Worksheet 6

Student Name: Mayank Vashishta **UID:** 22CS12920

Branch:CSE **Section/Group:** 605-B

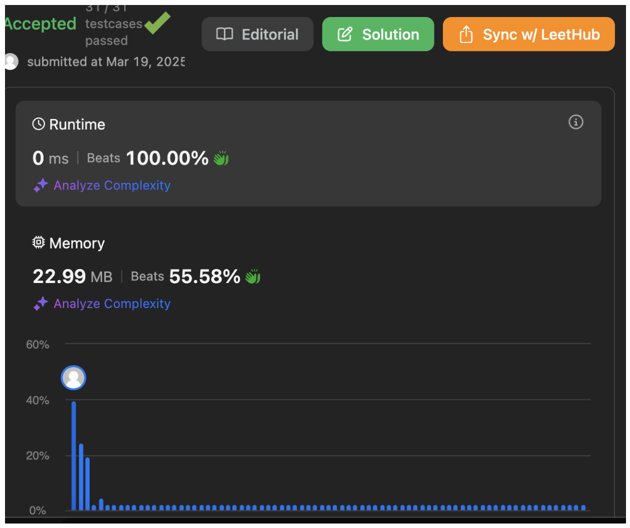
Semester: 6 **Date of Performance:** 19/03/25

Subject Name: AP **Subject Code:** 22CSP-351

1. Given an integer array nums where the elements are sorted in ascending order, convert it to a height-balanced binary search tree.

```
TreeNode* sortedArrayToBST(vector<int>& nums, int left, int right) {

    if (left > right) return nullptr;  // Base case


    int mid = left + (right - left) / 2;  // Middle element

    TreeNode* root = new TreeNode(nums[mid]);  // Create root node


    // Recursively build left and right subtrees

    root->left = sortedArrayToBST(nums, left, mid - 1);

    root->right = sortedArrayToBST(nums, mid + 1, right);


    return root;

}


// Helper function to start recursion
```

```
TreeNode* sortedArrayToBST(vector<int>& nums) {
    return sortedArrayToBST(nums, 0, nums.size() - 1);
}
```

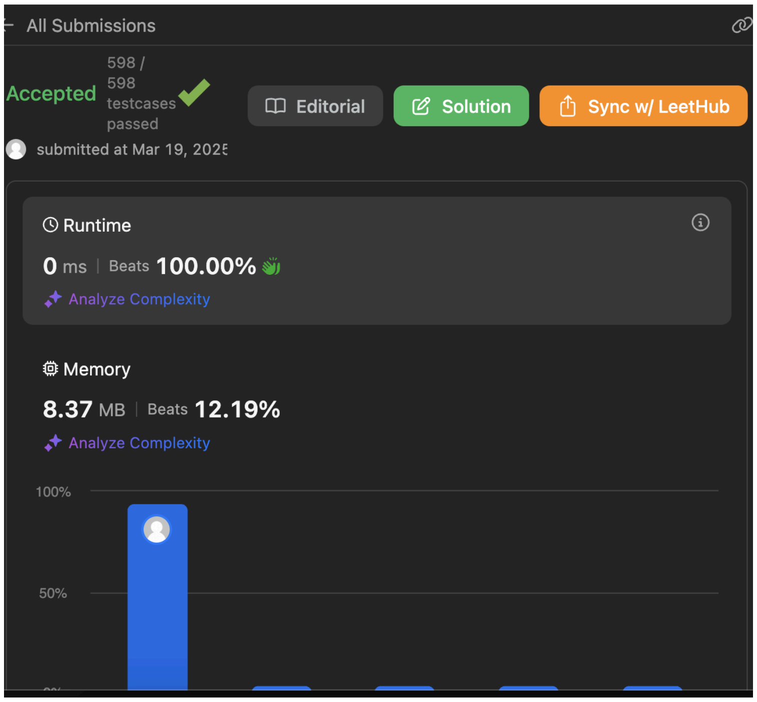

Accepted 31 / 31 testcases passed
submitted at Mar 19, 2025

Runtime
0 ms | Beats 100.00%

Memory
22.99 MB | Beats 55.58%

2. Given a positive integer n, write a function that returns the number of set bits in its binary representation (also known as the Hamming weight).

```
class Solution {
public:
    int hammingWeight(uint32_t n) {
    int count = 0;
    while (n != 0) {
        count += (n & 1);
        n >>= 1;
    }
    return count;
    }
};
```



