Multiple Choice Test

Chapter 11.05
Informal Development of Fast Fourier Transform

1. Using the definition $E = e^{-i\frac{2\pi}{N}}$, and the Euler identity $e^{\pm i\theta} = \cos(\theta) \pm i\sin(\theta)$, the value of $E^{\frac{N}{6}}$ can be computed as
   (A) $0.866 - 0.5i$
   (B) $-0.866 + 0.5i$
   (C) $-0.5 - 0.866i$
   (D) $0.5 - 0.866i$

2. Using the definition $E = e^{-i\frac{2\pi}{N}}$, and the Euler identity $e^{\pm i\theta} = \cos(\theta) \pm i\sin(\theta)$, the value of E^{6N} can be computed as
   (A) $1 + i$
   (B) $1 - i$
   (C) 1
   (D) -1

3. Given $N = 2$, and $\{f\} = \begin{Bmatrix} f(0) \\ f(1) \end{Bmatrix} = \begin{Bmatrix} 14 + 6i \\ -2 + 4i \end{Bmatrix}$. The first part of $\widetilde{C}_n = \widetilde{C}(n) = \sum_{k=0}^{N-1} f(k)E^{nk}$ can be expressed as

$$\widetilde{C}(0) = \sum_{k=0}^{1} f(k)E^{nk} = f(0)E^{(0)(0)} + f(1)E^{(0)(1)}$$

$$\widetilde{C}(1) = f(0)E^{(1)(0)} + f(1)E^{(1)(1)}$$

The values for $\begin{Bmatrix} \widetilde{C}(0) \\ \widetilde{C}(1) \end{Bmatrix}$ can be computed as

   (A) $\begin{Bmatrix} 12 + 10i \\ 16 + 2i \end{Bmatrix}$
   (B) $\begin{Bmatrix} 10 + 12i \\ 2 + 16i \end{Bmatrix}$
   (C) $\begin{Bmatrix} -12 + 10i \\ -16 + 2i \end{Bmatrix}$
   (D) $\begin{Bmatrix} 10 - 12i \\ 2 - 16i \end{Bmatrix}$

4. For $N = 2^4 = 16$, level $L = 2$ and referring to Figure 1, the only terms of vector $f_2(-)$ which only need to be computed are:

   (A) $f_2(4-7, 12-15)$
   (B) $f_2(0-3, 8-11)$
   (C) $f_2(0-7)$
   (D) $f_2(8-15)$

5. For $N = 2^4 = 16$, level $L = 3$ and referring to the Figure 1, the only companion nodes associated with $f_3(0)$ and $f_3(1)$ are

   (A) $f_3(4)$ and $f_3(5)$
   (B) $f_3(6)$ and $f_3(7)$
   (C) $f_3(14)$ and $f_3(15)$
   (D) $f_3(2)$ and $f_3(3)$

6. Given $N = 4$, and

$$f_0\begin{pmatrix}0\\1\\2\\3\end{pmatrix} = \begin{Bmatrix}-4+i\\1-2i\\-2+3i\\3-4i\end{Bmatrix}.$$

   Corresponding to level $L = 1$, one can compute $f_1(2)$ as

   (A) $-2-2i$
   (B) $4-6i$
   (C) $4+6i$
   (D) $-4-4i$

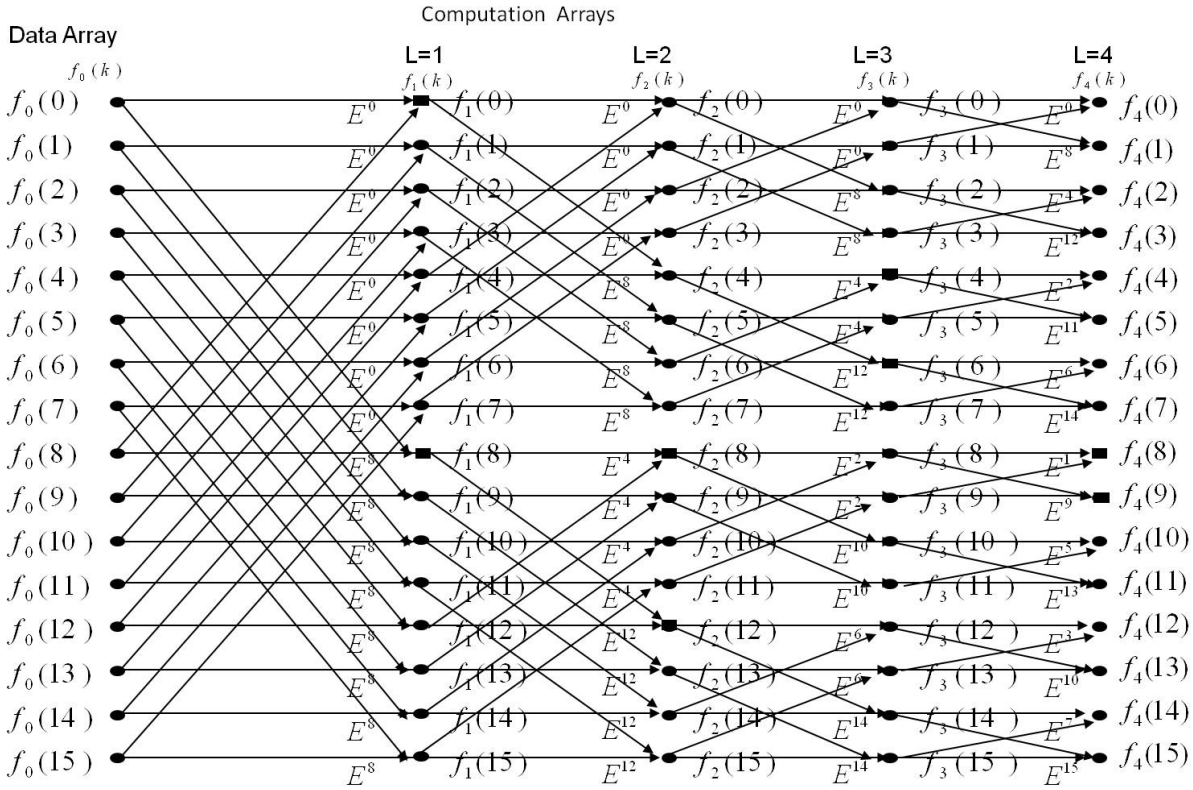

Figure 1: Figure referring to Question 4&5