Lab 1

Lab 1 introduces basic concepts of MATLAB. Below is the assignment, and what I'll expect you to turn in. Below that is a quick overview of the necessary MATLAB commands to complete this lab.

Assignment:

1) Sinusoidal Synthesis

a) Synthesis 2 sinusoidal signals of differing frequency and amplitude. Use a 3 x 1 sub-plot to plot each individual signal and then the sum of the two. Make sure the resulting signal is in the range [-1, 1].

b) Play the output of the combined signal, can you hear both frequencies?

c) Make sure your plots have the proper ranges on the axes as well as axis labels and a plot title.

2) Wav File

a) Read a .wav file - any .wav file (preferably 5 - 10 seconds in length). Find one on the web at sites such as freesound.org. If you really have no creativity or imagination you can use this one.

b) Plot the waveform, labeling the x-axis with time in seconds.

c) Try playing the sound using a faster or slower sample rate than it was recorded. How does the sound change?

d) Plot and play just the first two seconds of the file.

3) Combining a wav file with a sinusoid

a) Generate a 440 Hz tone of the same length as the wav file you used for part 2.

b) Combine the tone with the wav file.

c) Plot and play the output, making sure that the signal does not exceed [-1, 1]. (label the x-axis with time in seconds).

d) Write the output to a new wav file, named "YourName-Lab1.wav"

Submission Requirements

Export all plots as .png files and use Word (or similar) to compile them into one document along with a writeup for each section briefly explaining what you did, and what problems (if any) you encountered in the process. All plots and write up should be submitted as a **single PDF file**. Your code can either be in one .m file, or in separate files for each portion. Either way, **make sure you name your files so that I know what they are!** You do not need to submit your original .wav file used in problem 2, but please submit the combined file that you generated in problem 3.

Lab 1

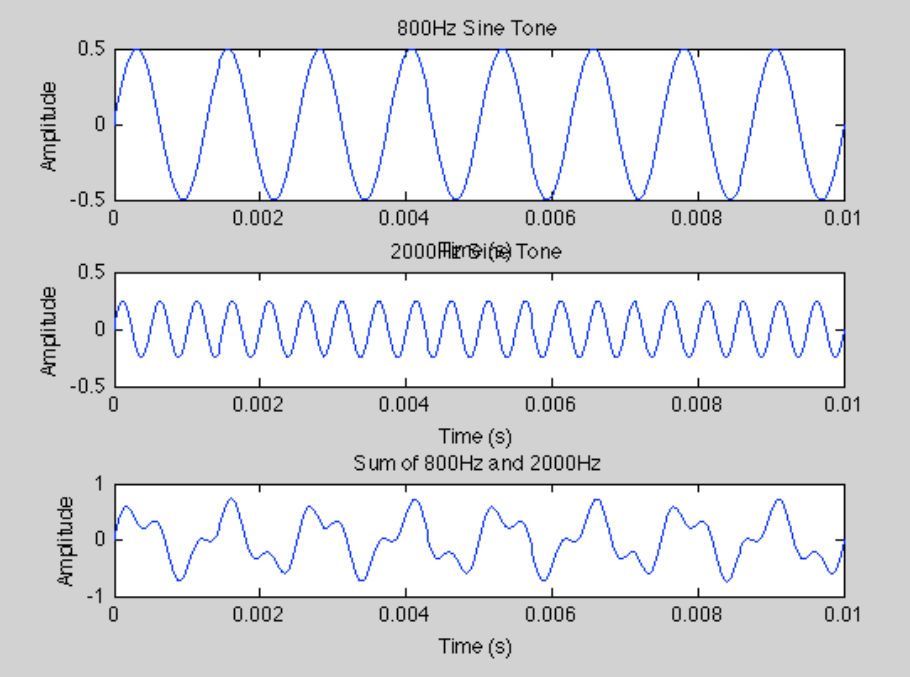
Nate Paternoster 9/13/13

1) Code:

```
fs = 44100;
T = 1/fs;
t = 0:T:0.5;
f1 = 800;
f2 = 2000;
w1 = 2*pi*f1;
w2 = 2*pi*f2;
a1 = 0.5;
a2 = 0.25;

y1 = a1*sin(w1*t);
y2 = a2*sin(w2*t);
y3 = y1+y2;

sound(y1);
sound(y2);
soundsc(y3);

tplot = 0:T:0.01;
y1 = a1*sin(w1*tplot);
y2 = a2*sin(w2*tplot);
y3 = y1+y2;

subplot(3,1,1);
plot(tplot,y1);
title('800Hz Sine Tone');
xlabel('Time (s)');
ylabel('Amplitude');
```

```
subplot(3,1,2);
plot(tplot,y2);
title('2000Hz Sine Tone');
xlabel('Time (s)');
ylabel('Amplitude');

subplot(3,1,3);
plot(tplot,y3);
title('Sum of 800Hz and 2000Hz');
xlabel('Time (s)');
ylabel('Amplitude');
```

