Q SCI 482 Assignment 7 (100 points)

Q1: The effect of vitamin C on guinea pig teeth (100 points)

A study is examining the effect of vitamin C on the growth rate of guinea pig teeth (measured in mm). Each guinea pig receives either 0.5, 1.0 or 2.0 mg of ascorbic acid (vitamin C), and the dose may be administered directly in the form of a pill, or indirectly as a dose of orange juice. The data in long format are contained in `"7 Guineapigdata.csv"`. Since the individuals are assigned randomly to each treatment, it is assumed that the variances among treatments are similar. It is also expected that tooth growth is normally distributed.

1a) Read the data into an R object and use the `table()` function to check that you have a balanced two-factor ANOVA design. (5 points)

1b) For the rest of the assignment (for grading simplicity), choose the dose to be Factor A and the supplement type to be Factor B. Test the underlying assumptions of the two-factor ANOVA, using Levene's Test (short way around) for homogeneity of variances. Write down your conclusions. (10 points)

1c) Run a two-factor ANOVA on the data the short way around. Copy and paste the output table in R that includes the degrees of freedom, mean square, *p*-values etc. Interpret the resulting *p*-values in your own words. (15 points).

1d) Provide the plot for standardized residuals, the Q-Q plot, and run a Shapiro-Wilks test (short-way around), to check whether the data are really normally distributed. Paste the plots into this document, and explain your conclusions about whether the data are normally distributed. (15 points)

1e) Plot the interaction plot for these data. What do you conclude from this plot? (10 points)

1f) Run the two-factor ANOVA the long way around for these data. Report the intermediate steps involving calculating the means (grand mean, means of the levels of each factor, cell means), sums of squares and DF (total, factor A, factor B, interaction, error), the relevant mean squares, *F* statistics, and *p*-values. Report your final answers in a table similar to that presented in the lectures. (45 points)