ASSIGNMENT -6 (ADVANCED PROGRAMMING)
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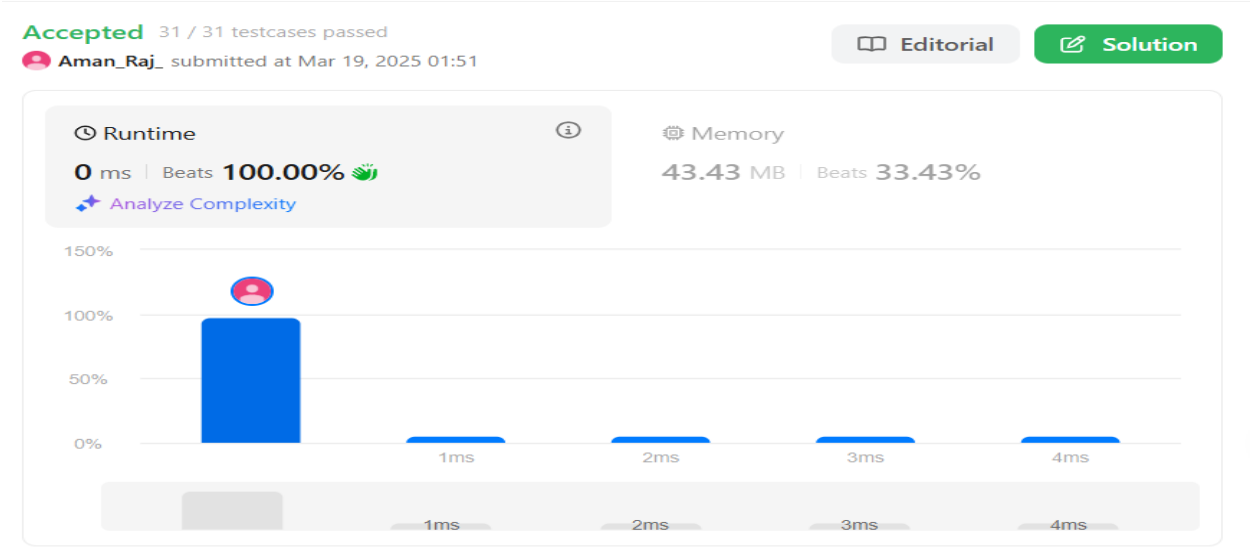
1. **Problem 1:** Convert Sorted Array to Binary Search Tree
2. **Implementation/Code:**

```
class Solution {
    public TreeNode sortedArrayToBST(int[] nums) {
        return constructBST(nums, 0, nums.length - 1);    }
    private TreeNode constructBST(int[] nums, int left, int right) {
        if (left > right) {
            return null;        }
        int mid = left + (right - left) / 2;
        TreeNode root = new TreeNode(nums[mid]);
        root.left = constructBST(nums, left, mid - 1);
        root.right = constructBST(nums, mid + 1, right);

        return root;    }}
```

