)
(I am usually in SERC reading room by 5:30 pm)

Course abstract: Review of basic statistical theory and matrix algebra; general regression models, computer application to regression techniques, residual analysis, selection of regression models, response surface methodology, nonlinear regression models, experimental design models, analysis of covariance. Emphasis on applications and many illustrative examples. (Material + Regression computing + Matrices)

Course objective: Students will gain an understanding of regression methods including simple linear regression, least squares estimation, multiple linear regression, checking model adequacy, diagnostics for leverage and influence, variable selection and model building, multicollinearity, weighted least squares, and robust regression. Students will be able to perform analyses using regression methods. Students will be able to execute regression procedures in Statistical Analysis System (SAS) software to analyze data.

Prerequisites: Basic working knowledge of statistical methods typically covered in an introductory statistics course. You will need to know how to compute and interpret the sample mean, standard deviation, correlation coefficient between two variables, have previous exposure to probability distributions (normal, t, chi-square, F), be familiar with the concepts of testing hypotheses (the two-sample t-test, for example), constructing and interpreting a confidence interval. Previously covered concepts will be reviewed as they are needed. Calculus level mathematical skills including an introduction to matrices and an understanding of SAS or R basics are assumed.

Textbook: *Introduction to Linear Regression Analysis*, Douglas C. Montgomery, 5th edition, John Wiley & Sons, Inc., 2012. A copy is on reserve at the Library of Science and Medicine.

Consider purchasing SAS software (license + media $100): (1 year license)
https://software.rutgers.edu/

Sakai class site:
16:960:563:01 Spring 2014 : Regression Analysis **Lecture notes, assignments, announcements will be posted on this site.**

Grading: In-class Midterm Exam (45%) is scheduled for March 13: 6:40-9:30 pm
In-class Final Exam (55%) is scheduled for May 8: 8:00PM-11:00 pm
HW assignments (submitted electronically using Sakai)

Attendance and completion of HW assignments in Sakai are considered to be minimum requirements to pass this course.

Key dates: No class on March 20**,** (Spring Recess). Midterm Exam: March 13.
Last Class: May 1. Final Exam: May 8.

Course Outline (there are 14 class meetings + Final Exam night) keyed to text:

1. Introduction.

2. Simple Linear Regression. Least squares estimation, hypothesis testing, confidence intervals, maximum likelihood estimation

3. Multiple Linear Regression. Least squares estimation, matrix approach, hypothesis testing, multicollinearity

4. Model Adequacy Checking. Residual analysis, partial regression, lack of fit

5. Transformations and Weighting to Correct Model Inadequacies. Variance stabilizing transformations, generalized and weighted least squares

6. Diagnostics for Leverage and Influence. Influence, leverage, measures of influence, measures of leverage

7. Polynomial Regression Models. Polynomial models in one variable

8. Indicator Variables. Regression approach to analysis of variance

9. Multicollinearity. Effects of multicollinearity, multicollinearity diagnostics, methods for dealing with multicollinearity

10. Variable Selection and Model Building. Model building criteria, all possible regressions, stepwise regression, strategy for variable selection

11. Validation of Regression Models. Validation techniques

12. Introduction to Nonlinear Regression. Nonlinear least squares, parameter estimation, statistical inference

13. Generalized Linear Models. Logistic Regression, Poisson Regression

14. Regression Analysis of Time Series Data. Detecting autocorrelation: the Durbin Watson test, estimation of parameters

15. Other Topics in the Use of Regression Analysis. Robust regression. M-estimators, properties of robust estimators, bootstrapping in regression