

## Experiment - 5

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**Subject Name:** AP LAB-II

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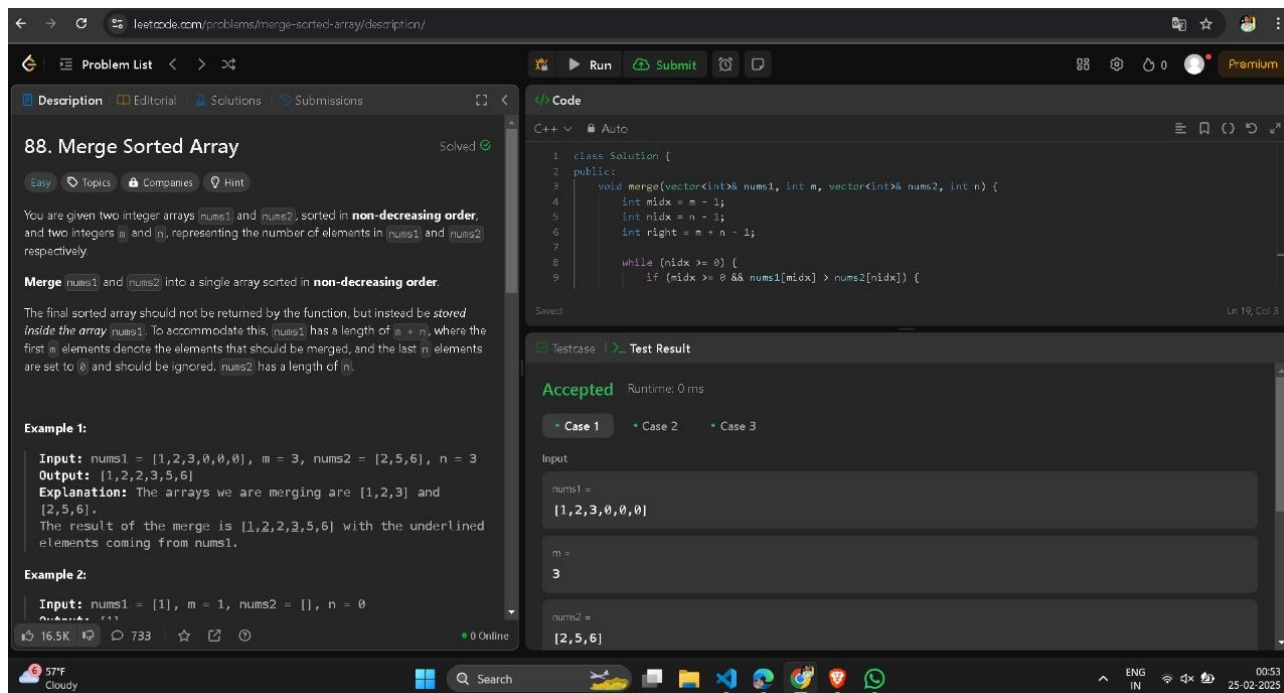
**Section/Group:** 634/A

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**Subject Code:** 22CSP-351

## Problem 5.1: Merge Sorted Array.

### 1. Output:



**88. Merge Sorted Array** Solved

Easy Topics Companies Hint

You are given two integer arrays `nums1` and `nums2`, sorted in **non-decreasing order**, and two integers `m` and `n`, representing the number of elements in `nums1` and `nums2` respectively.

Merge `nums1` and `nums2` into a single array sorted in **non-decreasing order**.

The final sorted array should not be returned by the function, but instead be stored *inside the array* `nums1`. To accommodate this, `nums1` has a length of `m + n`, where the first `m` elements denote the elements that should be merged, and the last `n` elements are set to 0 and should be ignored. `nums2` has a length of `n`.

**Example 1:**

Input: `nums1 = [1,2,3,0,0,0]`, `m = 3`, `nums2 = [2,5,6]`, `n = 3`  
Output: `[1,2,2,3,5,6]`  
Explanation: The arrays we are merging are `[1,2,3]` and `[2,5,6]`.  
The result of the merge is `[1,2,2,3,5,6]` with the underlined elements coming from `nums1`.

