Assignment3

1. There are duplicate elements I

Given an integer array `nums`. Return `true` if any value appears at least twice in the array, and `false` if every element is unique.

Example 1:

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

Example 2:

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

Example 3:

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

Tips:

- `1 <= nums.length <= 10^5`
- `-10^9 <= nums[i] <= 10^9`

2. There are duplicate elements II

Given an integer array `nums` and an integer `k`, determine if there are two distinct indices `i` and `j` in the array such that `nums[i] == nums[j]` and `abs(i - j) <= k`.

Example 1:

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

Example 2:

```
Input: nums = [1, 0, 1, 1], k = 1
Output: true
```

Example 3:

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

Tips:

- `1 <= nums.length <= 10^5`
- `-10^9 <= nums[i] <= 10^9`
- `0 <= k <= 10^5`

3. There are duplicate elements III

Given an integer array `nums` and two integers `indexDiff` and `valueDiff`, find out if there exist two indices `(i, j)` such that:

- `i != j`
- `abs(i - j) <= indexDiff`
- `abs(nums[i] - nums[j]) <= valueDiff`

If such indices exist, return `true`; otherwise, return `false`.

Example 1:

```
Input: nums = [1, 2, 3, 1], indexDiff = 3, valueDiff = 0
Output: true
Explanation: It is possible to find (i, j) = (0, 3).
             Satisfying the following three conditions:
                i != j ---> i != 3;
                abs(i - j) <= indexDiff ---> abs(0 - 3) <= 3;
                abs(nums[i] - nums[j]) <= valueDiff ---> abs(1 - 1) <= 0.
```

Example 2:

```
Input: nums = [1, 5, 9, 1, 5, 9], indexDiff = 2, valueDiff = 3
Output: false
Explanation: Unable to find satisfying indices (i, j) that meet all three
conditions. Therefore, return false.
```

Tips:

- `2 <= nums.length <= 10^5`
- `-10^9 <= nums[i] <= 10^9`
- `1 <= indexDiff <= nums.length`
- `0 <= valueDiff <= 10^9`