Statistics 8052
Spring 2008
B. Grund

Assignment #10

(Due: Monday, April 21, 2008)

Written Assignment:

Reading:

- Pinheiro and Bates, skim Chapter 1; read Chapter 2 (for now, you may skip multilevel models), *read carefully 2.3-2.6*; Chapter 4.2.1
- Faraway, Chapter 8.1-3.

Written Assignment:

1. Analyze the `Oxboys` data in Pinheiro and Bates, p. 437, section A.19, displayed on p. 99.
   a) Describe the growth curves (height vs. age) for the boys. Assume a boy-specific intercept, and uncorrelated within-boy errors.
      - Test whether the slope is zero.
      - Test whether the slope is the same for all boys
      - Assuming that the slope is the same for all boys, does adding quadratic term improve the model fit? Perform a test.
      - Select a model that fits the data well, write it up as a linear model with all assumptions, and shortly describe to a non-statistician client what this model means.
      - In your model, estimate all relevant parameters and provide confidence intervals.

   b) Use the model with boy-specific intercept, the same slope for all boys. Compare three models for the within-boy error ε_i -- no correlation, compound symmetry, and autocorrelated error with lag 1.

   c) Provide a grid plot, showing for each subject the fitted height vs. age (lines) and the observed height versus age (points). Provide a grid of residual plots, showing residuals vs. age for each subject. What do you conclude?

   d) (Do not submit for grading) p. 53, exercise 2.

2. PB, page 96, exercise 1 – see comment below.

   Comment: The Oats data is described in section 1.6, pages 45-52. The model `fm4Oats` is a split-plot model, where nitro is fixed, but used as a linear covariate, `Block` and `Variety` are the nested grouping factors. The split-plot was analyzed in Pinheiro and Bates in the framework of repeated measures designs (the data is grouped by whole plots, and the effect of whole plots is modeled as random). The preferred model on the split-plot level in the lecture notes fitted a straight line for yield versus nitrogen; in `lme()`, this is reproduced by

   ```
   fm4Oats <- lme(yield ~ nitro, data=Oats, random= ~1 | Block/Variety)
   ```

   Additionally: Analyze the Oats data as a split-plot using `aov()` as in the lecture notes. (use 6 blocks; the lecture used a subset of the data, with 4 blocks). Compare the result to the corresponding `anova( )` for the `lme( )` model

   ```
   m <- lme(yield ~ factor(nitro)*Variety, data=Oats, random= ~1 | Block/Variety)
   ```