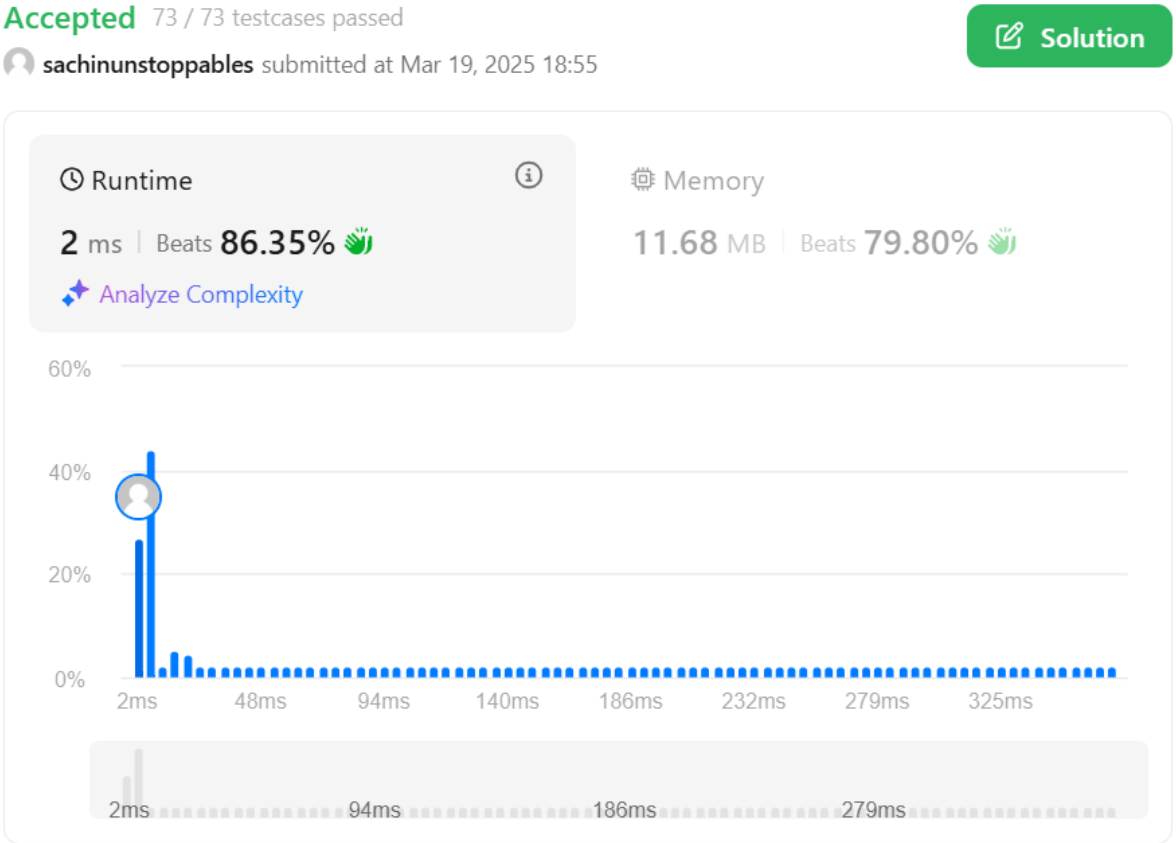
Name – Sachin Kumar **UID – 22BCS16347** **Subject – AP LAB**

1.Longest Nice Substring.

```
 class Solution {
public:
  string longestNiceSubstring(string s) {
    int n=s.length();
    if (s.length()<2) {
      return "";
    }
    bool lower[26]={false};
    bool upper[26]={false};
    for(char c:s){
      if(islower(c)){
        lower[c-'a']=true;
      }
      else{
        upper[c-'A']=true;
      }
    }
    for(int i=0;i<n;i++){
      char c=s[i];
      if(islower(c)&&!upper[c-'a']){
        string left=longestNiceSubstring(s.substr(0,i));
        string right=longestNiceSubstring(s.substr(i+1));
        return left.length()>=right.length()?left:right;
      }
      if(isupper(c)&&!lower[c-'A']){
        string left=longestNiceSubstring(s.substr(0,i));
        string right=longestNiceSubstring(s.substr(i+1));
        return left.length()>=right.length()?left:right;
      }
    }
    return s;
  }
};
```

