

Assignment 4

The assignment contains one questions, **each with 5 parts (a)-(e)** worth 10 points, for a total of 50 points. Your answers must be submitted in the form of a PDF and include both the answers to the question, along with your R code and output used to generate your answers.

Question 1

The data for this question come from a high performance ceramics experiment done at NIST. The purpose of the experiment was to characterize the effect of five machining factors on the mean strength of the resulting ceramic. The five factors were: Table Speed, Down Feed Rate, Wheel Grit, Direction, and Batch. Each factor had two levels. The Mean Speed was measured for each of the $2^5 = 32$ possible combinations of factor levels.

You can read in the data from the file attached to the Assignment on myCourses by using

```
ceramic_data<-dget("ceramic.txt")
```

Remember that the `ceramic.txt` file must be in your current working directory, or you need to specify an alternate path.

- (a) What class of object is `ceramic_data`?
- (b) Using the `ceramic_data` object, compute the **median Mean_Strength** by Batch, i.e. write a line of code that produces a vector that computes the mean of all observations in each batch, respectively. What is the difference in mean by Batch?
- (c) Compute the overall **standard deviation** of the `Mean_Strength` values across all 32 observations. **Hint: remember that this type of object is stored internally as an generic vector.**
- (d) Using the `ceramic_data` object, compute the **average Mean_Strength** for each of the four groups defined by the cross-classification of `Table_Speed` and `Direction`. **Hint:** the most succinct way to do this would return a 2x2 table with `Table_Speed` levels in the rows and `Direction` levels in the columns.
- (e) Compute the difference in means between the Longitudinal and Transverse levels of `Direction` for each level of Slow and Fast separately. **Hint:** Use part (d) and the `apply` function.