

$\pi/2$  $\pi/2$  $\frac{1}{4}$  $\frac{21}{9}$ 
$$N/C$$
 $\frac{5}{4}$  $\frac{1}{4}$ 
$$n/4$$
$$N/C$$

A A A

A A A



A A A

A A A

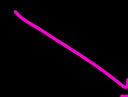
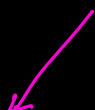


6

A hand-drawn diagram of a simple machine. It features a yellow pulley with a rope passing over it. A weight, represented by a yellow circle with a cross, is attached to one end of the rope. A pink arrow points downwards from the weight, indicating the direction of the force or movement.


 A A A A A A A A A A A A A A A A A A


 A



A A A A A A A A A A A A A A A A A

~~$\emptyset$~~





A A A A A A A A A A A A A A A A

~~$\emptyset$~~

$N = 100$

$\frac{1}{100} \approx \frac{1}{99} \approx \frac{1}{98} \dots$

$\dots$

$1$

$\Rightarrow$

$\frac{1}{100}$

$\approx$

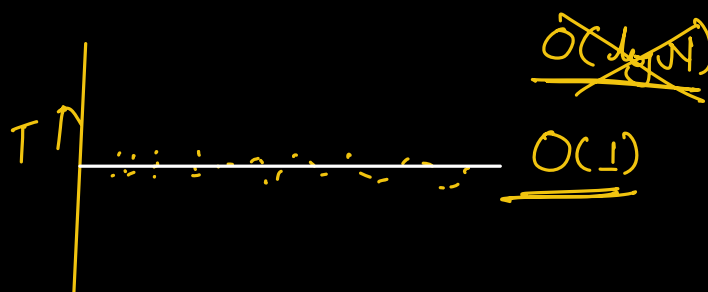
$\frac{1}{10}$

$N \log N$



Avg Case

$O(N \log N)$



10	7	2	12	15	8	20	9	6	21
7	2	8	9	6	10	12	15	20	21
2	6	7	8	9	10	12	15	20	21



```
void quicksort (int[] A, int s, int e) {
```

TC :  $O(N \log N)$

$O(N^2)$

SC :  $O(\log N)$

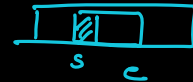
if ( $s \geq e$ ) return;

p = partition (A, s, e);  $\rightarrow \begin{matrix} O(N) \\ O(1) \end{matrix}$

quicksort (A, s, p-1);

quicksort (A, p+1, e);

}



<u>10</u>	7	2	4	6	8	9	20	15	12
			e	s					
			↓	↓					
10	4	5	3	16	20	21	30		

```

int partition (int[] A, int l, int r) {
    s = l+1, e = r;
    while (s <= e) {
        if (A[s] <= A[l]) {
            s++;
        }
        else if (A[e] > A[l]) {
            e--;
        }
        else {
            swap(A, s, e);
            s++; e--;
        }
    }
    swap(A, l, e);
    return e;
}

```

TC:  $O(N)$   
 SC:  $O(1)$

Bubble  
 Insertion  
 selection  
 merge  
 Quick  
 Tim Sort  
 Count Sort ( $O(N)$ )

b z a d e  
     ↓  
 a b d e z