Find all Duplicate Numbers (easy)

We'll cover the following

Problem Statement

We are given an unsorted array containing ‘n’ numbers taken from the range 1 to ‘n’. The array has some duplicates, **find all the 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++

```
def find_all_duplicates(nums):
  duplicateNumbers = []
  # TODO: Write your code here
  return duplicateNumbers

```

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:

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```python
def find_all_duplicates(nums):
  i = 0
  while i < len(nums):
    j = nums[i] - 1
    if nums[i] != nums[j]:
      nums[i], nums[j] = nums[j], nums[i]  # swap
    else:
      i += 1

  duplicateNumbers = []
  for i in range(len(nums)):
    if nums[i] != i + 1:
      duplicateNumbers.append(nums[i])

  return duplicateNumbers


def main():
  print(find_all_duplicates([3, 4, 4, 5, 5]))
  print(find_all_duplicates([5, 4, 7, 2, 3, 5, 3]))


main()
```

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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Problem Challenge 1

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