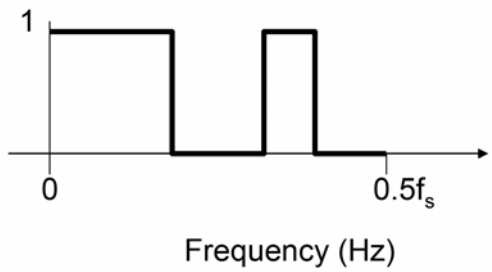
EE432 Fall 07 Lesson 30 In-Class Activity

Custom Filters: suppose you wish to create a frequency filter that has a magnitude response that looks like this:



Lets try to use a 12 point DFT, so that the vector M=[1 1 1 1 0 0 0 1 1 0 0 0] closely approximates this. Remember that the leftmost point represents 0 Hz, and the rightmost represents 0.5 * f_s. What kind of filter is this? Let's create this custom filter and find an impulse response in MATLAB that might give us the desired frequency response.

Perform the following steps.

1. Create the magnitude vector M, and let the phase vector be all zeros, the same size as M.
2. Convert the magnitude and phase vectors to real and imaginary component vectors (ReX and ImX), so you can use your inverse DFT function.
3. Take the inverse DFT of ReX and ImX. This yields an aliased impulse response h[n].
4. Shift this impulse response to the right (using your *delay* function) by 10.
5. Multiply this by a Blackman or Hamming window of the same size.
6. Append 300 zeros to the windowed, time-shifted impulse response of step 5.
7. Take the DFT of this zero-padded, windowed, and time-shifted h[n].
8. Stem plot the magnitude of the DFT. Does it have the shape of the desired frequency response?
9. Improve your result by starting with an M vector that has more points (e.g., try doubling the number of zeros and ones that appear), then start over at step 1.
10. You can also experiment by varying the amount of shift in step 4.