Assignment 2

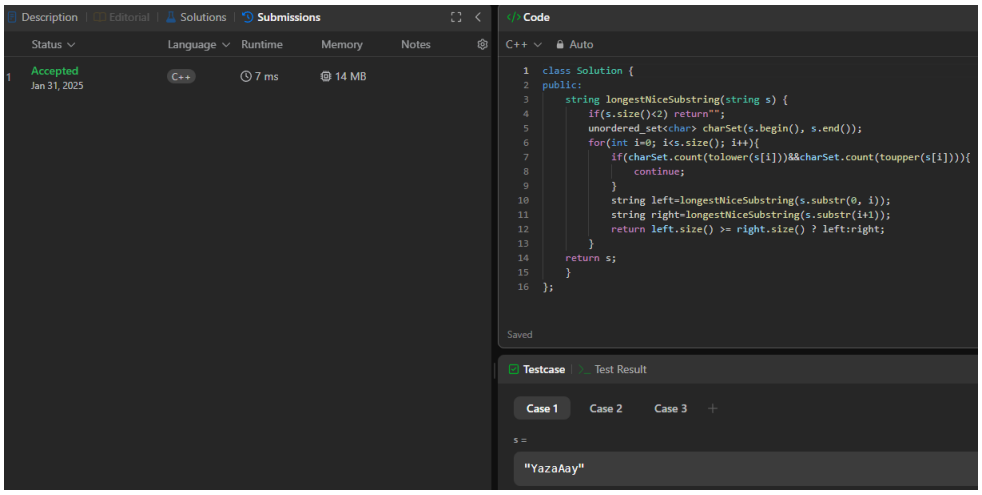
Student Name: Aryan Mehta **UID:22BCS12209**
Branch: BE-CSE (General) **Section/Group: FL_IOT-602 A**
Semester:6th **Date of Performance: 04-02-25**
Subject Name: Advanced Programming Lab-2 **Subject Code: 22CSP-351**

1. Aim: 1763. Longest Nice Substring

Implementation/ Code:

```
class Solution {
public:
    string longestNiceSubstring(string s) {
        if(s.size()<2) return"";
        unordered_set<char> charSet(s.begin(), s.end());
        for(int i=0; i<s.size(); i++){
            if(charSet.count(tolower(s[i]))&&charSet.count(toupper(s[i]))){
                continue;
            }
            string left=longestNiceSubstring(s.substr(0, i));
            string right=longestNiceSubstring(s.substr(i+1));
            return left.size() >= right.size() ? left:right;
        }
    return s;
    }
};
```

Output:

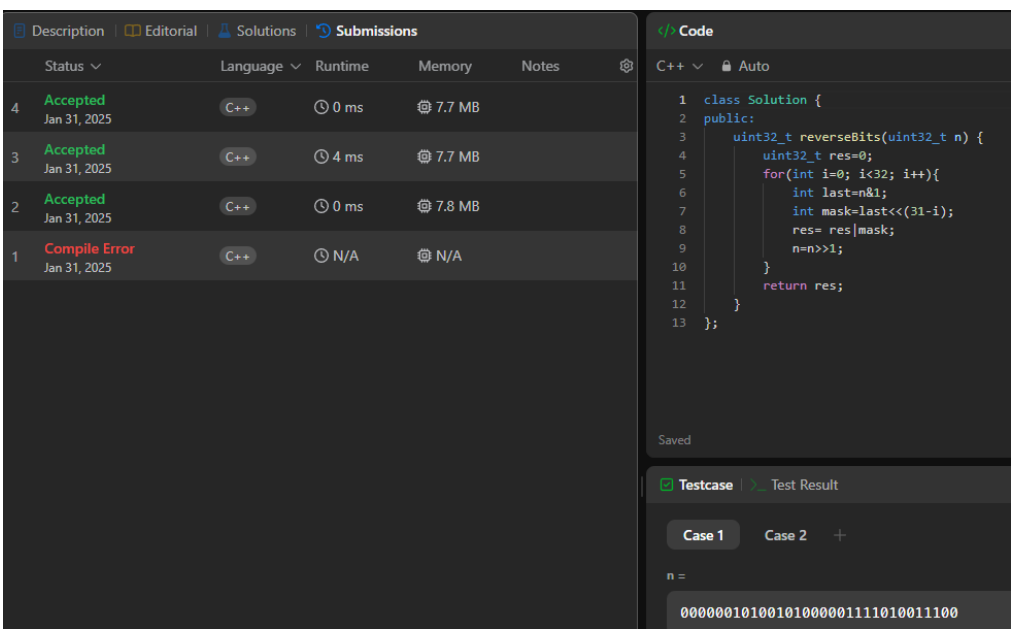


2. Aim: 190. Reverse Bits

Implementation/ Code:

```
class Solution {
public:
    uint32_t reverseBits(uint32_t n) {
        uint32_t res=0;
        for(int i=0; i<32; i++){
            int last=n&1;
            int mask=last<<(31-i);
            res= res|mask;
            n=n>>1;
        }
        return res;
    }
};
```

Output:



