Statistics 505: Regression Analysis

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Text: **Applied Linear Regression Models, 4th Edition.** We will use the book a lot. It is fine to use **Applied Linear Statistical Models** instead.

Prerequisites: Stat 516 or Stat 501. Basic linear algebra will be used.

Grading: Final Exam (40%)
Exam 1 (20%) Exam 2 (20%)
Problem Sets (20%)

Problem sets: There will be frequent (almost daily) short problems posted on the web after almost every class and due the next class. We will go over them at the start of class, and you will grade them yourselves.

Exam 1: Take home exam. Available on web 9/30, due 10/3
Exam 2: Take home exam. Available on web 11/16, due 11/21

Office Hours: Mon: 11-12. Fri 1-2. Other times by appointment.

Description: This course provides an introduction to linear regression methods.

Modeling:
Simple and multiple linear regressions
Dummy variables, interactions, polynomials, and transformed variables
Standard notation to write down and communicate regression models
Matrix formulation of a linear regression model

Estimation and Inference:
Estimation of regression coefficients, error variances, and predicted responses
Analysis of variance (ANOVA) table
Statistical inferences about terms in the model: t-tests, F-tests, multiple testing, confidence and prediction intervals.
Assumptions, how to assess whether they are met, and remedies
Model building and automatic model building / variable selection.

Computing:
We will use R to compute in this class, and we will not assume you have used R before. We will have "computational classes" throughout the semester when you will work through a computational exercise on a laptop (or a shared laptop) during class.

Tentative Schedule: (Please note that I expect this to change - the course content and pace will adapt to how the class is going.)

Sept 7 Linear Regression with One Predictor.
Sept 9 Linear Regression with One Predictor.
Sept 12 **Computational class. *Introduction to R.* Please bring laptop.**
Sept 14 Inferences in Regression and Correlation.
Sept 16 Inferences in Regression and Correlation.
Sept 19 **Computational class. Please bring laptop.**
Sept 21 Inferences in Regression and Correlation.
Sept 23 Inferences in Regression and Correlation.
Sept 26 Inferences in Regression and Correlation.
Sept 28 Diagnostics and Remedial Measures.
Sept 30 Optional office hour session during class time. **(Exam 1 available.)**
Oct 3 Matrix Approach to Linear Regression / examples **(Exam 1 due.)**
Oct 5 Matrix Approach to Linear Regression / examples.
Oct 7 **Computational class. Please bring laptop**.
Oct 11 Multiple Regression I: model, anova, estimation.
Oct 12 Multiple Regression I: model, anova, estimation.
Oct 14 Multiple Regression I: model, anova, estimation.
Oct 17 Multiple Regression II: extra sums of squares & collinearly.
Oct 19 Multiple Regression II: extra sums of squares & collinearly.
Oct 21 Multiple Regression II: extra sums of squares & collinearly.
Oct 24 Models for Quantitative and Qualitative Predictors.
Oct 26 Models for Quantitative and Qualitative Predictors.
Oct 28 Models for Quantitative and Qualitative Predictors.
Oct 31 Models for Quantitative and Qualitative Predictors.
Nov 2 **Computational class. Please bring laptop.**
Nov 4 Model Selection and Validation.
Nov 7 Model Selection and Validation.
Nov 9 Diagnostics.
Nov 14 Diagnostics.
Nov 16 **Computational class. Please bring laptop.** (**Exam 2 available.)**
Nov 18 Optional review session during class time.
Nov 21 Logistic and Poisson Regression. (**Exam 2 due.)**
Nov 23 Logistic and Poisson Regression
Nov 28 Longitudinal / repeated measures / mixed models.
Nov 30 Longitudinal / repeated measures / mixed models.
Dec 2 **Computational class. Please bring laptop.**
Dec 5 Classification methods.
Dec 7 Classification methods.
Dec 9 Review and examples.