**PRE 905: Multivariate Analysis  
Homework #5 (Total 10 Points)  
Due: Friday, March 7, 2014 at 11:59pm.**

To complete Homework #5, first please download the sample dataset entitled pre905\_hw05\_data.csv. This dataset contains information for students on two variables, an achievement test scaled score, and a variable that describes a rating of their teacher’s effectiveness. The TeacherEf variable is sampled from a standard normal distribution. All questions are worth 1 point each.

1. Calculate the mean and standard deviation of the sample ScaleScore variable. Report.
2. Plot the likelihood function for the mean of the scale scores using the sample standard deviation as “known.” Paste graph below. What is the value of the relative likelihood of the sample mean in the distribution?
3. Using the GLS function in the NLME package, create an empty model for the ScaleScore variable using maximum likelihood estimation. Does the model converge? How do you know?
4. What is the -2\*log likelihood value for the model?
5. How do the estimates for the mean and standard deviation of ScaleScore in the model compare to the ones computed in question 1? Paste the relevant R output and interpret.
6. Use ML regression to predict ScaleScore using the TeacherEf variable. In order to increase the interpretability of your results, center the ScaleScore variable at its mean before regressing it on TeacherEf. What is the -2\*log likelihood value for this new model?
7. Do the AIC and BIC values differ between the two models? If so, briefly interpret this difference.
8. Evaluate the significance of the TeacherEf variable for predicting ScaleScore using a chi-square difference test. Paste all relevant calculations and output with your interpretations below.
9. What is the R Squared value for the regression model? Interpret.
10. Write-up: Describe how the maximum likelihood estimation process works. How is this similar and different from ordinary least squares estimation? What are the benefits and limits of this type of estimation? When is it appropriate to use maximum likelihood estimation?

**Submission Instructions:**

All homework and final answers must be your own and not be copied or paraphrased from anyone else’s answers. Homework must be submitted via email ([jtemplin@ku.edu](mailto:jtemplin@ku.edu)) in the form of Microsoft Word document with the name: 905\_FirstLast\_HW#.docx. Late homework will have a penalty of 1% per calendar day.