Stat 402 B – Exam 1 Take-home Problems
Due at the beginning of the exam on Friday, April 9, 2010

1. [30 pts] A U.S. drug company is developing a new compound for lowering serum cholesterol and wishes to conduct an experiment to determine the new compound’s effectiveness. Elevated serum cholesterol levels are associated with higher incidence of heart attacks and strokes. Lowering serum cholesterol is important to the health of many individuals. Dosage is an important consideration and so the drug company wishes to test its new compound at different dosage levels (0 mg, 10 mg, 20 mg and 40 mg). Total cholesterol can be determined by a simple blood test and will be used to evaluate the effectiveness of the various dosages of the drug. The drug company will use people between the ages of 50 and 64 in the experiment.

a) [3] What are the response, conditions and experimental material for the experiment?

b) [4] The drug company wants to recruit people for the experiment.
   i. If the company wishes to be able to detect 1.6 standard deviation differences in the mean total cholesterol for the four dosages with Alpha = 0.05 and Beta = 0.05, how many people will the company need to recruit for a completely randomized design?
   ii. What is a disadvantage of using a completely randomized design for this experiment?

c) [4] An alternative design would use age as a blocking variable. Given the number of people you found for b);
   i. How many blocks should be used?
   ii. How will blocks be formed? Be specific and include the context of the experiment.

d) [5] For the number of people you found in b) and the blocks you formed in c) describe how you will randomly assign people to the treatments in order to produce a randomized complete block design. You must be specific and completely describe your procedure. From the description you give, I should be able to reproduce your procedure for assigning people to treatments.

e) [5] Give a partial ANOVA table giving all the sources of variation and degrees of freedom for the experiment.
   i. If the experiment is run as a completely randomized design.
   ii. If the experiment is run as a randomized complete block design.

f) [5] What is the difference between the “error” variation, as quantified by the mean square error, for the completely randomized design and the “error” variation, as quantified by the mean square error, for the randomized complete block design for the experiments described above? In order to answer this question you must describe what is contributing to the “error” variation within the context of the problem for each design.

g) [4] Suppose that the randomized complete block design is used for the experiment and the resulting analysis indicates that there are no statistically significant differences among the mean total cholesterol values for the four levels of the drug. Comment on whether this result indicates that the drug is ineffective in changing serum cholesterol levels. Is there an alternate explanation of this result?