EC5.201 – Signal Processing – Quiz 2

Q1. [5 marks] Consider the length 5 signal $x[n] = \{\underset{\uparrow}{0}, 1, 2, 2, 1\}$. Find the 5-point discrete Fourier transform (DFT) of this signal. Obtain a simplified expression and show that it is real valued.

Q2. [5 marks] Consider the length 4 signal $x[n] = \{\underset{\uparrow}{1}, 1, -1, -1\}$. Find the 4-point DFT of this signal using the Radix-2 decimation in time FFT algorithm. Show all the steps and intermediate computations.

Q3. [5 marks] A signal $x[n]$ has length N. Two distinct signals of length $2N$ are created using $x[n]$ as follows:

(a) the signal $y_1[n]$ is obtained by padding N zeros to $x[n]$,

(b) the signal $y_2[n]$ is obtained by appending a copy of $x[n]$ to itself.

Let $Y_1[k]$ and $Y_2[k]$ be the $2N$-length DFT of $y_1[n]$ and $y_2[n]$ respectively. Express $Y_2[k]$ in terms of $Y_1[k]$.

Q4. [5 marks] Find the Z transform of the signal $(\frac{1}{2})^n \sin(\frac{\pi}{2}n)u[n]$ and plot its region of convergence and the location of its poles and zeros.