P1 Name three sources of digital signals that we did not discuss in class.

This class, DSP, will obviously be Matlab-intensive. Yet it need not be hard to understand intuitively. The next three problems involves an ECG data file showing one cardiac cycle of my heart beat as measured by chest electrodes. The signal has been corrupted by high-frequency noise (I did not add this; it is real noise from the environment because chest electrodes are a high-impedance signal). To complete these problems, download the file PS1_ecg.txt from my website and save it to your current working directory in Matlab (to find out where this is, type pwd at the Matlab prompt for "Present working directory". You can change this directory to anywhere on the network using the dropdown box at the top of Matlab's toolbar.

P2 The data file PS1_ecg.txt is stored in plain ASCII text format. Examine the file using a text editor (e.g. Notepad) to see its simple format. Use the following code to read the list of numbers into a single vector called x. This is a very useful capability; you may want to keep track of this code snippet.

```
fid = fopen('PS1_ecg.txt');   % open the file and stores a shortcut to it in variable fid
c = textscan(fid,'%f')        % read the vector of floating point numbers into a single cell called c
fclose(fid);                  % close the file and release control of it back to the operating system
x = c{1};                     % copy the vector of ecg samples from cell variable c them into vector x
```

Plot it, title it, and label the axes using the commands plot, title, xlabel, and ylabel. Turn in the plot AND the commands you used to generate it (including your textscan commands). See how easy it is to cut and paste into a Word document using Edit→Copy Figure.

P3 It looks fuzzy because there is high frequency noise in it. The goal of this assignment is to remove the noise. One simple way to do this is to average adjacent samples. This is called a "moving average filter" and is commonly used by Wall Street firms to spot underlying trends in noisy stock data. Create a new signal whose value at sample *i* is the average of the original signal's values at *i* and *i*+1. For credit, attach a plot and the commands you used to generate it.

Hint 1: You can use the following snippet of Matlab code to help structure your solution.

```
N=length(x);              % N holds the number of samples in signal vector x.
for i=1:N                 % loop through every sample in vector x
  xNew(i) = x(i);         % Sample code sets the new signal equal to the old signal
end
plot(xNew)
```

Hint 2: If you get an error "index exceeds matrix dimensions" it is because you tried to access an element of the matrix that is not present. For instance, if x is 240 elements long, and you tried to access x(241), you will get this error. In MATLAB, vectors begin at index 1, not 0 as in C.

P4 Use subplot to create a single figure with the "before" plot on top and the "after" plot on the bottom. Make sure both plots have neatly labeled titles and axis labels. For credit you need only attach your figure; you do not need to list the commands you used to generate it.