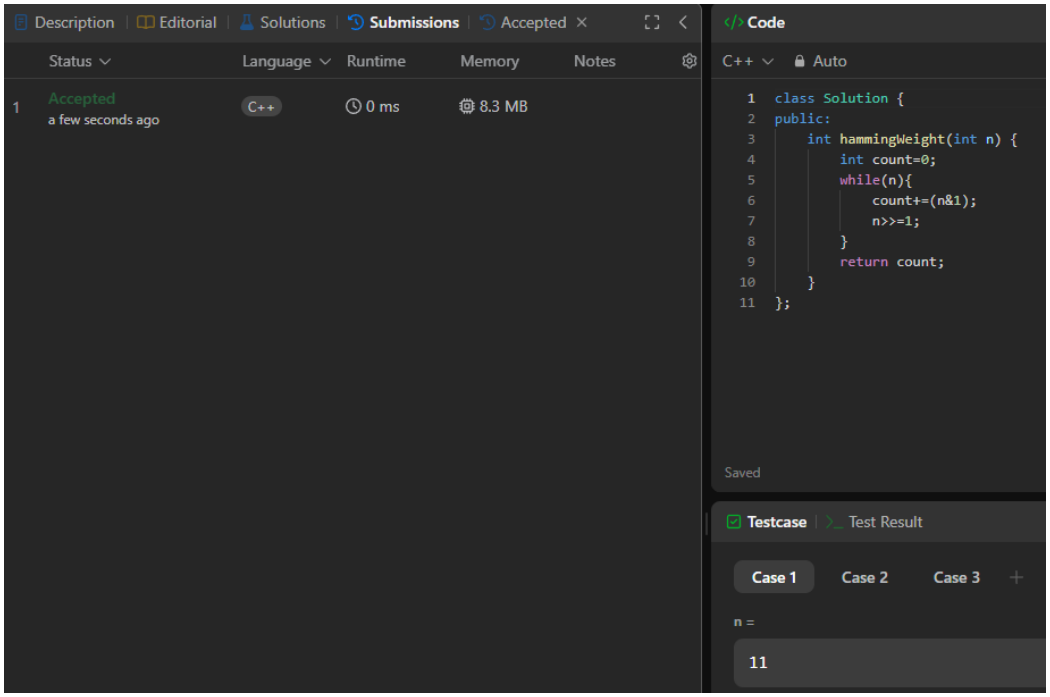
3. Aim: 191. Number of 1 Bits

Implementation/ Code:

```
class Solution {
public:
    int hammingWeight(int n) {
        int count=0;
```

```
        while(n){
            count+=(n&1);
            n>>=1;
        }
        return count;
    }
};
```

Output:



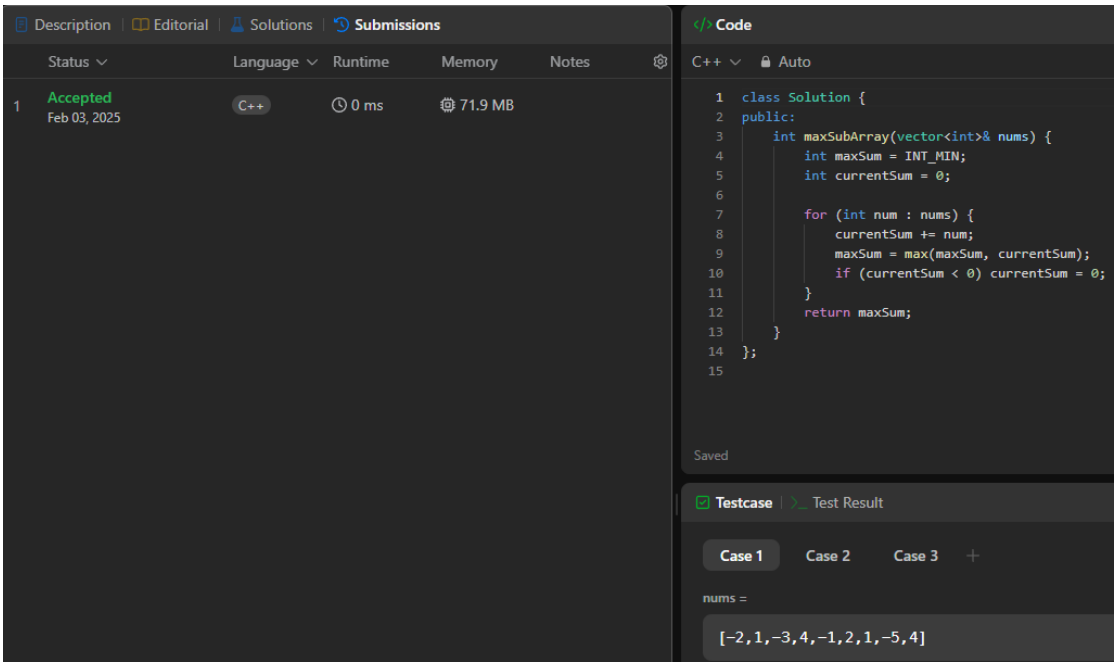
4. Aim: 53. Maximum Subarray

Implementation/ Code:

```
class Solution {
public:
    int maxSubArray(vector<int>& nums) {
        int maxSum = INT_MIN;
        int currentSum = 0;
        for (int num : nums) {
            currentSum += num;
            maxSum = max(maxSum, currentSum);
            if (currentSum < 0) currentSum = 0;
        }
        return maxSum;
    }
```

```
};
```

Output:

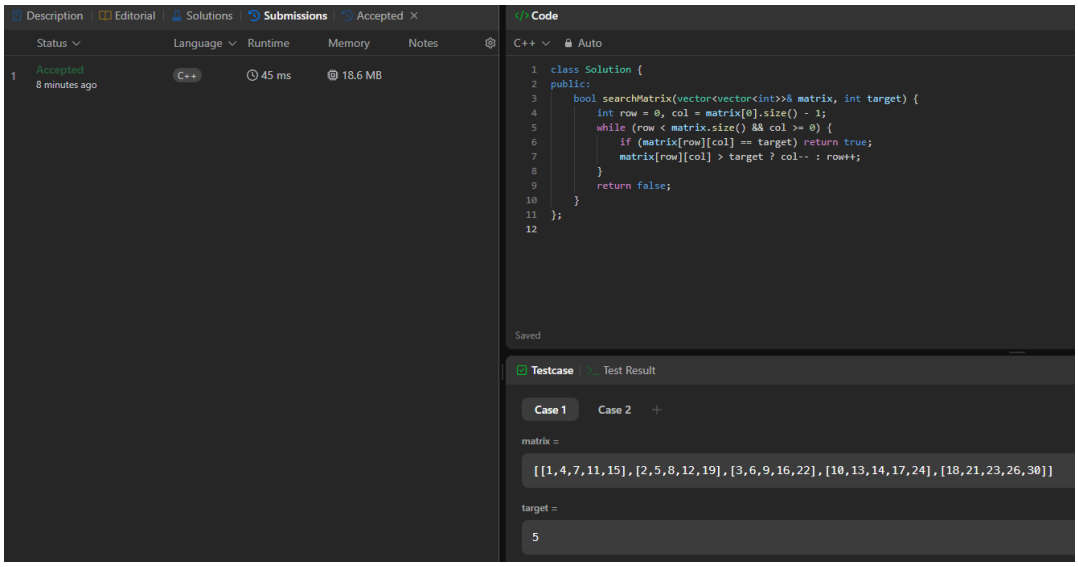


5. **Aim:** 240. Search a 2D Matrix II

Implementation/ Code:

```
class Solution {
public:
    bool searchMatrix(vector<vector<int>>& matrix, int target) {
        int row = 0, col = matrix[0].size() - 1;
        while (row < matrix.size() && col >= 0) {
            if (matrix[row][col] == target) return true;
            matrix[row][col] > target ? col-- : row++;
        }
        return false;
    }
};
```

