STAT 700, Fall 2011
Homework 9 Problems
due Wed. November 16

2 Problems. Please follow the Lab report directions off the homework web page.

1. The concentrations (in nanograms per milliliter) of plasma epinephrine were measured for ten dogs under: (1) isofluorane, (2) halothane, and (3) cyclopropane anesthesia. (Ref: Perry et al, 1974).

We will study **blocking** and we will use data available off the class web page:

`http://www.rohan.sdsu.edu/~babailey/stat700/dog.dat`

You can use the header information already in the file. Consider the 10 dogs as blocks and the different anesthesia as treatments.

(a) Plot the data using strip charts. Describe any differences that you see.

(b) We will now consider the blocks as random effects, so the model is:

$$Y_{ij} = \mu + \alpha_i + \beta_j + \varepsilon_{ij},\ i = 1, \ldots, I; j = 1, \ldots J. \tag{1}$$

where α_i are independent $N(0, \sigma^2_\alpha)$ random variables, ε_{ij} are independent $N(0, \sigma^2)$ random variables, and β_j are constants subject to $\sum_{j=1}^{J} \beta_j = 0$. The α_i and ε_{ij} are independent.

Fit a linear mixed effects model with `lme`. Give summary and diagnostics plots of the residuals. What do you conclude? Make sure that a factor is a factor!

(c) Test the hypothesis $\mathrm{H}_0 : \sigma^2_\alpha = 0$ vs $\mathrm{H}_1 : \sigma^2_\alpha \neq 0$, using a LRT. What do you conclude?

2. If we consider the blocks as fixed effects, we return to the classical two-way fixed effects model.

(a) Write down the classical effects ANOVA model. Define all variables and parameters. Make sure to give the range of the indices of the variables and parameters. Give any distributional assumptions for the random variables.

(b) Test if there is a difference in treatment effects (there are 2 of them!). Be sure to state the null and alternative hypotheses. Give the R ANOVA table and state your conclusion at the $\alpha = 0.05$ level. Include diagnostic plots of the residuals. Note: Do not add an interaction term. Make sure that a factor is a factor!

(c) Compare the p-value corresponding to the anesthesia treatment effect in (b) to the p-value obtained from Problem 1. What do you conclude?