Tutorial 5 EE4C5

Q1

Prove the following properties of the DFT from lecture 12:

a. Circular shift property
b. Circular convolution property
c. Multiplication property

Q2

Compute the N-point DFT of each of the following sequences:

a. $x_1[n] = \delta[n]$
b. $x_2[n] = \delta[n - n_0]$ where $0 < n_0 < N$
c. $x_3[n] = \alpha^n$
d. $x_4[n] = u[n] - u[n - n_0]$ where $0 < n_0 < N$

Q3

Find the 10-point inverse DFT of:

$$X[k] = \begin{cases} 3, & k = 0 \\ 1, & 1 \leq k \leq 9 \end{cases}$$

Q4.

Consider the finite-length sequence:

$$x[n] = \delta[n] + 2\delta[n - 5]$$

a. Find the 10-point discrete Fourier transform of $x[n]$
b. Find the sequence that has a discrete Fourier transform $Y[k] = e^{j2k\frac{2\pi}{10}}$

Q5

Find the circular convolution of the following sequences using the concentric circle method.

$$x[n] = \{2,1,2,1\} \text{ and } y[n] = \{1,2,3,4\}$$

Q6

Consider the sequence:

$$x[n] = \delta[n] + 2\delta[n - 2] + \delta[n - 3]$$

a. Find $y[n]$, the 4-point circular convolution of $x[n]$ with itself.
b. If $h[n] = \delta[n] + \delta[n - 1] + 2\delta[n - 3]$ find the four-point circular convolution of $x[n]$ with $h[n]$