

ARRAYS - Assignment

Question 1: Given an integer array `nums`, return `true` if any value appears at least twice in the array, and return `false` if every element is distinct.

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`

Constraints:

- $1 \leq \text{nums.length} \leq 10^5$
- $-10^9 \leq \text{nums}[i] \leq 10^9$

Question 2: There is an integer array `nums` sorted in ascending order (with distinct values). Prior to being passed to your function, `nums` is possibly rotated at an unknown pivot index `k` ($1 \leq k < \text{nums.length}$) such that the resulting array is `[nums[k], nums[k+1], ..., nums[n-1], nums[0], nums[1], ..., nums[k-1]]` (0-indexed). For example, `[0,1,2,4,5,6,7]` might be rotated at pivot index 3 and become `[4,5,6,7,0,1,2]`.

Given the array `nums` after the possible rotation and an integer `target`, return *the index of target if it is in `nums`, or -1 if it is not in `nums`.*

You must write an algorithm with $O(\log n)$ runtime complexity.

Example 1:

Input: `nums = [4, 5, 6, 7, 0, 1, 2], target = 0`

Output: `4`

Example 2:

Input: `nums = [4, 5, 6, 7, 0, 1, 2], target = 3`

Output: `-1`

Example 3:

Input: `nums = [1]`, `target = 0`

Output: `-1`

Constraints:

- $1 \leq \text{nums.length} \leq 5000$
 - $-10^4 \leq \text{nums}[i] \leq 10^4$
 - All values of `nums` are unique.
 - `nums` is an ascending array that is possibly rotated.
 - $-10^4 \leq \text{target} \leq 10^4$
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Question 3: You are given an array `prices` where `prices[i]` is the price of a given stock on the i^{th} day.

Return the maximum profit you can achieve from this transaction. If you cannot achieve any profit, return 0.

Example 1:

Input: `prices = [7, 1, 5, 3, 6, 4]`

Output: `5`

Explanation: Buy on day 2 (price = 1) and sell on day 5 (price = 6), profit = $6 - 1 = 5$.

Note that buying on day 2 and selling on day 1 is not allowed because you must buy before you sell.

Example 2:

Input: `Prices = [7, 6, 4, 3, 1]`

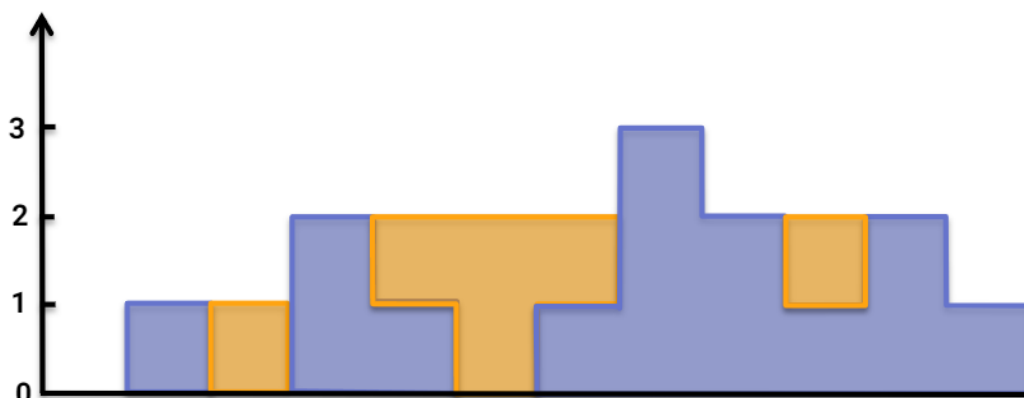
Output: `0`

Explanation: In this case, no transactions are done and the max profit = 0.

Constraints:

- $1 \leq \text{prices.length} \leq 10^5$
 - $0 \leq \text{prices}[i] \leq 10^4$
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Question 4: Given n non-negative integers representing an elevation map where the width of each bar is 1, compute how much water it can trap after raining.



Example 1:

Input: height = [0, 1, 0, 2, 1, 0, 1, 3, 2, 1, 2, 1]

Output: 6

Explanation: The above elevation map (black section) is represented by array [0,1,0,2,1,0,1,3,2,1,2,1]. In this case, 6 units of rain water (blue section) are being trapped.

Example 2:

Input: height = [4, 2, 0, 3, 2, 5]

Output: 9

Constraints:

- $n == \text{height.length}$
- $1 \leq n \leq 2 \times 10^4$
- $0 \leq \text{height}[i] \leq 10^5$

Question 5: Given an integer array `nums`, return all the triplets `[nums[i], nums[j], nums[k]]` such that $i \neq j$, $i \neq k$, and $j \neq k$, and $\text{nums}[i] + \text{nums}[j] + \text{nums}[k] == 0$. Notice that the solution set must not contain duplicate triplets.

Example 1:

Input: nums = [-1, 0, 1, 2, -1, -4]

Output: [[-1, -1, 2], [-1, 0, 1]]

Example 2:

Input: `nums = []`

Output: `[]`

Example 3:

Input: `nums = [0]`

Output: `[]`

Constraints:

- $0 \leq \text{nums.length} \leq 3000$
 - $-10^5 \leq \text{nums}[i] \leq 10^5$
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