

20.24.1 LOG N TIME

COMPLEXITY EXAMPLE 2

```
for ( $i = n; i \geq 1; i = \frac{i}{2}$ ) {  
     $c = c + 1;$   
}
```

SOLUTION

$$i = \frac{i}{2} \longrightarrow i * 2 = i \text{ or}$$

If we see by Iteration :

$$\text{iter1} \longrightarrow n \Rightarrow \frac{n}{2^0}$$

$$\text{iter2} \longrightarrow \frac{n}{2} \Rightarrow \frac{n}{2^1}$$

$$\text{iter3} \longrightarrow \frac{n}{2^2}$$

$$\text{iter4} \longrightarrow \frac{n}{2^4}$$

... ..

$$\text{itern} \longrightarrow \frac{n}{2^k}$$

*$i * 2 = i$, when $i = n$, we can write it as: $i * 2 = n$.*

$$\text{iter 1} = 1$$

$$\text{iter 2} = i * 2 = n$$

$$\text{iter 2} = i * 2^2 = n$$

$$\text{iter 3} = i * 2^3 = n$$

....

$$\text{iter } k = i * 2^k = n$$

$$\text{Hence, } i = \frac{n}{2^k}$$

$$\Rightarrow \frac{n}{2^k} = 1$$

$$\Rightarrow n = 2^k$$

$$\Rightarrow k = \log_2 n$$

$$\Rightarrow \textit{Hence } O(\log (n))$$