Name:

**Hierarchical Linear Modeling**

Psyc 741, Spring 2025

**Due Date**: March 3, 2025 (11:00 AM)

***Homework #2***

For this homework assignment, you will be carrying out null, random intercept, and random slope models and interpreting the relevant output.

You will be completing the following questions, some of which involve conducting analyses in R. You will hand in the answers to the questions; enter them into this word document. Some of the answers involve you copying and pasting your R code. However, you also need to submit your *complete* R code too (saved as a .R script file). Submit both this completed document and your R script file to the submission portal for the Homework #2 Submission portal on Canvas.

1. Import the **schools.csv** data file on Canvas into RStudio. This data file contains information about samples of students nested within various schools.

**Null Model** [30 points]

1. Execute a null multilevel model with the ID values for the schools as the random intercept variable and student math scores as the dependent variable. Make sure that maximum likelihood (ML) is used as the estimator. Paste your R syntax below.
2. Report the following sample sizes from the data:
   1. Number of individual participants: \_\_\_\_\_\_\_\_\_\_
   2. Number of groups: \_\_\_\_\_\_\_\_\_\_\_\_
3. Report the following fit statistics from the null model:
   1. AIC: \_\_\_\_\_\_\_\_\_\_\_
   2. BIC: \_\_\_\_\_\_\_\_\_\_\_
   3. -2LL: \_\_\_\_\_\_\_\_\_\_\_\_
4. Report the following variance components from the model output:
   1. Between-group variance: \_\_\_\_\_\_\_\_\_
   2. Within-group variance: \_\_\_\_\_\_\_\_\_
5. Calculate and report the intraclass correlation coefficient (ICC) below and interpret its value.

**Random Intercept Model** [50 points]

1. There is a variable in the dataset that contains the individual socioeconomic status of the students on a standardized scale. The models below also include the school average (mean) socioeconomic status scores. Create an aggregate version of the socioeconomic status variable such that the mean socioeconomic status of the students for each school is included in the data frame. Copy/paste your R syntax below.
2. Execute a random intercept model with the same random intercept from the null model as above and the following fixed effects predictors: the socioeconomic status of the student, the school average socioeconomic status variable you created in Q7, the size of the school, and whether the school is private (0 = private, 1 = public). Make sure that maximum likelihood (ML) is used as the estimator. Paste your R syntax below.
3. Report the following fit statistics from the random intercept model:
   1. AIC: \_\_\_\_\_\_\_\_\_\_\_
   2. BIC: \_\_\_\_\_\_\_\_\_\_\_
   3. -2LL: \_\_\_\_\_\_\_\_\_\_\_\_
4. Report the following variance components from the random intercept model output:
   1. Between-group variance: \_\_\_\_\_\_\_\_\_
   2. Within-group variance: \_\_\_\_\_\_\_\_\_
5. Report and interpret all the fixed effects slope results below in APA format. Make sure to include the relevant statistical information in your reporting.
6. To help demonstrate the effect size of the random intercept model, calculate and report below the between-group proportional reduction in variance (BG-PRV) and within-group proportional reduction in variance (WG-PRV) between the null model and the random intercept model. What is your final determination of the effect size of this random intercept model?

**Random Slope Model** [20 points]

1. Execute a random slope model that is the same as the random intercept model above but also has a random effect for the individual socioeconomic predictor included. Paste your R syntax below.
2. Report the random slope estimate below.
3. What is your determination of this random slope effect? Use statistical information to support your determination.