36-463/663: Multilevel & Hierarchical Models
Fall 2016
HW04 – Due Thu, 29 Sept 2016

Announcements

- Homework is due as a single pdf on Blackboard, by 11:59pm on Sept 29.
- Reading in Gelman & Hill (G&H):
  - This homework covers G&H Chapters 5–6.
  - Next week we will be looking at G&H Chapters 7–8.

Exercises

1. Read and try out the ideas in G&H Chapter 5. Note that code and data sets are available at the class website under "week04". Then do and turn in:
   (a) G&H Chapter 5, #2. *Do not* use a computer or graphing calculator, etc., for this exercise. Do a real freehand drawing. Neatness and accuracy both count! *[Since you are turning the exercises in online, feel free to use a drawing or paint program of some kind to make your drawing, or use a smartphone app, etc., to scan a paper-and-pencil drawing to something you can include in your final pdf for this assignment.]*
   (b) G&H Chapter 5, #8. The "rodents" folder is under "hw04" at the class website. *In part (b), you* must *write a few sentences explaining how you applied, or did not apply, the principles explained in section 4.6 of the book, in building your new model.*
2. Read and try out the ideas in G&H Chapter 6. Note that the code and data sets are available at the class website under "Week04". Then do and turn in:
   (a) G&H Chapter 6, #1. *The "risky.behavior" folder is under "hw04" at the class website.*
   (b) G&H, Chapter 6, #3. Answer G&H, Chapter 5, #1(a), using both the probit and logit models (so you will do 1(a) twice); be sure to follow the directions for Ch 6, #3, in doing this exercise. *The "nes" folder is under "hw04" at the class website.*
   (c) G&H, Chapter 6, #6. I haven't talked about t-regression at all in class, so you should try to make sense of this on your own (with the help of office hours, etc. of course). There is also a very brief discussion on pp. 124–125 (section 6.6) of G&H. For example, the model `lm(y ~ x)` looks like

   $$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i, \quad \varepsilon_i \overset{iid}{\sim} \sigma \cdot N(0,1) \ ^*$$

   while the model `tlm(y ~ x)` (package `hett`) looks like

   $$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i, \quad \varepsilon_i \overset{iid}{\sim} \sigma \cdot t_3$$

   (the errors are distributed like a constant times a t distribution on 3 df). See `http://en.wikipedia.org/wiki/Student's_t-distribution` for some further details, if you wish. *The "congress" folder is under "hw04" at the class website. You will need both the 1988.asc and 1986.asc data sets for this problem. They can be read into R using* `read.table()`*, and then matched up by state and district using the* `merge()` *command.*

[*] Note that $\sigma \cdot N(0,1)$ is the same as $N(0, \sigma^2)$ by the usual transformation formulas for random variables.