Factorial ANOVA

Directions: **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 (not computer output) and must be legible. Students with questions about the homework should contact the teaching assistant, Jonas Ventimiglia, or Dr. Harring directly. Homework 3 is worth 24 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.

Factorial, Two-Way ANOVA

1. Create a two-way cross-tabulation of the data (Helmet by Side). Is the design balanced? Report descriptive statistics including measures of central tendency, dispersion, and shape of the distribution of GSI by treatment group (4 pts).

2. Draw an interaction plot to visualize group means. Just based on the plot, do you think there is a significant interaction? Explain why. Do you think there is a main effect for Helmet? Explain. Do you think there is a main effect for Side? Explain. (6 pts)

3. Write the two-way ANOVA model for the effects of helmet and side of impact on GSI. Define all the symbols you introduce in the context of this data set. (2 pts)

4. Report the omnibus F-test and η^2 for the main and interaction effects. What are your conclusions? Use the statistical write-up template. (8 pts)

5. We suspect that the effect of *Side* on GSI differs between Helmet 1 and 3. Express such an interaction contrast and perform the test using function glht( ) in R or the GLM module in SPSS. (4 pts)