**HOMEWORK 7**

*Multiple Regression: Multicollinearity and Quadratic Relationships*

Reading: This assignment focuses on content from your textbook, *STAT2: Modeling with Regression and ANOVA*, Chapter 3 Sections 4-5. Read these sections of your textbook.

Notes:

* For questions requiring you to use JMP, you must provide a copy of your output at the end of your assignment or embedded within your assignment. No credit will be given if you do not include your output, even if your answer is correct.
* Recall that you can download JMP to your personal computer for free. See the JMP information posted on Canvas. Problems due to not getting JMP working will not allow you to submit your assignment late. Please plan to work ahead and email your instructor questions if needed.
* You are required to use your own words in answering all homework questions. You cannot copy information from the book or other sources.
* Round all numbers to 2 decimal places unless otherwise specified.
* For all questions requiring calculations, show your work in order to receive credit.

1. 3.43 – 2008 U.S. presidential polls (page 149).

Answer the following questions using the example provided in your book. Include the parameter estimates output from JMP and graph used to check the conditions.

* 1. What is the fitted quadratic regression equation? Use a quadratic model with Days to predict Margin.

Predicted margin = 4.4779 + -0.6044\*Days + Days\*(Days \* 0.0211)

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* 1. Are the necessary conditions/assumptions for linear regression met? Explain.

- Linearity: there is not a linear relationship between the predictor and response variable

- Independence: met because there is a random sample

- Constant variance: the data is not plotted in the shape of a fan in the Residual by Predicted Plot so the condition is met.

- Normality of errors: the data falls within the range of the boundaries suggested by JMP. This condition is met.

* 1. Is there a significant concave-up relationship between Days and Margin?

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Ho: β2=0 where β2 = rating coefficient for β2X21  
Ha: β2 > 0

Test statistic = 5.60

*p*-value = 0.0005

Conclusion: There is overwhelming evidence to suggest there is a significant concave-up relationship between Days and Margin

1. 4.2 – Adirondack High Peaks (page 188).

Use the dataset described in the book to answer the following questions.

Response variable = Time

Explanatory variables = Elevation, Difficulty, Ascent, Length

Run the following analysis and include your JMP output:

* Create scatterplot and correlation matrices.
* Run *Fit Model* to predict Time using the 4 explanatory variables. Do not include any interaction or quadratic terms.
* Show the VIF’s in the *Fit Model* output.
  1. Based on the output, do you have any concerns about multicollinearity. Make sure to discuss the scatterplot and correlation matrices, signs of the slopes, significance of the slopes in relation to the ANOVA and R2, and the VIF values.

The scatterplot (Actual by Predicted Plot) shows a strong linearly positive relationship a couple outliers seen in the y-direction. The scatterplot matrix has mainly positive relationships. The strongest correlation with Time is Length. The weakest correlation with Time is Elevation. The VIF for the explanatory variables are not greater than 5, showing no indication of multicollinearity. There is no correlation greater than 0.9 between any of the explanatory variables from the correlation matrix, and the signs of the estimated slopes for the explanatory variables and corresponding correlation matrix values are not opposite. The t-tests for nearly all of the individual slopes are significant, and the R^2 value is high. The t-tests for nearly all of the individual slopes are significant and the F-test is significant. Overall, there are no concerns about multicollinearity.

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