Stat 414 – Day 17
Imperfect Hierarchies (Cross-Classified, Multiple Membership) (Ch. 13)

Last Time: Logistic regression
- When do you use logistic regression?
- What is the logit transformation?
- How do we interpret the intercept? A slope?
- What are the variance components in a multilevel logistic regression?
- How do we compute an intraclass correlation coefficient for a random intercepts model?
- What are the "fitted values" in a multilevel logistic regression?
- What are the residuals in a multilevel logistic regression?

Example 1: The response variable is attainment score at age 16 for pupils that attended various combinations of primary and secondary schools. CrossAttainment.txt
pid = primary school identifier
sid = secondary school identifier
vrq = verbal reasoning score
sex = sex (Assuming sex = 0 = male, sex = 1 = female)

(a) Center the verbal reasoning score variable.

(b) How many unique primary and secondary school combinations are there? To how many different secondary schools did a primary school sent the pupils?

(c) What happens if you try to fit a normal two-level random intercepts model with primary schools nested within secondary schools?

(d) Fit a crossed model with random intercepts. How do the models compare? (*Hint*: Things don't change too much, why not?)

(e) Calculate the following intraclass correlation coefficients
- Same primary, but different secondary schools

- Same secondary, but different primary schools

- Same primary and same secondary school

(f) Now fit a model with crossed effects, and verbal aptitude and gender as fixed explanatory variables.

(g) Try to include a random slope for centered vrq for both classification variables. [*Note:* In other software packages, to create the random slopes for the second classification variable (pick the one with smaller number of categories), have to create some dummy variables for these categories and then "cross" these with vrq but restrict the covariance between all interaction dummies to be zero.]

(h) Summarize what you learn from the model.