Assignment #6 — Due Monday, March 19, 2007, by 4:00 P.M.

Turn in homework in lecture, discussion, or your TA's mailbox. Please indicate the discussion section you expect to attend to pick up this assignment.

311: Tues. 1:00–2:15 **312:** Wed. 2:30–3:45 **313:** Wed. 1:00–2:15

Many more of you should heed the following and include *much* less computer output!

Many problems on this assignment require using the computer. Your turned in solutions should not include all of the computer output and graphs that you will produce. Write your solutions and include only sparingly computer output or graphs when necessary to support a point you are making in response to the problem question.

If a problem asks for a graph, provide it. If the problem asks for you to comment about a graph, you do not need to include the graph in your solution.

1. A forest scientist is interested in studying the relationship between the terminal velocity of falling maple samaras and a measure of their size and weight known as disk loading. A samara is the winged fruit that falls to the ground with a helicopter-like motion. The disk loading is a quantity related to helicopter aerodynamics.

   In an experiment samaras were randomly selected from each of three distinct trees (of the same species). The disk loading (`loading`) for each samara was determined and the terminal velocity (`velocity`) was measured in the laboratory. The forest scientist conducting the study hypothesizes that there is a linear relationship between terminal velocity and disk loading. The scientist wishes to determine whether the relationship is the same for each tree.

   The data consist of 13 observations from Tree 1, 11 observations from Tree 2, and 12 observations from Tree 3. The file `samara.txt` contains the data.

   Investigate the data and determine an appropriate model. Support your selection of the best model. Comment on which regression coefficients are the same for each tree and which are different.

2. Consider the full data set from the file `larch.txt`. For this problem you do not need to consider tests for any possible transformations. The regression coefficients $\beta_2, \beta_3, \beta_4, \beta_5$ correspond to the explanatory variables stored in columns 2–5 (`nitro, phos, potas, ash`), respectively. For each test, report the F test statistic, the degrees of freedom for the reference distribution, and the p-value.

   (a) Test the hypothesis: $H_0 : (\beta_3 = \beta_5 = 0 | \beta_0, \beta_2, \beta_4)$.
   (b) Test the hypothesis $H_0 : (\beta_4 = 3\beta_2 | \beta_0)$.

3. Consider the following experimental design. A dairy scientist is interested in testing the effect of diet on nitrogen content in manure. He would like to generalize the results he finds to all dairy cows of a given species in the US. The scientist designs four diets which differ in content. The experimental setup allows for individual measurement of nitrogen content of the manure, but cows in each diet group eat from a common source. The scientist has access to a large research herd. For the experiment, he selects 8 primiparous cows (cows that have given birth once) and 8 multiparous cows (cows that have given birth multiple times). The associated variable is called *parity*. The researcher assigns two cows from each parity level into each of the four treatment groups. Each cow is measured at the begining of the experiment and after one and two months on the assigned diet. (Realistic designs would be different.)

   For each of the following variables, indicate if it should be treated as a fixed effect or a random effect. Briefly explain. The variables are: *diet*, *parity*, *period* (time of measurment), and *id* (unique identifier for each cow).

Work to do, but not turn in.

- Read Chapter 10 of the textbook.