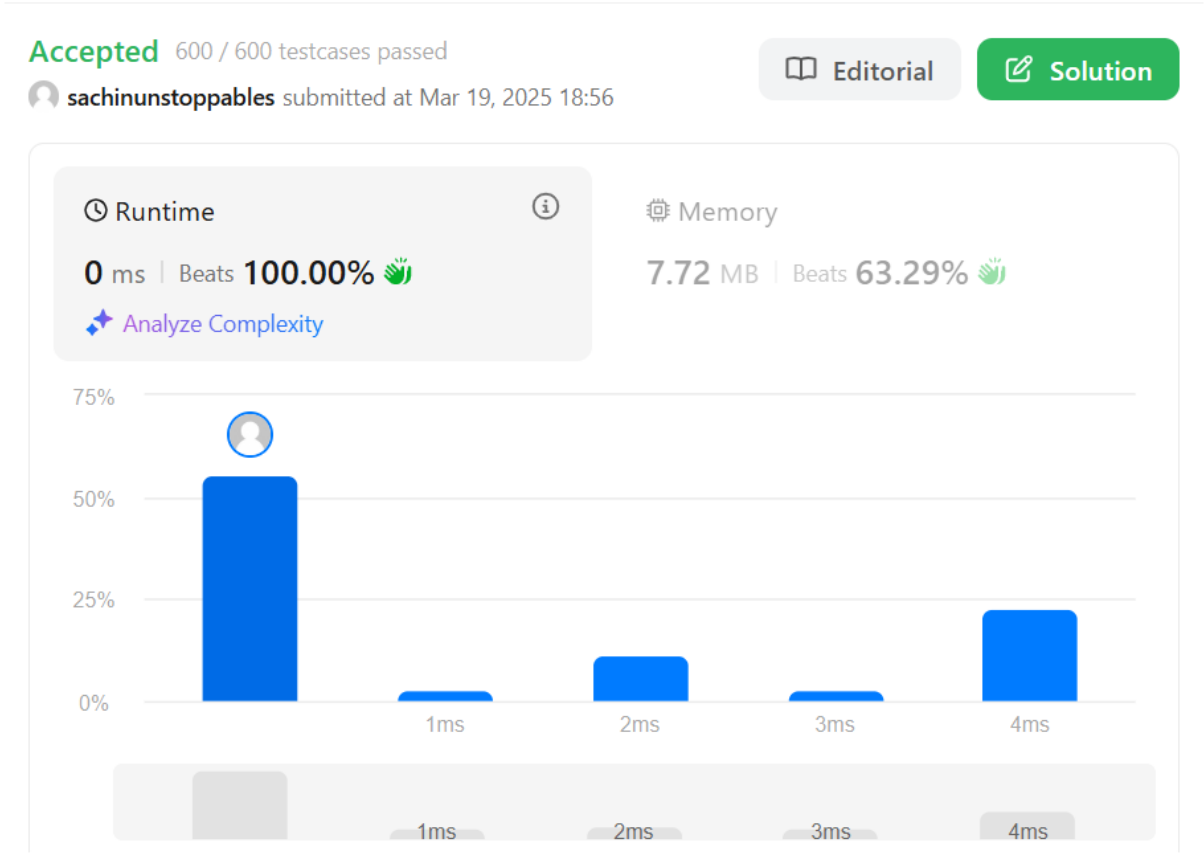
OUTPUT:-



2.Reverse Bits:

```
class Solution {
public:
   uint32_t reverseBits(uint32_t n) {
      uint32_t result = 0;
      for (int i = 0; i < 32; i++) {
         result = (result << 1) | (n & 1);  // Shift result left and add the last bit of n
         n >>= 1;  // Shift n right to process the next bit
      }
      return result;
   }
};
```

