Math 644, Fall 2012
Homework 4 Due: Friday, 11/16/2012

1. Exercises 6.1, 6.2 from the textbook.

2. In a small-scale regression study, the following data were obtained.

i :	1	2	3	4	5	6
X_{i1}	7	4	16	3	21	8
X_{i2}	33	41	7	49	5	31
Y_i	42	33	75	28	91	55

   Assume that the multiple linear regression model with independent error terms is appropriate. Using matrix methods, obtain the expressions of (1) $\mathbf{b}$, (2) $\mathbf{e}$, (3) SSR, (4) $s^2(\mathbf{b})$, (5) $\hat{Y}$ when $X_1 = 10, X_2 = 30$, (6) $s^2(\hat{Y})$ when $X_1 = 10, X_2 = 30$, and using R to numerically calculate these expressions.

3. A student stated: "Adding predictor variables to a regression model can never reduce R^2, so we should include all available predictor variables in the model." Comment.

4. Refer to Patient satisfaction data (see the example of chapter 2 in lecture notes).

   (a) Test whether X_3 can be dropped from the regression model given that X_1 and X_2 are retained. Use the F^* test statistic and level of significance 0.025. State the alternatives, decision rule, and conclusion. What is the P-value of the test?

   (b) Test whether $\beta_1 = -1.0$ and $\beta_2 = 0$ at the level of significance 0.025. State the alternatives, full and reduced models, decision rule and conclusion. What is the P-value of the test?

5. The following regression model is being considered in a water resources study: $Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i1} X_{i2} + \beta_4 \sqrt{X_{i3}} + \varepsilon_i$. State the reduced model for testing whether or not: (1) $\beta_3 = \beta_4 = 0$, (2) $\beta_3 = 0$, (3) $\beta_1 = \beta_2 = 5$, (4) $\beta_4 = 7$.