**Example 2:**

Input: `nums1 = [1]`, `m = 1`, `nums2 = []`, `n = 0`

```

1 class Solution {
2 public:
3     void merge(vector<int>& nums1, int m, vector<int>& nums2, int n) {
4         int midx = m - 1;
5         int midx2 = m - 1;
6         int right = m + n - 1;
7
8         while (midx >= 0) {
9             if (midx >= 0 && nums1[midx] > nums2[midx2]) {

```

Accepted Runtime: 0ms

Case 1 Case 2 Case 3

Input

`nums1 =`  
`[1,2,3,0,0,0]`

`m =`  
`3`

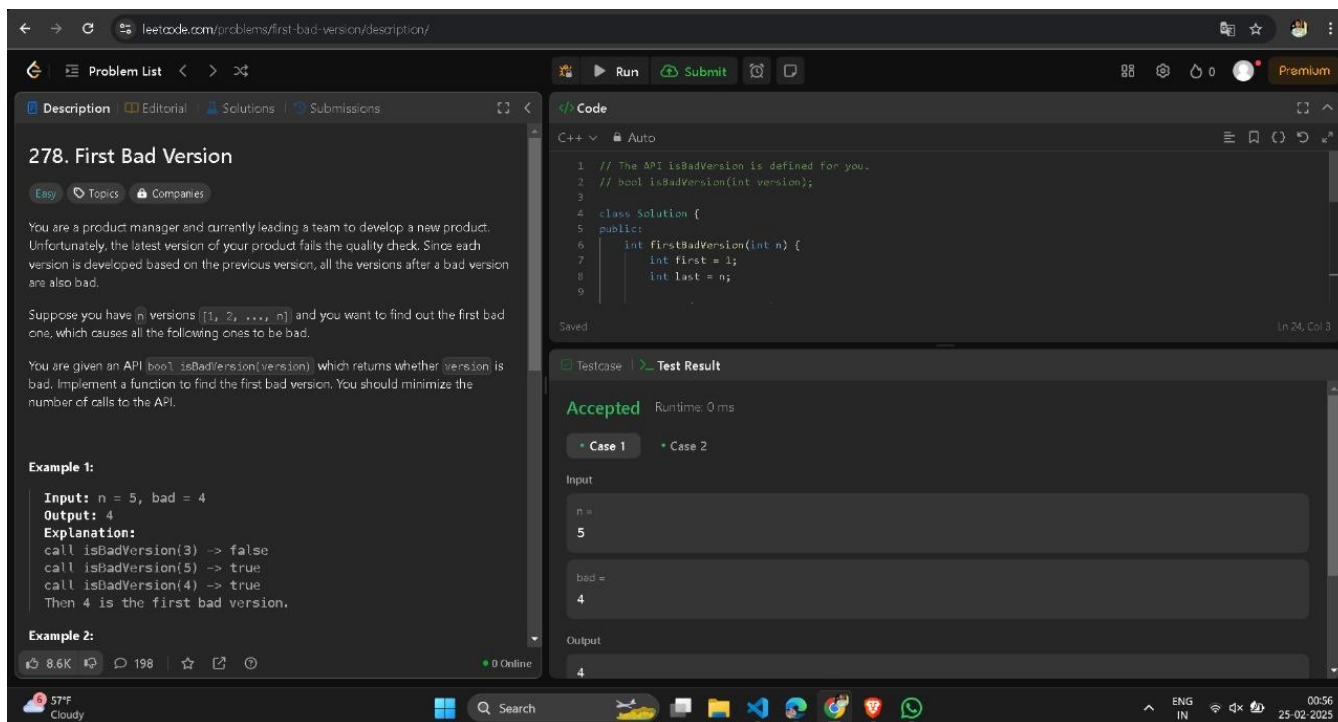
`nums2 =`  
`[2,5,6]`

### 2. Learning outcomes:

1. Understanding the Two-Pointer Technique
2. Mastering In-Place Merging
3. Time Complexity Analysis
4. Handling Edge Cases

## Problem 5.2: First Bad Version

### 1. Output:



The screenshot displays the LeetCode interface for the problem "278. First Bad Version". The problem description on the left explains that a product manager is leading a team to develop a new product, but the latest version fails a quality check. Since each version is based on the previous one, all versions after a bad one are also bad. The goal is to find the first bad version in a range [1, 2, ..., n] using an API `isBadVersion(version)` that returns a boolean. The description includes two examples: Example 1 with `n = 5, bad = 4` and Example 2 with `n = 5, bad = 4`. The right side of the interface shows a C++ solution using binary search. The code defines a `Solution` class with a `firstBadVersion` method that uses a while loop to find the first bad version. The test results section shows that the solution is "Accepted" with a runtime of 0 ms. The input is `n = 5` and `bad = 4`, and the output is `4`.

