One-Way ANOVA & MCPs

<u>Directions</u>: **Remember, all answers must be word-processed using *Microsoft Equation Editor* for any other statistical/mathematical notation software. Answers to the homework questions should appear on 8.5" x 11" paper (<u>not</u> computer output) and must be legible. Students with questions about the homework should contact the teaching assistant, Jonas Ventimiglia, or Dr. Harring directly. Homework 2 is worth 25 points. Point totals for each questions are provided.

Use the data set **Lacrosse.csv**. The Gadd Severity Index (GSI, outcome) is a measure of head impact and has been used in a number of studies of head trauma. The data set includes factory-based GSI ratings for 4 models of lacrosse helmets (Helmet, a factor with 4 levels) and the location of the impact (Side; 1 = front and 2 = back). Answer the following questions using $\alpha = 0.05$ for all hypothesis tests.

One-Way ANOVA and Post-Hoc Comparisons

For this set of analyses, we focus only on the Helmet factor. Note that *Helmet* is not recognized as a factor by default, so manual conversion is necessary.

1. Perform an exploratory data analysis (EDA) using graphical and numerical summaries. What does this information convey about the plausibility of a significant omnibus F-test? Explain (3 pts)

2. Write out the one-way ANOVA model. Define all the symbols and variables you introduce in the context of this data set. (4 pts)

3. Report the omnibus F-test, η^2, and ω^2. Write up the results using the statistical results template for this ANOVA analysis. Make sure to include effect size measures and their interpretations. (4 pts)

4. Is the normality assumption violated? Report relevant graphics to support your conclusion. (2 pts)

5. Perform Levene's test to check the assumption of homoscedasticity. What is your conclusion based on the test? Does this result concur with the graph of residuals versus fitted values? Explain? (3 pts)

6. Express the contrasts for all pairwise comparisons between groups. Test the contrasts using the Benjamini-Yekutieli (BY) procedure for controlling false discovery rate (FDR). Compare this results of the BY procedure with the Bonferroni procedure to control family-wise error rate (FWER). What differences between the procedures do you notice? (4 pts)

7. Write out a complete set of orthogonal contrasts for the four helmet groups. Show/demonstrate that they are indeed mutually orthogonal. (5 pts)