Class 7

Tuesday, January 11, 2022 9:10 PM

Complexity Analysis → Time
→ Space / Memory

1 second এ 10^8 সংখ্যক iteration/task সম্পন্ন করতে পারে।

Time Complexity Analysis

```
for(int i=0; i<n; i++)
{
    //some work
}
FINISH
```

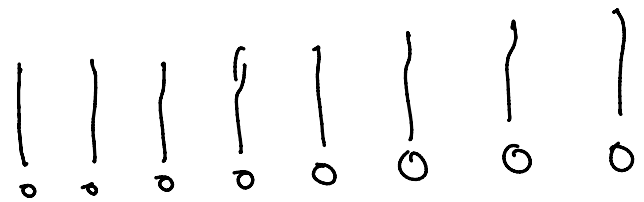
Big-O notation

O(N)

THREAD = 4

N/4

t = 1s



$O(10^5 \times N) \rightarrow O(N)$

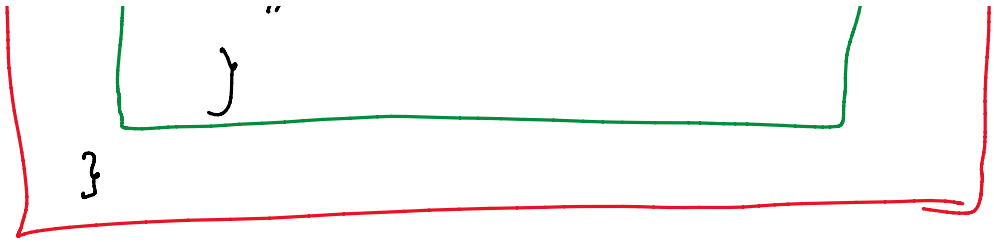
```
for(int i=0; i<n; i++)
{
    for(int j=0; j<5; j++)
    {
        //some task
    }
```

5 বার n বার

O(5N)

O(N) ✓

~~$O(N^2)$~~



$O\left(\frac{N}{10}\right) \longrightarrow O(N)$

$$O\left(\frac{5N^2}{3} \times \log(N) + 1000\right)$$

$$\approx O\left(\frac{5N^2 \log N}{3}\right)$$

$$\approx O(N^2 \log N)$$

$O(N)$

```
for(int i=1; i<n; i++)
{
    for(int j=1; j<=n; j=j*2)
    {
    } //
}
```

$O(\log_2(N))$

$O(N \log_2 N)$

$O(N)$

$O(N^2)$

$n = 1024$

$j = 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024$

$2^0, 2^1, 2^2, 2^3, \ldots, 2^k$

$2^k \leq n$

$\Rightarrow \log(2^k) \leq \log(n)$

$1 + 2 + 3 + 4 + \ldots + (n-1)$

$= \frac{n(n+1)}{2} - n = \frac{n^2+n}{2} - \frac{2n}{2}$

$= \frac{n^2+n-2n}{2}$

$= O(n^2 + n - n)$

$\Rightarrow \log(2^k) \leq \log(n)$

$\Rightarrow k \cdot \log(2) \leq \log(n)$

$\Rightarrow k \leq \frac{\log_k(n)}{\log_k(2)}$

$\log_a b = \frac{\log_k b}{\log_k a}$

$\Rightarrow k \leq \log_2(n)$

$k \leq 10$

$= O(n^2 + n - n)$

$= O(n^2)$

$n = 1024$

$\log_2(n) = 10$

$2^{10} = 1024$

$\log_a(N) = x$ $\quad a^x = N$

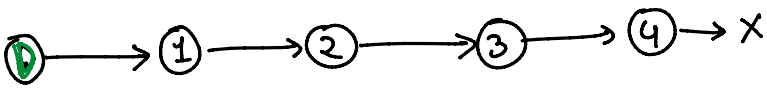
$O(n/k)$

$n = 5$

$k = 10000$

```
for(i=0; i<n; i++)
    for(j=0; j<n; j++)
    {
```

y



	LINKED LIST	ARRAY
INSERTION	O(1)	O(N)
DELETION	O(1)	O(N)
RANDOM ACCESS	O(N)	O(1)