21 April 2019
To: CBEE 213 Class
From: Professor Koretsky
Subject: Homework #4

Below is the fourth homework assignment of the quarter. This assignment is due 3 May 2019 (Friday) by 5 PM on Gradescope. You will submit one file with your computer work and another file where you report your answers. Please conform to the updated format described on the class web site. http://classes.engr.oregonstate.edu/cbee/spring2019/cbee213-010/HWFormat.pdf If you have any questions, feel free to see me or one of the other instructors during office hours or by appointment.

1. Text 4-53 part a. Perform a Hypothesis Test following the 5 steps we discussed in class.

4-53. An article in *Computers in Electrical Engineering* ("Parallel Simulation of Cellular Neural Networks," 1996, Vol. 22, pp. 61–84) considered the speed-up of cellular neural networks (CNN) for a parallel general-purpose computing architecture. The data follow.

3.775302	3.350679	4.217981	4.030324	4.639692
4.139665	4.395575	4.824257	4.268119	4.584193
4.930027	4.315973	4.600101		

(a) Is there sufficient evidence to reject the claim that the mean speed-up exceeds 4.0? Assume that $\alpha = 0.05$.

2. Text 4-71. Perform the Hypothesis Test (part a) following the 5 steps we discussed in class.

4-71. The percentage of titanium in an alloy used in aerospace castings is measured in 51 randomly selected parts. The sample standard deviation is $s = 0.37$.

(a) Test the hypothesis H_0: $\sigma = 0.35$ versus H_1: $\sigma \neq 0.35$ using $\alpha = 0.05$. State any necessary assumptions about the underlying distribution of the data.
(b) Find the P-value for this test.
(c) Construct a 95% two-sided CI for σ.
(d) Use the CI in part (c) to test the hypothesis.

3. Turbidity is a measure of the cloudiness of water and is used to indicate water quality levels. The following data for turbidity were collected on the Rio Grande river during spring and summer.

Temperature [C]	Turbidity [FAU]
22.9	125
24.0	118
22.9	103
23.0	105
20.5	26

26.2	90
25.8	99
26.1	100
26.9	105
22.8	55
27.0	267
26.1	286
26.2	235
26.6	265

A. Identify the appropriate dependent and independent variables
B. Complete a spreadsheet to calculate the linear regression coefficients by the three methods we used in class [trendline, solver, sum of squares].
C. Calculate the estimated measurement standard deviation, $\hat{\sigma}$, and correlation coefficient (r) from the spreadsheet values as we did in class (i.e., "manually").
D. Calculate values of the confidence intervals of the regression coefficients using your spreadsheet with appropriate values for $t_{\alpha/2,\nu}$ from the Statistics Table on the class web site. Verify the value you looked up in the Appendix with the =t.inv(…) Excel function.
E. Plot values of the confidence interval and the prediction interval for the entire range of T.

4. The following heat capacity data, in [J/mol/K] vs. temperature, in [K] have been measured for *n*-butane (Chen S.S., 1975).

C_P	[J/mol/K]	38.07	55.35	67.32	76.44	92.3	98.49	98.95	124.77	148.66	169.28
T	[K]	50	100	150	200	273.15	298.15	300	400	500	600

C_P	[J/mol/K]	187.02	202.38	215.73
T	[K]	700	800	900

A. Using the matrix method in MATLAB, fit these data to a polynominial expression of the form:

$$c_P = A + BT + CT^2$$

B. Calculate the sum of the square error $\hat{\sigma}$, and R^2.
C. How do your results compare with those published in the literature?