Output:

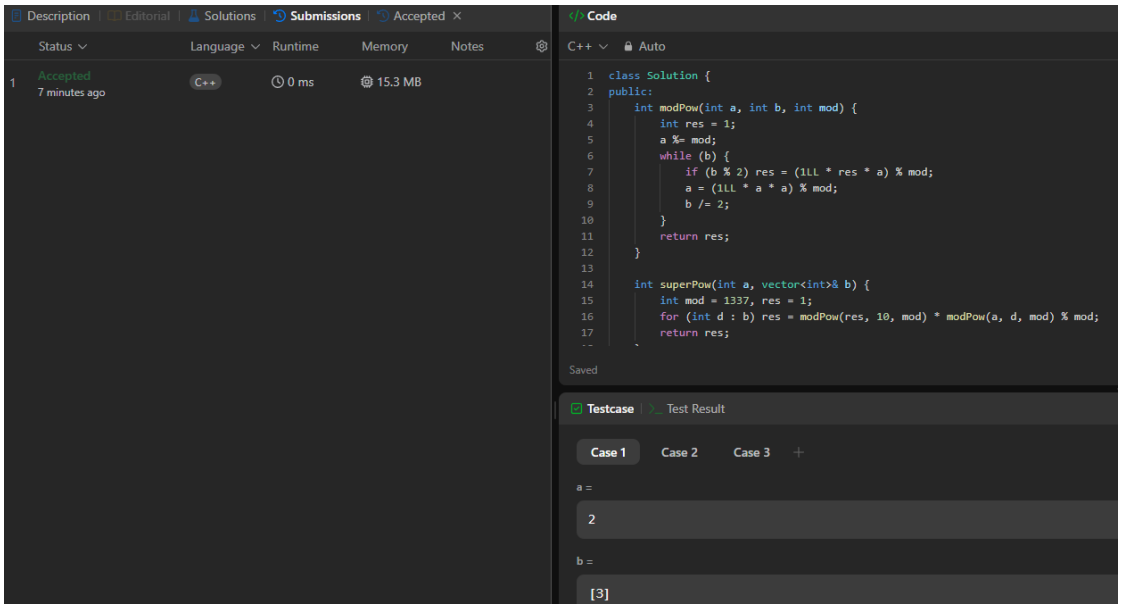


6. Aim: 372. Super Pow

Implementation/ Code:

```
class Solution {
public:
    int modPow(int a, int b, int mod) {
        int res = 1;
        a %= mod;
        while (b) {
            if (b % 2) res = (1LL * res * a) % mod;
            a = (1LL * a * a) % mod;
            b /= 2;
        }
        return res;
    }

    int superPow(int a, vector<int>& b) {
        int mod = 1337, res = 1;
        for (int d : b) res = modPow(res, 10, mod) * modPow(a, d, mod) % mod;
        return res;
    }
};
```

Output:

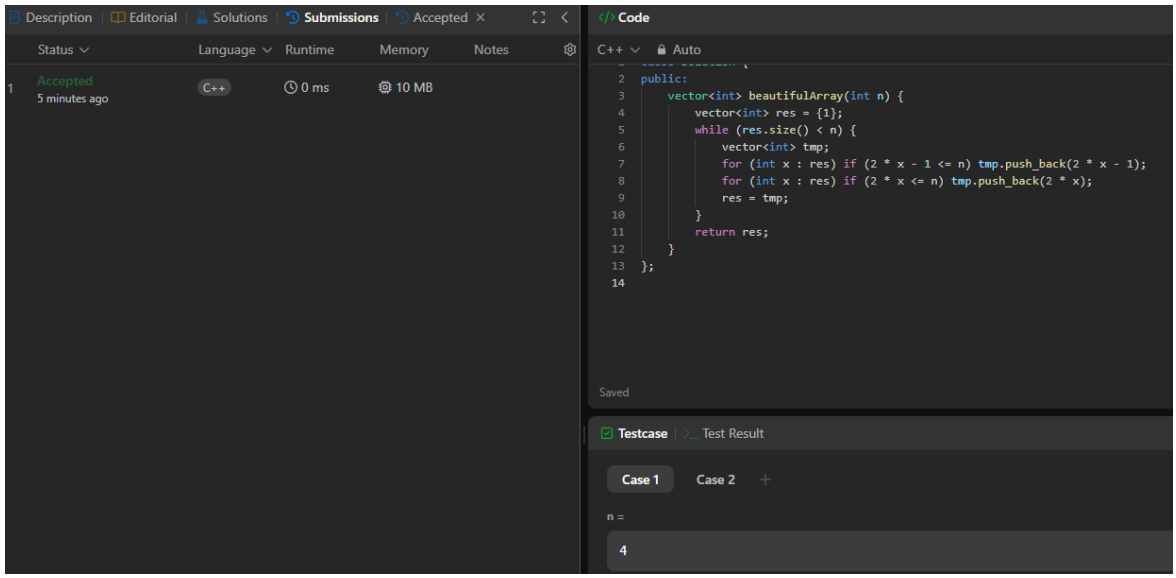


7. Aim: 932. Beautiful Array

Implementation/ Code:

```
class Solution {
public:
    vector<int> beautifulArray(int n) {
        vector<int> res = {1};
        while (res.size() < n) {
            vector<int> tmp;
            for (int x : res) if (2 * x - 1 <= n) tmp.push_back(2 * x - 1);
            for (int x : res) if (2 * x <= n) tmp.push_back(2 * x);
            res = tmp;
        }
        return res;
    }
};
```

Output:

