**PSYC 5670: Multilevel modeling**

**Homework 4**

**Due Thursday 12/5**

Dataset: HW4.csv available on D2L

This dataset contains information on 50 subjects measured at 10 equally-spaced time points. *W1* and *W2* are time-invariant predictor variables. There is no missing data.

Hint: don’t forget to set *stringsAsFactors=FALSE* when you read a csv file into R!

1. Implement a data visualization of your choice to help you get a handle on what might be happening in this data.
2. Produce a table of descriptive statistics. You will need to give the descriptives for Y at each time point. W1 and W2 are time-invariant covariates and should be described appropriately.
3. Prepare the data for analysis by grand-mean centering W1 and W2. You will also need to create a new time variable that is centered at year=2003.
4. Fit and interpret the unconditional growth model.
5. Adding or removing main effects and interactions as needed, explore the model specification until you are satisfied that the model is a reasonable summary of the data. You may consider:
   1. Is the effect of time linear or nonlinear?
   2. Is the effect of time moderated by W1 or W2?
   3. Is there a three-way interaction between time, W1, and W2?
   4. Is there an interaction between W1 and W2?
6. Returning to the final model from #4, now let’s work on the specification of the residual covariance matrix. Estimate each of the following models and report the AIC value. Which is preferred? How many parameters are estimated in each model in this data?
   1. Random effects model with a free covariance between the intercept and slope (e.g. the default).
   2. Random effects model with a diagonal tau matrix (this means that the covariance term between the random intercept and slope is fixed to zero, using the || operator).
   3. gls model with an unstructured residual covariance matrix.
   4. gls model with an autoregressive residual covariance matrix.
   5. gls model with an unstructured residual covariance matrix.
7. Using the final specification of the fixed effects that you determined in step #4 and the optimal specification of the residual structure from step #5, produce a table of the fixed effects estimates and their standard errors and *p* values. Interpret the meaning of each coefficient in the model, including the random effects.