Stat 581 Problem Set # 5

1. A factorial experiment is used to develop a nitride etch process on a single wafer plasma etching tool. The design factors are the gap between the electrodes and the RF power applied to the cathode. The response variable is the etch rate for silicon nitride. The data is available on Blackboard as an Excel File.

(a) Provide a general definition of an interaction effect.
(b) State the two factor with interaction ANOVA model. Compute estimates of the model parameters.
(c) Test for an interaction effect. Compute the test statistic F_{AB} and the p-value. Provide an interpretation, stated in the context of the problem.
(d) Graph an interaction plot.
(e) Perform pairwise comparisons using the Fisher LSD method to investigate differences between the treatment combinations. Provide the grouping information.
(f) Provide an overall interpretation to the analysis, stated in the context of the problem.

2. The factors that affect the breaking strength of a synthetic fiber are being studied. A factorial experiment is run using the four production machines and the three operators. The data is available on Blackboard as an Excel File.

(a) Fit the interaction model. Test for an interaction effect and for main effects. Compute the test statistics F_A, F_B, F_{AB} and the p-values. Provide an interpretation, stated in the context of the problem.
(b) Fit the additive model. Perform pairwise comparisons using the Fisher LSD method to investigate differences between operators. Provide the grouping information.
(c) Compute confidence intervals for the between operator differences.
(d) Graph an interaction plot for both the interaction model and the additive model. Explain how the analysis is providing a simplification to the observed data.