continued from last day....

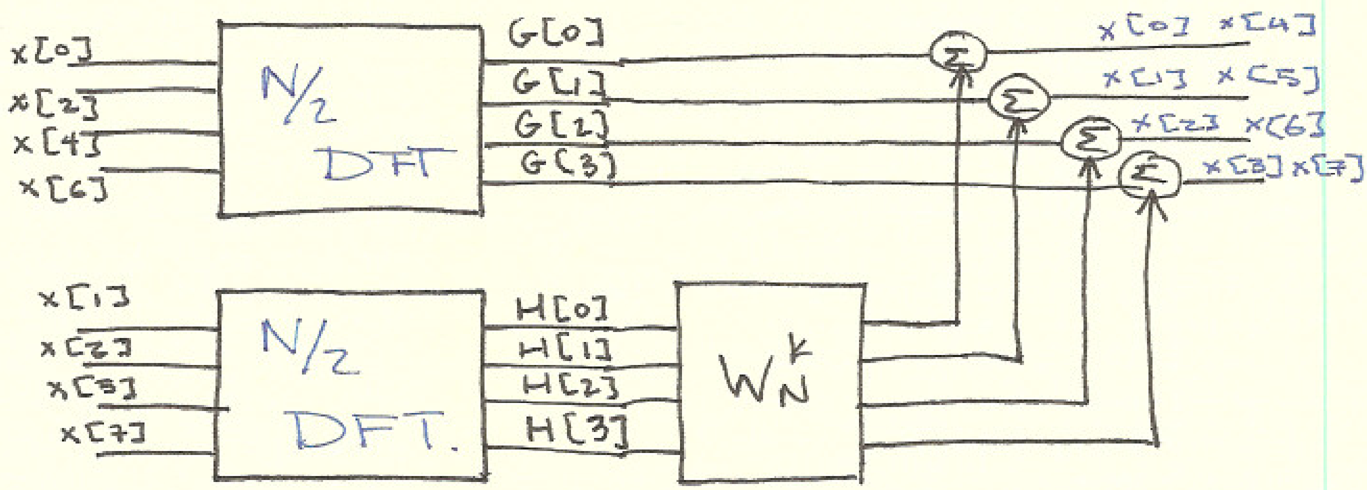
Total number of complex multiplications

$$2\left(\frac{N}{2} \times \frac{N}{2}\right) + N$$

For N point DFT direct computation total number of multiplyeations is N^2

Hence if $N > 2$, the total number of computations is reduced.

Let $N = 8$; that means 8 pt DFT computation.



This process can be continued until we have N, 1 point DFT sequence.

Refference fig. 9.4; 9.5; 9.7; 9.10

Figure 9.7 is sometimes known as the Butterfly computation.

Comparison of multiplication

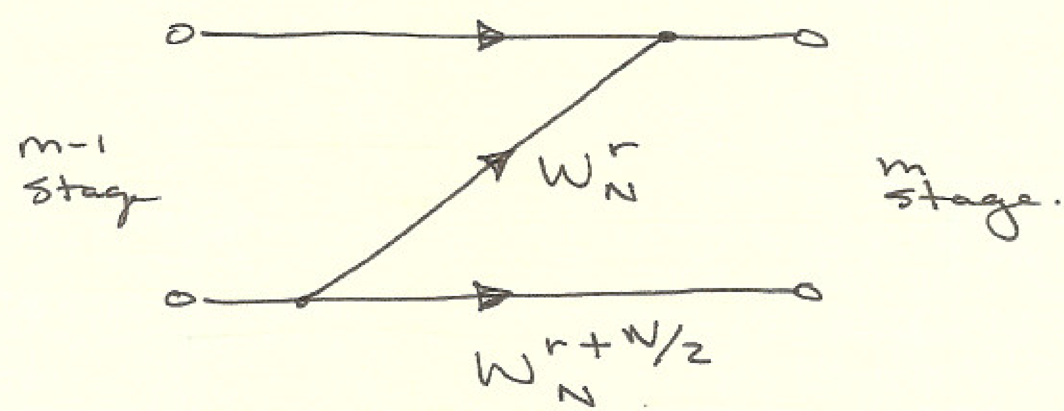
$$N = 2^d$$

$$d = \log_2 N$$

Then there are a total of d stages. The total number of multiplications is Nd.

For direct computation it is N^2

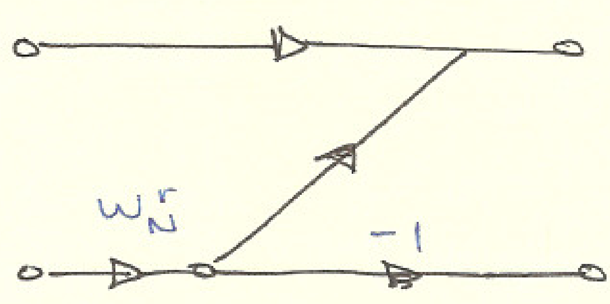
Basic structure of fig 9.7 is a follows.



$$W_N^{r+N/2} = W_N^r \, W_N^{N/2}$$

$$= W_N^r \cdot e^{-j\frac{2\pi}{N}\cdot N/2}$$

$$= -W_N^r$$



The sequence is fig. 9.10 is in bit reversal order

b_2	b_1	b_0	b_0	b_1	b_2
0	0	0	0	0	0
0	0	1	1	0	0
0	1	0	0	1	0
0	1	1	1	1	0
1	0	0	0	0	1
1	0	1	1	0	1
1	1	0	0	1	1
1	1	1	1	1	1

o/p. i/p

Declinction of in freq (DIF) FFT.

In this case $X[k]$ will be divided into smaller sequences in the same manner as DIT-FFT.

$$X[k] = \sum_{n=0}^{N-1} x[n] W_N^{kn}$$

$$X[2r] = \sum_{n=0}^{N-1} x[n] W_N^{2rn}$$

$$0 \le r \le \frac{N}{2} - 1$$

Check figures 9.17 → 9.19 from text for diagrams.

★ Only need to know DIT-FFT 8 pt for the exam.

IDFT Computation.

(DIT-FFT) algorithm.

$$x[n] = \frac{1}{N} \sum_{k=0}^{N-1} X[k]\, W_N^{-kn}$$

$$= \frac{x'[n]}{N}$$

Basic structure for IDFT