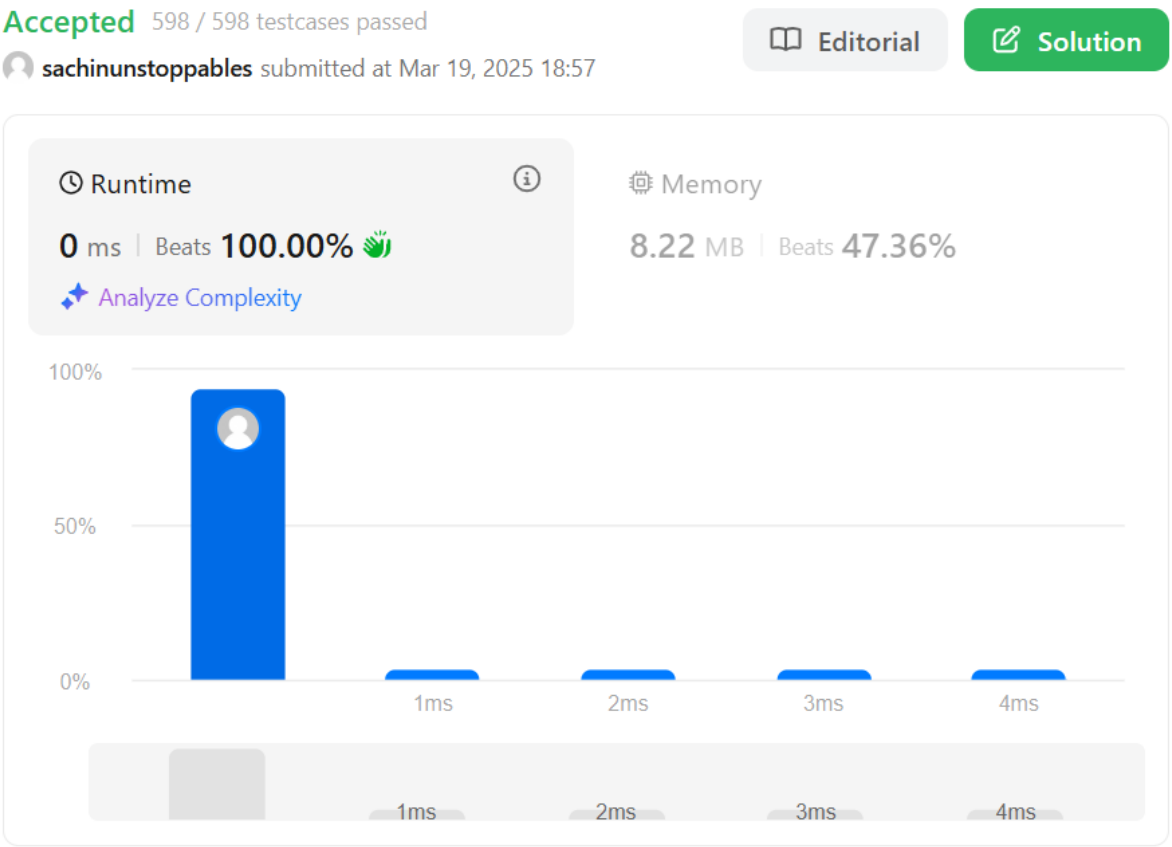
OUTPUT:-



3.Number of 1 Bits

```
class Solution {
public:
   int hammingWeight(int n) {
      int count = 0;
      while (n) {
         count += (n & 1); // Add 1 if the last bit is 1
         n >>= 1;        // Right shift n to check the next bit
      }
      return count;
   }
};
```

