CPH 931 — Fall 2009 — Dr. Charnigo

Written Assignment 1

Written Assignment 1 is due on Friday 18 September at the end of class.

The data in {BloodPressure.xls} pertain to a small pilot study comparing the performances of three antihypertensive medications on ten male subjects with mild hypertension. The first subject received medication 1 for two months, after which time his systolic blood pressure was assessed during a doctor's visit. Following a two month washout period, the first subject then received medication 2 for two months, after which time his systolic blood pressure was again asssesed. Following another two month washout period, the first subject received medication 3 for two months, after which time his systolic blood pressure was assessed once more. The same was done for each of the other nine subjects. In addition, each subject was given a personality test and classified as "Type A" or "Type B". Finally, at the time of each systolic blood pressure assessment, each subject was asked how many days he exercised in a typical week during the past two months.

[10] 1. Putting aside the question of whether the sample size was reasonable (since this was, after all, a pilot study), do you have any concerns about the manner in which this study was conducted? Please describe your concerns and indicate what you might have done differently had you conducted this study.

[20] 2. Notwithstanding your concerns about the manner in which this study was conducted, please perform a repeated measures ANOVA in which SBP is the response variable, MED is the explanatory variable, and SUBJECT is the blocking variable. Can you distinguish among the three antihypertensive medications? If yes, which medications appear more or less effective than the others?

[10] 3. Explain why the repeated measures ANOVA that you performed is not an entirely satisfactory way of analyzing the data. What limitations can be overcome by linear mixed modeling?

[60] 4. Consider a linear mixed model in which SBP is the response variable, MED and PERS are categorical explanatory variables, EXER is a numerical explanatory variable, interaction between MED and PERS is allowed, and SUBJECT is used to define random effects.

Note: To respond to the following items, you will need to use ESTIMATE and CONTRAST statements in your application of PROC MIXED. These are illustrated in the SAS code files for the Lecture 1 and Lecture 2 examples. In addition, you may wish to review the SAS code file for my solution to Written Assignment 2 from Fall 2008. Then ask me questions as needed. Most students have to wrestle with ESTIMATE and CONTRAST statements at first, but they soon discover that ESTIMATE and CONTRAST statements are very useful!

[10] a. Specify m and define $X_1, \ldots, X_m$ for the linear mixed model.

[10] b. State (in terms of $\beta_1, \ldots, \beta_m$) and test the null hypothesis that EXER is altogether unrelated to SBP.

[10] c. State and test the null hypothesis that MED is unrelated to SBP among Type A males.

[10] d. State and test the null hypothesis that MED is altogether unrelated to SBP.

[10] e. State and test the null hypothesis that MED and PERS do not interact.

[10] f. Among Type A males, what is the estimate of the expected difference in SBP after treatment with medication 3 and exercise 4 days a week versus after treatment with medication 2 and exercise 0 days a week? Is the estimate significantly different from zero?