## Time Complexity & Space Complexity

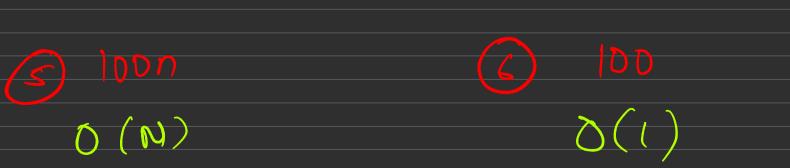
\* Time complexity: Big Theta (Avg care) \* Things to Remember while find T:C

- Ignore constant
- Always consider highest Values Infinity Value

$$(n^2)$$
  $(n^2)$   $(n^2)$   $(n^2)$   $(n^2)$   $(n^2)$ 

$$\frac{3}{2} + \frac{1}{2} + \frac{1}{2}$$

$$\frac{1}{2} + \frac{1}$$



Made with Goodnotes

(

9) 18 N. log N

® nlogn

(10) N. 109 N

Invieasing Order ?

N < N. log N

$$fr(i=1; i \leq n; i++)$$
 $O(1)$ 
 $fr(i=1; i \leq n; i++)$ 
 $O(N)$ 

$$\begin{cases} f(x) & \text{if } |x| \leq 0 \\ \text{if } |x| \leq 0 \end{cases} = \int_{-\infty}^{\infty} |x| dx =$$

Made with Goodnotes

for ( j=1; j <n; j=1\*2) 0 (log2H)

$$fr(i=1 : iCN : i=i*3) (log_3 N)$$
 $i=1 = 3^{\circ}$ 
 $i=3 = 3^{\circ}$ 
 $i=9 = 3^{\circ}$ 
 $i=23=23^{\circ}$ 
 $i=23=23^{\circ}$ 
 $i=23=23^{\circ}$ 
 $i=23=33^{\circ}$ 
 $i=23=33^{\circ}$ 

for (i=1; i <n:i++)  $O(\mu^2)$ for (j=1; (\nijet) for ( i = 1 ; i < n:i++) } for (j=1; j<n;j=j\*4) D (N.1094N)

Made with Goodnotes

## input size required time complexity

 $n \le 10$  O(n!)

 $n \le 20$   $O(2^n)$ 

 $n \le 500$   $O(n^3)$ 

 $n \le 5000$   $O(n^2)$ 

 $n \le 10^6$   $O(n \log n)$  or O(n)

n is large O(1) or  $O(\log n)$ 

Algorithm (applied to Array)	Time Complexity		
	Best Cases	Average Cases	Worst Cases
Bubble sort	O(n)	O(n <sup>2</sup> )	O(n <sup>2</sup> )
Selection sort	O(n <sup>2</sup> )	O(n <sup>2</sup> )	O(n <sup>2</sup> )
Insertion sort	O(n)	O(n <sup>2</sup> )	$O(n^2)$
Shell sort	O(n log(n))	$O(n \log^2(n))$	$O(n \log^2(n))$
Merge sort	O(n log(n))	O(n log(n))	O(n log(n))
Quick sort	O(n log(n))	O(n log(n))	O(n <sup>2</sup> )
Heap sort	O(n log(n))	O(n log(n))	O(n log(n))
Counting sort	O(n+k)	O(n+k)	O(n+k)
Bucket sort	O(n+k)	O(n+k)	O(n <sup>2</sup> )
Radix sort	O(nk)	O(nk)	O(nk)

S.NO	Big O Notation	Name
1.	O(1)	Constant Time Complexity
2.	O(log n)	Logarithmic Time Complexity
3.	O(n)	Linear Time complexity
4.	O(n log n)	Linearithmic Time Complexity
5.	O(n^2)	Quadratic Time Complexity
6.	O(n^3)	Cubic Time Complexity
7.	O(n^y)	Polynomial Time Complexity
8.	O(2^n)	Exponential Time Complexity
9.	O(n!)	Factorial Time Complexity