3. **Output:**

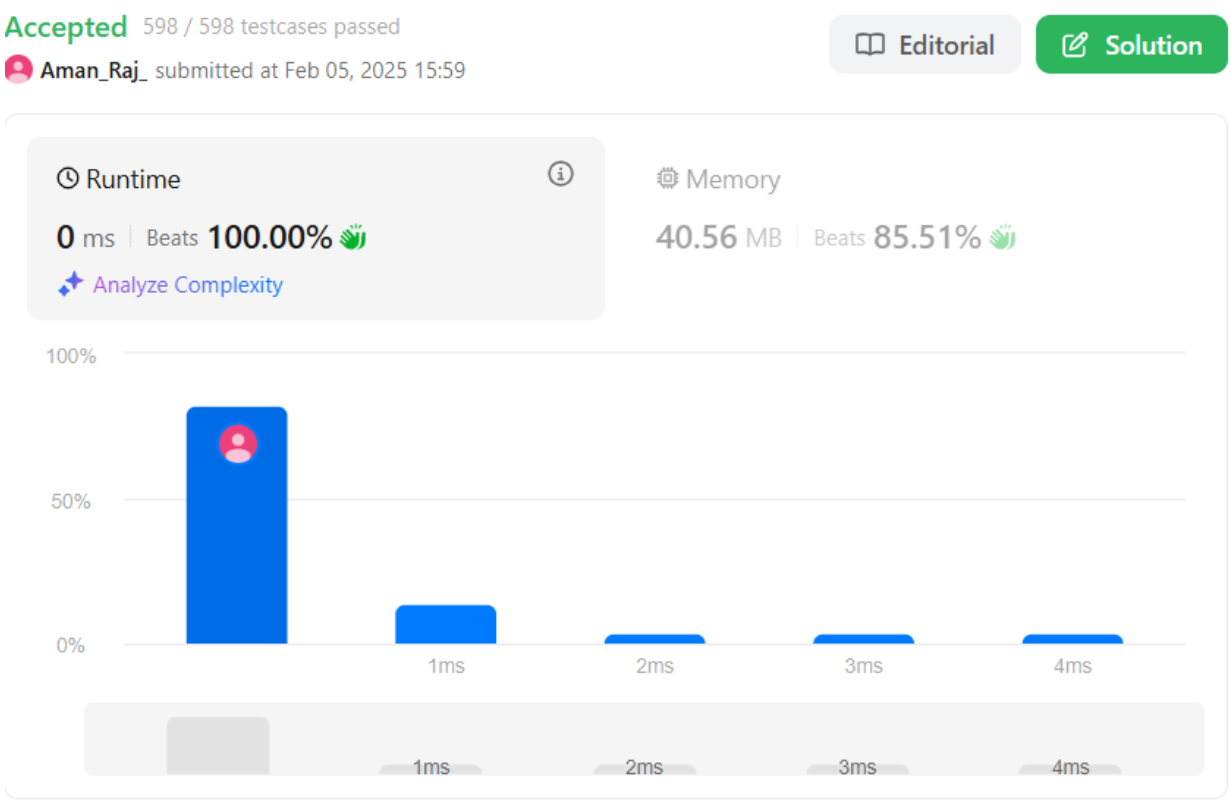


1. **Problem 2:** Number of 1 bits

2. **Implementation/code:**

```
public class Solution {
    public int hammingWeight(int n) {
        int count = 0;
        while (n != 0) {
            count += (n & 1);
            n >>>= 1;
        }
        return count;
    }
}
```

