Homework 10
STAT 4025/5025 – Due Sunday, April 17th 11:00 pm
35 points 4025 / 38 for 5025

1. Do part h of HW 9. [5 pts]
2. An engineer is interested in the effects of cutting speed (A), tool geometry (B), and cutting angle (C) on shot pattern diameter (mm) for rifle barrels. Two levels of each factor are chosen, and three replicates of a 2^3 factorial design are run. The results located in the file 'barrel_accuracy.csv'. [19 pts]

    a. Write out the effect for factor B using the 'lower-case' notation and interpret the slope coefficient for factor B. [2 pts]
    b. Write out the expression for the full regression model. [2 pts]
    c. By hand, compute the sum of squares associated with the main effect for factor B. [2 pts]
    d. Determine the best model for predicting barrel accuracy by keeping only those terms whose terms which are statistically significant at the 0.05 level AND any main effects that are involved in a statistically significant interaction. [2 pts]
    e. Using interaction and main effect plots, what coded factor levels of A, B and C would you recommend using for minimum pattern diameter? Explain. [3 pts]
    f. Produce an appropriate contour plot for conveying which combination of A, B and C produce optimal pattern diameter (i.e. diameter minimized). Interpret the plot. [2 pts]
    g. Find a 95% confidence interval on the pattern diameter at the optimal setting of A, B and C. [3 pts]
    h. Analyze the residuals. Are there any obvious patterns? Check for Normality as well as equal variance across each level of your main effects. [3 pts]

3. An experiment was conducted to study the efficacy of five different pesticides upon the yield of corn. Ten Nebraska farms were identified for participation and each farm set aside 5 one-acre plots for application of the pesticides (1 pesticide on each plot). Pesticides were randomly assigned to each of the five one acre plots on each farm. The partially completed ANOVA table from the analysis of this data is below: [11 pts for 4025 and 14 pts for 5025]

Source	Df	SS	MS	F
Blocks		135		
Treatments		100		
Residual				
Total		307		

    a. What is the name of this experimental design and justify your answer. [2 pts]
    b. Complete the ANOVA table above. [4 pts]

c. Write the linear model which corresponds to the appropriate analysis of this data. [2 pts]
d. Determine if there is a significance difference among the means of the five treatments. Be sure to state your hypotheses, provide the test-statistic, compute the p-value and state a conclusion. Use a significance level of 0.05. [3 pts]
e. **Grad students only**: Suppose you want to compare the mean of treatment 1 to the average of treatments 2 and 3. Give the estimated standard error of the desired comparison. [3 pts]