Homework 12 (Practice)

1. [Ch. 9.1, Exercise 1, pg. 674] Return to the data from Homework 4, Exercise 1. The article "Polyglycol Modified Poly (Ethylene EtherCarbonate) Polyols by Molecular Weight Advancement" by R. Harris (*Journal of Applied Polymer Science*, 1990) contains some data on the effect of reaction temperature on the molecular weight of resulting poly polyols. The data for eight experimental runs at temperature 165°C and above are as follows (see website for `polyols.csv`):

Pot temperature (°C)	Average molecular weight
165	808
176	940
188	1183
205	1545
220	2012
235	2362
250	2742
260	2935

   a) Find s_{LF} for these data. What does this intend to measure in the context of the engineering problem?
   b) Give a 90% two-sided confidence interval for the increase in mean average molecular weight that accompanies a 1°C increase in temperature here.
   c) Give individual two-sided confidence intervals for the mean average molecular weight at 212°C and also at 250°C.
   d) Use a hypothesis test (via p-value) with $\alpha = .05$ to determine if there is a significant linear relationship between molecular weight and temperature of poly polyols.

2. [Ch 9.2, Exercise 2, Pg. 697] Return to the study in Homework 5, Exercise 2. Here are some data (also on website as `pulp.csv`) taken from the article "Chemithermomechanical Pulp from Mixed High Density Hardwoods" by Miller, Shankar, and Peterson (*Tappi Journal*, 1988). Given are the percent NaOH used as a pretreatment chemical, x_1, the pretreatment time in minutes, x_2, and the resulting value of a specific surface area variable, y (with units of cm^2/g), for nine batches of pulp produced from a mixture of hardwoods at a treatment temperature of 75°C in mechanical pulping.

% NaOH, x_1	Time, x_2	Specific Surface Area, y
3	30	5.95
3	60	5.60
3	90	5.44
9	30	6.22
9	60	5.85
9	90	5.61
15	30	8.36
15	60	7.30
15	90	6.43

   Consider an analysis of the data based on the model $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \epsilon$.

   a) Find s_{SF}. What does this intend to measure in the context of the engineering problem?
   b) Give 90% individual two-sided confidence intervals for all of β_0, β_1, and β_2.
   c) Give individual 90% individual two-sided confidence intervals for the mean specific surface area, first when $x_1 = 9.0$ and $x_2 = 60$ and then when $x_1 = 10.0$ and $x_2 = 70$.

d) Use a hypothesis test (via p-value) with $\alpha = .05$ to determine if there is a significant linear relationship between specific surface area weight and time, with % NaOH held fixed.