


Cycle Sort

Given an

$$\text{Array} = \begin{bmatrix} 3 & 5 & 2 & 1 & 4 \\ 0 & 1 & 2 & 3 & 4 \end{bmatrix}$$

X When we know the range of the numbers in an Array, we Cycle Sort

When range of numbers is $(1, N) \Rightarrow$ use
Cycle Sort

Cycle Sort Algorithm

$$\text{Initial Index} = \begin{bmatrix} 3 & 5 & 2 & 1 & 4 \\ 0 & 1 & 2 & 3 & 4 \end{bmatrix}$$

The range of numbers = $(1, 5)$

$$\text{After Sort} = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ i & 0 & 1 & 2 & 3 & 4 \end{bmatrix}$$

Value at index = Index + 1
(because index starts at 0)

$$\text{Value} = \text{Index} + 1$$

$$\text{Index} = \text{Value} - 1$$

X

Start
at $j=0$

5	2	1	4		
j	0	1	2	3	4

2	5	3	1	4	
j	0	1	2	3	4

5	2	3	1	4	
j	0	1	2	3	4

4	2	3	1	5	
j	0	1	2	3	4

1	2	3	4	5	
j	0	1	2	3	4

Now if the element at the first
index is correct move to the second
position and check $\Rightarrow j = j + 1$

	1	2	3	4	5
j	0	1	2	3	4

Value at index 2 is correct

$$\Rightarrow j = j + 1$$

$$j = 1 + 1 = 2$$

↓

	1	2	3	4	5
j	0	1	2	3	4

$$j = 2 + 1 = 3$$

	1	2	3	4	5
j	0	1	2	3	4

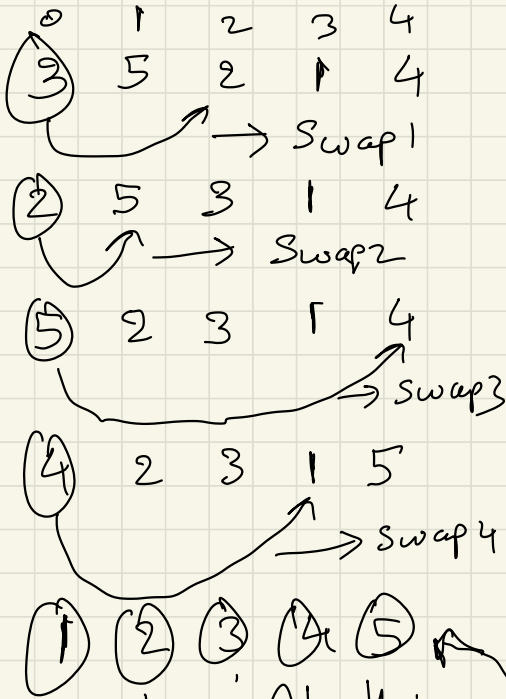
$$j = 3 + 1 = 4$$

Exit loop when $(j = N - 1)$

→ As since all element till "~~N-2~~" index is already in the correct place, we don't have to check the number at "~~N-1~~" index

Time Complexity

Worst Case example



At this point we made 5 additional Comparisons

Start

End

here and check if 1 is at the correct index

→ Check if 5 is at the correct index.

→ Total 5 Comparisons

Total

= 4 Swaps made
 + 5 Comparisons

$$= 9$$

$$= N - 1 + N$$

$$= (2N - 1)$$

$$= O(N)$$