OUTPUT:-



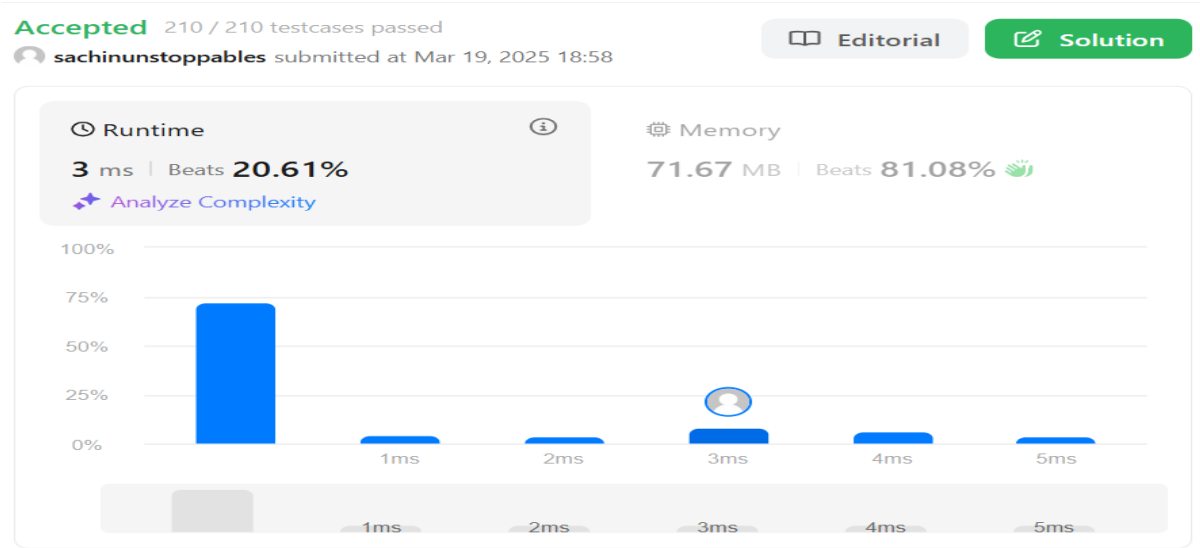
4.Maximum Subarray:

```
class Solution {
public:
   int maxSubArray(vector<int>& nums) {
      int current_sum = 0;
      int max_sum = nums[0]; // Initialize max_sum with the first element

      for (int num : nums) {
         current_sum = max(num, current_sum + num); // Take the maximum of starting new subarray or extending current subarray
         max_sum = max(max_sum, current_sum); // Update max_sum if current_sum is greater
      }

      return max_sum; // Return the maximum subarray sum found
   }
};
```

OUTPUT:-

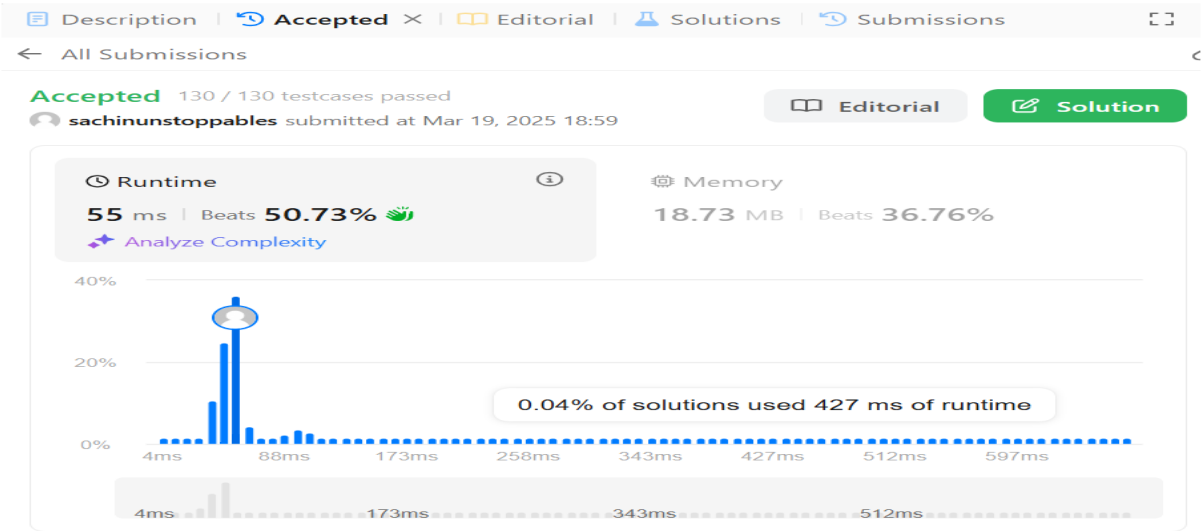


5.Search a 2D Matrix II

```
class Solution {
public:
    bool searchMatrix(vector<vector<int>>& matrix, int target) {
        int rows = matrix.size();
        if (rows == 0) return false;
        int cols = matrix[0].size();

        int row = 0, col = cols - 1; // Start from top-right corner
        while (row < rows && col >= 0) {
            if (matrix[row][col] == target)
                return true;
            else if (matrix[row][col] > target)
                col--; // Move left
            else
                row++; // Move down
        }
        return false;
    }
};
```