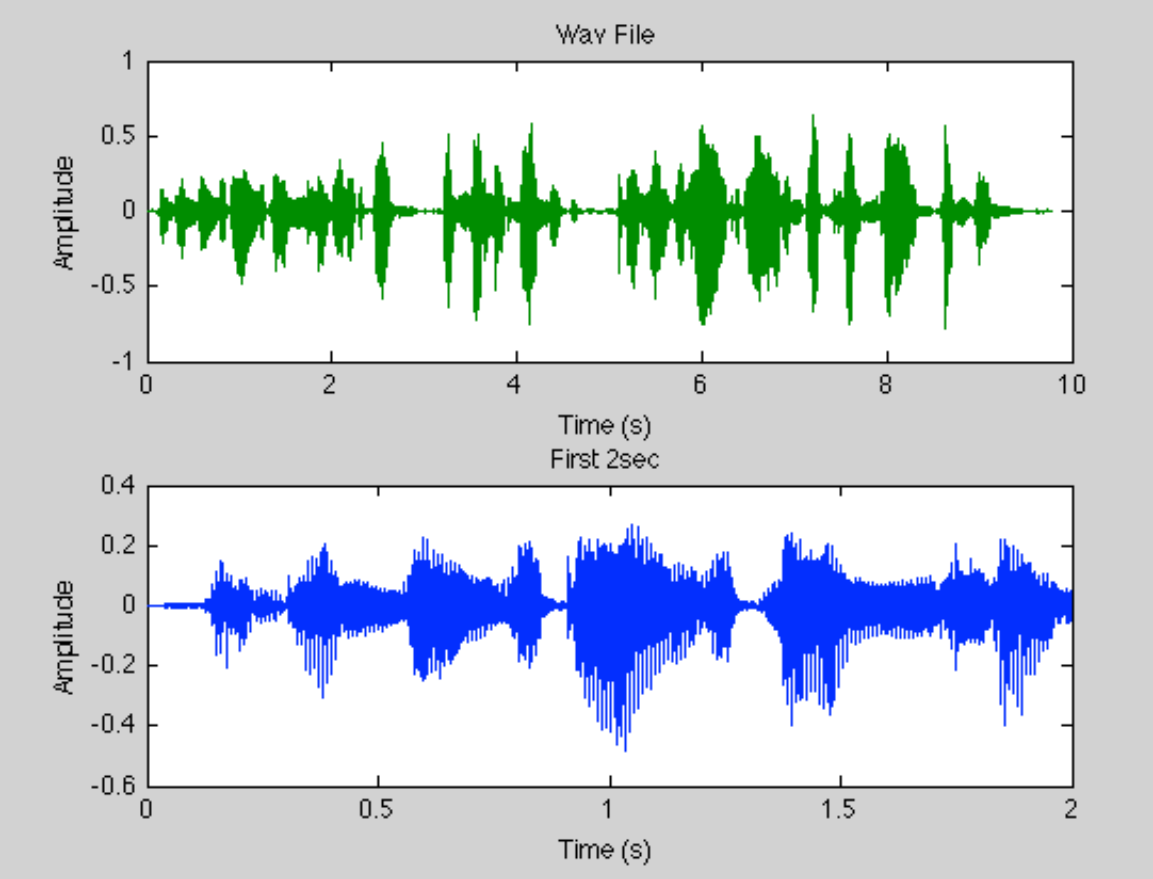
→ Two sine waves, y1 and y2, were created that have respective amplitudes a1 and a2 and frequencies w1 and w2. Their sum is represented by wave y3. I play all three of them consecutively to compare.



2) Code:

```
[z sf nbits] = wavread('16122__incarnadine__sinister-preacher-reading-revelations.wav');
Tz = 1/sf;
tplotz = 0:(length(z)-1);
tplotz = tplotz*Tz;
subplot(2,1,1);
plot(tplotz,z);
title('Wav File');
xlabel('Time (s)');
ylabel('Amplitude');
sound(z,sf);
sound(z,55555);
sound(z,25000);
   % With a higher sample rate the pitch of the waveform rises, and with a
   % lower sampling rate the pitch of the waveform drops

z_2sec = z(1:(2*sf));
tplotz_2sec = 0:(length(z_2sec)-1);
tplotz_2sec = tplotz_2sec*Tz;
subplot(2,1,2);
plot(tplotz_2sec,z_2sec);
title('First 2sec');
xlabel('Time (s)');
ylabel('Amplitude');
sound(z_2sec,sf);
```

→A wav file was read in and played at various sample rates. The waveform for that file was plotted.



3) Code:

```
w440 = 2*pi*440;
Y_440 = 0.3*sin(w440*tplotz);
Y_440 = Y_440';        %I needed these two steps to get the
Y_440(1,2) = 0;        %matrix dimensions to match when
combining
sound(Y_440,sf);
y4 = Y_440 + z;        %combining here
plot(tplotz,y4);
xlabel('Time (s)');
ylabel('Amplitude');
soundsc(y4,sf);
wavwrite(y4,sf,nbits,'NatePaternoster-Lab1.wav');
```

→ A 440Hz sine wave was created and summed with the wav file read in previously. The resulting waveform was played and plotted. I ran into some difficulties summing the two waveforms together because the dimensions of each waveform's matrix did not match initially.