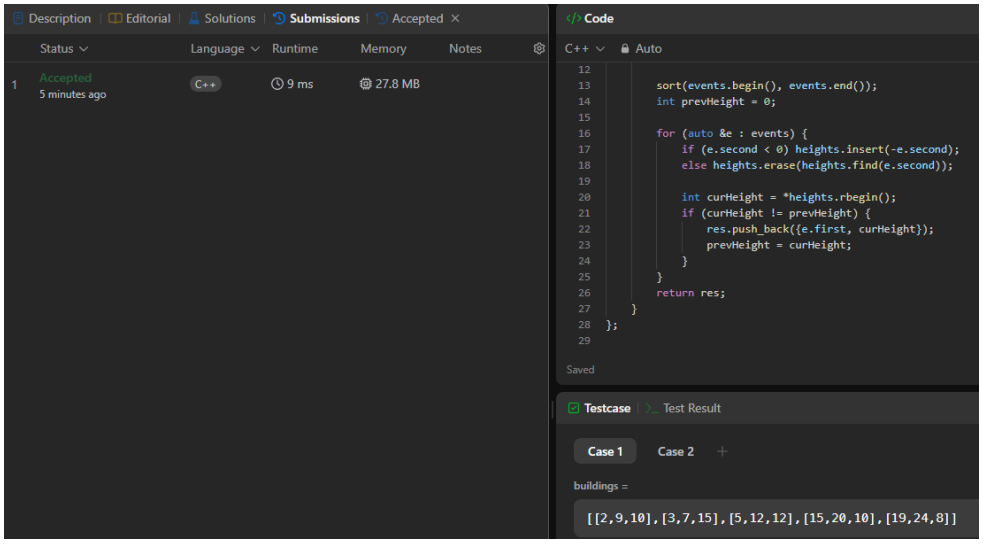


8. Aim: 218. The Skyline Problem

Implementation/ Code:

```
class Solution {
public:
    vector<vector<int>> getSkyline(vector<vector<int>>& buildings) {
        vector<pair<int, int>> events;
        multiset<int> heights = {0};
        vector<vector<int>> res;
        for (auto &b : buildings) {
            events.emplace_back(b[0], -b[2]);
            events.emplace_back(b[1], b[2]);
        }
        sort(events.begin(), events.end());
        int prevHeight = 0;
        for (auto &e : events) {
            if (e.second < 0) heights.insert(-e.second);
            else heights.erase(heights.find(e.second));

            int curHeight = *heights.rbegin();
            if (curHeight != prevHeight) {
                res.push_back({e.first, curHeight});
                prevHeight = curHeight;
            }
        }
        return res;
    }
};
```

Output:

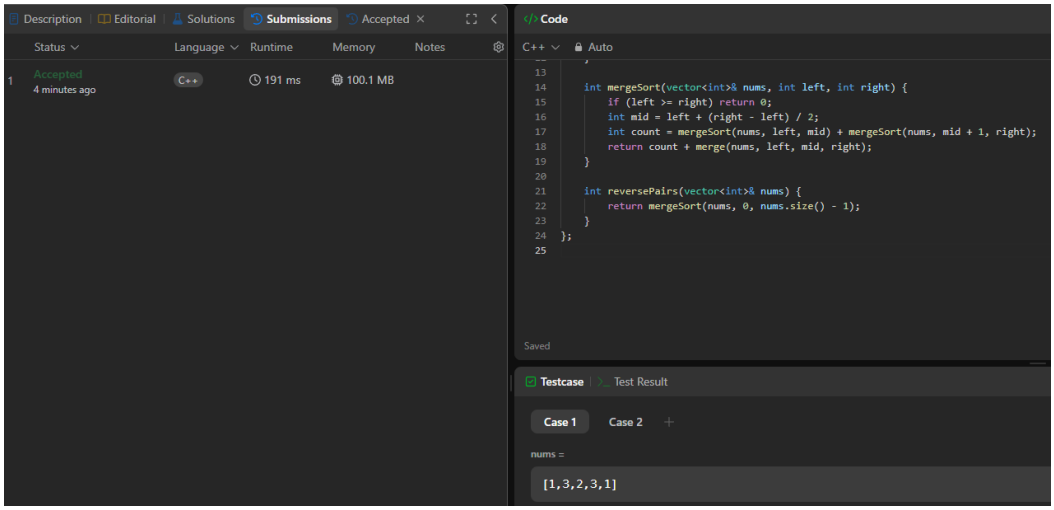


9. Aim: 493. Reverse Pairs

Implementation/ Code:

```
class Solution {
public:
    int merge(vector<int>& nums, int left, int mid, int right) {
        int count = 0, j = mid + 1;
        for (int i = left; i <= mid; i++) {
            while (j <= right && nums[i] > 2LL * nums[j]) j++;
            count += j - (mid + 1);
        }

        inplace_merge(nums.begin() + left, nums.begin() + mid + 1, nums.begin() + right + 1);
        return count;
    }

    int mergeSort(vector<int>& nums, int left, int right) {
        if (left >= right) return 0;
        int mid = left + (right - left) / 2;
        int count = mergeSort(nums, left, mid) + mergeSort(nums, mid + 1, right);
        return count + merge(nums, left, mid, right);
    }

    int reversePairs(vector<int>& nums) {
        return mergeSort(nums, 0, nums.size() - 1);
    }
};
```

Output:



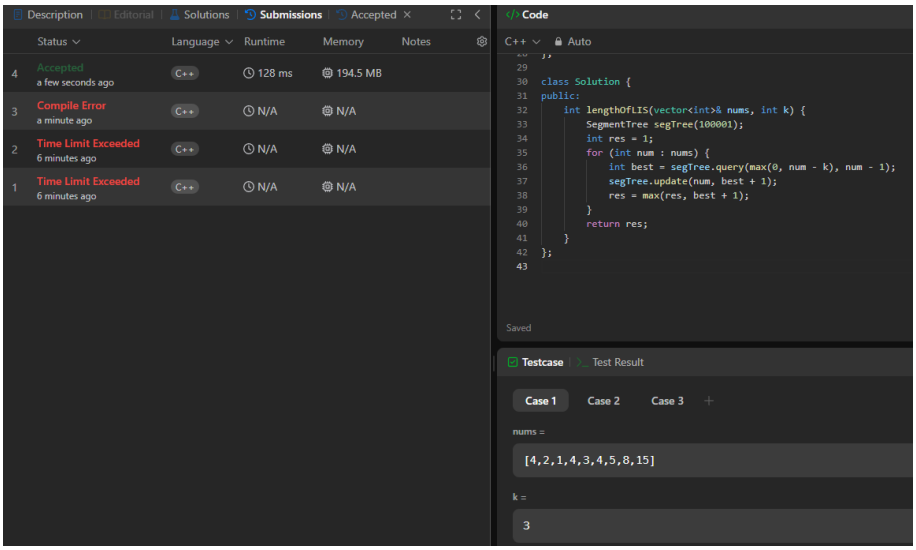
10. Aim: 2407. Longest Increasing Subsequence II

