ASSIGNMENT2 QUESTION4

4. (a) Compute the convolution $\langle 1, \underbrace{0, 0, \ldots, 0}_{k}, 1\rangle * \langle 1, \underbrace{0, 0, \ldots, 0}_{k}, 1\rangle$ (10 pts)

(b) Compute the DFT of the sequence $\langle 1, \underbrace{0, 0, \ldots, 0}_{k}, 1\rangle$ (10 pts)

Answer:

(a).For $seq = \langle 1, k\ number\ of\ zeros, 1\rangle$ the associated polynomial is $S(x) = 1 + x^{k+1}$; thus the convolution of itself are the coefficients of the polynomial $S^2(x) = (1 + x^{k+1})^2 = x^{2k+2} + 2x^{k+1} + 1$.

$So\ we\ get\ \langle 1, k\ number\ of\ zeros, 2, k\ number\ of\ zeros, 1\rangle$

(b) For $seq = \langle 1, k\ number\ of\ zeros, 1\rangle$ the associated polynomial is $S(x) = 1 + x^{k+1}$.

$$DFT(s) = \left\langle P_s(\omega_{k+2}^{0}), P_s(\omega_{k+2}^{1}), \cdots P_s\left(\omega_{k+2}^{k+1}\right)\right\rangle$$

$$= \langle 1 + \omega_{k+2}^{0\cdot(k+1)}, 1 + \omega_{k+2}^{1\cdot(k+1)}, \cdots, 1 + \omega_{k+2}^{(k+1)\cdot(k+1)}\rangle$$

$$= \langle 2, 1 + \omega_{k+2}^{k+1}, 1 + \omega_{k+2}^{2(k+1)}, \cdots, 1 + \omega_{k+2}^{(k+1)^2}\rangle$$