GATE ASSIGNMENT 4

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Download all python codes from

https://github.com/Ananthoju−Pranav−Sai/EE3900/blob/main/Gate_Assignment_2/codes

and latex-tikz codes from

https://github.com/Ananthoju−Pranav−Sai/EE3900/tree/main/Gate_Assignment_2/Gate_Assignment_2.tex

1 GATE EC 2010 Q.16

For an N-point FFT Algorithm with N = 2^m which one of the following statements is TRUE ?

A It is not possible to construct a signal flow graph with both input and output in normal order

B The number of butterflies in the m^{th} stage in N/m

C In-place computation requires storage of only 2N node data

D computation of a butterfly requires only one complex multiplication.

2 Solution

The FFT algorithm decomposes the DFT into $\log_2 N$ stages, each of which consists of N/2 butterfly computations.
Each butterfly computes 2 complex numbers p+αq and $p - \alpha q$ where α is a complex number.

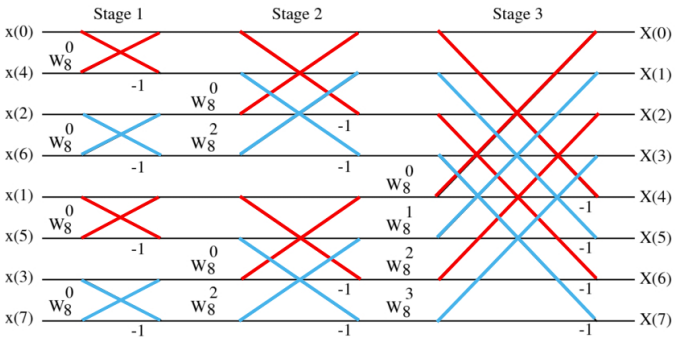

Fig. 4: Signal flow graph representing butterflies for m=3

Option	Explanation
A	It is possible to construct a signal flow graph with both input and output in normal order as shown in the figure below.
B	The number of butterflies in any stage is N/2
C	There are $\log_2 N$ stages and each stage consists of N/2 butterflies and each butterfly consists 2 nodes. So computation requires storage $N \log_2 N$ node data
D	Computation of butterfly requires only one complex multiplication and 2 complex addition.

TABLE 4: Option explanations

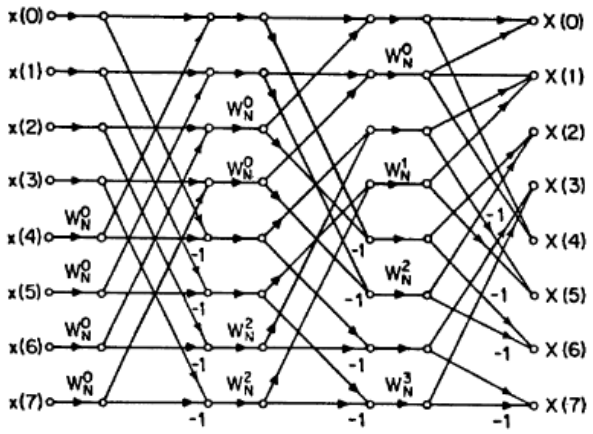

Fig. 4: Signal flow graph with both input and output in normal order for m=3
Source : Oppenheim and Schafer