CIS 401: Problem Set 2

Essential Knowledge–Please give a brief answer (1-2 sentences) for each

1. You downloaded a large set of data from the web. You type load and the data appears on your workspace as an n-by-2 array. The description of the data said the first column contains the observation times and the second column contains the data values. Missing data is indicated by -999. You want to compute the mean of the data which you can do using the Matlab command mean (type help mean to learn about it). Give some lines of Matlab code that will compute the mean of the data (the second column). You must find a way to exclude the -999's from the computation. Assume that the name of the data array is "data."

   The easiest way is to create an index to the good data using find:

   ≫ Good=find(data(:,2) = -999);

   and then take the mean

   ≫ damean=mean(data(Good,2));

2. You've been asked to help plan for a robot exploration of Mars. The planetary geologists running the show have listed a series of points (in Martian latitude and longitude) where they would like the robot to visit. You need to determine whether the robot will have enough fuel to visit all of these points, and this involves turning Martian lat-lon into meters. The function ll2xy.m in the Problem Sets section of the web page does this for Earth. (Please do not use the version of ll2xy.m used in the SSHvel example of Lecture04. It uses nargin which we haven't discussed, yet.) To perform the computations on Mars, you need to substitute the Martian radius for the Earth's radius. Since you expect to perform these kinds of calculations for several different planets or moons (you've applied for a job to work on a lunar rover), how would you modify ll2xy.m so that you can prescribe any radius you want? You should only have to change a couple of lines, and you are not allowed to use the input command to ask for the radius. Be sure your solution will work for any planet or moon.

The only acceptable way to do this is to introduce R, the radius, as an input to the function. This involves changing the function line to

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function [x,y]=ll2xy(lat,lon,ref,R)
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and then delete the line in the function where R is set to the radius of the Earth.

Programming: More Signal Analysis

4. Describe what you did to scrippsSST.txt in order to get it into Matlab and how you extracted the columns.

   Place a comment (%) in front of the first line, or delete it entirely. No other changes are needed.

5. Paste your version of myfft.m. This function should be properly commented and should perform any error checking.

6. Paste your version of FourierMat.m. This function should be properly commented and should perform any error checking.

   Excellent implementations of myfft.m and FourierMat.m were provided by many students. Anat Maoz's versions (with a couple of slight modifications) are available on the web. She noticed that for FourierMat to work correctly, $t(1)$ in $t(j) - t(1)$ inside the expression for F must be the first element from the time vector passed to myfft. Her version of myfft captures this value and passes it to the user. The value must then be passed to FourierMat.

7. Plot the spectrum of the temperature data (DON'T send it to me). Does the spectrum contain any especially energetic frequencies (peaks)? If so at what frequencies do they occur, and how do they relate to the original data?

   A peak is present at a frequency close to 1 year. The large oscillations in the temperature data also occur at this frequency. Not even southern California is immune from seasonal cycles.