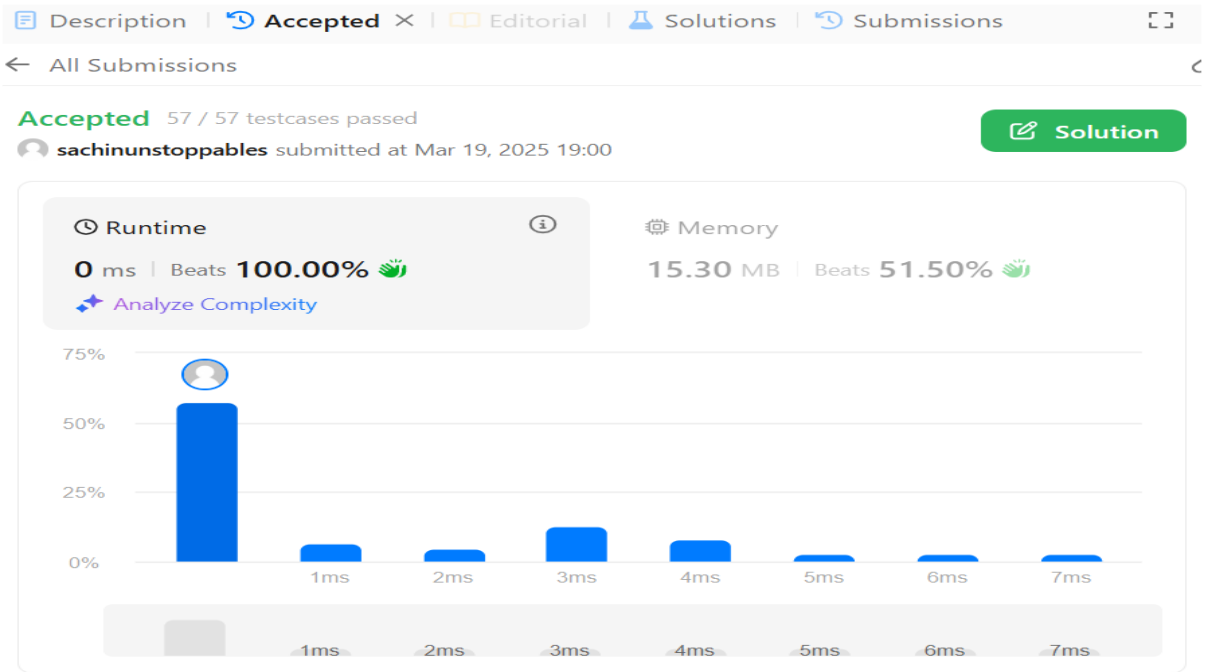
OUTPUT:-



6.Super Pow:-

```
class Solution {
public:
  const int MOD = 1337;
  int powmod(int x, int y) {
    int result = 1;
    x %= MOD; // Take mod at start to avoid large numbers
    while (y) {
      if (y % 2 == 1) // If y is odd, multiply by x
        result = (result * x) % MOD;
      x = (x * x) % MOD; // Square x and take mod
      y /= 2; // Reduce y by half
    }
    return result;
  }
  int superPow(int a, vector<int>& b) {
    int result = 1;
    for (int digit : b) {
      result = powmod(result, 10) * powmod(a, digit) % MOD;
    }
    return result;
  }
};
```

OUTPUT:-



7.Beautiful Array:

