5.3 (15pts):

The yield of a chemical process is being studied. The two most important variables are thought to be the pressure and the temperature. Three levels of each factor are selected, and a factorial experiment with two replicates is performed. The yield data are as follows.

1. Analyze the data and draw conclusions. Use α = 0.05.
2. Prepare appropriate residual plots and comment on the model’s adequacy.
3. Under what conditions would you operate this process?

5.4 (10pts):

An engineer suspects that the surface finish of a metal part is influenced by the feed rate and the depth of cut. He selects three feed rates and four depths of cut. He then conducts a factorial experiment and obtains the following data:

1. Analyze the data and draw conclusions. Use α = 0.05.
2. Prepare appropriate residual plots and comment on the model’s adequacy.
3. Obtain point estimates of the mean surface finish at each feed rate.
4. Find the P-values for the tests in part A.

5.5 (5pts):

For the data in Problem 5.4, compute a 95 percent confidence interval estimate of the mean difference in response for feed rates of 0.20 and 0.25 in/min.

5.21 (10pts):

The yield of a chemical process is being studied. The two factors of interest are temperature and pressure. Three levels of each factor are selected; however, only nine runs can be made in one day. The experimenter runs a complete replicate of the design on each day. The data are shown in the following table. Analyze the data, assuming that the days are blocks.

1. Analyze the data from this experiment (use α = 0.05).
2. Analyze the residuals.
3. Repeat the analyses from parts A and B using ln(y) as the response. Comment on the results.

5.28 (10pts):

A manufacturer of laundry products is investigating the performance of a newly formulated stain remover. The new formulation is compared to the original formulation with respect to its ability to remove a standard tomato-like stain in a test article of cotton cloth using a factorial experiment. The other factors in the experiment are the number of times the test article is washed (1 or 20) and whether or not a detergent booster is used. The response variable is the stain shade after washing (12 is the darkest, 0 is the lightest). The data are shown in the following table.

1. Conduct an analysis of variance. Using α = 0.05. What conclusions can you draw?
2. Investigate model adequacy by plotting the residuals.