Problem 1. Consider the finite-duration signal $x[n] = \{1, 2, 3, 1\}$

(a) Compute its four-point DFT by solving explicitly the 4-by-4 system of linear equations defined by the inverse DFT formula.

(b) Check the answer in part (a) by computing the four-point DFT, using its definition.


Problem 3. Suppose we have two four-point sequences $x[n]$ and $h[n]$ as follows

$$x[n] = \cos\left(\frac{n\pi}{2}\right) \quad n = 0, 1, 2, 3$$

$$h[n] = 2^n \quad n = 0, 1, 2, 3$$

(a) Calculate the four-point DFT $X[k]$.

(b) Calculate the four-point DFT $H[k]$.

(c) Calculate $y[n] = x[n] \circ_4 h[n]$ by doing the circular convolution directly.

(d) Calculate $y[n]$ in part (c) by multiplying the DFTs of $x[n]$ and $h[n]$ and performing an inverse DFT.


Evaluate the following without computing the inverse DFT of $X$. Justify your answers.

(a) Determine the remaining values of $X[k]$.

(b) $x[0]$

(c) $x[7]$

(d) $\sum_{n=0}^{13} x[n]$

(e) $\sum_{n=0}^{13} x[n]e^{\frac{4\pi j n}{14}}$

(f) $\sum_{n=0}^{13} |x[n]|^2$