Implementation/ Code:

```
class SegmentTree {
public:
    vector<int> tree;
    int size;

    SegmentTree(int n) {
        size = n;
        tree.resize(4 * n, 0);
    }

    void update(int index, int value, int node = 1, int start = 0, int end = 100000) {
        if (start == end) {
            tree[node] = value;
            return;
        }
        int mid = (start + end) / 2;
        if (index <= mid) update(index, value, 2 * node, start, mid);
        else update(index, value, 2 * node + 1, mid + 1, end);
        tree[node] = max(tree[2 * node], tree[2 * node + 1]);
    }

    int query(int left, int right, int node = 1, int start = 0, int end = 100000) {
        if (left > end || right < start) return 0;
        if (left <= start && end <= right) return tree[node];
        int mid = (start + end) / 2;
```

```
        return max(query(left, right, 2 * node, start, mid), query(left, right, 2 * node + 1, mid + 1,
end));
    }
};

class Solution {
public:
    int lengthOfLIS(vector<int>& nums, int k) {
        SegmentTree segTree(100001);
        int res = 1;
        for (int num : nums) {
            int best = segTree.query(max(0, num - k), num - 1);
            segTree.update(num, best + 1);
            res = max(res, best + 1);
        }
        return res;
    }
};
```

Output:



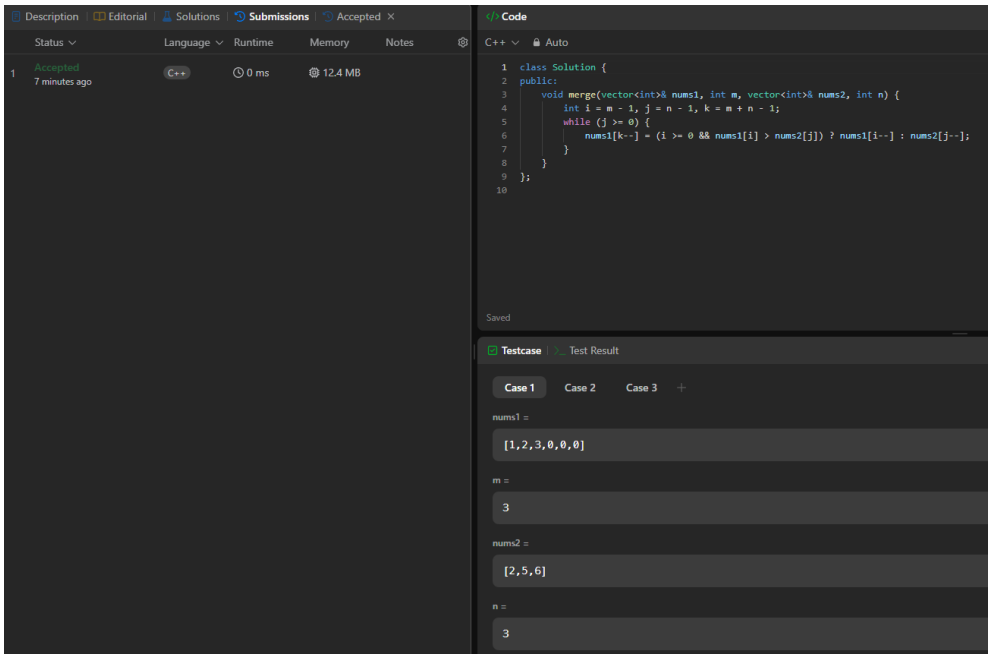
11. Aim: 88. Merge Sorted Array

Implementation/ Code:

```
class Solution {
public:
    void merge(vector<int>& nums1, int m, vector<int>& nums2, int n) {
        int i = m - 1, j = n - 1, k = m + n - 1;
        while (j >= 0) {
```

```
            nums1[k--] = (i >= 0 && nums1[i] > nums2[j]) ? nums1[i--] : nums2[j--];
        }
    }
};
```

Output:

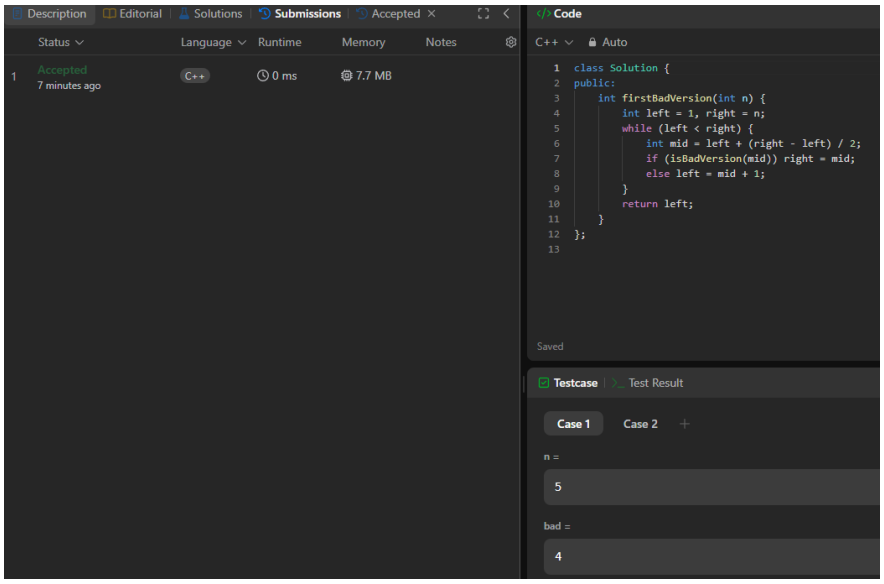


12. Aim: 278. First Bad Version

Implementation/ Code:

```
class Solution {
public:
    int firstBadVersion(int n) {
        int left = 1, right = n;
        while (left < right) {
            int mid = left + (right - left) / 2;
            if (isBadVersion(mid)) right = mid;
            else left = mid + 1;
        }
        return left;
    }
};
```

Output:

