

LEAST SQUARES DATA FITTING

These problem sets ask you to try least squares data fitting on some real data. Print out your computations to turn in.

Question 1: Head over to <http://academic.udayton.edu/kissock/http/Weather/citylistUS.htm> and download average temperatures in Detroit for the years 1995-2020. Let $T(k)$ be the temperature on the k -th day of the year.

Part 1: Fit this data to a least squares model of the form

$$T(k) = A + B \cos\left(k \frac{2\pi}{365.25}\right) + C \sin\left(k \frac{2\pi}{365.25}\right).$$

Part 2: According to this model, what is the coldest day of the year? What is the warmest?

Part 3: Suggest a way to add a term for climate change to your model. Does your data suggest significant temperature change in Detroit over this period?

Question 2: Take a look at Table 1 of <http://arxiv.org/pdf/0809.0209v2.pdf>.

Part 1: Fit Bolt and Thompson's positions to a quadratic of the form:

$$\text{position}(t) = (1/2)at^2 + v_0t + x_0.$$

Part 2: What should v_0 and x_0 be? Is your data consistent with this?

Part 3: How do your answers change if you only analyze the first five seconds of data?

Question 3: Think of a real world phenomenon and a model which you would like to fit it to. Your model should involve at least two parameters to be estimated.

Part 1: Explain the problem you are studying, what your model is, and why it is reasonable.

Part 2: Find a source of data for your problem with at least five data points, and at least twice as many data points as parameters. Give your raw data, and state where it came from.

Part 3: Fit your data to the model. What result do you get? Does it make sense?