Midterm Study Guide

Midterm - Friday Feb 5th in class

The midterm is closed book.
I will provide statistical tables if you need them (so you should know how to use them).
You should bring a calculator (although arithmetic errors are generally forgiven).

Things you will **not** have to do:

- write any R code
- invert more than a 2x2 matrix
- perform matrix arithmetic on more than a 3x3 matrix

Study guide:

State the multiple regression model in matrix form along with the assumptions on the errors and design matrix.

Describe the entries in the design matrix given a model and study description.

Define fitted values and residuals.

Describe the difference between random errors and residuals.

Derive the mean and variance-covariance matrix of the least squares estimates in multiple linear regression.

State the distribution of the least squares estimates under the assumption of Normal errors.

Identify properties of the least squares estimates (i.e. form of the estimates, mean, variance and distribution of the estiamtes, unbiasedness, BLUE, etc.) that rely on the Normality assumption.

State the Gauss-Markov theorem and discuss it's consequences in practice.

Describe the consequences of having orthogonal columns in the design matrix.

State the null distribution of t-statistics and F-statistics in hypothesis tests relevant to multiple linear regression models.

Construct t-based confidence intervals and hypothesis tests on individual parameters, or linear combinations of individual parameters, given either R output, or the neccessary estimates, and $(X^T X)^{-1}$

Construct prediction intervals for the mean response or a future response, given either R ouput, or the neccessary estimates, and $(X^T X)^{-1}$

Discuss the difference between a interval for the mean response and an interval for a future response.

Discuss ways in which a prediction model can go wrong.

Interpret a confidence interval or prediction interval in the context of a study.

Comment on the conclusion a hypothesis test would reach based on the result of a confidence interval/region.

Conduct an F-test to compare two models.

Interpret the result of an F-test in context of a study.

State the null and alternative hypotheses in the overall regression sum of squares F-test. How do you interpret a small p-value?

Find the linear parameteric function test equivalent to a model test and vice versa (i.e. HW#4 Q1).