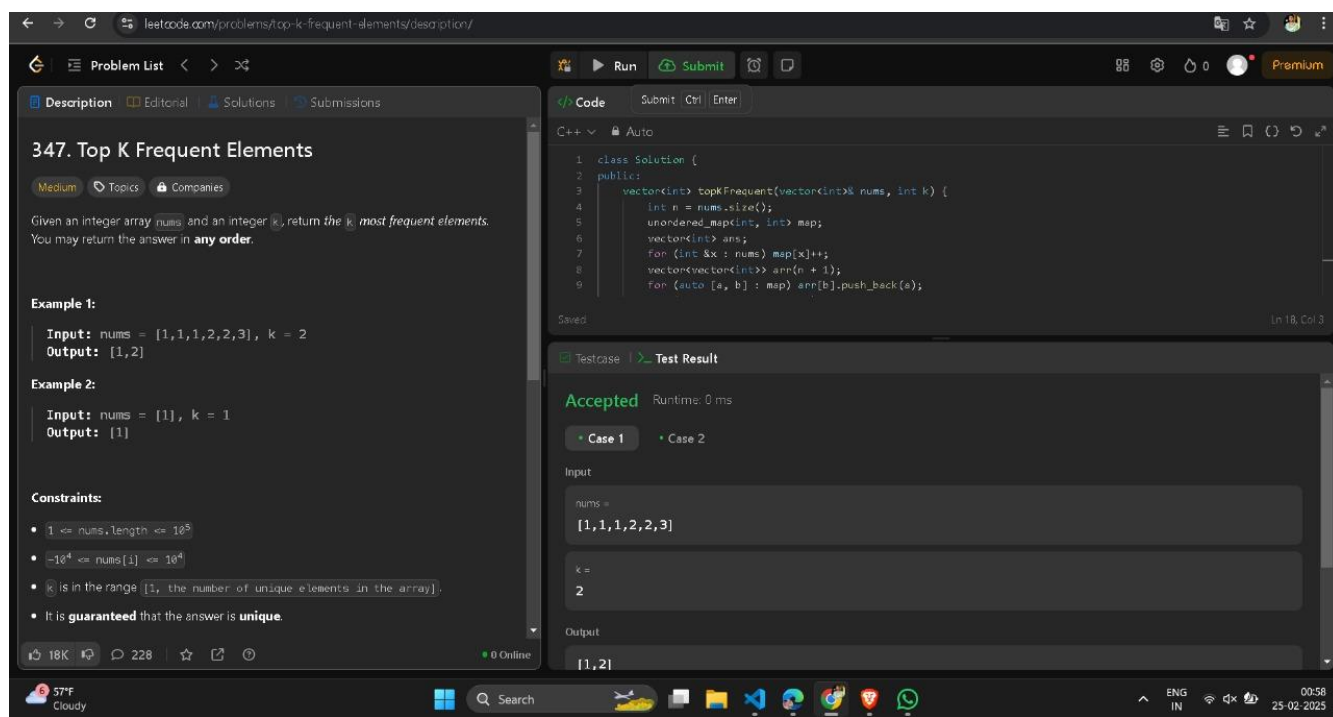
```
1 // The API isBadVersion is defined for you.
2 // bool isBadVersion(int version);
3
4 class Solution {
5 public:
6     int firstBadVersion(int n) {
7         int first = 1;
8         int last = n;
9     }
10 }
```

### 2. Learning Outcomes:

- Understanding Binary Search
- Reducing Time Complexity.
- Working with a Monotonic Condition.
- Implementing a Search with a Condition

