

Name _____

Psychology 5068
Hierarchical Linear Models
Homework 4
Due February 26, 2018

For this assignment, you will use the High School and Beyond data (HSB.csv) that were used for Homework 1.

1. Create four dummy codes to represent the four possible combinations of the variables, *minority* and *female*:

minority girls (MG): minority = 1, female = 1
minority boys (MB) minority = 1 and female = 0
nonminority girls (NMG): minority = 0 and female = 1
nonminority boys (NMB): minority = 0 and female = 0

2. Fit the following no-intercept model:

- (a) $\text{mathach} \sim -1 + \text{MG} + \text{MB} + \text{NMG} + \text{NMB} + (-1 + \text{MG} + \text{MB} + \text{NMG} + \text{NMB} | \text{School})$.
- (b) Construct weights for combining the fixed effect parameters from (a) that will test the main effect of Student Sex.
- (c) Construct weights for combining the fixed effect parameters from (a) that will test the main effect of Minority Status.
- (d) Construct weights for combining the fixed effect parameters from (a) that will test the Student Sex x Minority Status interaction.
- (e) Construct weights for combining the fixed effect parameters from (a) that will test the Minority Status effect, but just for males.
- (f) Construct weights for combining the fixed effect parameters from (a) that will test the Student Sex effect, but just for minority students.
- (g) Use the resulting weight matrix in `glht()` to obtain the significance tests. Which effects are significant?

3. Now fit this model

- (a) $\text{mathach} \sim 1 + \text{minority} + \text{female} + \text{minority:female} + (1 + \text{minority} + \text{female} + \text{minority:female} | \text{School})$
- (b) Do the main effects and interaction tests resemble the results from the previous analysis?
- (c) Construct weights for combining the fixed effect parameters from (a) that will reproduce the means for the four groups (MB, MG, NMB, and NMG).
- (d) Use the weight matrix with `glht()`. How close are the means to those that were present in the fixed effect parameters for the model in Question 2?

4. Fit the following model:

- (a) $\text{mathach} \sim 1 + \text{MB} + \text{NMG} + \text{NMB} + (1 + \text{MB} + \text{NMG} + \text{NMB} | \text{School})$.
- (b) What do the fixed effect parameters mean in this analysis?
- (c) Construct the weight matrix that will reproduce the means for the four groups (MB, MG, NMB, and NMG).
- (d) Construct the weight matrix necessary to reproduce the tests of the two main effects and the interaction.
- (e) Use the matrix in `glht()` and compare the results to those obtained in Question 2.

5. Compare the fit for the three models using the `anova()` function. If you named the fit objects: `Fit_1`, `Fit_2`, and `Fit_3`, then use `anova(Fit_1, Fit_2, Fit_3)`. The result should not surprise you; why not?