પુરવણી નંબર : ______ બેઠક નંબર : ______ નિરીક્ષકની સહી : ______

અંહીયાથી લખાણ શરૂ કરો.

8-point Decimation in time fast Fourier Algorithm

In DFT :- $X(k) = \sum_{n=0}^{N-1} x(n)\, e^{-j\frac{2\pi}{N}kn}$

in order to obtain FFT,
we divide this into odd and even numbers

$$\therefore X(k) = \underbrace{\sum_{m=0}^{\frac{N}{2}-1} x(2m)\, e^{-j\frac{2\pi}{N}k(2m)}}_{\text{Even Samples}} + \underbrace{\sum_{m=0}^{\frac{N}{2}-1} x(2m+1)\, e^{-j\frac{2\pi}{N}k(2m+1)}}_{\text{odd-samples}}$$

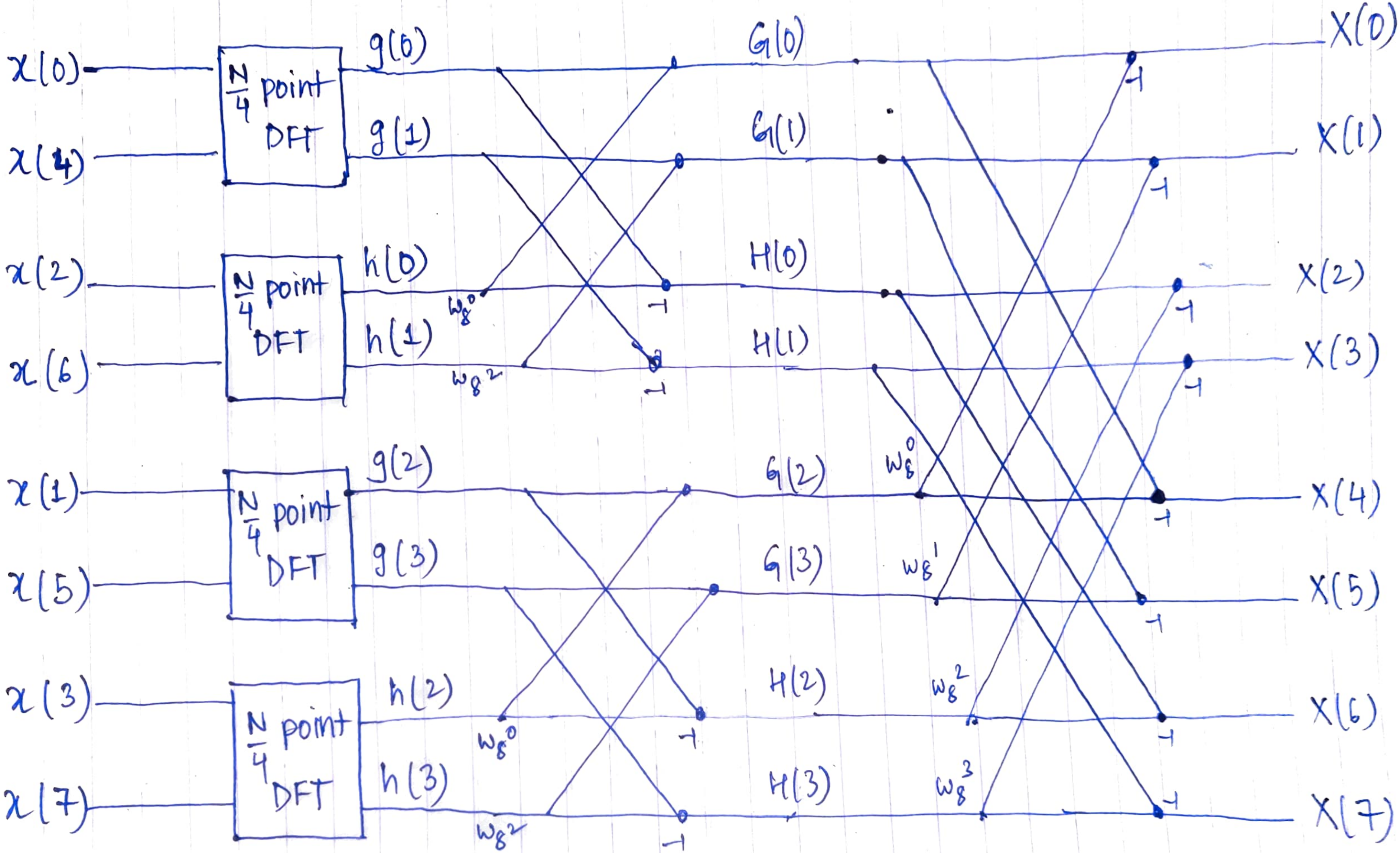
$$= \sum_{m=0}^{\frac{N}{2}-1} x(2m)\, e^{-j\frac{2\pi km}{N/2}} + \sum_{m=0}^{\frac{N}{2}-1} x(2m+1)\, e^{-j\frac{2\pi mk}{N/2}} \cdot \underbrace{e^{-j\frac{2\pi k}{N}}}_{\text{constant}}$$

$$= \underbrace{\sum_{m=0}^{\frac{N}{2}-1} x(2m)\, e^{-j\frac{2\pi km}{N/2}}}_{\frac{N}{2}\text{ point DFT}} + \underbrace{e^{-j\frac{2\pi k}{N}}}_{\text{twiddle factor }(W_N^k)} \underbrace{\sum_{m=0}^{\frac{N}{2}-1} x(2m+1)\, e^{-j\frac{2\pi mk}{N/2}}}_{\frac{N}{2}\text{ point DFT}}$$

but Here we want a 8-point Decimation
So we will consider N/4 point DFT

$$\boxed{\therefore X(k) = \left\{\frac{N}{4}\text{point DFT} + W_{\frac{N}{2}}^{k}\left[\frac{N}{4}\text{point DFT}\right]\right\} + W_N^k\left\{\frac{N}{4}\text{point DFT} + W_{\frac{N}{2}}^{k}\left[\frac{N}{4}\text{point DFT}\right]\right.}$$

final butterfly structure



Now the Computational Complexity for DFT will be a.) N^2 for Complex Multiplication
b.) $N(N-1)$ for Complex addition

And the Computational Complexity for FFT will be a.) $\frac{N}{2}\log_2 N$ for complex multiplication

b.) $N \log N$ for Complex addition

So we can say FFT is much faster that DFT when it comes to computational Complexity

Now I have Used a table to justify it will Values for DFT & FFT multiplication. (and also have indicated the ratio.

	N	DFT (N^2)	FFT ($\frac{N}{2}\log_2 N$)	Ratio
1.]	2	4	1	4:1
2.]	4	16	4	4:1
3.]	8	64	12	
4.]	64	4096	192	
5.]	1024	1048576	5120	