First Midterm Exam
ChE 231
Spring 2019

Problem 1 (20 pts). Consider a microfabrication process in which the probability of manufacturing a single acceptable unit is 0.99 and 20 units are analyzed for their acceptability.

1. (5 pts) What is the probability that all 20 units will be acceptable? What is the probability that none of the 20 units will be acceptable?

2. (15 pts) What is the probability that 18 or more of the units will be acceptable?

Problem 2 (35 pts). Consider a process for manufacturing solar films. The thickness of 8 solar films was measured as follows (units μm): $x = [3.4 \ \ 4.5 \ \ 2.9 \ \ 3.7 \ \ 4.1 \ \ 3.8 \ \ 5.1 \ \ 3.8]$.

1. (5 pts) Calculate the three sigma limits on the mean using the 8 samples and determine if a ninth sample with thiickness of 2.0 μm is an outlier.

2. (10 pts) Calculate the mean and the 90% confidence interval on the mean.

3. (10 pts) Calculate the variance and the 90% confidence interval on the variance.

4. (10 pts) Test the hypothesis that the mean $\mu = \mu_0 = 3$ versus the alternative that $\mu = \mu_1 > \mu_0$ at a significance level $\alpha = 0.1$.

Problem 3 (20 pts). Consider the following dataset collected for the effect of scaled relative humidity (x) on the scaled rate of a catalyzed reaction (y).

Experiment	1	2	3	4	5	6	7
x	-3	-2	-1	0	1	2	3
y	-1.1	0.2	-0.1	-0.3	1.4	0.6	0.8

Using a significance level $\alpha = 0.05$, test the hypothesis that x and y are uncorrelated against the alternative that they are correlated.

Problem 4 (25 pts). Consider the following dataset collected for the effect of the concentration of an inhibitor (x) on the scaled rate of a catalyzed reaction (y).

Experiment	1	2	3	4	5	6	7
x	-3	-2	-1	0	1	2	3
y	2.5	2.7	1.7	-1.6	-0.5	-2.5	-1.9

1. (15 pts) Perform linear regression to find a linear model between x and y.

2. (10 pts) Using a 90% confidence level, compute the confidence interval on the slope of your linear regression model in part 2.