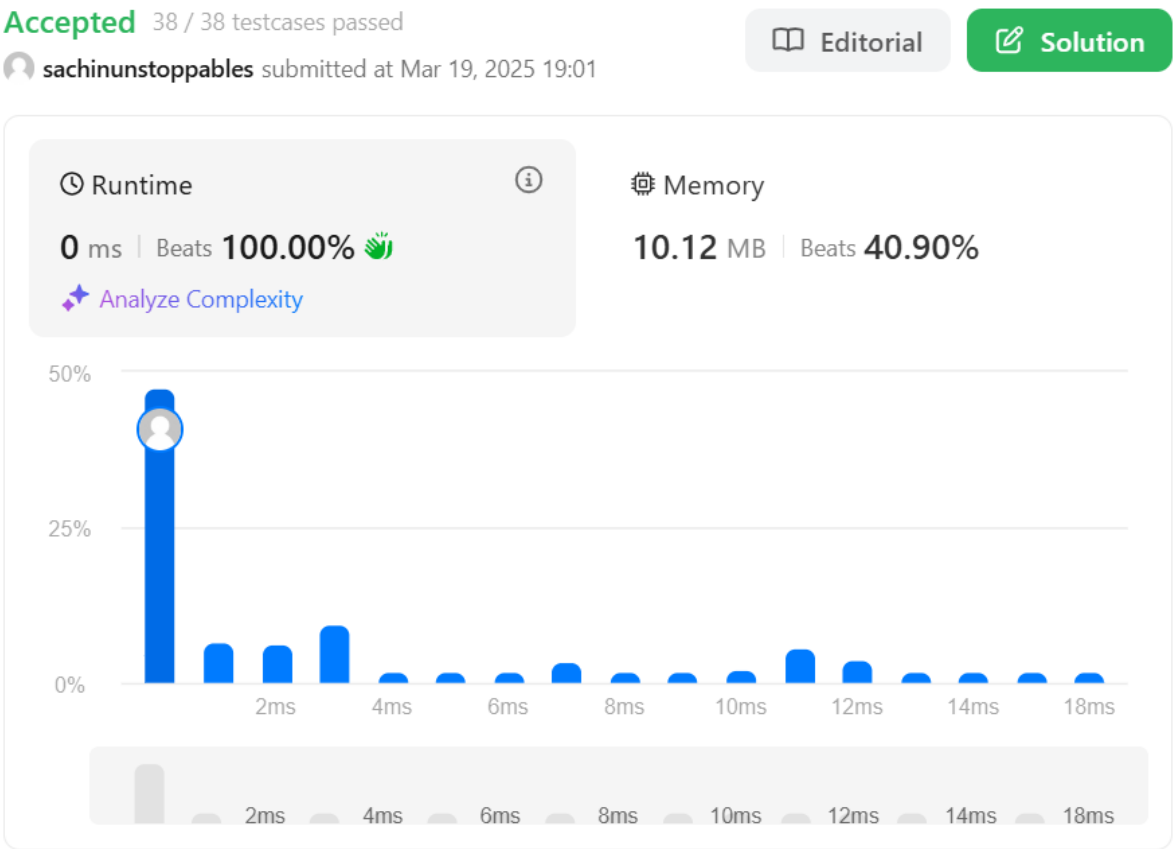
```
class Solution {
public:
  vector<int> beautifulArray(int n) {
    vector<int> result = {1}; // Start with base case

    while (result.size() < n) {
      vector<int> temp;

      // Generate odd values
      for (int num : result) {
        if (num * 2 - 1 <= n)
          temp.push_back(num * 2 - 1);
      }
      for (int num : result) {
        if (num * 2 <= n)
          temp.push_back(num * 2);
      }
      result = temp; // Update result
    }
    return result;
```

```
    }
};
```