Accepted 598 / 598 testcases passed
submitted at Mar 19, 2025

Runtime
0 ms | Beats 100.00%

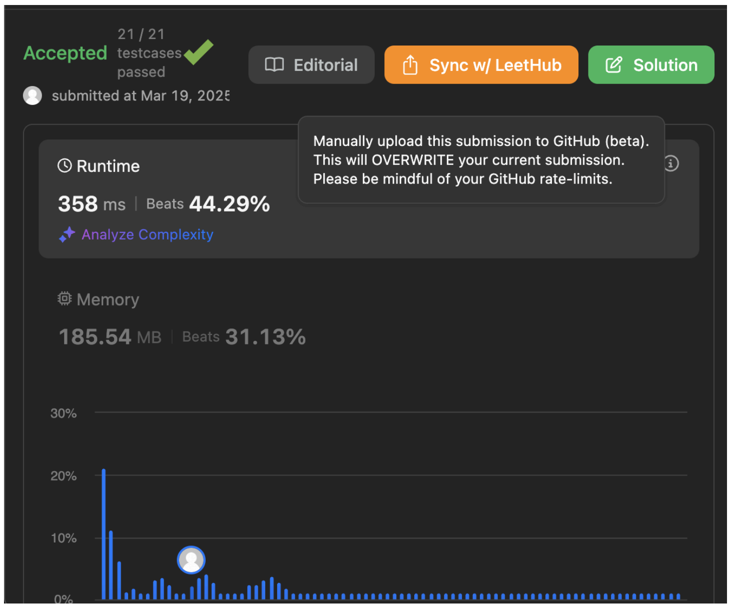
Memory
8.37 MB | Beats 12.19%

3. Given an array of integers nums, sort the array in ascending order and return it.

   You must solve the problem without using any built-in functions in O(nlog(n)) time complexity and with the smallest space complexity possible.

```
void merge(vector<int>& nums, int left, int mid, int right) {
    int n1 = mid - left + 1;  // Size of left subarray
    int n2 = right - mid;  // Size of right subarray

    // Create temporary arrays
    vector<int> leftArr(n1);
    vector<int> rightArr(n2);

    // Copy data to temporary arrays
    for (int i = 0; i < n1; i++)
        leftArr[i] = nums[left + i];
    for (int i = 0; i < n2; i++)
        rightArr[i] = nums[mid + 1 + i];

    // Merge two sorted subarrays
    int i = 0, j = 0, k = left;
    while (i < n1 && j < n2) {
        if (leftArr[i] <= rightArr[j])
            nums[k++] = leftArr[i++];
        else
            nums[k++] = rightArr[j++];
    }

    // Copy remaining elements
    while (i < n1) nums[k++] = leftArr[i++];
    while (j < n2) nums[k++] = rightArr[j++];
}
```

```
// Merge Sort function
void mergeSort(vector<int>& nums, int left, int right) {
   if (left < right) {
      int mid = left + (right - left) / 2;  // Find the middle point
      mergeSort(nums, left, mid);  // Sort left half
      mergeSort(nums, mid + 1, right);  // Sort right half
      merge(nums, left, mid, right);  // Merge sorted halves
   }
}


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



