STA 471 Practice Problems 2

1. Consider the simple linear regression model in matrix terms. Under what conditions is the estimate of the $\boldsymbol{\beta}$-vector nonexistent?

2. Consider the multiple linear regression model in matrix terms.
a. List the model assumptions using matrix notation.
b. Describe the model assumptions using words.
c. In the ANOVA table, write $SS_{Regression}$, RSS, and SYY using matrix notation.

3. Consider a multiple linear regression model where $p = 5$.
What are the hypotheses associated with the F-test in the "Analysis of Variance" and the F-tests in the "Effects Tests" output in JMP?

4. **a.** Is a polynomial regression model an example of a linear regression model? Please explain.
b. Why would one want to "center" the predictor variables prior to finding the estimates of the parameters in the model?
c. What is a hierarchical regression model?

5. Are there some important transformations to consider which are not members of the Box-Cox family of transformations? Please explain.

6. **a.** Consider a regression model having only one predictor variable that takes on the values 0 or 1. Is the test $H_o : \beta_1 = 0$ versus $H_1 : \beta_1 \neq 0$ the same as the two-sample t-test for the equality of two populations means assuming equal but unknown population variances? Please explain.
b. What is an ANCOVA model? Explain in detail.

7. **a.** What are the dimensions of the hat matrix?
b. Show that the residuals $\widehat{e}_i$ are correlated by examining the properties of the residual vector.