3. **Output:**

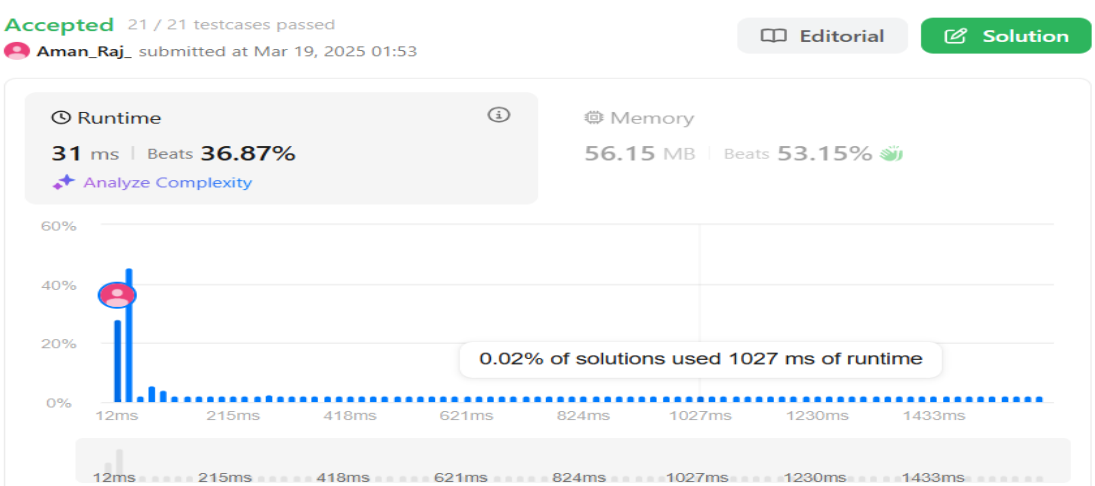


1. **Problem 3:** Sort an Array

2. **Implementation/Code:**

```
class Solution {
    public int[] sortArray(int[] nums) {
        mergeSort(nums,0,nums.length-1);
        return nums; }
    public static void mergeFun(int[] arr, int l, int m, int r) {
        int n1 = m + 1 - l;  int n2 = r - m; int[] left = new int[n1];
        for (int i = 0; i < n1; i++) {left[i] = arr[l + i];   }
        int[] right = new int[n2];
        for (int i = 0; i < n2; i++) { right[i] = arr[m + 1 + i];  }
        int i = 0, j = 0, k = l;
        while (i < n1 || j < n2) {
            if (j == n2 || i < n1 && left[i] < right[j]) arr[k++] = left[i++];
            else   arr[k++] = right[j++];    } }
    public static void mergeSort(int[] arr, int low, int high) {
        if (low < high) { int middle = (high - low) / 2 + low;
            mergeSort(arr, low, middle);
            mergeSort(arr, middle + 1, high);
            mergeFun(arr, low, middle, high);     } }}
```

3. **Output:**

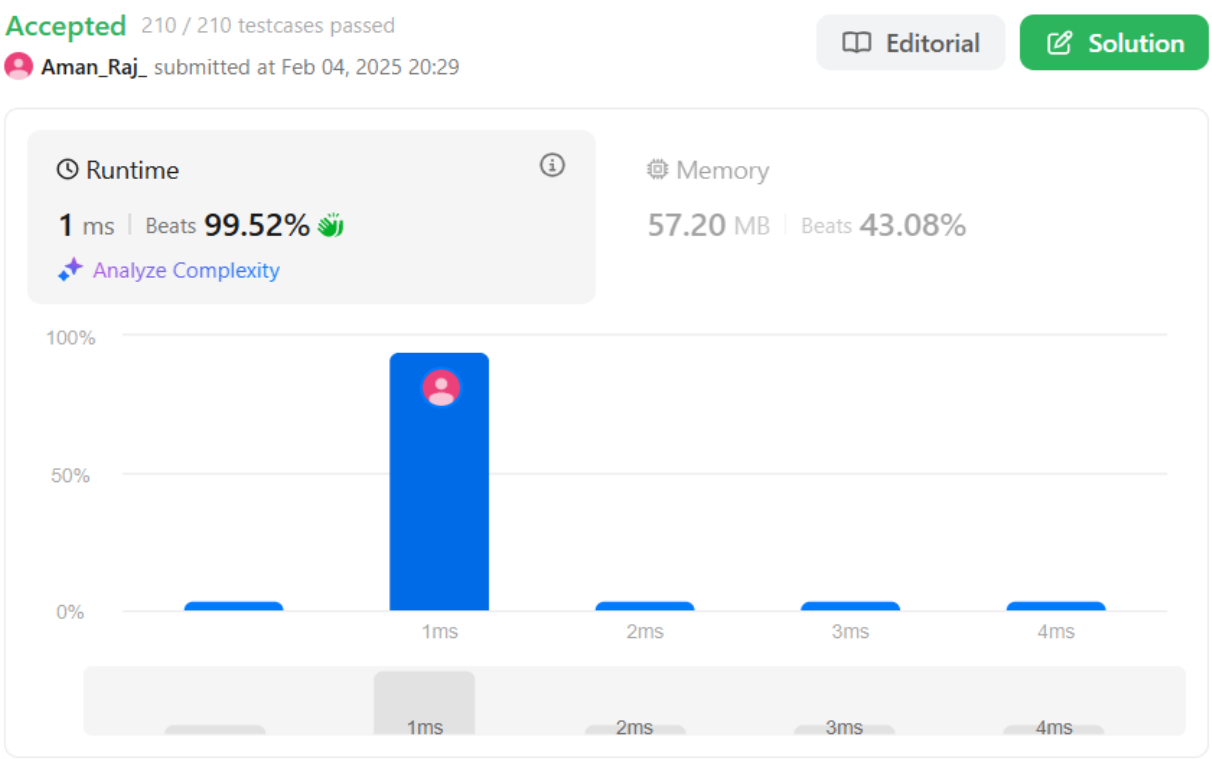


1. **Problem 4:** Maximum Sub array

2. **Implementation/code:**

```
public class Solution {
    public int maxSubArray(int[] nums) {
        int maxSum = nums[0], currentSum = 0;
        for (int num : nums) {
            currentSum = Math.max(num, currentSum + num);
            maxSum = Math.max(maxSum, currentSum);
        }
        return maxSum;
    }
}
```

