Exercises Week 8

DSP

1. Compute the circular convolution of the two signals:

$$x_1[n] = [1, 3, 1, 3]$$

$$x_2[n] = [2, 2, 5, 5]$$

2. Compute the circular convolution in $N = 7$ points of the same two signals (i.e. append zeros to make length 7, then do circular convolution)

3. Consider a periodic signal $x[n]$ with period $N = 6$ and the DFT coefficients:

   X_k = [21.0000 + 0.0000i , -3.0000 + 5.1962i , -3.0000 + 1.7321i , -3.0000 + 0.0000i , -3.0000 - 1.7321i , -3.0000 - 5.1962i]

   Write $x[n]$ as a sum of sinusoids.

4. Consider a periodic signal $x[n]$ with period $N = 5$ and the DFT coefficients:

   X_k = [15.0000 + 0.0000i , -2.5000 + 3.4410i , -2.5000 + 0.8123i , -2.5000 - 0.8123i , -2.5000 - 3.4410i]

   Write $x[n]$ as a sum of sinusoids.

5. Find the DFT coefficients of the periodic signal with period $\{1, 1, 0, 0\}$, and write the signal as a sum of sinusoidal components.

6. Write the DFT calculation in Ex.5 as a matrix multiplication.

7. Compute $x[n]$ in Ex.3 and Ex.4, in two ways:

   - using the definition formula
   - using the matrix form