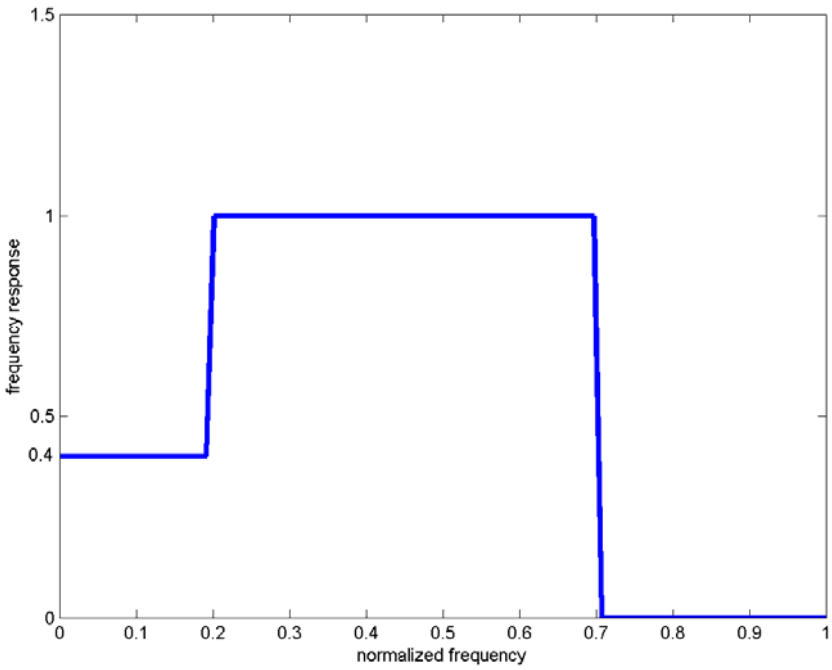
In The Name of God
Sharif University of Technology
Department of Computer Engineering

Signals & Systems – CE 242
Spring 2006
Computer Assignment 4
Due Date: 85/4/13

1. Choose a piece of an audio signal with large enough samples (typically more than 500000).
   a. Plot the magnitude of its FT. Note that frequency axis should be indexed with appropriate values with respect to sampling frequency.
   b. Determine the range of frequency for which the content of signal is significant.
   c. Eliminate the portion of the signal spectrum which is corresponding to the frequencies above 8 KHz. Then convert the signal to audio and listen to it and explain the difference.
   d. Add a Gaussian noise with zero mean and variance equal to 0.3 to the original signal.
   e. Plot the magnitude of FT of noisy signal and compare with part a.
   f. Regarding result of part e, explain the effect of noise.
   g. Convert the noisy signal to audio signal and listen to it.

2.
   a. Design a discrete-time low pass filter with $\omega_c = \frac{\pi}{10}$ using Butterworth, Chebyshev I and Elliptic approaches with 7 samples.
   b. Plot the impulse response of designed filters.
   c. Plot the frequency response of designed filters using “freqz” command.
   d. Filter the signal of Q.1 (part a) using designed filters and convert them to audio signals. Listen and explain.
   e. Plot the spectrum (frequency content) of filtered signals.

3.
   a. Design a 12-tap filter to realize the following frequency pattern using Parks-McClellan algorithm.
   b. Plot the impulse response and frequency response of designed filter.
   c. Compare the frequency response of designed filter with that of desired pattern.
   d. Now change the order of filter to 20 and redo previous parts.



Good Luck.
Mohammad Sadegh Talebi