Q7

Sol. DFT uses recussive function.

For an array of ~~size~~ size $n = 2^m$

DFT of n size array = DFT of $\frac{n}{2}$ size array

+ number x DFT of $\frac{n}{2}$ size array

At this step,

No. of operations are ~~n~~ $\frac{n}{2}$ (Fo

$\frac{n}{2}$ (For multiply a number W^{q}_{x} with each member of ~~$\frac{n}{2}$~~ $\frac{n}{2}$ size array)

$\frac{n}{2}$ (For summing each element of 2 $\frac{n}{2}$ size array).

Total operations at this step $= \frac{n}{2} + \frac{n}{2}$

$= n$

Now, similarly to compute DFT of $\frac{n}{2}$ size array.

we need $\frac{n}{2}$ Number of operations.

But, we have to compute 2 DFT of $\frac{n}{2}$ size

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Thus, total number of operation in ~~Calculating of all need $\frac{n}{2}$ size ar~~

~~Calcu~~ calculating DFT of ~~all~~ total 2 numbers of $\frac{n}{2}$ size array $= 2 \times \frac{n}{2}$

$= n$

Similarly, to compute the DFT of $\frac{n}{4}$ size array, we need to perform $\frac{n}{4}$ numbers of operation. But we need ~~4~~ DFT of 4 $\frac{n}{4}$ size array

Thus, total numbers of operations $= 4 \times \frac{n}{4}$

$= n$

Similarly, going to ~~least~~ minium size, we need only 1 operation to perform to compute DFT of 1 size array. But we need to calculate DFT of n such 1 ~~d~~ size array. Thus, number of operations need in total $= n$.

Total of operation needed overall

$= n + n + n + \ldots m$ times

But ~~n~~ $n = 2^m \Rightarrow m = \log_2 n$

$= n + n + n + \ldots \log_2 n$ times

$= n \log_2 n$

Thus, alogrithm is $O(n \log_2 n)$