Assignment 4
STAT 705, Spring 2020

This is a graded assignment, worth 25 points.
The data for this homework assignment is in the file "Homework 4 data.txt".

This is an extension of the data we examined in Homework #3. The experiment consisted of growing a particular type of bacterium in a laboratory setting, for the purpose identifying the conditions under which the bacteria would grow the best (i.e., produce the most bacteria). In homework #3, we examined only one factor, but now we examine three factors. The variables are

Time	number of hours of incubation (i.e., the time the bacteria is allowed to grow)
Temp	temperature (in degrees Celsius) in which the bacteria is grown
Conc	percent concentration of tryptone, a nutrient that is supposed to help the bacteria grow
Count	amount of bacteria (in millions of colony forming units) at the end of the incubation period

We are interested in determining which, if any, of the three factors (Time, Temp and Conc) affect the amount of bacteria. As with the earlier homework assignments, you will enter your answers directly into Canvas, and you will also need to upload your SAS program file.

Instructions

Run an three-way analysis of variance, including all interactions, on the provided data.

- **Each of the three predictors are factors. None of them should be treated as numeric.**
- **Include all interactions.**
- **For the response variable, use the square root of Count.**

Use the results of your analysis to answer the following questions. Base all of your answers on this model. **Please do NOT analyze any other model.**

The questions are on the next page.

Question 1. Give one reason why we would use the square root of Count (instead of Count) as the response variable.

Question 2. Do all combinations of the factors Time, Temp and Conc produce the same mean amount of bacteria? The answer involves exactly one hypothesis test. In addition to your answer (yes or no), provide the test statistic and the p-value of the test you use to make this decision.

Question 3. Which, if any, of the interactions are significant? Provide the p-value of every interaction test you use to make this decision (whether it is significant or not). Clearly label each test.

Question 4. In the Type III sums of squares (SS) table, the degrees of freedom for Conc is 4. Briefly explain why the degrees of freedom is 4.

Question 5. Is there a significant difference in mean bacteria comparing Concentration 0.8% and Concentration 1%? If this depends on Time and/or Temperature, your answer will involve multiple hypothesis tests. Clearly describe each test and provide the p-value of each test.

Question 6. Is there a significant difference in mean bacteria comparing Temperature 27 and Temperature 43? If this depends on Time and/or Concentration, your answer will involve multiple hypothesis tests. Clearly describe each test and provide the p-value of each test.

Question 7. Provide a 95% confidence interval for the mean bacteria count (in millions of colony forming units) for Concentration 1.2%, Time 48 hours and Temperature 27°C.