Stat 333: Applied Regression Analysis
Spring 2015
Due Date: Friday, March 6 in class

Relevant text chapters: Ch. 3 & 4

Instructions: You may (and are encouraged to) discuss homework problems with other students, but the solutions that you should provide should be your own and not directly copied from another student. Show your work wherever possible, and write out the formulas you used to arrive at your solutions. If you have any questions or difficulties, you are more than welcome to come see me in my office.
Note that datasets for textbook problems can be found on the CD that came with the textbook or can be downloaded from

https://netfiles.umn.edu/users/nacht001/www/nachtsheim/index.html

1. Ch. 3, Problem 3.18 (p. 151), parts a) – d)

In addition, use this data and the Box-Cox procedure to find a power transformation for Y. Print out the plot of the log-likelihood against λ. What is the MLE of λ?

Next, take as your estimate of $\hat{\lambda}$ to be the MLE of λ rounded to the nearest 0.5. Plot $Y^{\hat{\lambda}}$ against X . Fit the SLR model of the transformed Y against X using your value of $\hat{\lambda}$, and print out your output from the function summary(). Plot the fitted values against the residuals and create a normal scores plot of the residuals. Comment on these plots and compare them to your output from part d. Do you have a preference for the square-root transformation on X or the Box-Cox transformation on Y? Explain your reasons.

2. Using the GPA data (Ch. 1, Problem 1.19), do the following:

a) Obtain Bonferroni joint confidence intervals for β_0 and β_1, using a 95% family confidence coefficient

b) Plot confidence ellipses for β_0 and β_1, using a 90%, 95%, and 99% family confidence coefficients.

c) Given your answers to a) and b), would it be reasonable to expect that $\beta_0 = 2.0$ and that $\beta_1 = 0.025$? Explain your reasoning.

3. Ch. 4, Problem 4.1 (p. 172)

4. Ch. 4, Problem 4.15 (p. 174)

5. For the no-intercept model $Y_i = \beta_1 X_i + \varepsilon_i$

a) Prove that

$$Var(\hat{\beta}_1) = \frac{\sigma^2}{\sum_i {X_i}^2}$$

b) Given the estimate of the mean response $E(\widehat{Y_h}) = E(\hat{\beta}_1 X_h) = \beta_1 X_h$, prove that

$$Var(\widehat{Y_h}) = \frac{\sigma^2 {X_h}^2}{\sum_i {X_i}^2}$$