OUTPUT:-

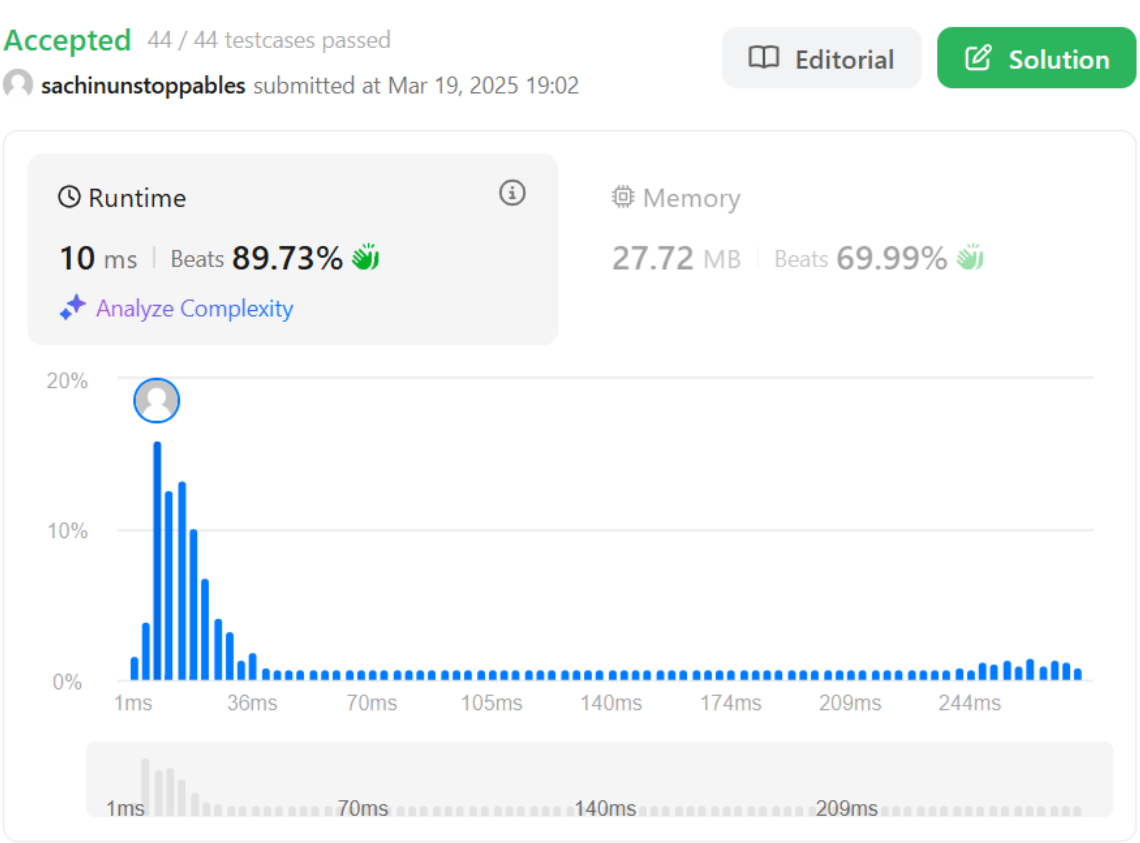


8.The Skyline Problem:

```
class Solution {
public:
    vector<vector<int>> getSkyline(vector<vector<int>>& buildings) {
        vector<pair<int, int>> events;
        for (const auto& b : buildings) {
            events.emplace_back(b[0], -b[2]); // Start event (negative height)
            events.emplace_back(b[1], b[2]);  // End event (positive height)
        }
        sort(events.begin(), events.end());
        multiset<int> heights = {0};
        int prevMaxHeight = 0;
        vector<vector<int>> skyline;
```

```
        // Process events
        for (const auto& e : events) {
            int x = e.first, h = e.second;
            if (h < 0) {
                heights.insert(-h);
            } else {
                // End of a building: remove height
                heights.erase(heights.find(h));
            }
            int currMaxHeight = *heights.rbegin();
            if (currMaxHeight != prevMaxHeight) {
                skyline.push_back({x, currMaxHeight});
                prevMaxHeight = currMaxHeight;
            }
        }
        return skyline;
    }
};
```

