Statistics 5200 Fall 2020 Homework 7

Assignment Due: Mon 14 Dec

Directions: Each of the four exercises below describes a different study. For each exercise, do the following:

(a) (4 points) Identify which of the six "named designs" in this course (randomized complete block design, latin square design, split plot design, split split plot design, strip plot design, or repeated measures design) best describes the corresponding study.

(b) (4 points) Briefly explain which features of the study lead you to this decision in (a).

(c) (4 points) Sketch out a table or diagram with sample randomization(s) (not a Hasse diagram).

For examples on these three parts, see Questions 4 & 6 on the Spring 2015 Final Exam, Questions 3 & 5 on the Fall 2017 Final Exam, and Questions 1 & 3 on the Fall 2018 Final Exam on the class website.

This assignment will be graded out of 48 points (12 total points for each exercise).

Exercises:

1. Four competing treatments (coded ASP, ACET, IBU, XRT) for mild headache relief are being considered by a large nursing home. Twelve residents with frequent mild headaches are enrolled in a small study to compare these four treatments, with three residents randomly assigned to each treatment. After enrollment, at their first reported mild headache, each resident is given a single dose of their assigned treatment. Each resident is asked to rate the percentage of initial headache pain remaining at 20 minutes, 40 minutes, 60 minutes, and 90 minutes after receiving this single dose. The researchers then have 48 observations in their data set (four time points for each of three subjects in each of four treatments).

2. A commercial bakery has three recipes (coded 1, 2, 3) for cupcakes, and two different temperatures (coded 350, 375) at which the cupcakes could be baked. The bakery is interested in identifying how recipe and temperature affect cupcake volume. Three days (coded 1, 2, 3) are set aside to study this. On each day, one batch of cake batter is prepared from each recipe (you can think of each batch being randomly assigned a recipe). The cupcake pans in this bakery have three wells, and two pans are used each day. From each batch that day, two scoops of batter are extracted, and each scoop is poured into a well of one of the two cupcake pans, so that each pan has one scoop from each of the three recipes. Then each pan is randomly assigned a baking temperature in an oven, so that each pan that day is baked at a different temperature. The volume of each baked cupcake is measured after cooling. There are a total of 18 baked cupcakes in this study – 3 recipes at each of 2 temperatures on each of 3 days. Based on past studies, the bakery is comfortable assuming that the exact pan and oven used does not affect anything.

3. Girl Scout leaders are interested in learning how sales type and cookie menu affect cookie sales during their popular fundraiser. There are two sales types [coded D for door-to-door and T for table (like at a grocery store or mall)], and there are four cookie menus (coded A, B, C, D; each with a different list of cookies customers can buy from the girls). The Girl Scouts are geographically organized into councils comprised of troops of around 30 girls. Each troop is assigned a sales type and cookie menu to use during the fundraising period, and the number of cookies sold by each troop is recorded. To save costs on the delivery of the cookies to the troops, all troops in a council must use the same cookie menu. Eight councils are participating in this study, and each council has four participating troops, for a total sample size of 32. Each council is randomly assigned a cookie menu (with two councils for each cookie menu), and then the troops within each council are randomly assigned a sales type (with two troops for each sales type in each council).

4. Marketing researchers want to know how characteristics of television commercials affect viewer recall of a product. The researchers know that viewer education level (coded 1, 2, 3, 4) and age class (coded i, ii, iii, iv) affect viewer recall, but the researchers don't have any control over those factors. They can only control the commercial characteristics. Sixteen representative viewers are selected – four from each education level and four from each age class. The marketing researchers prepare four versions (coded A, B, C, D) of the same commercial for their product. The content is the same for each version, but they differ in the volume of music (louder in versions A & B, softer in versions C & D) and gender of the commercial narrator (male in A & C, female in B & D). (Although commercial version is the factorial combination of music volume and narrator gender, you can just consider it as a four-level treatment factor.) Each commercial version is assigned to exactly one viewer within each education level, and also to exactly one viewer within each age level. Each viewer is shown their assigned commercial once, and contacted four days later to tell everything they remember about the product. The marketing researchers convert each viewer's response to a numeric recall score (with points based on various features of the product).