Name _____

Psychology 5068
Hierarchical Linear Models
Homework 8
Due April 2, 2018

In class we examined the application of HLM to measurement models using data from 60 families in which all children were assessed on measures of verbal and spatial abilities. The file for those data (iq.csv) also contains a child-level variable (*order*) that represents each child's birth order (ranging from 0 for first born children to 1 for last born children), and, a family-level variable (fam_size) that represents the number of children in each family. Much research has examined birth order and family size effects on mental abilities, sometimes suggesting that early born children have an advantage over later born children, that this effect is stronger for verbal abilities than for spatial abilities, and that birth order effects are stronger in larger than in smaller families.

1. First, create a grand-mean-centered version of the family size variable. Name it *fam_size_GMC*.

2. Begin with the following model (Model_1), which treats all coefficients as random:

```
Model_1 <- lmer(IQ_Data$score ~ -1 + verbal + spatial + order:verbal + order:spatial +
        fam_size_GMC:verbal + fam_size_GMC:spatial + fam_size_GMC:order:verbal +
        fam_size_GMC:order:spatial +
        (-1 + verbal + spatial|child_unique) +
        (-1 + verbal + spatial + order:verbal + order:spatial|family),
        data=IQ_Data)
```

   Is there any evidence for birth order or family size effects in this analysis?

3. Modify the first model (call the modification Model_2) in a way that will provide an omnibus test for family size effects when the two models are compared. (Hint: The models should differ by 4 degrees of freedom).

   What does this model comparison tell you about the presence of family size effects in this sample?

4. Now modify Model_2 to remove all birth order effects (call the new model Model_3) and conduct a model comparison to Model_2.

   (a) What can you conclude from this comparison?
   (b) Compare Model_3 to Model_1. What is being tested and what does it offer beyond the previous two model comparisons?

5. Using the most parsimonious of the three previous models, modify it (call it Model_4) to provide a model comparison that tests the significance of the true score correlation between verbal and spatial abilities at the level of the child.