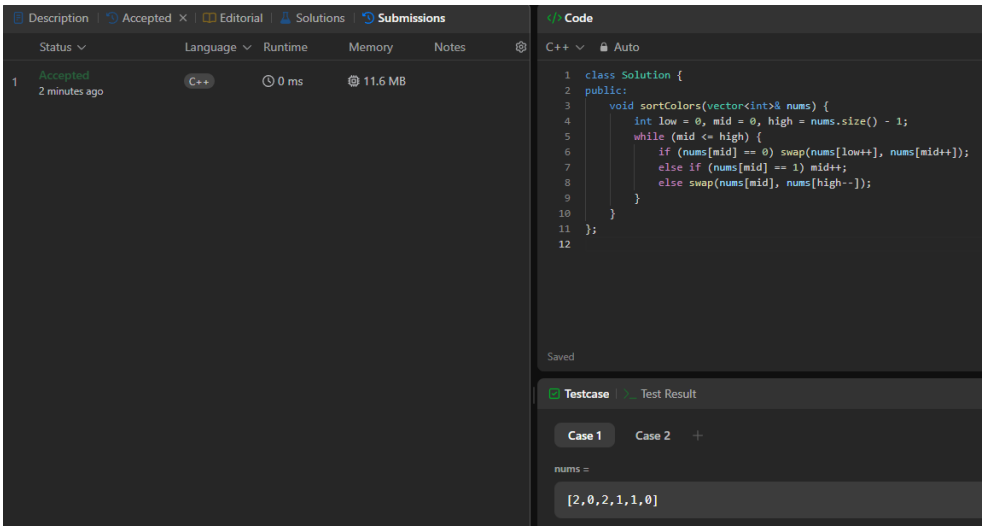


13. Aim: 75. Sort Colors

Implementation/ Code:

```
class Solution {
public:
    void sortColors(vector<int>& nums) {
        int low = 0, mid = 0, high = nums.size() - 1;
        while (mid <= high) {
            if (nums[mid] == 0) swap(nums[low++], nums[mid++]);
            else if (nums[mid] == 1) mid++;
            else swap(nums[mid], nums[high--]);
        }
    }
};
```

Output:

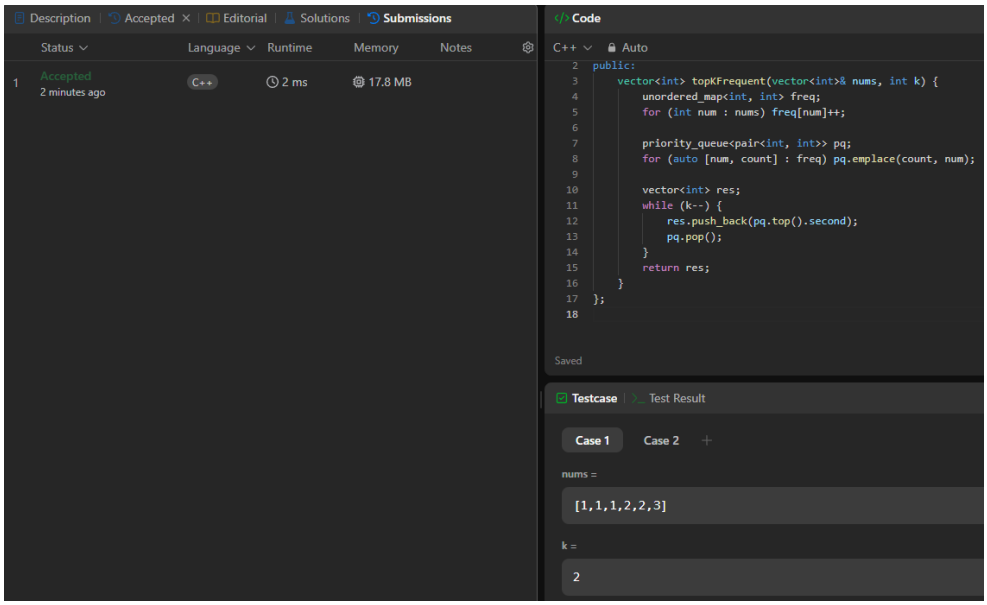


14. Aim: 347. Top K Frequent Elements

Implementation/ Code:

```
class Solution {
public:
    vector<int> topKFrequent(vector<int>& nums, int k) {
        unordered_map<int, int> freq;
        for (int num : nums) freq[num]++;

        priority_queue<pair<int, int>> pq;
        for (auto [num, count] : freq) pq.emplace(count, num);

        vector<int> res;
        while (k--) {
            res.push_back(pq.top().second);
            pq.pop();
        }
        return res;
    }
};
```

Output:

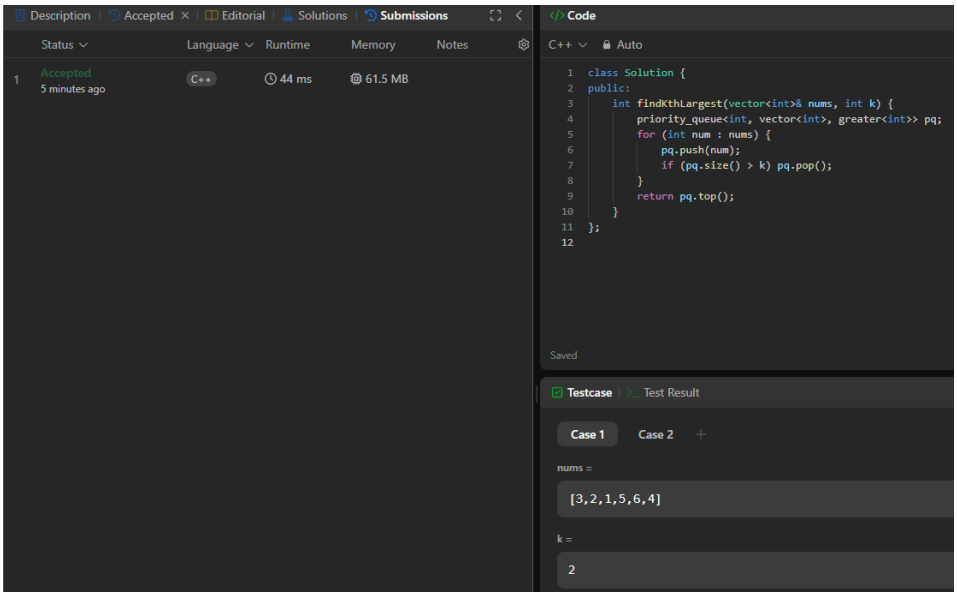


15. Aim: 215. Kth Largest Element in an Array

Implementation/ Code:

```
class Solution {
public:
    int findKthLargest(vector<int>& nums, int k) {
        priority_queue<int, vector<int>, greater<int>> pq;
        for (int num : nums) {
            pq.push(num);
            if (pq.size() > k) pq.pop();
        }
        return pq.top();
    }
};
```

Output:

