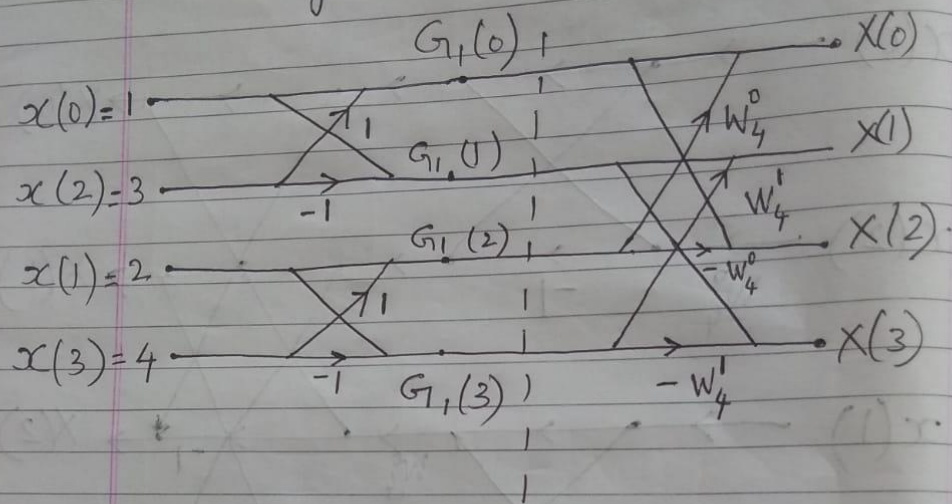


Use DIT-FFT algorithm.

Stage 1.



Stage 1

$$G_1(0) = x(0) + x(2) = 1 + 3 = 4$$

$$G_1(1) = x(0) - x(2) = 1 - 3 = -2$$

$$G_1(2) = x(1) + x(3) = 2 + 4 = 6$$

$$G_1(3) = x(1) - x(3) = 2 - 4 = -2$$

Stage 2

$$X(0) = G_1(0) + W_4^0 G_1(2) = 4 + 1(6) = 10$$

$$X(1) = G_1(1) + W_4^1 G_1(3) = -2 + (-j)(-2) = -2 + j2$$

$$X(2) = G_1(0) - W_4^0 G_1(2) = 4 - 1(6) = -2$$

$$X(3) = G_1(1) - W_4^1 G_1(3) = -2 - (-j)(-2) = -2 - j2$$

$$\therefore X(k) = \{10, -2 + j2, -2, -2 - j2\}$$

By Matrix method,

$$X(k) = [W_4]_{4 \times 4} x(n)$$

$$\therefore X(k) = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -j & -1 & j \\ 1 & -1 & 1 & -1 \\ 1 & j & -1 & -j \end{bmatrix} \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$

$$\therefore X(k) = \begin{bmatrix} 10 \\ -2 + 2j \\ -2 \\ -2 - 2j \end{bmatrix}$$

$$\therefore X(k) = \{10, -2 + 2j, -2, -2 - 2j\}$$