

## Introduction to DSP: Systems - Assignment: Discrete Fourier Transform

1. Determine the circular convolution of the sequences.

$$x_1[n] = \{1, 2, 3, -1\} \quad \text{and} \quad x_2[n] = \{1, -1, 0, 2, 1\}$$

The first element of the sequences correspond to  $x_1[0]$  and  $x_2[0]$ .

2. Using the eight 8-point DFT of the following sequence,

$$x[n] = \begin{cases} 1, & 0 \leq n < 2 \\ 0, & 2 \leq n < 8 \end{cases}$$

compute the DFT of the following signals,

$$(a) \quad x_1[n] = \begin{cases} 2, & 0 \leq n < 2 \\ 0, & 2 \leq n < 6 \\ -1, & 6 \leq n < 8 \end{cases}$$

$$(b) \quad x_2[n] = \begin{cases} 1, & n = 0 \\ 2, & n = 1 \\ 1, & n = 2 \\ 0, & 3 \leq n < 8 \end{cases}$$

3. Compute the energy of the  $N$ -point sequence,

$$x[n] = \cos\left(\frac{2\pi k_0}{N}n\right), \quad 0 \leq n < N-1$$