Accepted 21 / 21 testcases passed
submitted at Mar 19, 2025

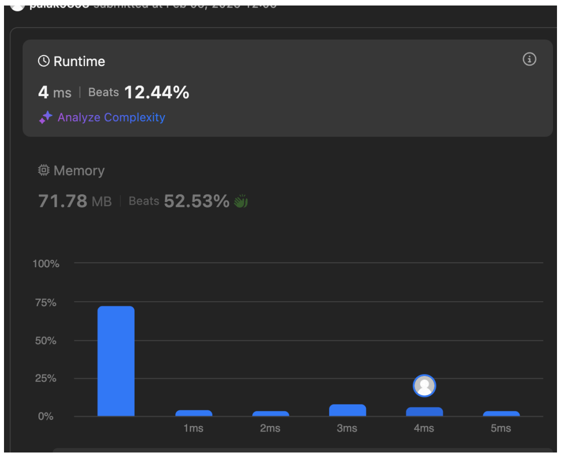
Manually upload this submission to GitHub (beta). This will OVERWRITE your current submission. Please be mindful of your GitHub rate-limits.

Runtime
358 ms | Beats 44.29%

Memory
185.54 MB | Beats 31.13%

4. Given an integer array nums, find the subarray with the largest sum, and return its sum.

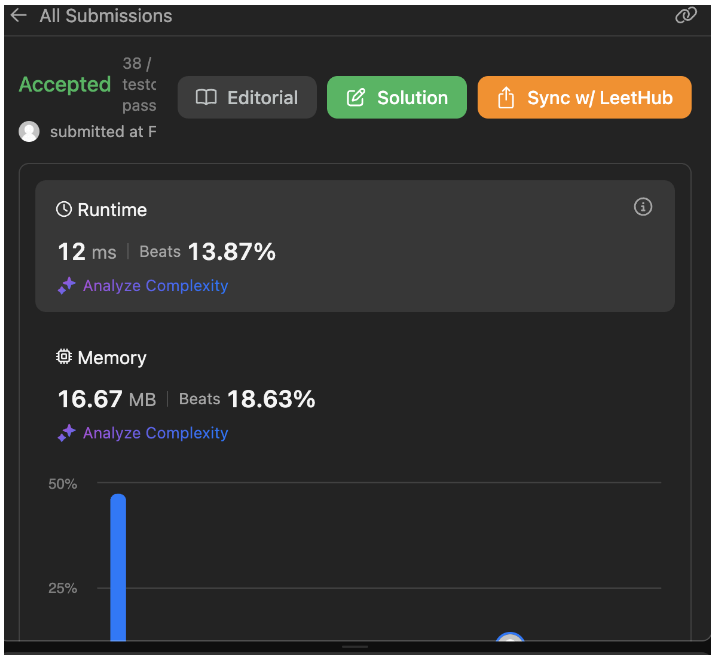
```
int maxSubArray(vector<int>& nums) {
    int maxSum = nums[0];
    int currentSum = nums[0];

    for (int i = 1; i < nums.size(); ++i) {
        currentSum = max(nums[i], currentSum + nums[i]);  // Extend the subarray or start a new one
        maxSum = max(maxSum, currentSum);                // Update the max sum
    }

    return maxSum;
}
```


Runtime
4 ms | Beats 12.44%
Analyze Complexity
Memory
71.78 MB | Beats 52.53%

5. An array nums of length n is beautiful if: nums is a permutation of the integers in the range [1, n].

For every 0 <= i < j < n, there is no index k with i < k < j where 2 * nums[k] == nums[i] + nums[j]. Given the integer n, return any beautiful array nums of length n. There will be at least one valid answer for the given n.

```
class Solution {
public:
    vector<int> beautifulArray(int n) {
    if (n == 1) return {1};

    vector<int> odd = beautifulArray((n + 1) / 2);  // Construct for odd indices
    vector<int> even = beautifulArray(n / 2);       // Construct for even indices

    vector<int> result;
    for (int x : odd) result.push_back(2 * x - 1);  // Map odd part: 2*x - 1
    for (int x : even) result.push_back(2 * x);     // Map even part: 2*x

