

Q3]

$$a) \quad x(n) = \{1, 2, 3, 4\}$$

we know that

$$x(k) = (W_N^{nk}) \cdot x(n)$$

Thus

DFT \rightarrow

$$X_4 = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -j & -1 & j \\ 1 & -1 & 1 & -1 \\ 1 & j & -1 & -j \end{bmatrix} \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$

$$= \begin{bmatrix} 1+2+3+4 \\ 1-2j-3+4j \\ 1-2+3-4 \\ 1+2j-3-4j \end{bmatrix} = \begin{bmatrix} 10 \\ -2+2j \\ -2 \\ -2-2j \end{bmatrix}$$

IDFT

$$X_4 = \frac{1}{4} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & j & -1 & j \\ 1 & -1 & 1 & -1 \\ 1 & j & -1 & -j \end{bmatrix} \begin{bmatrix} 10 \\ -2+2j \\ -2 \\ -2-2j \end{bmatrix}$$

$$= \frac{1}{4} \begin{bmatrix} 10-2+2j-2-2-2j \\ 10-2j+2j^2+2+2j+2j^2 \\ 10+2-2j-2+2+2j \\ 10-2j-2j^2+2-2j-2j^2 \end{bmatrix}$$

Rebecca Dias
BEA (19)

Rebecca Dias
(19)
BEA

$$= \frac{1}{4} \begin{bmatrix} 10 - 2 + 2j - 2 - 2 - 2j \\ 10 - 2j - 2 + 2 + 2j - 2 \\ 10 + 2 - 2j - 2 + 2 + 2j \\ 10 + 2j + 2 + 2 - 2j + 2 \end{bmatrix}$$

$$= \frac{1}{4} \begin{bmatrix} 4 \\ 8 \\ 12 \\ 16 \end{bmatrix}$$

$$= \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$

$$\begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix} = \begin{bmatrix} 1 + 2 + 3 + 4 \\ 1 + 2 - 3 - 4 \\ 1 - 2 + 3 - 4 \\ 1 - 2 - 3 + 4 \end{bmatrix}$$

$$\begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix} = \frac{1}{4} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix}$$