**Assignment 5 - Introduction to Least Squares Fitting**

**NOTE:** Generate and submit a jupyter notebook with the title "yourname-assignment5.ipynb" to Moodle after completing the assignment.

1. [LEAST SQUARES FIT] Consider the two data sets below and fit them using a least squares fit. You literally can just modify the code provided in this lesson’s Jupiter notebook to work with these new data sets.

Data Set 1: (1,1.1); (2,2.2); (3,2.9); (4,3.5); (**5,15.1**); (6,6); (7;7.1) (8;8.3), (9,9.9); (**10,11.2**)

Data Set 2: (1,1.1); (2,2.2); (3,2.9); (4,3.5); (**5,5.1**); (6,6); (7;7.1) (8;8.3), (9,9.9); (**10,21.2**)

Note these data sets are nearly identical except for the bolded differences. It would appear each data set has an outlier point. Comment on how these points influence your fits? If you remove your outliner points how do these data sets compare?

1. [REAL DATA FITTING] Consider the diode curve data found here. Use this diode data to find a line that best describes the diode’s resistance after current is flowing through the diode. Pick the data range for this fit requires you to make a choice. How can you quantitatively defend your choice?

**Part A)** Write the code to explicitly calculate the least squares parameters of the line. Note, you may need to make some small change(s) relative to the code you were provided. Plot your fit alongside the provided data.

**Part B)** Now fit the diode to the Shockley Diode equation. Use this equation for your fit:

You can estimate the parameters and V (associated with 300 K). Here is a description of how this equation can be used:

https://en.wikipedia.org/wiki/Shockley\_diode\_equation

What problems (if any) do you encounter? There are multiple solution pathways here, possible paths include: (i) Note the log plot on Wikipedia, does that look like something you could fit? (ii) Alternatively, do numpy or scipy have a least squares fit designed for logarithmic systems? (iii) Or, consider non-linear least squares fitting options. The scipy “optimize” library might have options for you.

Again, plot your resulting fit along with the experimental data.