

Binary Search

Assignment Questions



1. Given a sorted array of n elements and a target 'x'. Find the last occurrence of 'x' in the array. If 'x' does not exist return -1.

Input 1: $\text{arr}[] = \{1, 2, 3, 3, 4, 4, 4, 5\}$, $x = 4$
Output 1: 6

2. Given a sorted binary array, efficiently count the total number of 1's in it.

Input 1: $a = [0, 0, 0, 0, 1, 1]$
Output 1: 2

3. Given a matrix having 0-1 only where each row is sorted in increasing order, find the row with the maximum number of 1's.

Input matrix : 0 1 1 1
0 0 1 1
1 1 1 1 // this row has maximum 1s
0 0 0 0
Output: 2

4. Given an array of integers nums containing $n + 1$ integers where each integer is in the range $[1, n]$ inclusive in sorted order. There is only one repeated number in nums, return this repeated number.

Input 1: $\text{arr}[] = \{1, 2, 3, 3, 4\}$
Output 1: 3

Input 2: $\text{arr}[] = \{1, 2, 2, 3, 4, 5\}$
Output 2: 2

5. Given a number 'n'. Predict whether 'n' is a valid perfect square or not.

Input 1: $n = 36$
Output 1: yes

Input 2: $n = 45$
Output 2: no

6. You have n coins and you want to build a staircase with these coins. The staircase consists of k rows where the i th row has exactly i coins. The last row of the staircase may be incomplete.

Given the integer n , return the number of complete rows of the staircase you will build.

Example 1:

Input: $n = 5$

Output: 2

Explanation: Because the 3rd row is incomplete, we return 2.

Example 2:

Input: $n = 8$

Output: 3

Explanation: Because the 4th row is incomplete, we return 3.

7. Write a program to apply binary search in array sorted in decreasing order.

8. You have a sorted array of infinite numbers, how would you search an element in the array?

9. You are given an $m \times n$ integer matrix matrix with the following two properties:

- Each row is sorted in non-decreasing order.
- The first integer of each row is greater than the last integer of the previous row.

Given an integer target , return true if target is in matrix or false otherwise.

You must write a solution in $O(\log(m * n))$ time complexity.

Example 1:

Input: matrix = `[[1,3,5,7],[10,11,16,20],[23,30,34,60]]`, target = 3

Output: true

Example 2:

Input: matrix = `[[1,3,5,7],[10,11,16,20],[23,30,34,60]]`, target = 13

Output: false

10. There is an integer array nums sorted in non-decreasing order (not necessarily with distinct values).

Before being passed to your function, nums is rotated at an unknown pivot index k ($0 \leq k < \text{nums.length}$) 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, `[0,1,2,4,4,5,6,6,7]` might be rotated at pivot index 5 and become `[4,5,6,6,7,0,1,2,4,4]` . Given the array nums after the rotation and an integer target , return true if target is in nums , or false if it is not in nums .

You must decrease the overall operation steps as much as possible.

Example 1:

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

Output: true

Example 2:

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

Output: false