Exercício 2.3/4: Usando as expressões

$$X_k = (x, E_k) = \sum_{m=0}^{N-1} x_n e^{-i2\pi \cdot k \frac{n}{N}} \quad (DFT)$$

$$\underbrace{}_{E_k}$$

$$x = \frac{1}{N} \sum_{k=0}^{N-1} X_k E_k \quad (IDFT)$$

Calcule a DFT do vetor $y = (1, 2, 0, -1)$
$k\{0, 1, 2, 3\}$ $N = 4$

$k = 0$

$$X_0 = Y_0 \overline{E_0}(0) + Y_1 \overline{E_0}(1) + Y_2 \overline{E_0}(2) + Y_3 \overline{E_0}(3)$$

$$= 1 \cdot 1 \quad + 2 \cdot 1 \quad + 0 \cdot 1 \quad + (-1) \cdot 1$$

$$= 2$$

$k = 1$

$$X_1 = Y_0 \overline{E_1}(0) + Y_1 \overline{E_1}(1) + Y_2 \overline{E_1}(2) + Y_3 \overline{E_1}(3)$$

$$= 1 \cdot 1 \quad + 2 \cdot (-i) + 0 + (-1)(i)$$

$$= 1 - 3i$$

$k = 2$

$$X_2 = Y_0 \overline{E_2}(0) + Y_1 \overline{E_2}(1) + Y_2 \overline{E_2}(2) + Y_3 \overline{E_2}(3)$$

$$= 1 \cdot 1 + 2(-1) + 0 + (-1)(-1)$$

$$= 0$$

$k = 3$

$$X_3 = Y_0 \overline{E_3}(0) + Y_1 \overline{E_3}(1) + Y_2 \overline{E_3}(2) + Y_3 \overline{E_3}(3)$$

$$= 1 \cdot 1 + 2 \cdot (i) + 0 + (-1) \cdot (-i)$$

$$= 1 + 3i$$

$$X_n = (2, 1-3i, 0, 1+3i)$$

$$E_{4,0} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \quad \overline{E_{4,0}} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$$

$$E_{4,1} = \begin{bmatrix} 1 \\ i \\ -1 \\ -i \end{bmatrix} \quad \overline{E_{4,1}} = \begin{bmatrix} 1 \\ -i \\ -1 \\ +i \end{bmatrix}$$

$$E_{4,2} = \begin{bmatrix} 1 \\ -1 \\ 1 \\ -1 \end{bmatrix} \quad \overline{E_{4,2}} = \begin{bmatrix} 1 \\ -1 \\ 1 \\ -1 \end{bmatrix}$$

$$E_{4,3} = \begin{bmatrix} 1 \\ -i \\ -1 \\ +i \end{bmatrix} \quad \overline{E_{4,3}} = \begin{bmatrix} 1 \\ i \\ -1 \\ -i \end{bmatrix}$$

CALCULE A IDFT DO VETOR $W = (3, 1+i, 1, 1-i)$

$K = (0, 1, 2, 3)$ $N = 4$

$K = 0$

$$x_0 = (W_0 E_0(0) + W_1 E_0(1) + W_2 E_0(2) + W_3 E_0(3))/N$$

$$= (3 + (1+i) + 1 + 1-i)/4$$

$$= 6/4 = \frac{3}{2} = 1.5$$

$K = 1$

$$x_1 = (W_0 E_1(0) + W_1 E_1(1) + W_2 E_1(2) + W_3 E_1(3))/N$$

$$= (3 + i - 1 - 1 - i - 1)/4$$

$$= 0$$

$K = 2$

$$x_2 = (W_0 E_2(0) + W_1 E_2(1) + W_2 E_2(2) + W_3 E_2(3))/N$$

$$= (3 - 1 - i + 1 - 1 + i)/4$$

$$= \frac{2}{4} = 0.5$$

$K = 3$

$$x_3 = (W_0 E_3(0) + W_1 E_3(1) + W_2 E_3(2) + W_3 E_3(3))/N$$

$$= (3 - i + 1 - 1 + i + 1)/4$$

$$= \frac{4}{4} = 1$$

$$x_n = (1.5, 0, 0.5, 1)$$