EC380 Mini Project 3 – Tone Removal

For this mini project you are to work on your own, however you are free to discuss ideas with others. This MATLAB project is part of a sequence of mini projects.

Background:

For this mini project you will write a simple MATLAB program that removes unwanted tones from a wav file. The file **Exam2Answers.wav** in the G:ee\ece380\Mini Projects\03 ToneRemoval directory has had some unwanted tones added to it. You job is to remove the tones so you can hear the message better.

Approach

There at two steps needed to remove the tones. First determine the frequencies of the interfering tones, and second, filter out those frequencies.

Find the frequencies

The following MATLAB code will read the wav file and plot a spectrogram of it.

```
[xx,fs] = wavread('Exam2Answers');
xx = xx';
figure(1)
specgram(xx, [], fs)
```

Estimate the frequencies of the tones from the spectrogram. Convert the frequencies in Hz to digital frequencies in $\hat{\omega}$.

Filter the Frequencies

A weighted three-point averager is enough to remove one frequency at a time. Given the impulse response:
$$h[n] = \{1, A, 1\}$$
find the frequency response $H(e^{j\hat{w}})$ in terms of A. Find the values of A needed to remove each of the unwanted frequencies. Once you have the correct values, this code can be used to remove one frequency at a time:

```
hh = [1, AA, 1];
yy = filter(hh, 1, xx);
```

You will have to fill in your values for **AA**. You can check the frequency response of your filter by using freqz:

```
ww = -pi:pi/100:pi;
HH = freqz(hh,11,ww);
plot(ww,abs(HH));
```

Hint: You will have to use multiple filters. Once you have it working combine those filters into one filter.

Due Date:

This assignment is due Tuesday 13-Jan-2004 at the start of class.
What is due:
1. wav file of your cleaned up file.
2. One page memo describing what you did. Have a table listing the frequency in Hz, the digital frequency, and A for each tone. Include a spectrogram of the cleaned up signal. Highlight any **extras** you did.
3. Your MATLAB code.

Email the wav file to your instructor (Mark.A.Yoder@Rose-Hulman.edu or Keith.Hoover@Rose-Hulman.edu). Use the subject "ece380: Mini Project 3". Print (don't' email) your memo and MATLAB code and hand it in class.