Stat 581 Problem Set # 11

1. An experiment is conducted to study the strength of fiber produced by $a = 3$ different machines. Fiber strength may also be affected by the thickness (measured as a diameter) of the raw material. Response variable y is fiber strength, factor A is machine, and covariate x is thickness. The data is available on Blackboard as an Excel File.

(a) Test for machine effect using an ANOVA model. Compute the F statistic and the p-value.
(b) Provide an interpretation, stated in the context of the problem. In particular, note the role the covariate is playing in the analysis.

(c) Now test for machine effect using an ANCOVA model. Compute the F statistic and the p-value.
(d) Provide an interpretation, stated in the context of the problem. Note the role the covariate is playing in this analysis.

(e) Compute the estimated regression of strength on diameter for each machine.
(f) Create a scatterplot of thickness versus strength for each machine, including the regression lines.

(g) Compute the sample mean strength and the sample mean thickness for each machine. Compute the least squares means.
(h) Explain how the information from the covariate adjusts the determination of machine effect.

2. An experiment is conducted to investigate the effects of temperature (factor A) and pressure (factor B) on the yield of a chemical reaction. Two levels of each factor are considered, but missing values prevent the running of a full factorial. The data is available on Blackboard as an Excel File.

(a) Test for the marginal effect of temperature on yield. Compute the F statistic and the p-value.
(b) Test for the partial effect of pressure on yield. Compute the F statistic and the p-value.
(c) Explain how a marginal effect is defined differently than a partial effect.

(d) Compute the fitted values for the model with temperature effects only.
(e) Compute the fitted values for the model with pressure effects only.
(f) Compute the fitted values for the model with both temperature and pressure effects.