287. Find the Duplicate Number

- 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 using 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

Example 3:

- **Input:** nums = [3,3,3,3,3]
- **Output:** 3

Constraints:

- $1 <= n <= 10^5$
- nums.length == n + 1
- 1 <= nums[i] <= n
- All the integers in nums appear only once except for precisely one integer which appears two or more times.

Follow up:

- How can we prove that at least one duplicate number must exist in nums?
- Can you solve the problem in linear runtime complexity?