OUTPUT:-

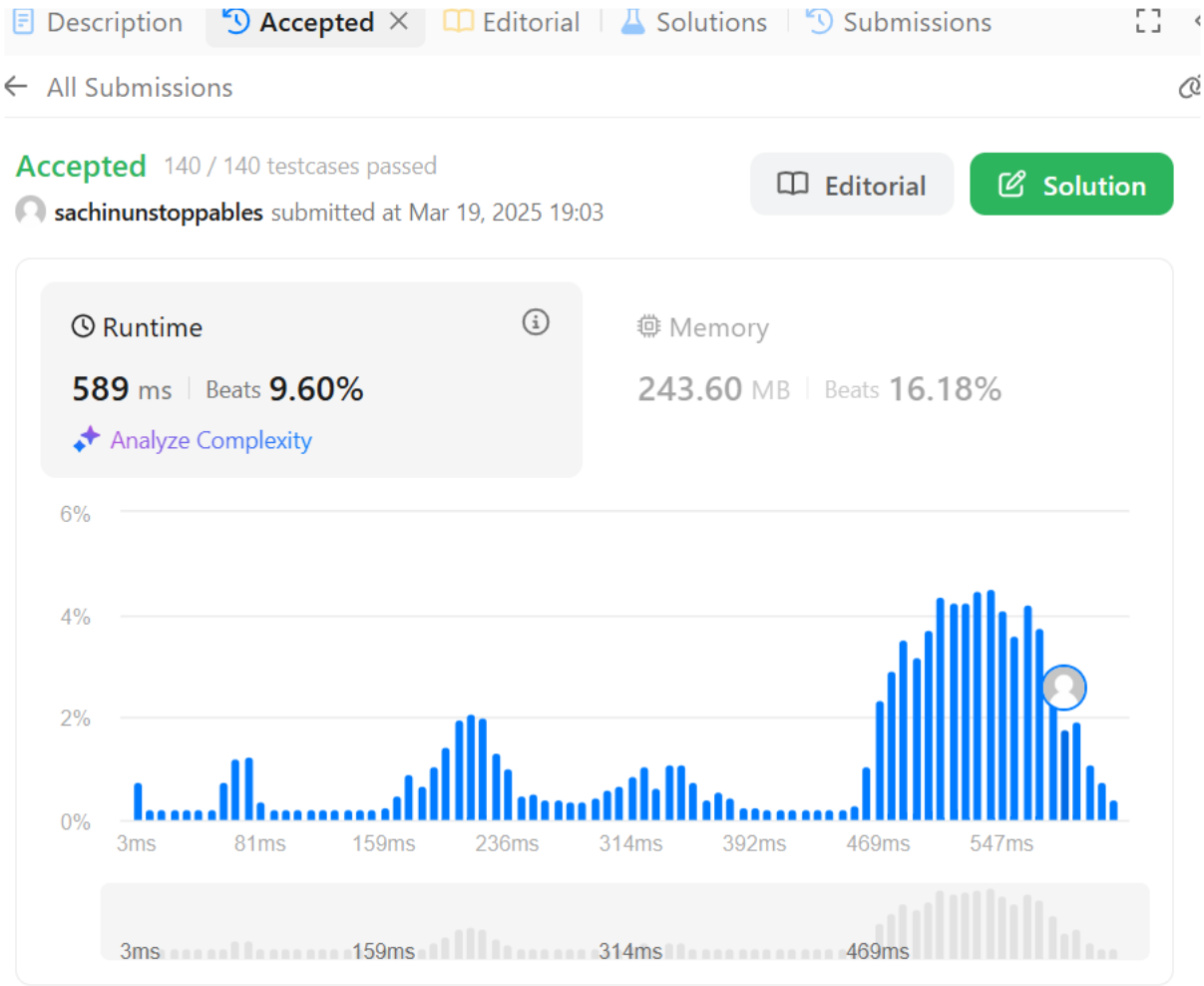


9.Reverse Pairs

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

```
    }
    void merge(vector<int>& nums, int left, int mid, int right) {
        vector<int> temp;
        int i = left, j = mid + 1;
        while (i <= mid && j <= right) {
            if (nums[i] <= nums[j]) temp.push_back(nums[i++]);
            else temp.push_back(nums[j++]);
        }
        while (i <= mid) temp.push_back(nums[i++]);
        while (j <= right) temp.push_back(nums[j++]);
        for (int k = left; k <= right; k++) {
            nums[k] = temp[k - left];
        }
    }
};
```

OUTPUT:-



10: Longest Increasing Subsequence II

```
#include <vector>

#include <algorithm>

using namespace std;

class SegmentTree {

public:

   vector<int> tree;

   int size;


   SegmentTree(int n) {

      size = n;

      tree.assign(4 * n, 0);

   }

   int query(int node, int start, int end, int L, int R) {

      if (R < start || end < L) return 0; // Out of range

      if (L <= start && end <= R) return tree[node]; // Inside range

      int mid = (start + end) / 2;

      return max(query(2 * node, start, mid, L, R),

               query(2 * node + 1, mid + 1, end, L, R));

   }

   void update(int node, int start, int end, int index, int value) {

      if (start == end) {

         tree[node] = value;

      } else {

         int mid = (start + end) / 2;

         if (index <= mid) update(2 * node, start, mid, index, value);

         else update(2 * node + 1, mid + 1, end, index, value);


         tree[node] = max(tree[2 * node], tree[2 * node + 1]);

      }

   }

};


class Solution {

public:
```

```
  int lengthOfLIS(vector<int>& nums, int k) {
    int maxVal = *max_element(nums.begin(), nums.end());
    SegmentTree segTree(maxVal + 1);
    int maxLIS = 0;
    for (int num : nums) {
      int bestPrevLIS = segTree.query(1, 0, maxVal, max(0, num - k), num - 1);
      int newLIS = bestPrevLIS + 1;
      segTree.update(1, 0, maxVal, num, newLIS);
      maxLIS = max(maxLIS, newLIS);
    }
    return maxLIS;
  }
};
```

OUTPUT:-