3. **Output:**

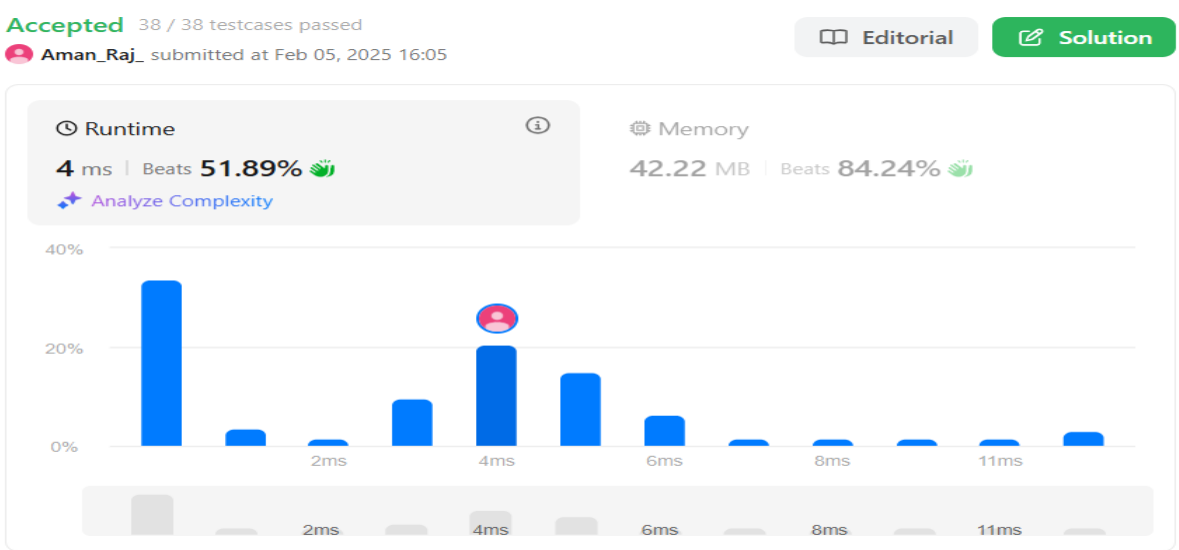


1. **Problem 5:** Beautiful Array

2. **Implementation/Code:**

```
import java.util.*;
public class Solution {
    public int[] beautifulArray(int N) {
        List<Integer> result = new ArrayList<>();
        result.add(1);
        while (result.size() < N) {
            List<Integer> temp = new ArrayList<>();
            for (int num : result) {
                if (num * 2 - 1 <= N) temp.add(num * 2 - 1);      }
            for (int num : result) {
                if (num * 2 <= N) temp.add(num * 2);       }
            result = temp;     }
        int[] arr = new int[result.size()];
        for (int i = 0; i < result.size(); i++) {
            arr[i] = result.get(i);   }
        return arr;  }}
```

