287. Find the Duplicate Number

Difficulty	medium
☑	☑
Finished	@July 8, 2023
Problem	array
Previously asked company	Goldman Sachs
website	leetcode

Question:

Given an array of integers `nums` containing `n + 1` integers where each integer is in the range `[1, n]` inclusive.

There is only **one repeated number** in `nums`, return *this repeated number*.

You must solve the problem **without** modifying the array `nums` and uses only constant extra space.

Example 1:

```
Input: nums = [1,3,4,2,2]
Output: 2
```

Example 2:

```
Input: nums = [3,1,3,4,2]
Output: 3
```

Optimal solution:

We cannot use hash map because we have to solve the problem **with** only constant extra space.

We cannot use sorting because we have to solve the problem **without** modifying the array `nums`

Algorithm used: Floyd's Algorithm to find starting point of cycle in linked list cycle.

Time complexity: O(n)
where n is the number of nodes in the linked list

Space complexity: O(1)

```
class Solution(object):
    def findDuplicate(self, nums):
        slow, fast = 0, 0
        while True:
            slow = nums[slow]
            fast = nums[nums[fast]]
            if slow == fast:
```

```
                break

        slow2 = 0
        while True:
            slow = nums[slow]
            slow2 = nums[slow2]
            if slow == slow2:
                return slow
```