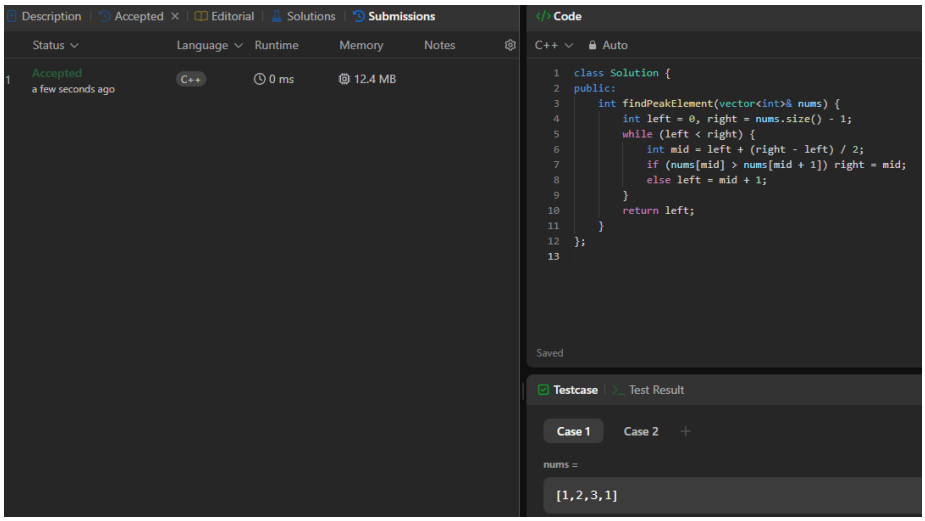


16. Aim: 162. Find Peak Element

Implementation/ Code:

```
class Solution {
public:
    int findPeakElement(vector<int>& nums) {
        int left = 0, right = nums.size() - 1;
        while (left < right) {
            int mid = left + (right - left) / 2;
            if (nums[mid] > nums[mid + 1]) right = mid;
            else left = mid + 1;
        }
        return left;
    }
};
```

Output:

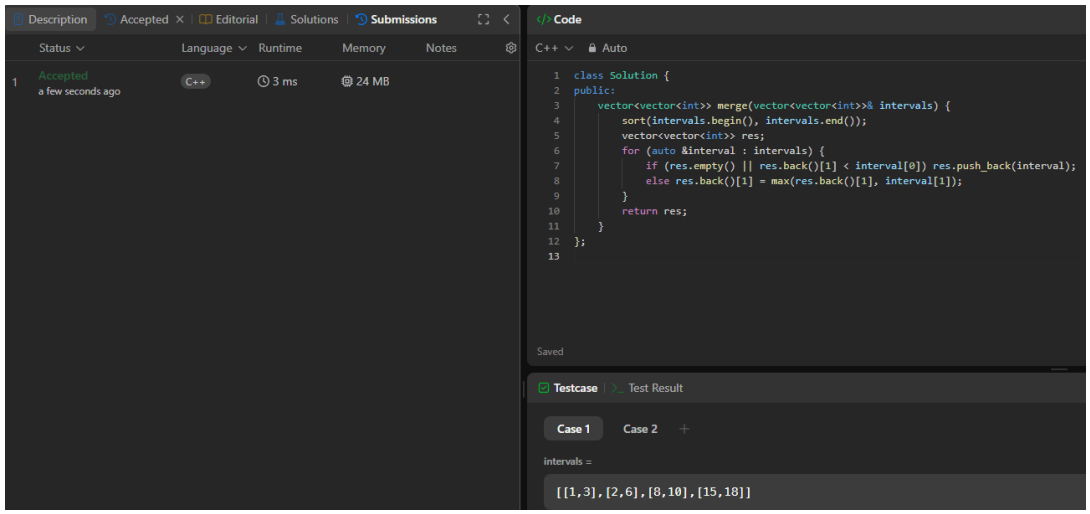


17. Aim: 56. Merge Intervals

Implementation/ Code:

```
class Solution {
public:
    vector<vector<int>> merge(vector<vector<int>>& intervals) {
        sort(intervals.begin(), intervals.end());
        vector<vector<int>> res;
        for (auto &interval : intervals) {
            if (res.empty() || res.back()[1] < interval[0]) res.push_back(interval);
            else res.back()[1] = max(res.back()[1], interval[1]);
        }
        return res;
    }
};
```

Output:

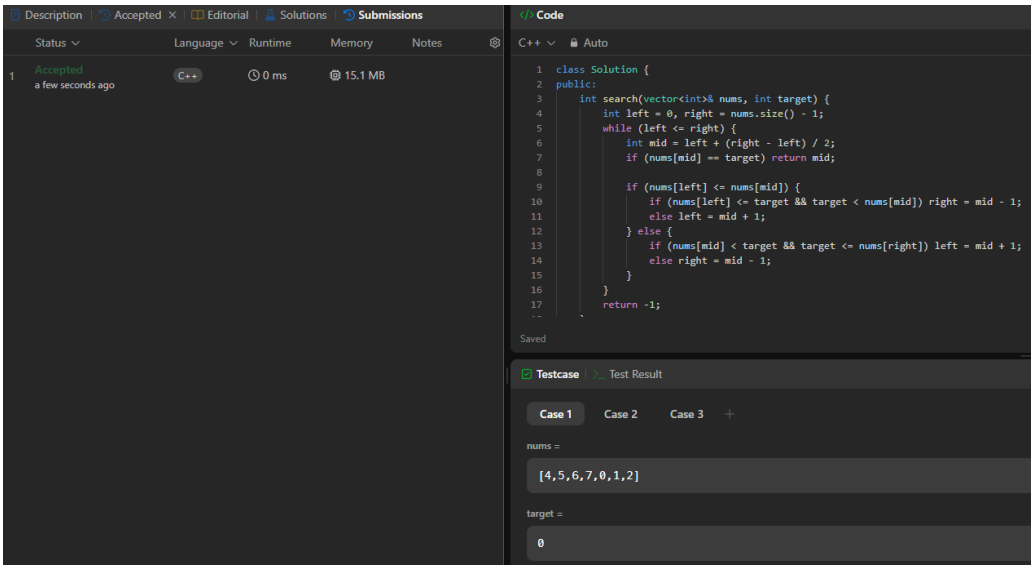


18. Aim: 33.Search in Rotated Sorted Array

Implementation/ Code:

```
class Solution {
public:
    int search(vector<int>& nums, int target) {
        int left = 0, right = nums.size() - 1;
        while (left <= right) {
            int mid = left + (right - left) / 2;
            if (nums[mid] == target) return mid;

            if (nums[left] <= nums[mid]) {
                if (nums[left] <= target && target < nums[mid]) right = mid - 1;
                else left = mid + 1;
            } else {
                if (nums[mid] < target && target <= nums[right]) left = mid + 1;
                else right = mid - 1;
            }
        }
        return -1;
    }
};
```

