

$\Theta(n \lg n)$

Counting Sort

$\Theta(n)$

Linear.

↳ Range of the inputs is predecided

{0, 1, 2, 3}

k possibilities for keys

Number of entries  $\rightarrow 1000$   
 $N$

$\Theta(N+k)$

$N \gg k$

8 entries

$\rightarrow \{0, 1, 2, 3\}$   
 $k=4$

i : 0 1 2 3 4 5 6 7

A[i] : 1 3 1 2 3 1 0 0

Count[j] : 0 1 2 3  
 2 3 1 2

Frequency

Count[i] : 2 5 6 8  
 1 4/3/2 5 7/6

$Count[j] = Count[j] + Count[i-1]$

i : 0 1 2 3 4 5 6 7

A[i] : 1 3 1 2 3 1 0 0

j : 1 to k  
 0 1 2 3 4 5 6 7  
 0 0 1 1 1 2 3 3  
 4

Count[A[i]] : 4 7 3 5 6 2 1 0  
 - 1

Count[A[i]]--;

Sorted Array : [0 0 1 1 1 2 3 3]

- 1) Initialize Count array
- 2) Compute freq. of {0, 1, 2, 3} in A[i]  $\rightarrow$  Count
- 3) Compute position of {0, 1, 2, 3}  $\rightarrow$  update Count

④ Reflect the sorted order based on positions.

① for ( $j : 0$  to  $k-1$ ) {  
     $\text{count}[j] = 0;$   
}

$j: 0, 1, 2, 3$   
    ↓  
 $\text{count}[j]: 0 \ 0 \ 0 \ 0$

② for ( $i : 0$  to  $N-1$ ) {  
     $\text{count}[A[i]]++;$   
}

③ for ( $j : 1$  to  $k-1$ ) {  
     $\text{count}[j] += \text{count}[j-1];$   
}

④ for ( $i : 0$  to  $N-1$ ) {  
     $S[\text{count}[A[i]] - 1] = A[i];$   
     $\text{count}[A[i]]--;$   
}