

# Homework 7

*Due July 3, 2017 in class*

Please show all work for full credit. Print and staple your assignment together and submit by end of class the due date. If you cannot attend class on the due date, please arrange to submit your homework prior to the due date.

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  $\text{cm}^2/\text{g}$ ), 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  $\beta_0$ ,  $\beta_1$ , and  $\beta_2$ .
- 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.