Assignment 3

Objective: Signal processing through simple time domain operations.

Part 1 :

Q1. Play!!

Write a program to simulate a single echo effect on the given audio file with this assignment. Single echo effect is more like an addition of audio signal with its own delayed version which we can write mathematically as,

$y(t) = x(t) + alpha*x(t-d)$

where, $x(t)$ is the original signal and $x(t-d)$ is the d time delayed version of original signal. Alpha is a decay amplitude factor. You may like to try with d = 350 millisecond and alpha = 0.2 .

Compare your output with signal generated by an audio processing software 'audacity' (explained in the last). See Effects -> Echo.

Just for information, this operation is an also an example of FIR filter (You will encounter this term in later part of your DSP syllabus). **Also note that while the representation has been given in the continuous domain, you will need to discretize(sample) it to generate it on the computer.**

Q2. Think!!

In assignment 1, you have developed an algorithm to segment voice signal into desirable and undesirable part. Your desirable signal blocks are actually the DTMF signals which have mixtures of two frequencies corresponding to a phone key. Now, next task is to decode the keys from these signals.

Write a program to decode the phone key from the given DTMF signal.

Hint: You know all 8 fixed frequencies to generate these DTMF signals. For more information read the class notes. Use fixed frequency signals as a basis and try to correlate them with given DTMF signal blocks.

Audacity Software:

It is a open source software to do basic signal processing operations over audio and voice signals. Please walk through it and use different effects and visualisation tools given in this software. We will mainly use this software and point out specific features of it as per the requirement of assignments.

Download link: http://audacity.sourceforge.net/

Part 2:

Q1. Design and plot (in MATLAB) the chirp transmit waveform of a pulsed radar for the following specification?

- Maximum Unambiguous Range = 300 km [To derive PRF (Pulse repetitive frequency)]
- Duty cycle = 10% (To derive uncompressed pulse width)
- Range resolution = 30 metres (To derive compressed pulse width, bandwidth and sampling frequency)
- Centre frequency (fc) = 60 MHz