## Problem 5.3: Top K frequent elements

### 1. Output:



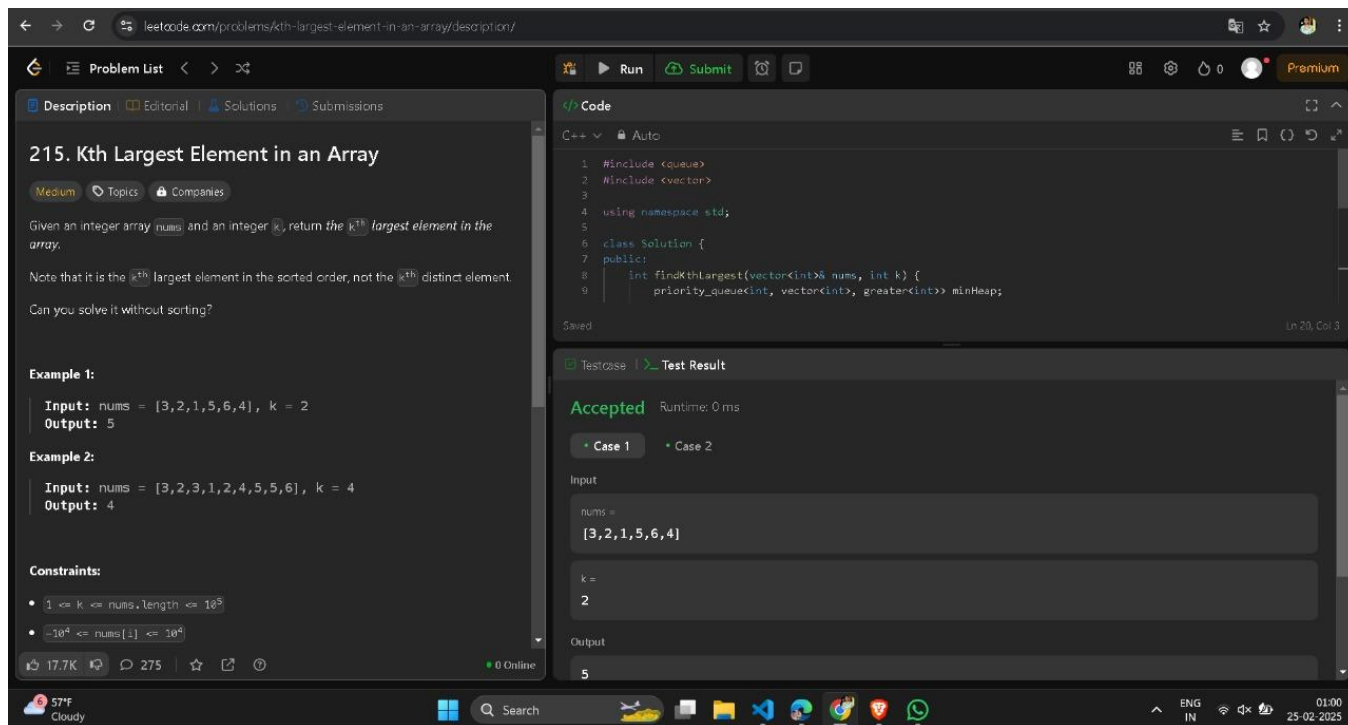
The screenshot shows the LeetCode interface for problem 347, "Top K Frequent Elements". The problem description states: "Given an integer array `nums` and an integer `k`, return the `k` most frequent elements. You may return the answer in **any order**." Example 1: Input: `nums = [1,1,1,2,2,3]`, `k = 2`; Output: `[1,2]`. Example 2: Input: `nums = [1]`, `k = 1`; Output: `[1]`. Constraints include `1 <= nums.length <= 10^5`, `-10^4 <= nums[i] <= 10^4`, `k` is in the range `[1, the number of unique elements in the array]`, and the answer is guaranteed to be unique. The code editor shows a C++ solution using a hash map and a priority queue. The test result shows "Accepted" with a runtime of 0 ms for Case 1, where the input is `nums = [1,1,1,2,2,3]` and `k = 2`, resulting in the output `[1,2]`.

### 2. Learning Outcomes:

- Understanding Frequency Counting (Hash Maps)
- Priority Queues (Heaps)
- Sorting and Bucket Sort.
- QuickSelect Algorithm (Partitioning)

## Problem 5.4: Kth Largest element in an array

### 1. Output:



215. Kth Largest Element in an Array

Medium Topics Companies

Given an integer array `nums` and an integer `k`, return the `kth` largest element in the array.

Note that it is the `kth` largest element in the sorted order, not the `kth` distinct element.

Can you solve it without sorting?

**Example 1:**

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

**Example 2:**

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

**Constraints:**

- `1 <= k <= nums.length <= 105`
- `-104 <= nums[i] <= 104`

17.7K 275 0 Online

```
1 #include <queue>
2 #include <vector>
3
4 using namespace std;
5
6 class Solution {
7 public:
8     int findKthLargest(vector<int>& nums, int k) {
9         priority_queue<int, vector<int>, greater<int>> minHeap;
```

Accepted Runtime: 0ms

Case 1 Case 2

Input

nums =  
[3,2,1,5,6,4]