    return result;
}

};
```



Accepted 38 / testc pass

submitted at F

Runtime

12 ms | Beats 13.87%

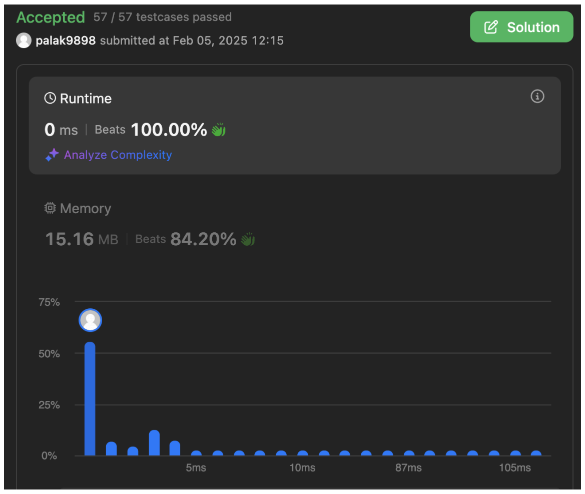
Memory

16.67 MB | Beats 18.63%

6. Your task is to calculate ab mod 1337 where a is a positive integer and b is an extremely large positive integer given in the form of an array.

```
int modPow(int a, int b, int mod) {

    int result = 1;

    a %= mod;

    while (b > 0) {

        if (b % 2 == 1) {

            result = (result * a) % mod;

        }

        a = (a * a) % mod;

        b /= 2;

    }

    return result;

}
```

```
// Function to calculate a^b % 1337 where b is given as a vector of digits
int superPow(int a, vector<int>& b) {
    if (b.empty()) return 1;


    int lastDigit = b.back();
    b.pop_back();


    int part1 = modPow(superPow(a, b), 10, MOD);  // a^(remaining digits * 10) % MOD
    int part2 = modPow(a, lastDigit, MOD);        // a^lastDigit % MOD


    return (part1 * part2) % MOD;
}
```



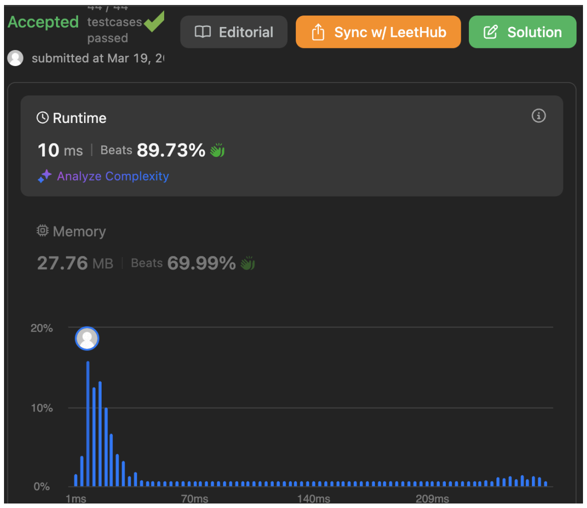
Accepted 57 / 57 testcases passed
palak9898 submitted at Feb 05, 2025 12:15

Runtime
0 ms | Beats 100.00%

Memory
15.16 MB | Beats 84.20%

7. An array nums of length n is beautiful if: nums is a permutation of the integers in the range [1, n]. For every 0 <= i < j < n, there is no index k with i < k < j where 2 * nums[k] == nums[i] + nums[j]. Given the integer n, return any beautiful array nums of length n. There will be at least one valid answer for the given n.

```
vector<vector<int>> getSkyline(vector<vector<int>>& buildings) {
    vector<pair<int, int>> events;  // Stores {x, height} events
    multiset<int> heights = {0};    // Max heap using multiset
    vector<vector<int>> result;

    // Convert buildings into events
    for (auto& b : buildings) {
        events.push_back({b[0], -b[2]}); // Start event (negative height for max heap)
        events.push_back({b[1], b[2]});  // End event (positive height)
    }

    // Sort events
    sort(events.begin(), events.end());

    int prevMaxHeight = 0;  // Previous max height

    // Process events
    for (auto& [x, h] : events) {
        if (h < 0) {
            heights.insert(-h); // Add building height
        } else {
            heights.erase(heights.find(h)); // Remove building height
        }
        int currMaxHeight = *heights.rbegin(); // Get max height from set


        if (currMaxHeight != prevMaxHeight) {
            result.push_back({x, currMaxHeight});
            prevMaxHeight = currMaxHeight;
        }
    }


    return result;
}
```



Accepted 44 / 44 testcases passed
submitted at Mar 19, 2

Runtime
10 ms | Beats 89.73%
Analyze Complexity

Memory
27.76 MB | Beats 69.99%