

\* 448. Find all numbers disappeared in an array:-

→  $nums[]$  will be in range of 1 to  $n$ .

→ Return an array of all the integers in the range  $[1, n]$  that do not appear in  $nums[]$ .

\* Example:-

Input:  $nums = [4, 3, 2, 7, 8, 2, 3, 1]$

Output:  $[5, 6]$

Input:  $nums = [1, 1]$

Output:  $[2]$

\* Solution:-

\* Bruteforce approach:-

→ Create a map.

→ Iterate over the array  $\&$  for each element, check if it is present as a key in the map.

→ If present then do nothing else add it in the map.

→ Iterate from 1 to  $n$   $\&$  for every value between 1 to  $n$ , check if the value exists in the map.

→ If not then add it in the result list.

Time complexity :-  $O(n)$

Space complexity :-  $O(n)$

## \* Approach 2 :- Improving the space complexity

→ We know that all the elements in the array are between  $[1, n]$ .

→ So, there are no negatives.

arr = [4, 3, 2, 7, 8, 2, 3, 1]  
0 1 2 3 4 5 6 7

→ We will pollute the array by negating its value.

→ Iterate over the array.

→ For any  $arr[i] = |x|$ , we will go to  $arr[x-1]$  & negate it only if it is  $> 0$ .

i = 0

$arr[i] = 4$ ,  $|4| = 4$

$arr[4-1] = arr[3] *= -1$

arr = [4, 3, 2, -7, 8, 2, 3, 1]  
0 1 2 3 4 5 6 7

i = 1

$arr[i] = 3$ ,  $|3| = 3$

$arr[3-1] = arr[2] *= -1$

arr = [4, 3, -2, -7, 8, 2, 3, 1]  
0 1 2 3 4 5 6 7

i = 2

$arr[i] = -2$ ,  $|-2| = 2$

$arr[2-1] = arr[1] *= -1$

arr = [4, -3, -2, -7, 8, 2, 3, 1]  
0 1 2 3 4 5 6 7

i = 3

$arr[i] = -7$ ,  $|-7| = 7$

$arr[7-1] = arr[6] *= -1$

arr = [4, -3, -2, -7, 8, 2, -3, 1]  
0 1 2 3 4 5 6 7

i = 4

$arr[i] = 8$ ,  $|8| = 8$

$arr[8-1] = arr[7] *= -1$

arr = [4, -3, -2, -7, 8, 2, -3, -1]  
0 1 2 3 4 5 6 7

$$i = 5$$

$$\text{arr}[i] = 2, \quad |2| = 2$$

$$\text{arr} = [4, -3, -2, -7, 8, 2, -3, -1]$$

0   1   2   3   4   5   6   7

$\text{arr}[2-1] = \text{arr}[1]$  which is already -ve, so continue.

$$i = 6$$

$$\text{arr}[i] = -3, \quad |-3| = 3$$

$$\text{arr} = [4, -3, -2, -7, 8, 2, -3, -1]$$

0   1   2   3   4   5   6   7

$\text{arr}[3-1] = \text{arr}[2]$  which is already -ve, so continue.

$$i = 7$$

$$\text{arr}[i] = -1, \quad |-1| = 1$$

$$\text{arr} = [-4, -3, -2, -7, 8, 2, -3, -1]$$

0   1   2   3   4   5   6   7

$$\text{arr}[1-1] = \text{arr}[0] * -1$$

→ Again iterate over the array.

1) If any element  $> 0$ , that means  $(i+1)$  element is absent as we were not able to negate it.

2) Add that  $(i+1)$  in the result array.

Time complexity :-  $O(n)$

Space complexity :-  $O(1)$