EECS 360
Homework #15

1. Section 6.17 Participation Activities
   6.17.2: Computing a DFT.
   6.17.3: DFT of a finite sequence.
   6.17.4: DFT of a finite sequence, without zero-padding.
   6.17.5: Discrete Fourier transforms.
   6.17.6: Cyclic convolution, graphical and textual methods.
   6.17.7: DFT and convolution.
2. Section 6.17 Challenge Activity
   6.17.1: Discrete Fourier transform (DFT)
3. Exercise 6.17.1
4. Exercise 6.17.3
5. Section 6.18 Participation Activities
   6.18.1: Data window properties.
   6.18.2: Data window equations.
   6.18.4: Cosine signal spectra with rectangular and Hamming data windows.
   6.18.5: Rectangular and Hamming data windows reveal presence of cosine signal components.
   6.18.6: Rectangular and Hamming data windows with a small-magnitude cosine signal.
6. Section 6.18 Challenge Activity
   6.18.1: Data windows
7. Section 6.19 Participation Activities
   6.19.1: Padding data arrays for the FFT.
   6.19.3: FFT and lowpass filtering.
   6.19.4: Filtering via thresholding.
8. Exercise 6.19.3 a
9. Section 6.20 Participation Activities
   6.20.1: Discrete filter terminology.
   6.20.2: Lowpass filter designed by windowing.
   6.20.4: Window design of FIR differentiator, with rectangular window.
10. Section 6.21 Participation Activities
    6.21.5: IIR filter design..
11. Let $x(t) = \cos(2\pi 1000t)$ be sampled at 64000 samples/sec.
    a. For a record length of 2ms find the DFT of x[n] and plot |DFT[x[n]]|
    b. For a record length of 2.343ms find the DFT of x[n] and plot |DFT[x[n]]|
    c. What is Δf in parts a. and b. above.
    d. Explain the difference between the results in parts a. and b. above.
12. Let $x(t) = \mathrm{tri}\left(\frac{t-0.001}{0.001}\right)$ be sampled at 64000 samples/sec.
    a. For a record length of 2ms find the DFT of x[n] and plot |DFT[x[n]]| from $0<f<2$kHz.
    b. For a record length of 20 ms find the DFT of x[n] and plot |DFT[x[n]]| from $0<f<2$kHz.
    c. Explain the difference between the results in parts a. and b. above.
13. Let h[n] = {5, 4, 3, 2, 1} and x[n] = {1, 2, 3, 4, 3 ,2 ,1}, use FFT algorithm to find the linear convolution of h[n] and x[n]. Check your result.
14. Use the Discrete Fourier Transform of a Two-Tone Signal to answer the following questions. Set the noise amplitude to 0.1 for this problem. Note the frequency of the fix tone is 770 Hz and the sample rate is 8000 samples/sec. Use the dBV scale.

    a. For N = 512 what is the record length and Δf.

    b. Set the sine frequency = 1000 and the sine amplitude =0.5. Describe and explain the change as N changes from 512 to 1024 to 4096.

c. Set the sine frequency = 1000 and the sine amplitude =0.5 and N=512. Describe and explain the change as the window is changed from rect to Hanning to Blackman.