EE-384 Classwork-1

Problem 1: Common sequence (turn in your codes)

1.1) Create a 'unit_impulse' **function** that creates a unit impulse sequence y(n). The function should accepts input arguments of n_p, n1, and n2 where n1 and n2 are the start and the end of the sequence; n_p is the position of the pulse. Note that for each value of n:

$$y(n) = \begin{cases} 1 \; when \; n = n\_p \\ 0 \; when \; n \neq n\_p \end{cases}$$

1.2) Create a 'unit_step' **function** that creates a unit step sequence y(n). The function should accepts input arguments of n_s, n1, and n2 where n1 and n2 are the start and the end of the sequence; n_s is the step position. Note that for each value of n:

$$y(n) = \begin{cases} 1 \; when \; n \geq n\_s \\ 0 \; when \; n < n\_s \end{cases}$$

Problem 2: Time-shift and Time-reversal (turn in your codes and plots)

2.1) Create a 'time_shift' **function** that create an output sequence y(n) as a delayed version of the input sequence x(n). The function should accept input arguments of x, n, and n_d where n_d is the number of samples delayed.

2.2) Let x(n) = 2n + 3, where n = -10:10.

a. Plot x(n).
b. Plot a time delayed version of x(n) delayed by 3 samples.
c. Plot the time-reversal of x(n)

2.3) Plot y(n) = 5*δ(n + 4) – 2* δ(n -2); n = -10:10

2.4) Plot z(n) = u(n) – u(n-4) ; n = -10:10

where δ(n) is the unit impulse sequence and u(n) is the unit step sequence.

Problem 3: Systems (turn in your codes and plots)

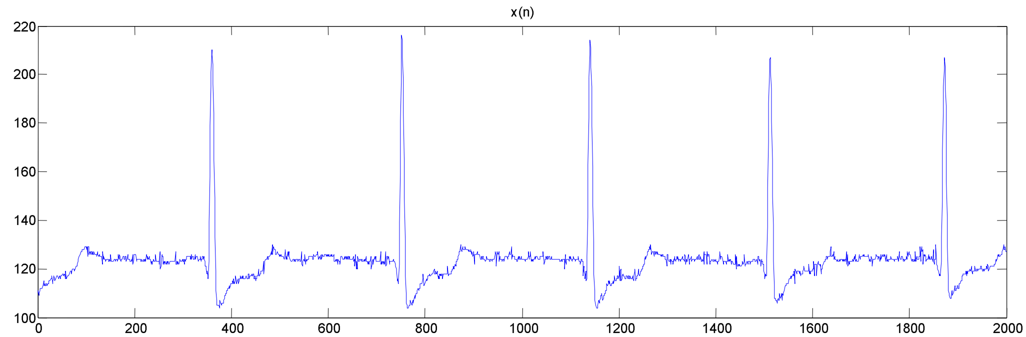
The additional file 'SAMPLE_ECG.mat' stores a sequence of Electrocardiography, an interpretation of the electrical activity of the heart over a period of time.

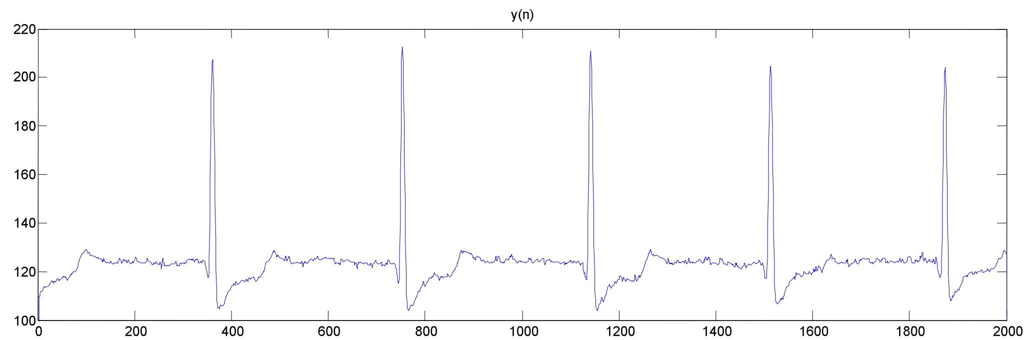
3.1) Load and Plot the signal. Call this signal x(n)

3.2) Using for loop, write a program that creates an output y(n) where

$$y(n) = \frac{x(n) + x(n+1) + x(n+2)}{3}$$

3.3) Plot both x(n) and y(n) in a same figure using the subplot command. The vertical axis varies from 100 to 200 and the horizontal axis varies from 0 to 2000 for both plots. Hint: use the command axis([0 2000 100 220]). Your figure should look similar to the following: (remember to put titles for each plots)





3.4) Does y(n) look smoother than x(n)? You have just filtered the original signal using a low-pass filter. The filter is supposed to remove high frequency components of the signal.

Read:

a) Direct form-II implementation of a standard difference equation.
b) Convolution of two discrete-time signals.
c) Nyquist theorem