k =  
2

Output

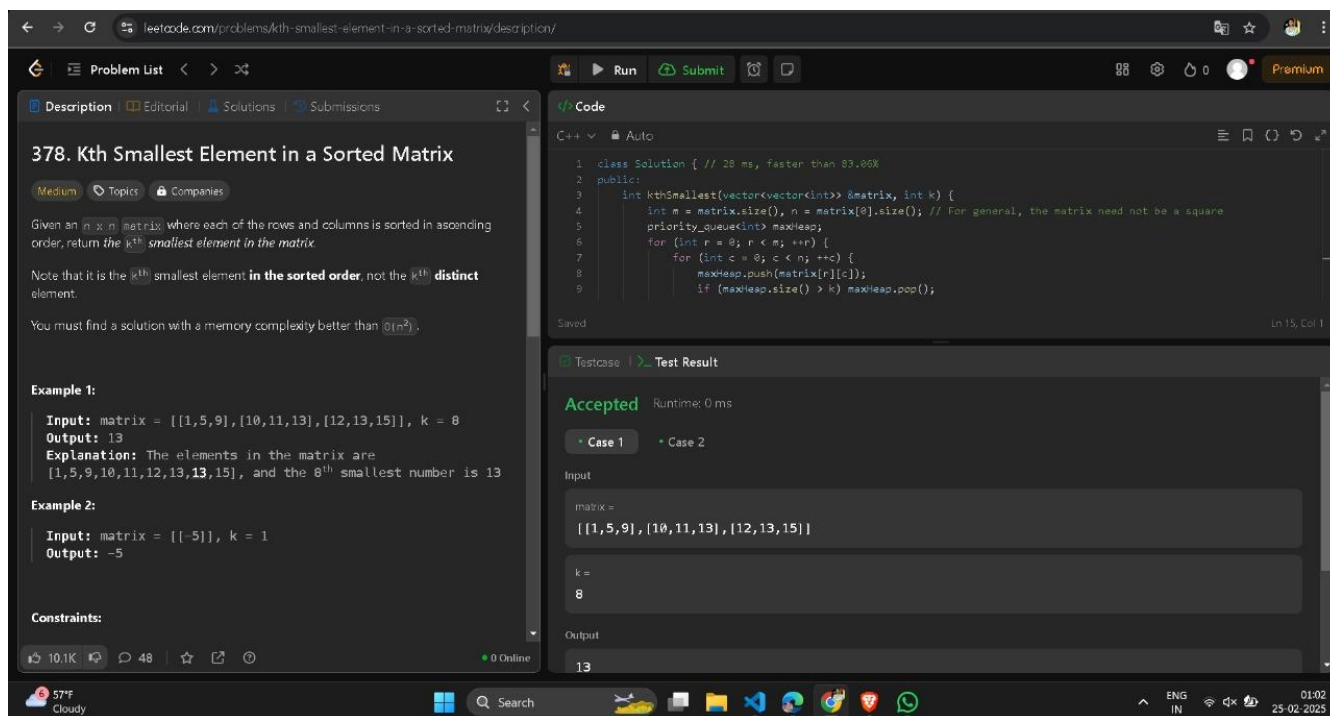
5

### 2. Learning Outcomes:

- Understanding Sorting and Its Complexity.
- Learning Efficient Selection Algorithms
- Working with Different Data Structures.
- Trade-offs Between Time and Space Complexity.

## Problem 5.5: Kth smallest element in a sorted matrix

### 1. Output:



378. Kth Smallest Element in a Sorted Matrix

Medium Topics Companies

Given an  $n \times n$  matrix where each of the rows and columns is sorted in ascending order, return the  $k^{\text{th}}$  smallest element in the matrix.

Note that it is the  $k^{\text{th}}$  smallest element in the sorted order, not the  $k^{\text{th}}$  distinct element.

You must find a solution with a memory complexity better than  $O(n^2)$ .

**Example 1:**

Input: matrix = [[1,5,9],[10,11,13],[12,13,15]], k = 8  
Output: 13  
Explanation: The elements in the matrix are [1,5,9,10,11,12,13,13,15], and the 8<sup>th</sup> smallest number is 13

**Example 2:**

Input: matrix = [[-5]], k = 1  
Output: -5

**Constraints:**

10.1K votes 48 comments 0 Online

```

1 class Solution { // 28 ms, faster than 83.86%
2 public:
3     int kthSmallest(vector<vector<int>> &matrix, int k) {
4         int m = matrix.size(), n = matrix[0].size(); // For general, the matrix need not be a square
5         priority_queue<int> maxHeap;
6         for (int r = 0; r < m; ++r) {
7             for (int c = 0; c < n; ++c) {
8                 maxHeap.push(matrix[r][c]);
9                 if (maxHeap.size() > k) maxHeap.pop();
10            }
11        }
12        return maxHeap.top();
13    }
14 };

```

Testcase: Test Result

Accepted Runtime: 0 ms

Case 1 Case 2

Input

matrix =

[[1,5,9],[10,11,13],[12,13,15]]

k =

8

Output

13

### 2. Learning Outcomes:

- Binary Search on Answer (Matrix Search Space)
- Heap (Priority Queue) Approach
- Matrix Traversal & Counting
- Time Complexity Trade-offs