3. **Output:**

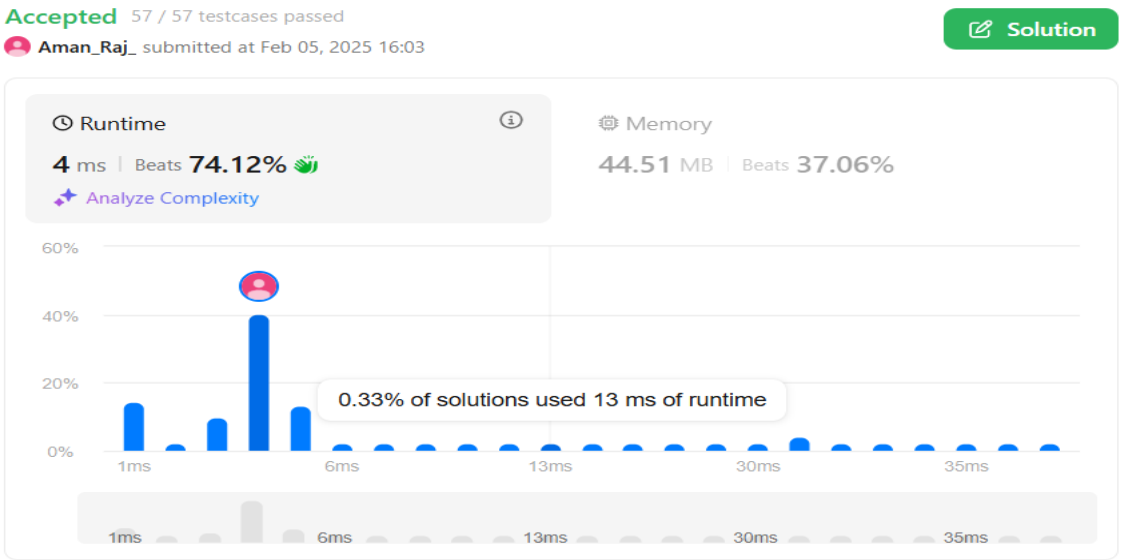


1. **Problem 6:** Super Pow

2. **Implementation/Code:**

```
public class Solution {
    private static final int MOD = 1337;
    private int pow(int a, int b) {
        int res = 1;
        a %= MOD;
        for (int i = 0; i < b; i++) {
            res = (res * a) % MOD;        }
        return res;    }
    public int superPow(int a, int[] b) {
        int res = 1;
        for (int i = b.length - 1; i >= 0; i--) {
            res = (res * pow(a, b[i])) % MOD;
            a = pow(a, 10);
        }
        return res;    }}
```

3. **Output:**



1. **Problem 7:** The Skyline Problem

2. **Implementation/Code:**

```
import java.util.*;
class Solution {
    public List<List<Integer>> getSkyline(int[][] buildings) {
        return divideAndConquer(buildings, 0, buildings.length - 1);
    }
    private List<List<Integer>> divideAndConquer(int[][] buildings, int left,
int right) {
        if (left > right) return new ArrayList<>();
        if (left == right) {
            List<List<Integer>> result = new ArrayList<>();
            result.add(Arrays.asList(buildings[left][0], buildings[left][2]));
            result.add(Arrays.asList(buildings[left][1], 0));
            return result;
        }

        int mid = left + (right - left) / 2;
        List<List<Integer>> leftSkyline = divideAndConquer(buildings, left,
mid);
        List<List<Integer>> rightSkyline = divideAndConquer(buildings, mid
+ 1, right);

        return mergeSkylines(leftSkyline, rightSkyline);
    }
    private List<List<Integer>> mergeSkylines(List<List<Integer>> left,
List<List<Integer>> right) {
        List<List<Integer>> result = new ArrayList<>();
        int h1 = 0, h2 = 0, i = 0, j = 0;
        while (i < left.size() && j < right.size()) {
            List<Integer> point1 = left.get(i);
            List<Integer> point2 = right.get(j);

            int x;
            if (point1.get(0) < point2.get(0)) {
```

```
            x = point1.get(0);
            h1 = point1.get(1);
            i++;
        } else if (point1.get(0) > point2.get(0)) {
            x = point2.get(0);
            h2 = point2.get(1);
            j++;
        } else {
            x = point1.get(0);
            h1 = point1.get(1);
            h2 = point2.get(1);
            i++;
            j++;      }
        int maxHeight = Math.max(h1, h2);
        if (result.isEmpty() || result.get(result.size() - 1).get(1) != maxHeight)
{
            result.add(Arrays.asList(x, maxHeight));          }       }
    while (i < left.size()) result.add(left.get(i++));
    while (j < right.size()) result.add(right.get(j++));

    return result;    }}
```

3. **Output:**