

AXSOS ACADEMY

Problem-Solving Patterns **Cyclic Sort**



Outline

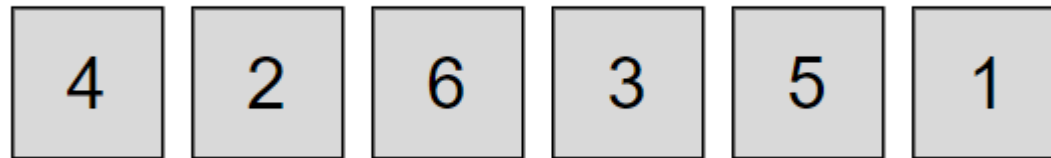
- Introduce the topic to the academy team including Idea, Problem statement, and solution. **(15 Minutes)**
- Practice a challenge with the team. **(15 Minutes)**
- Take feedback from the team and update later the slides and confluence accordingly. **(10 Minutes)**
- Team to evaluate the session. **(5 Minutes)**
- **Total time: 45 Minutes**

What is a Cyclic sort pattern?

- Cyclic sort is used for coding problems that involve arrays of numbers with a given range (from 1 to n).
- What do we mean by arrays with a given range??
- Include only the element from the given range.
- All the elements will be unique.

What is a Cyclic sort pattern?

- **Example:** An array with a given range from 1 to 6.
- Unsorted array within a given range from 1 to 6.



What is a Cyclic sort pattern?

- Sorted array within a given range from 1 to 6.



- Unsorted array without a given range from 1 to 6.



Problem Statement

- Write a function to sort the objects in place on their creation sequence number in $O(n)$ and without any extra space.
- in-place means to deal with the same given array without initiating a new one.

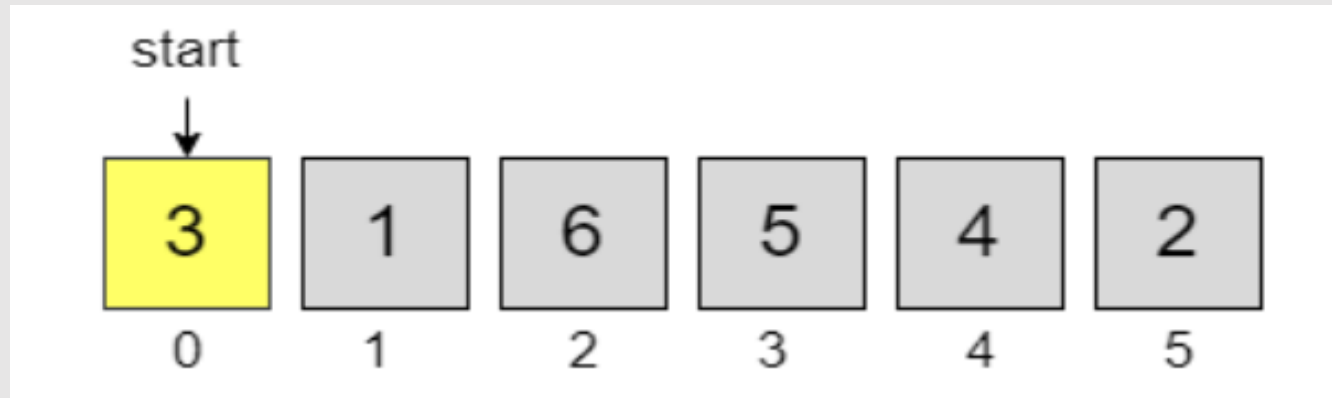
Solution

- Brute-Force solution indicates iterating two for loops.
- **B-F Time complexity:** $O(N^2)$ **Not accepted!**
- *Do we have a better solution??*

Solution

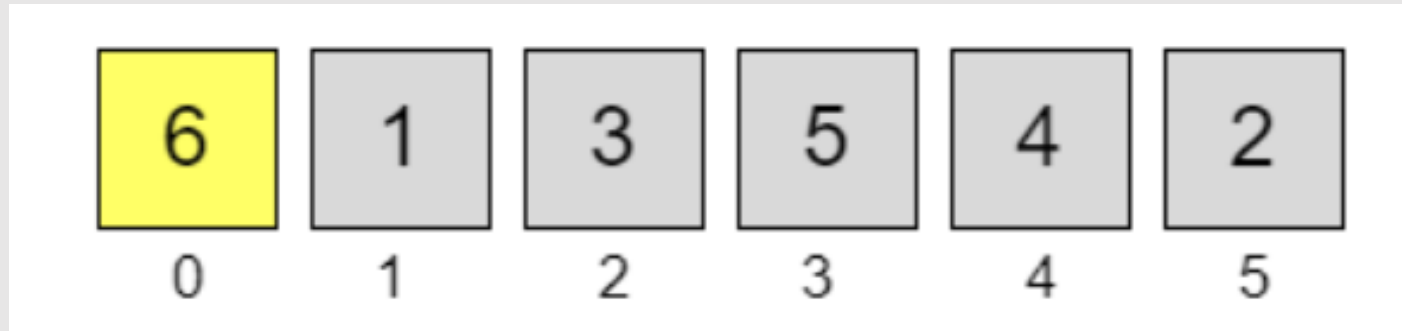
- Let's check the below-recommended solution.
- What if we iterate the array one number at a time, and if the current number we are iterating is not at the correct index, we swap it with the number at its correct index.
- This way we will go through all numbers and place them in their correct indices, hence, sorting the whole array.

Solution



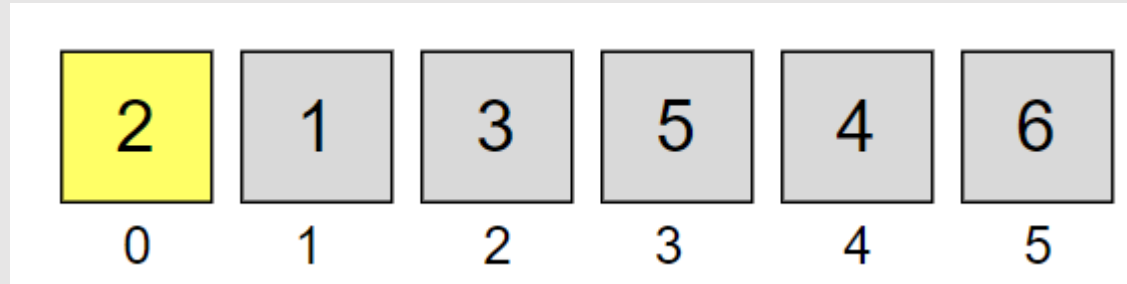
We start with the first element with index 0 which is 3. then we subtract the value by 1. The result of the subtraction shows the right place for this element. so $3 - 1 = 2$ (index 2). if the value of index 0 and index 2 is not the same we proceed with a swap.

Solution



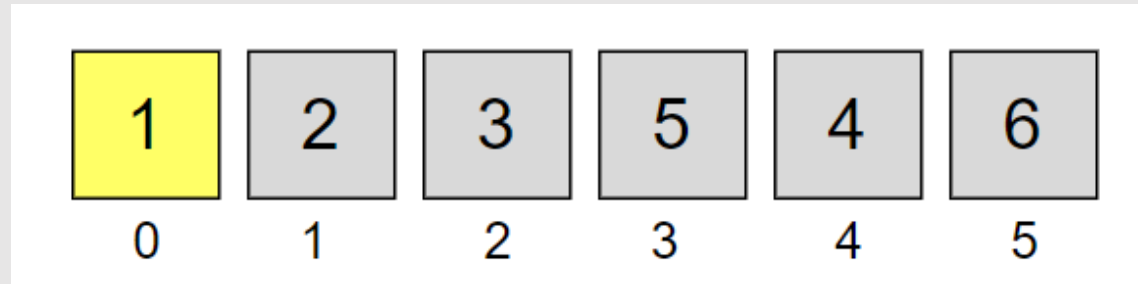
Again, we start with the first element with index 0 which is now 6. then we subtract the value by 1. The result of the subtraction shows the right place for this element. so $6 - 1 = 5$ (index 5). if the value of index 0 and index 5 is not the same we proceed with another swap.

Solution



Again, we start with the first element with index 0 which is now 2. then we subtract the value by 1. The result of the subtraction shows the right place for this element. so $2 - 1 = 1$ (index 1). if the value of index 0 and index 1 is not the same we proceed with another swap.

Solution

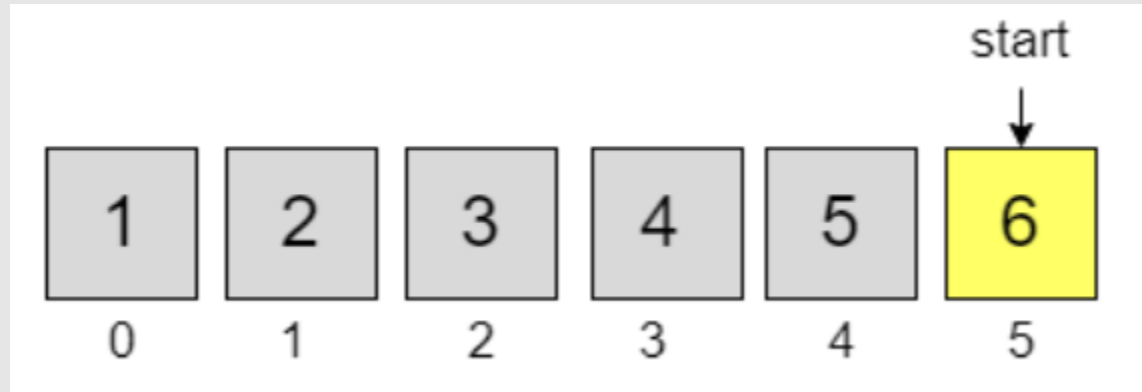


Again, we start with the first element with index 0 which is now 1. then we subtract the value by 1. The result of the subtraction shows the right place for this element. so $1 - 1 = 0$ (index 0). if the value of index 0 and index 0 is not the same we proceed with another swap. if they are the same then increment the start pointer by 1.

Solution

And so on

Solution



Now we start with the new start pointer element with index 5 which is now 6. then we subtract the value by 1. The result of the subtraction shows the right place for this element. so $6 - 1 = 5$ (index 5). if the value of index 5 and index 5 is not the same we proceed with another swap. if they are the same then increment the start pointer by 1.

Solution code

```
1 function cyclic_sort(arr){
2     let i = 0
3     while ( i < arr.length){
4         var newspot = arr[i] - 1;
5         if ( arr[i] !== arr[newspot]){
6             var newvalue = arr[i];
7             arr[i] = arr[newspot]
8             arr[newspot] = newvalue;
9         }else{
10             i++;
11         }
12     }
13     return arr;
14 }
15
16 arr = cyclic_sort([3,1,6,5,4,2])
17 console.log(arr);
18
```

Time & Space complexity

- **Time complexity:** $O(N) + O(N-1)$, which is $O(N)$.
- **Space complexity:** $O(1)$

Team Practice

- **Let's go to the below link:**
- <https://leetcode.com/problems/missing-number/>
- ***Time to solve is 15 minutes.***

Feedback



Evaluation

- **Let us evaluate this session by filling out the survey.**
- <https://forms.office.com/e/nYjZHFtsPV>
- **The aim of the evaluation is to enhance the content.**



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