

Problem set 3

1. Write a MATLAB script called `makedata.m` that creates a text file of artificial atmospheric temperature data called `temp.txt`. Imagine that you measure the temperature every hour for 30 days. The average temperature varies over the course of the day, according to the formula $20 - 5 \cos(2\pi h / 24)$, in degrees Celsius, where h is the time of day in hours. Each artificial measurement is given by this function, plus a normal random variable with mean 0.0 and standard deviation 3.0. The first column of the text file is the day of the measurement (1-30), the second column is the time in hours (0-23), and the third column is the temperature.

2. Write a script called `plotdata.m` that processes `temp.txt` as follows.

(a) Load the data from the file. Create a 24×2 matrix called `daytemp` in which the first column contains a time of day at which measurements were made (0-23), and the second column contains the average of the 30 measurements made at that time of day.

(b) Fit the function $a - b \cos(2\pi(h - c) / 24)$ to the data in `daytemp`, where h is the time of day, and a , b , and c are free parameters. Report the fit in the command window in the following format:

$$\text{temp}(h) = 20.3 - 4.9 * \cos(2 * \pi * (h - 0.1) / 24)$$

where your fitted parameters appear instead of 20.3, -4.9, and -0.1.

Optional: for bonus marks, give bootstrapped standard errors for the fitted parameters.

(c) Plot the data in `daytemp` and the fitted function on a single set of axes. Label the axes, use a large font, and generally format the figure as if you were including it in a research manuscript.

Include sufficient comments, and indicate your name in a comment in each file. Email your solution to me (rfm@yorku.ca) in a single .zip or .tar file named with your last name, e.g., `murray.zip`.

Due April 12, 2011