**PSYC 5670: Multilevel Modeling**

**Homework #2**

**Due 10/17**

Dataset: ECLS-K third-grade assessment (within)

In this assignment, you will practice creating variables with different kinds of centering. You will also learn to create aggregated versions of level-1 variables, which will be a useful skill since most datasets real-world datasets will not come with these variables pre-defined.

1. Import the data into R.
2. The variable **MTH\_T** will be out outcome of interest. Our predictors will include student race, sex, MTH\_T\_pre and SES. Consider a multilevel model of the following form (in reduced form):
3. Write the model in decomposed form.
4. What are the interpretations of coefficients , , if all of the predictor variables are entered without centering?
5. How could you create grand-mean centered versions of MTH\_T\_pre and SES? (Give R code). How would the interpretation of coefficients , , change if these two predictors were grand-mean centered?
6. How could you create group-mean centered versions of MTH\_T\_pre and SES? (Give R code). How would the interpretation of coefficients , , change if these two predictors were group-mean centered?
7. Add aggregated (level-2) versions of SES and Math pretest to the dataset. To do this, you will need to calculate the mean of these variables in each classroom and append them to the dataset. Show the code that you used to do this.
8. Grand-mean center the aggregated variables that you created in question 4.

Now we are going to go through a “typical” exploratory model-building exercise. (Note that this approach invalidates the p-values unless we correct them for the multiple peeks we took at the data). We are going to try to better understand the factors that are responsible for the development of third-graders’ reading achievement. Our key predictor variables are going to be gender, SES, and the math pretest T score. We seek to decompose these variables into their level-1 and level-2 components, so all should be group-mean centered in this step. Fit the following models in sequence.

1. Fit the following models in sequence.
   1. One-way ANOVA with random effects.
   2. Fixed effects only model, including sex, race, SES, and math pretest score. Group-mean center the continuous predictors. Note how sigma squared and tau00 change.
   3. Add a random slope for the Math pretest score.
   4. Try adding a random slope for SES. (Drop it if it doesn’t work)
   5. Add the level-2 aggregated variables to the model.
   6. Add cross-level interactions (SES \* SES mean) and (MTH\_T\_pre \* MTH\_T\_pre\_Mean) to the model. If you have convergence problems, try dropping the covariance term from the random effects. If that doesn’t work, drop the random slope.