Homework #14
Stat 202

3.18 What is wrong? Explain what is wrong with each of the following randomization procedures and describe how you would do the randomization correctly.

(a) Twenty students are to be used to evaluate a new treatment. Ten men are assigned to receive the treatment and 10 women are assigned to be the controls.

(b) Ten subjects are to be assigned to two treatments, 5 to each. For each subject, a coin is tossed. If the coin comes up heads, the subject is assigned to the first treatment; if the coin comes up tails, the subject is assigned to the second treatment.

(c) An experiment will assign 40 rats to four different treatment conditions. The rats arrive from the supplier in batches of 10 and the treatment lasts two weeks. The first batch of 10 rats is randomly assigned to one of the four treatments, and data for these rats are collected. After a one-week break, another batch of 10 rats arrives and is assigned to one of the three remaining treatments. The process continues until the last batch of rats is given the treatment that has not been assigned to the three previous batches.

3.19 Evaluate an online version of a course. An online version of a traditional course is to be evaluated by randomly assigning students to either the online version or the traditional course. The change in a standardized test score is the response variable. Explain why this experiment cannot be done in a double-blind fashion.

3.20 Can you change attitudes toward binge drinking? A experiment designed to change attitudes about binge drinking is to be performed using college students as subjects. Discuss some variables that you might use if you were to use a block design for this experiment.

3.21 Evaluate a new employee orientation program. Your company runs a two-day orientation program Monday and Tuesday each week for new employees. A new program is to be compared with the current one. Set up an experiment to compare the new program with the old. Be sure to provide details regarding randomization and what outcome variables you will measure.

3.22 Medical magnets. Some claim that magnets can be used to reduce pain. Design a double-blind experiment to test this claim. Write a proposal requesting funding for your study giving all of the important details including the number of subjects, issues concerning randomization, and how you will make the study double-blind.

3.23 Calcium and vitamin D. Vitamin D is needed for the body to use calcium. An experiment is designed the effects of calcium and vitamin D supplements on the bones of first-year college students. The outcome measure is the total body bone mineral content (TBBMC), a measure of bone health. Three doses of calcium will be used: 0, 200, and 400 mg/day. The doses of vitamin D will be 0, 50, and 100 international units (IU) per day. The calcium and vitamin D will be given in a single tablet. All tablets including those with no calcium and no vitamin D will look identical. Subjects for the study will be 90 men and 90 women.

(a) What are the factors and the treatments for this experiment?

(b) Draw a picture explaining how you would randomize the 180 college students to the treatments.

3.18. **(a)** Assigning subjects by gender is not random. It would be better to treat gender as a blocking variable, assigning five men and five women to each treatment. **(b)** This randomization will not necessarily divide the subjects into two groups of five. (Note that it *would* be a valid randomization to use this method until one group had four subjects, and then assign any remaining subjects to the other group.) **(c)** The 10 rats in a batch might be similar to one another in some way. For example, they might be siblings, or they might have been exposed to unusual conditions during shipping. (The safest approach in this situation would be to treat each batch as a block, and randomly assign two or three rats from each batch to each treatment.)

3.19. The experiment can be single-blind (those evaluating the exams should not know which teaching approach was used), but not double-blind, because the students will know which treatment (teaching method) was assigned to them.

3.20. For example, we might block by gender, by year in school, or by housing type (dorm/off-campus/Greek).

3.21. For example, new employees should be randomly assigned to either the current program or the new one. There are many possible choices for outcome variables, such as performance on a test of the information covered in the program, or a satisfaction survey or other evaluation of the program by those who went through it.

3.22. Subjects—perhaps recruited from people suffering from chronic pain, or those recovering from surgery or an injury—should be randomly assigned to be treated with magnets, or a placebo (an object similar to the magnets, except that it is not magnetic. Students should address some of the practical difficulties of such an experiment, such as: How does one measure pain relief? How can we prevent subjects from determining whether they are being treated with a magnet? (For the latter question, we might apply the treatments in a controlled setting, making sure that there is nothing metal with which the subjects could test their treatment object.)

3.23. **(a)** The factors are calcium dose, and vitamin D dose. There are 9 treatments (each calcium/vitamin D combination). **(b)** Assign 20 students to each group, with 10 of each gender. The complete diagram (including the blocking step) would have a total of 18 branches, below is a portion of that diagram, showing only three of the nine branches for each gender. **(c)** Randomization results will vary.