ECE 608 Assignment #3: ANOVAs and post-hoc tests

OVERVIEW

The purpose of this assignment is to being investigating more complex comparisons between groups using simple one-way ANOVAs, and post-hoc testing procedures. You will be asked to explore a large dataset and make inferences about group comparisons using parametric statistics.

About the dataset: BloodFlow_short.csv

For this assignment, we will use a sample dataset that describes how blood flow changes after different types of exercise. 96 men and women were recruited to perform one of 4 exercise conditions, and leg blood flow was measured at 0, 30, 60, 90, and 120 minutes after exercise.

ID: Subject IDs from 1 to 96
Sex: M = Male, F = Female
Cond: Different types of exercise (Rest, Bike, Sprint, Weights)
Time: Time after exercise from T0 (0 minutes) to T120 (120 minutes)
Flow: Leg blood flow

This report is due by 11:30 pm June 26 using the R Notebook layout. This format will allow you to include written descriptions of your code, which will be important for future assignments on the statistical theory behind common statistical tests. Please submit this report via Learn for grading, **naming it [Your last name]_Assignment3.Rmd** (e.g., Au_Assignment3.Rmd)

ASSIGNMENT INSTRUCTIONS [30 marks]

The goal of this assignment is to allow you to explore a dataset and make basic inferences about parametric data. The following objectives can be met many different ways with different solutions. In preparing your assignment in R markdown, restate the objective, summarize your approach, and insert your R code. This dataset is technically a two-factor design, but questions 1-3 only refer to the main effects of either sex, condition, or time. If no specific instructions are made to separate factors, let R pool the other factors and interpret the main effects.

You will need to load the following packages: tidyverse, ez, e1071, car

NOTE: This dataset contains incomplete cells, which you will have to deal with prior to using the ezANOVA function or you will receive the following error:

```
Error in ezANOVA_main(data = data, dv = dv, wid = wid, within = within,  :
  One or more cells returned NA when aggregated to a mean. Check your data.
```

I recommend you use na.omit(data.frame) to remove rows with NA values.

1. For this question, you do not have to check assumptions: [4 marks]
   a. Conduct the appropriate t-test for the effect of sex on Flow at T0. What is the t value?
   b. Conduct a one-way ANOVA for the effect of sex on Flow at T0. What is the F value?
   c. How does your t value squared (t^2) compare to your F value? In general, what would this signify?

2. For this question, **check assumptions and make the appropriate data transformations**: [6 marks]
   a. Run a one-way ANOVA to examine whether Flow differs by exercise condition. Report the ANOVA main effects in a publishable single-line summary.
   b. First, use t-tests with the Bonferroni correction method to assess main effects.
   c. Second, use the Tukey's HSD method to assess main effects.
   d. Is there a discrepancy between the p-value results from the post-hoc t-tests and the results from the Tukey's HSD? If so, why might this be?

3. For this question, **check all assumptions, make the appropriate data transformations**, run the analyses, summarize the main effects and posthocs in a publishable format, and make a publishable graph of the primary findings. [10 marks]
   a. Run a one-way ANOVA to examine whether flow changes over time.
   b. From the results, recreate the classic ANOVA table we have used in lecture

4. For this question, run the analyses, summarize the results and posthocs in a publishable format and make a publishable graph of the primary findings. [10 marks]
   a) Examine whether there is a difference between men and women for the blood flow response to exercise pooled across conditions (ignore Cond variable).
   b) From the results, recreate the classic ANOVA table we have used in lecture.