1. An animal study is being planned as a completely randomized design involving 6 treatment groups. Past studies indicate the standard deviation of a response "measurement" is no more than 7.0 units. Consider a balanced design and use 5% significance level.

   (a) What sample size per group is needed to detect a difference of 8.0 units between treatments 1 and 2 with 80% power?

   (b) What sample size is needed for the power of the overall F-test to be at least 80%, given that the researchers want to detect any pairwise difference in means of 8.0 units?

2. Suppose the animals used in Problem 1 are from three different suppliers, and the "supplier effect" is responsible for 60% of the "measurement" variance. Using the suppliers as blocks or using only one supplier, repeat Problem 1.

3. A researcher is planning a three-arm clinical trial with a time-to-event endpoint measured in days. In an earlier study involving the current standard-of-care treatment, the natural logarithm of time-to-event was approximately normal with mean 3.4 and standard deviation 0.5. The researcher thinks two new treatments might increase the average time-to-event by at least 14 days and wants to make sure he can detect this with 80% power using tests of 5% significance level. How many patients per group do you recommend him to consider?

4. An animal science researcher is planning a three-period crossover design to compare diets on milk production. Previous studies have suggested milk production to be normally distributed with a mean of 2100 liters and a standard deviation of 48 liters and that the intraclass correlation of milkings within a cow is 0.50. How many cows are needed if the researcher wants to detect differences in means of 20 liters (80% power)?

Please submit your solutions in a single pdf file to Brightspace by 12:20pm on March 3.