z5242692

Chenqu Zhao

COMP9101 (T2-2020)

Homework 2 – Q4

(a) According to the definition of linear convolution of two sequences, we form the polynomial $P(x) = 1 + x^{k+1}$. Simply square it by brute force since that the degree of the polynomial is small: $\left(P(x)\right)^2 = 1 + 2x^{k+1} + x^{2k+2}$.

Therefore, linear convolution of these two sequences is

$\langle 1,0,0, \dots ,0(k\ times),1\rangle \ * \ \langle 1,0,0, \dots ,0(k\ times),1\rangle$

$= \langle 1,0,0, \dots ,0(k\ times),2,0,0, \dots ,0(k\ times),1\rangle$

(b) Recall the computed polynomial $P(x) = 1 + x^{k+1}$. Consequently, the DFT is equal to:

$$\left\langle 1 + 1, 1 + (\omega_{k+2}^{0})^{k+1}, 1 + (\omega_{k+2}^{1})^{k+1}, \ldots, 1 + \left(\omega_{k+2}^{k+1}\right)^{k+1} \right\rangle$$

$$= \left\langle 2, 1 + \omega_{k+2}^{k+1}, 1 + \omega_{k+2}^{k}, \ldots, 1 + \omega_{k+2}^{1} \right\rangle$$