Output:

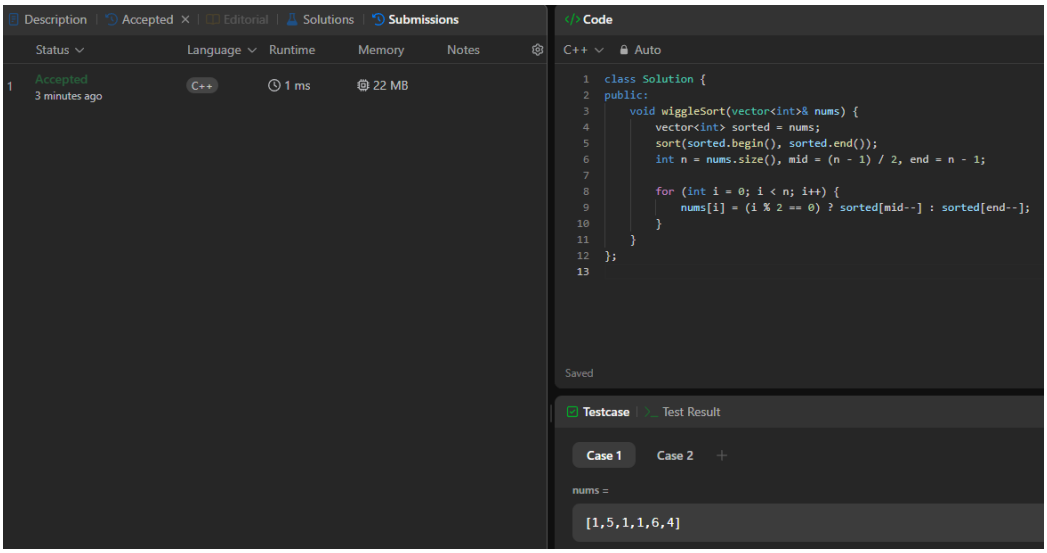


19. Aim: 324.Wiggle Sort II

Implementation/ Code:

```
class Solution {
public:
    void wiggleSort(vector<int>& nums) {
        vector<int> sorted = nums;
        sort(sorted.begin(), sorted.end());
        int n = nums.size(), mid = (n - 1) / 2, end = n - 1;

        for (int i = 0; i < n; i++) {
            nums[i] = (i % 2 == 0) ? sorted[mid--] : sorted[end--];
        }
    }
};
```

Output:

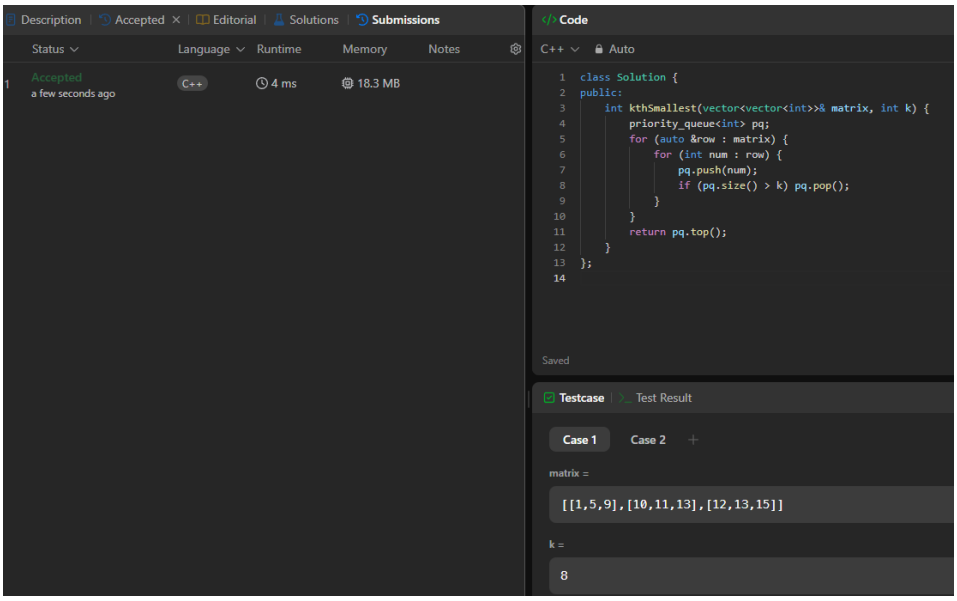


20. Aim: 378.Kth Smallest Element in a Sorted Matrix

Implementation/ Code:

```
class Solution {
public:
    int kthSmallest(vector<vector<int>>& matrix, int k) {
        priority_queue<int> pq;
        for (auto &row : matrix) {
            for (int num : row) {
                pq.push(num);
                if (pq.size() > k) pq.pop();
            }
        }
        return pq.top();
    }
};
```

Output:



21. Aim: 4.Median of Two Sorted Arrays

Implementation/ Code:

```
class Solution {
public:
    double findMedianSortedArrays(vector<int>& nums1, vector<int>& nums2) {
        if (nums1.size() > nums2.size()) return findMedianSortedArrays(nums2, nums1);

        int x = nums1.size(), y = nums2.size();
        int low = 0, high = x;

        while (low <= high) {
            int partitionX = (low + high) / 2;
            int partitionY = (x + y + 1) / 2 - partitionX;

            int maxX = (partitionX == 0) ? INT_MIN : nums1[partitionX - 1];
            int minX = (partitionX == x) ? INT_MAX : nums1[partitionX];
            int maxY = (partitionY == 0) ? INT_MIN : nums2[partitionY - 1];
            int minY = (partitionY == y) ? INT_MAX : nums2[partitionY];

            if (maxX <= minY && maxY <= minX) {
                if ((x + y) % 2 == 0) return (max(maxX, maxY) + min(minX, minY)) / 2.0;
                else return max(maxX, maxY);
            } else if (maxX > minY) {
                high = partitionX - 1;
            } else {
                low = partitionX + 1;
            }
```

```
        }
        return -1;
    }
};
```

Output: