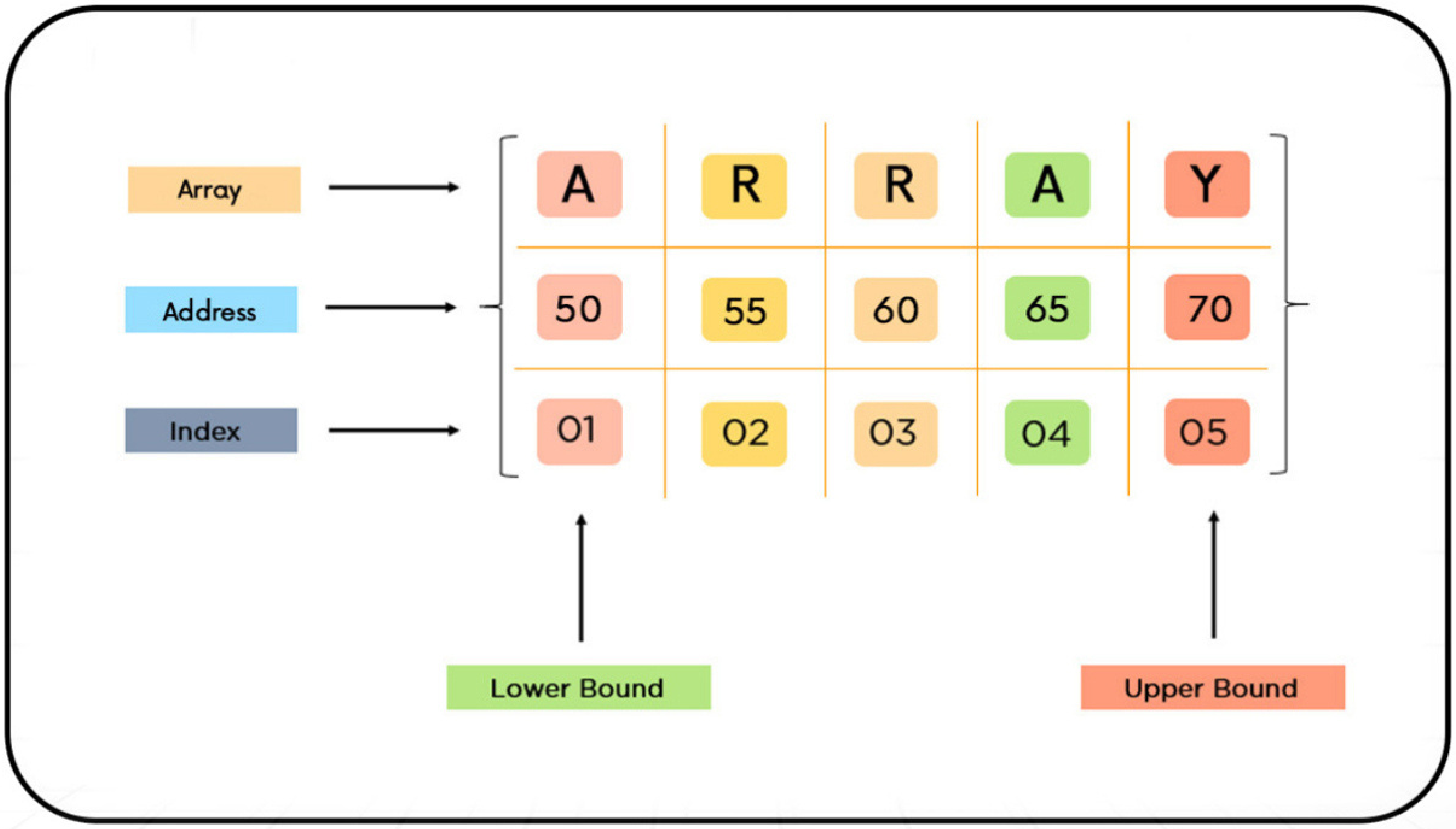
AlgoTutor

MASTER ARRAY IN JUST 05 DAYS



Day 1

Understanding Arrays

- Learn the basics of arrays: indexing, access, and memory allocation.
- Study the advantages and limitations of arrays.

Day 2

Array Operations and Complexity

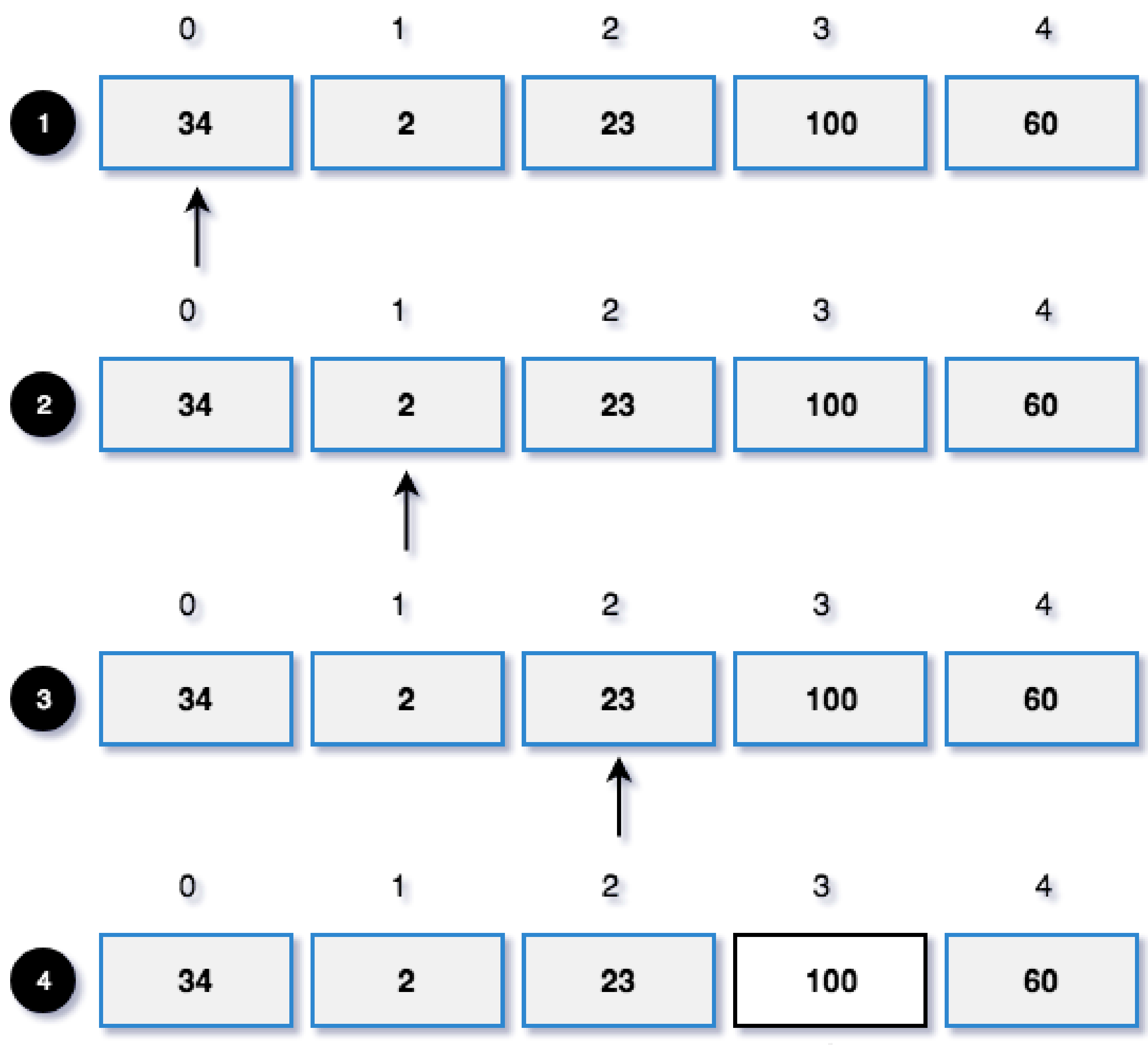
- Explore common array operations: insertion, deletion, searching.
- Understand time and space complexity analysis for array operations.

Operation	Array Fixed-Size	Growable Array	Singly or Doubly Linked List
`erase(r)`	O(1) best case O(n) worst case (r=0, n) O(n) average case	?	?
`insert(r,o)`		?	?
`at(r)`	O(1)	?	?
`set(r,o)`		?	?
`size()`		?	?
`empty()`		?	?

Day 3

Array Traversal and Searching

- Learn various methods for array traversal: linear, reverse, and 2D arrays.
- Practice searching algorithms such as linear search and binary search.



Day 4

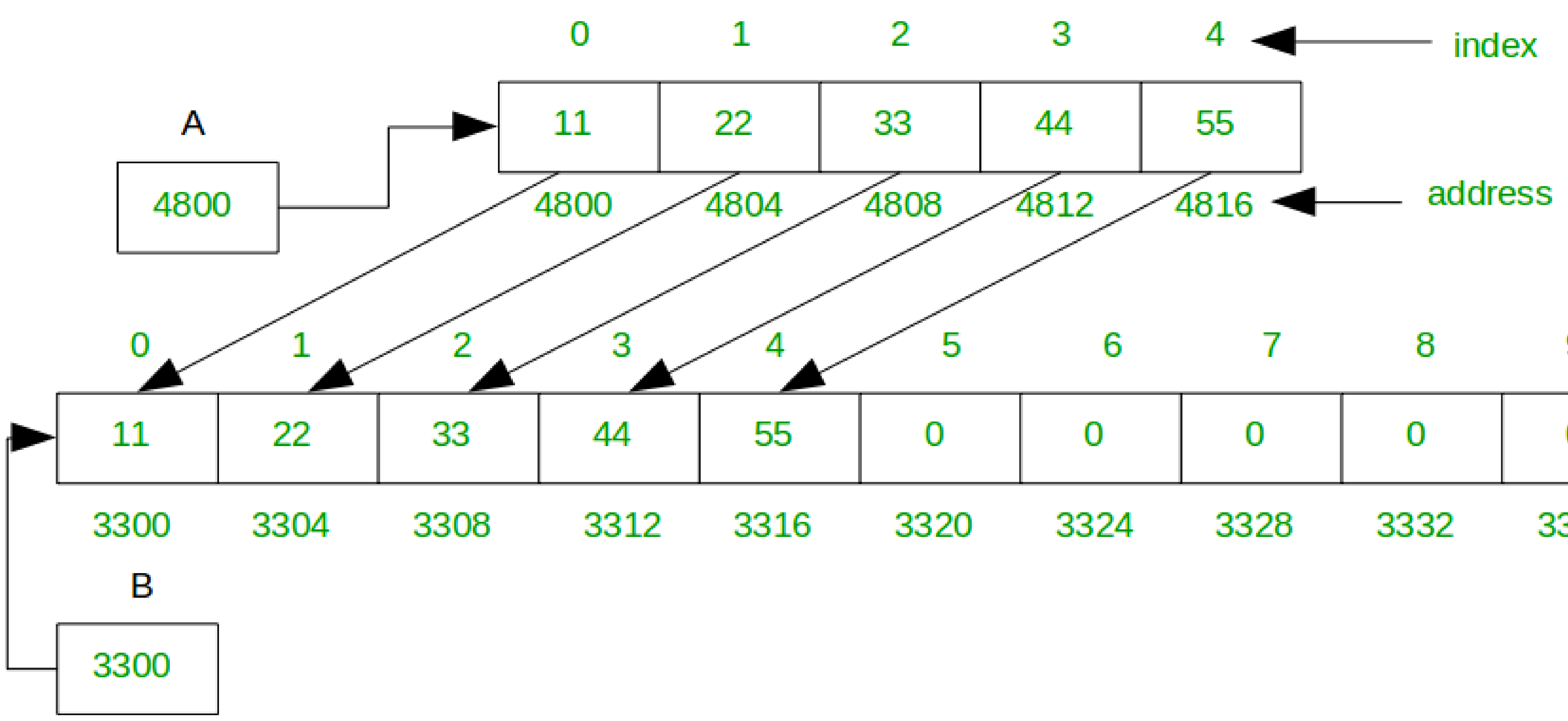
Sorting Algorithms

- Study sorting algorithms applicable to arrays: bubble sort, selection sort, insertion sort.
- Analyze time complexity and compare these algorithms.

Day 5

Dynamic Arrays (ArrayLists)

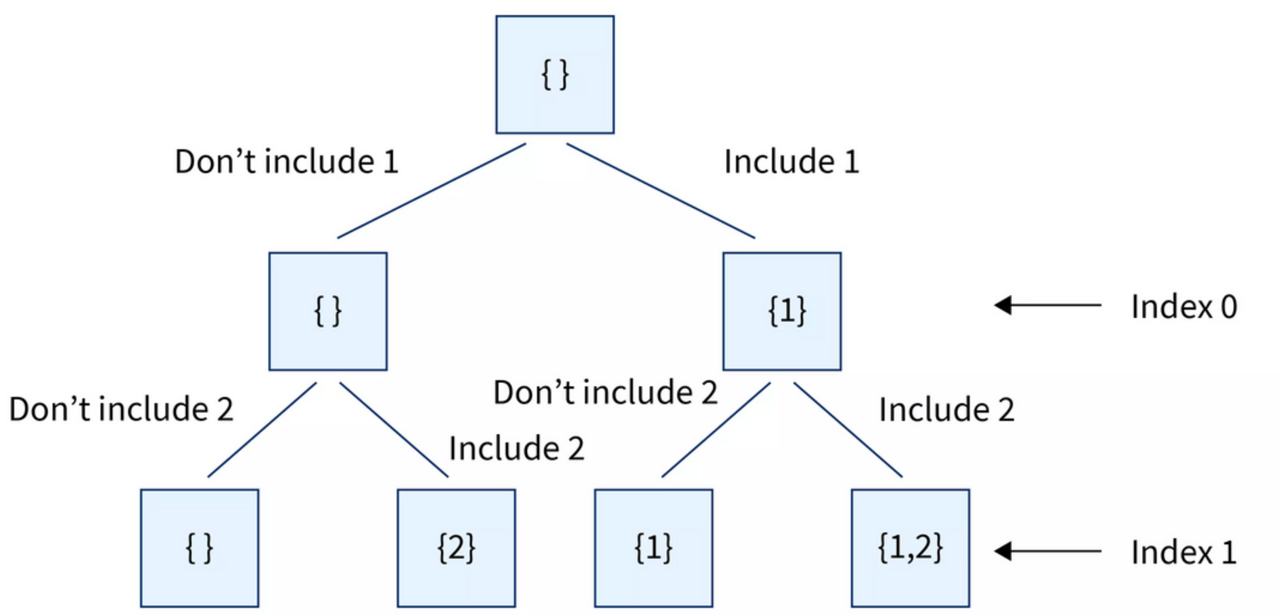
- Understand dynamic arrays (ArrayList in Java) and their advantages.
- Implement dynamic arrays and practice resizing.



Day 6

Subarrays and Subsequences

- Explore subarray and subsequence concepts.
- Solve problems involving subarrays and subsequences.



Day 7

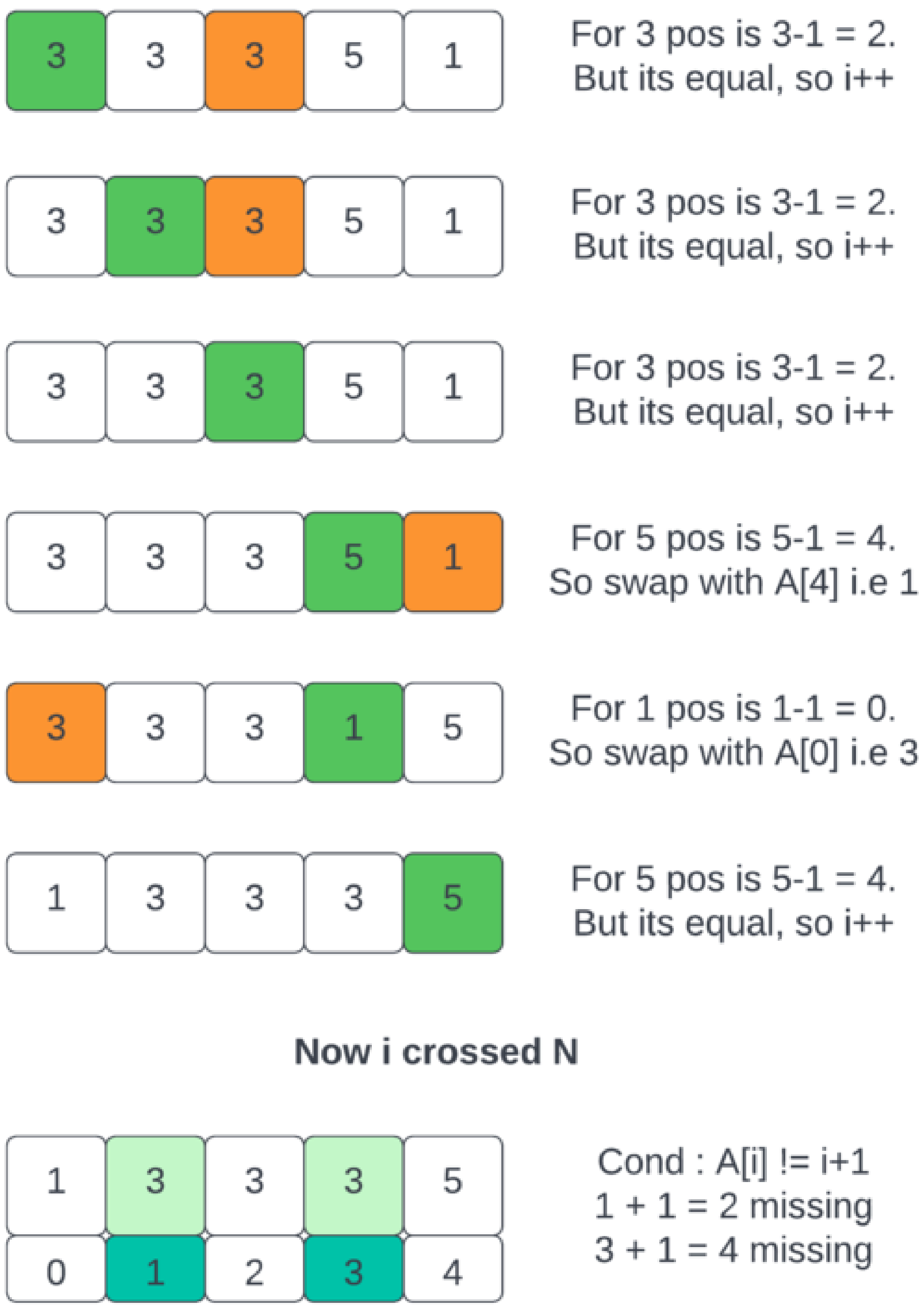
Array Rotation and Reversal

- Learn techniques for rotating and reversing arrays.
- Practice problems involving array rotation and reversal.

Day 8

Duplicate and Missing Elements

- Study approaches to find duplicate and missing elements in an array.
- Solve problems related to duplicate and missing values.



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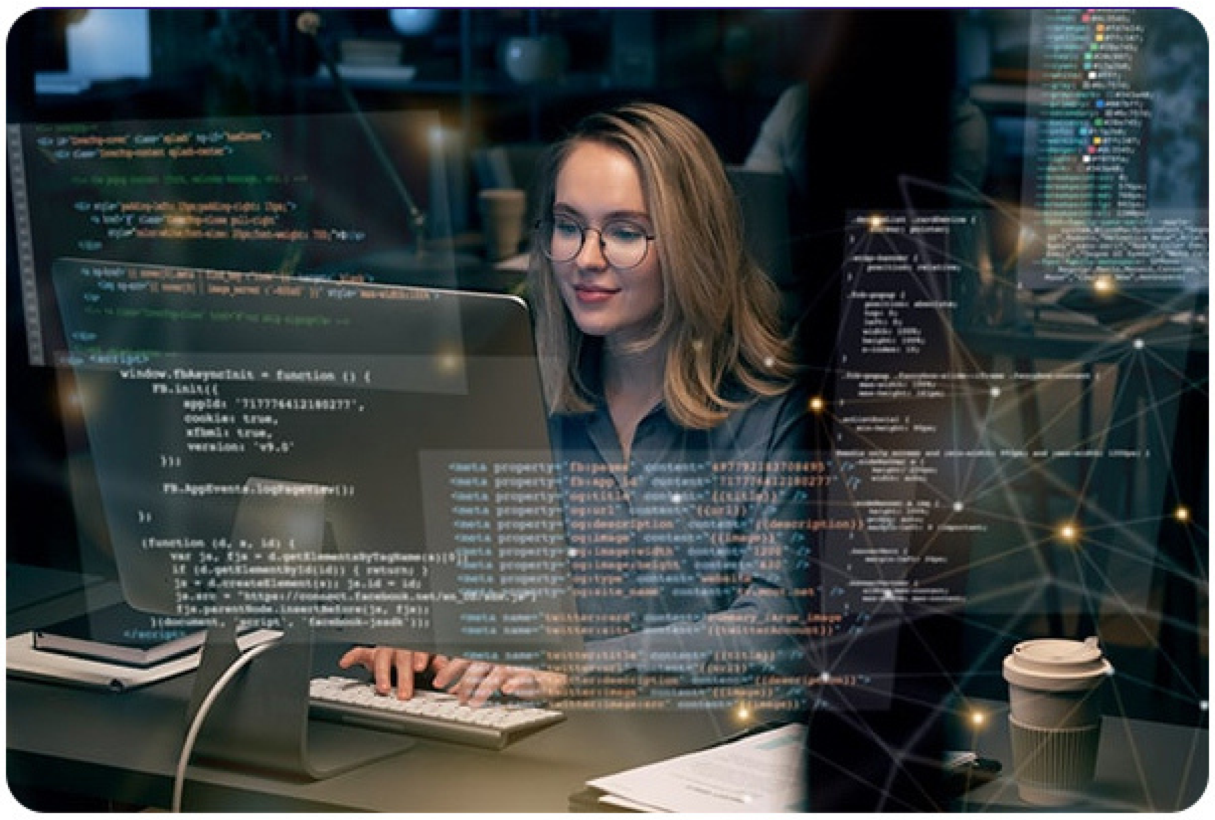

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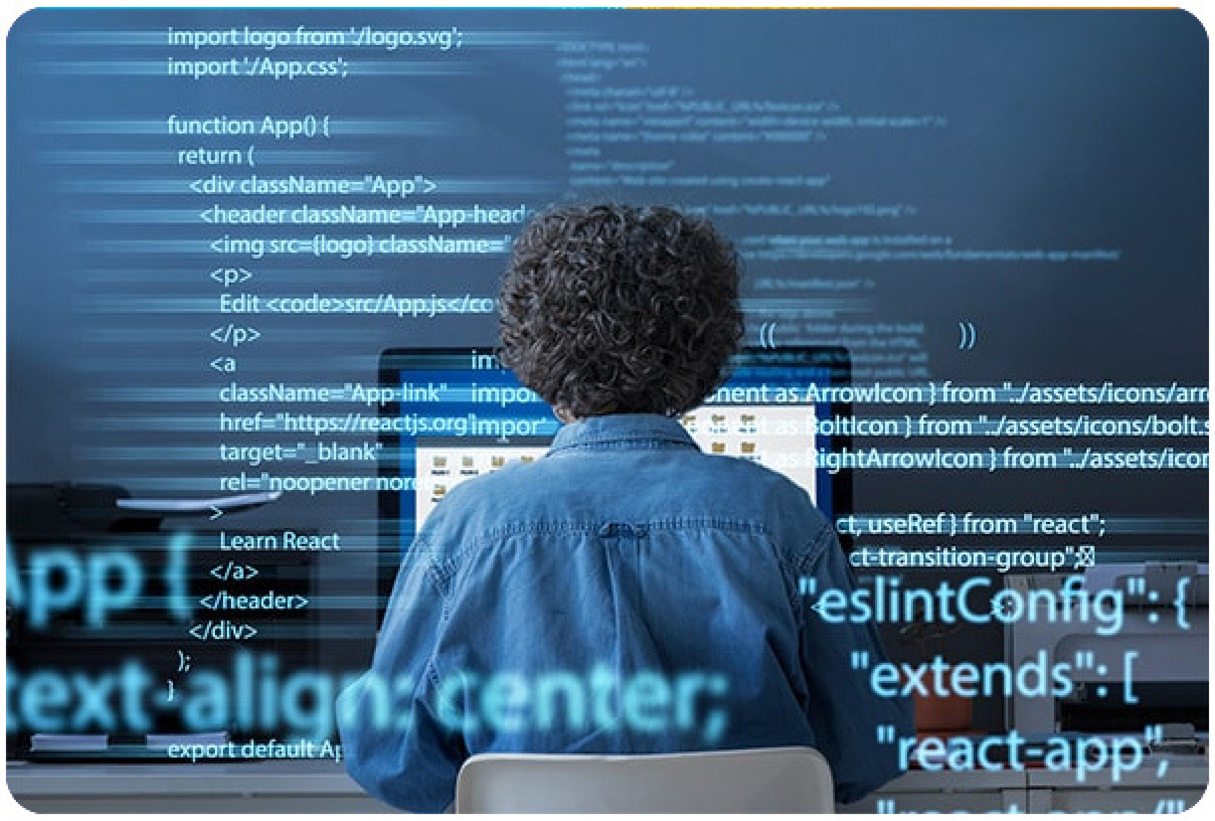

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Day 9

Frequency Count and Prefix Sum

- Explore techniques like frequency counting and prefix sum.
- Practice problems that involve counting elements and finding prefix sums.

Day 10

Review and Advanced Problems

- Review all the array concepts and problems you've learned.
- Challenge yourself with advanced array problems.

Important Practice Questions

01. Set Matrix Zeroes

Given an m x n integer matrix matrix, if an element is 0, set its entire row and column to 0's.

Example 1:

1	1	1
1	0	1
1	1	1

1	0	1
0	0	0
1	0	1

Input: matrix = [[1,1,1],[1,0,1],[1,1,1]]

Output: [[1,0,1],[0,0,0],[1,0,1]]

Example 2:

0	1	2	0
3	4	5	2
1	3	1	5

0	0	0	0
0	4	5	0
0	3	1	0

Input: matrix = [[0,1,2,0],[3,4,5,2],[1,3,1,5]]

Output: [[0,0,0,0],[0,4,5,0],[0,3,1,0]]

Practice

02. Two Sum

Given an array of integers nums and an integer target, return indices of the two numbers such that they add up to target.

You may assume that each input would have exactly one solution, and you may not use the same element twice.

You can return the answer in any order.

Example 1:
Input: nums = [2,7,11,15], target = 9
Output: [0,1]

Example 2:
Input: nums = [3,2,4], target = 6
Output: [1,2]

Example 3:
Input: nums = [3,3], target = 6
Output: [0,1]

Practice

03. Best Time to Buy and Sell Stock II

You are given an integer array prices where prices[i] is the price of a given stock on the ith day.

On each day, you may decide to buy and/or sell the stock. You can only hold at most one share of the stock at any time. However, you can buy it then immediately sell it on the same day.

Find and return the maximum profit you can achieve.

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

Example 2:
Input: prices = [1,2,3,4,5]
Output: 4

Example 3:
Input: prices = [7,6,4,3,1]
Output: 0

Practice

04. Best Time to Buy and Sell Stock

You are given an array prices where prices[i] is the price of a given stock on the ith day.

You want to maximize your profit by choosing a single day to buy one stock and choosing a different day in the future to sell that stock.

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

Example 2:
Input: prices = [7,6,4,3,1]
Output: 0

Practice

05. Sort Colors

Given an array nums with n objects colored red, white, or blue, sort them in-place so that objects of the same color are adjacent, with the colors in the order red, white, and blue.

We will use the integers 0, 1, and 2 to represent the color red, white, and blue, respectively.

You must solve this problem without using the library's sort function.

Example 1:
Input: nums = [2,0,2,1,1,0]
Output: [0,0,1,1,2,2]

Example 2:
Input: nums = [2,0,1]
Output: [0,1,2]

Practice

06. Find All Duplicates in an Array

Given an integer array nums of length n where all the integers of nums are in the range [1, n] and each integer appears once or twice, return an array of all the integers that appears twice.

You must write an algorithm that runs in O(n) time and uses only constant extra space.

Example 1:
Input: nums = [4,3,2,7,8,2,3,1]
Output: [2,3]

Example 2:
Input: nums = [1,1,2]
Output: [1]

Example 3:
Input: nums = [1]
Output: []

Practice

07. 3Sum

Given an integer array nums, return all the triplets [nums[i], nums[j], nums[k]] such that i != j, i != k, and j != k, and nums[i] + nums[j] + 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 = [0,1,1]
Output: []

Example 3:
Input: nums = [0,0,0]
Output: [[0,0,0]]

Practice

08. 4Sum

Given an array nums of n integers, return an array of all the unique quadruplets [nums[a], nums[b], nums[c], nums[d]] such that:

- 0 <= a, b, c, d < n
- a, b, c, and d are distinct.
- nums[a] + nums[b] + nums[c] + nums[d] == target

You may return the answer in any order.

Example 1:
Input: nums = [1,0,-1,0,-2,2], target = 0
Output: [[-2,-1,1,2],[-2,0,0,2],[-1,0,0,1]]

Example 2:
Input: nums = [2,2,2,2,2], target = 8
Output: [[2,2,2,2]]

Practice

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09. Search a 2D Matrix

You are given an m x 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:

1	3	5	7
10	11	16	20
23	30	34	60

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

Output: true

Practice

10. Longest Consecutive Sequence

Given an unsorted array of integers nums, return the length of the longest consecutive elements sequence.

You must write an algorithm that runs in O(n) time.

Example 1:
Input: nums = [100,4,200,1,3,2]
Output: 4

Example 2:
Input: nums = [0,3,7,2,5,8,4,6,0,1]
Output: 9

Practice

11. Find Peak Element

A peak element is an element that is strictly greater than its neighbors.

Given a 0-indexed integer array nums, find a peak element, and return its index. If the array contains multiple peaks, return the index to any of the peaks.

You may imagine that nums[-1] = nums[n] = -∞. In other words, an element is always considered to be strictly greater than a neighbor that is outside the array.

You must write an algorithm that runs in O(log n) time.

Example 1:
Input: nums = [1,2,3,1]
Output: 2

Example 2:
Input: nums = [1,2,1,3,5,6,4]
Output: 5

Practice

12. Single Element in a Sorted Array

You are given a sorted array consisting of only integers where every element appears exactly twice, except for one element which appears exactly once.

Return the single element that appears only once.

Your solution must run in O(log n) time and O(1) space.

Example 1:
Input: nums = [1,1,2,3,3,4,4,8,8]
Output: 2

Example 2:
Input: nums = [3,3,7,7,10,11,11]
Output: 10

Practice

13. Find Minimum in Rotated Sorted Array

Suppose an array of length n sorted in ascending order is rotated between 1 and n times. For example, the array nums = [0,1,2,4,5,6,7] might become:

- [4,5,6,7,0,1,2] if it was rotated 4 times.
- [0,1,2,4,5,6,7] if it was rotated 7 times.

Notice that rotating an array [a[0], a[1], a[2], ..., a[n-1]] 1 time results in the array [a[n-1], a[0], a[1], a[2], ..., a[n-2]].

Given the sorted rotated array nums of unique elements, return the minimum element of this array.

You must write an algorithm that runs in O(log n) time.

Example 1:

Input: nums = [3,4,5,1,2]

Output: 1

Practice

14. Search in Rotated Sorted Array II

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 <= k < 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, [0,1,2,4,4,4,5,6,6,7] 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

Practice

15. Search in Rotated Sorted Array

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 <= k < 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

Practice

16. Find First and Last Position of Element in Sorted Array

Given an array of integers nums sorted in non-decreasing order, find the starting and ending position of a given target value.

If target is not found in the array, return [-1, -1].

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

Example 1:
Input: nums = [5,7,7,8,8,10], target = 8
Output: [3,4]

Example 2:
Input: nums = [5,7,7,8,8,10], target = 6
Output: [-1,-1]

Practice

17. Search a 2D Matrix II

Write an efficient algorithm that searches for a value target in an m x n integer matrix matrix. This matrix has the following properties:

- Integers in each row are sorted in ascending from left to right.

Integers in each column are sorted in ascending from top to bottom.

Example 1:

1	4	7	11	15
2	5	8	12	19
3	6	9	16	22
10	13	14	17	24
18	21	23	26	30

Input: **matrix = [[1,4,7,11,15],[2,5,8,12,19],[3,6,9,16,22],[10,13,14,17,24],[18,21,23,26,30]], target = 5**

Output: **true**

Practice

18. Find a Peak Element II

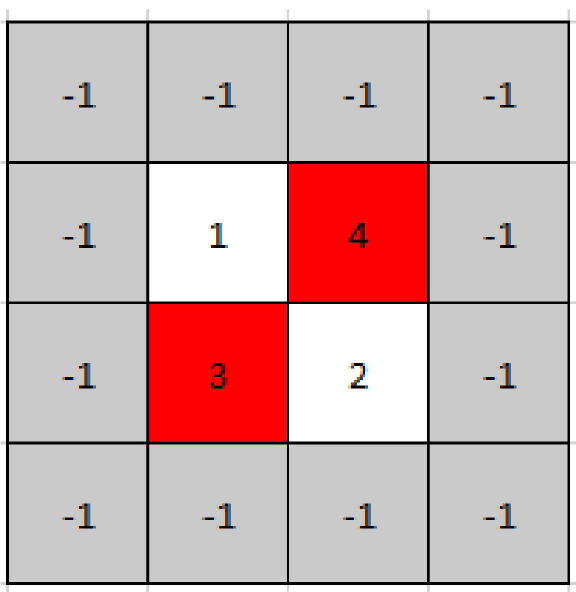
A peak element in a 2D grid is an element that is strictly greater than all of its adjacent neighbors to the left, right, top, and bottom.

Given a 0-indexed m x n matrix mat where no two adjacent cells are equal, find any peak element mat[i][j] and return the length 2 array [i,j].

You may assume that the entire matrix is surrounded by an outer perimeter with the value -1 in each cell.

You must write an algorithm that runs in O(m log(n)) or O(n log(m)) time.

Example 1:



Input: mat = [[1,4],[3,2]]

Output: [0,1]

Practice

19. Search Insert Position

Given a sorted array of distinct integers and a target value, return the index if the target is found.

If not, return the index where it would be if it were inserted in order.

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

Example 1:
Input: nums = [1,3,5,6], target = 5
Output: 2

Example 2:
Input: nums = [1,3,5,6], target = 2
Output: 1

Practice

20. Binary Search

Given an array of integers nums which is sorted in ascending order, and an integer target, write a function to search target in nums. If target exists, then return its index. Otherwise, return -1.

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

Example 1:
Input: nums = [-1,0,3,5,9,12], target = 9
Output: 4
Explanation: 9 exists in nums and its index is 4

Example 2:
Input: nums = [-1,0,3,5,9,12], target = 2
Output: -1
Explanation: 2 does not exist in nums so return -1

Practice