



Find all Duplicate Numbers (easy)

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Problem Statement

We are given an unsorted array containing 'n' numbers taken from the range 1 to 'n'. The array has some numbers appearing twice, **find all these duplicate numbers without using any extra space.**

Example 1:

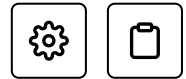
Input: [3, 4, 4, 5, 5]
Output: [4, 5]

Example 2:

Input: [5, 4, 7, 2, 3, 5, 3]
Output: [3, 5]

Try it yourself

Try solving this question here:



Java	Python3	JS	C++
<pre>1 def find_all_duplicates(nums): 2 duplicateNumbers = [] 3 # TODO: Write your code here 4 return duplicateNumbers 5</pre>			
<div> </div>			

Solution

This problem follows the **Cyclic Sort** pattern and shares similarities with Find the Duplicate Number

(<https://www.educative.io/collection/page/5668639101419520/5671464854355968/4522012447866880/>). Following a similar approach, we will place each number at its correct index. After that, we will iterate through the array to find all numbers that are not at the correct indices. All these numbers are duplicates.

Code

Here is what our algorithm will look like:

Java	Python3	C++	JS
<pre>1 def find_all_duplicates(nums): 2 i = 0 3 while i < len(nums): 4 j = nums[i] - 1 5 if nums[i] != nums[j]: 6 nums[i], nums[j] = nums[j], nums[i] # swap 7 else: 8 i += 1 9</pre>			

```
10 duplicateNumbers = []
11 for i in range(len(nums)):
12     if nums[i] != i + 1:
13         duplicateNumbers.append(nums[i])
14
15 return duplicateNumbers
16
17
18 def main():
19     print(find_all_duplicates([3, 4, 4, 5, 5]))
20     print(find_all_duplicates([5, 4, 7, 2, 3, 5, 3]))
21
22
23 main()
24
```



Time complexity

The time complexity of the above algorithm is $O(n)$.

Space complexity

Ignoring the space required for storing the duplicates, the algorithm runs in constant space $O(1)$.

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