Experiment 4

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Branch: IT **Section/Group:** 22BET_IOT-702/B

Semester: 6th **Date of Performance:** 14/02/25

Subject Name: Advance Programming-II **Subject Code:** 22ITP-367

Problem: 1.4.1: Longest Nice Substring

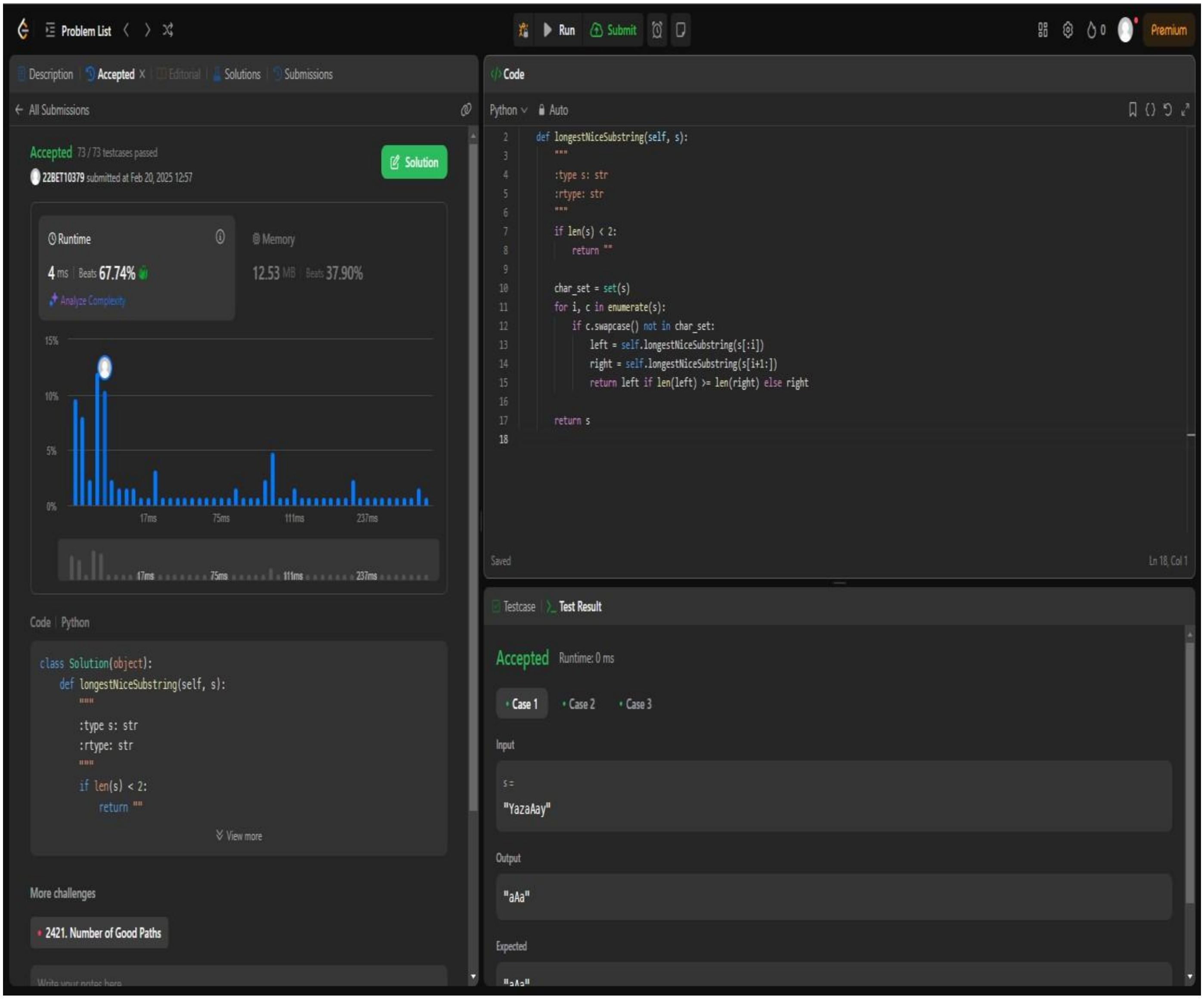
Problem Statement: A string s is considered **nice** if, for every character in the string, the character’s uppercase and lowercase forms both exist in the string.

1. **Objective:** Find the longest contiguous substring where every character has both its uppercase and lowercase counterpart present.

2. **Code:**

```
class Solution(object):
    def longestNiceSubstring(self, s):
        """
        :type s: str
        :rtype: str
        """
        if len(s) < 2:
            return ""

        char_set = set(s)
        for i, c in enumerate(s):
            if c.swapcase() not in char_set:
                left = self.longestNiceSubstring(s[:i])
                right = self.longestNiceSubstring(s[i+1:])
                return left if len(left) >= len(right) else right

        return s
```

3. Result:



Accepted 73 / 73 testcases passed

22BET10379 submitted at Feb 20, 2025 12:57

4 ms | Beats 67.74%

12.53 MB | Beats 37.90%

Code | Python

```python
class Solution(object):
    def longestNiceSubstring(self, s):
        """
        :type s: str
        :rtype: str
        """
        if len(s) < 2:
            return ""
```

View more

2421. Number of Good Paths

```python
    def longestNiceSubstring(self, s):
        """
        :type s: str
        :rtype: str
        """
        if len(s) < 2:
            return ""

        char_set = set(s)
        for i, c in enumerate(s):
            if c.swapcase() not in char_set:
                left = self.longestNiceSubstring(s[:i])
                right = self.longestNiceSubstring(s[i+1:])
                return left if len(left) >= len(right) else right

        return s
```

Accepted Runtime: 0 ms

Input

```
s =
"YazaAay"
```

Output

```
"aAa"
```

Expected

```
"aAa"
```

Problem 1.4.2: Reverse Bits

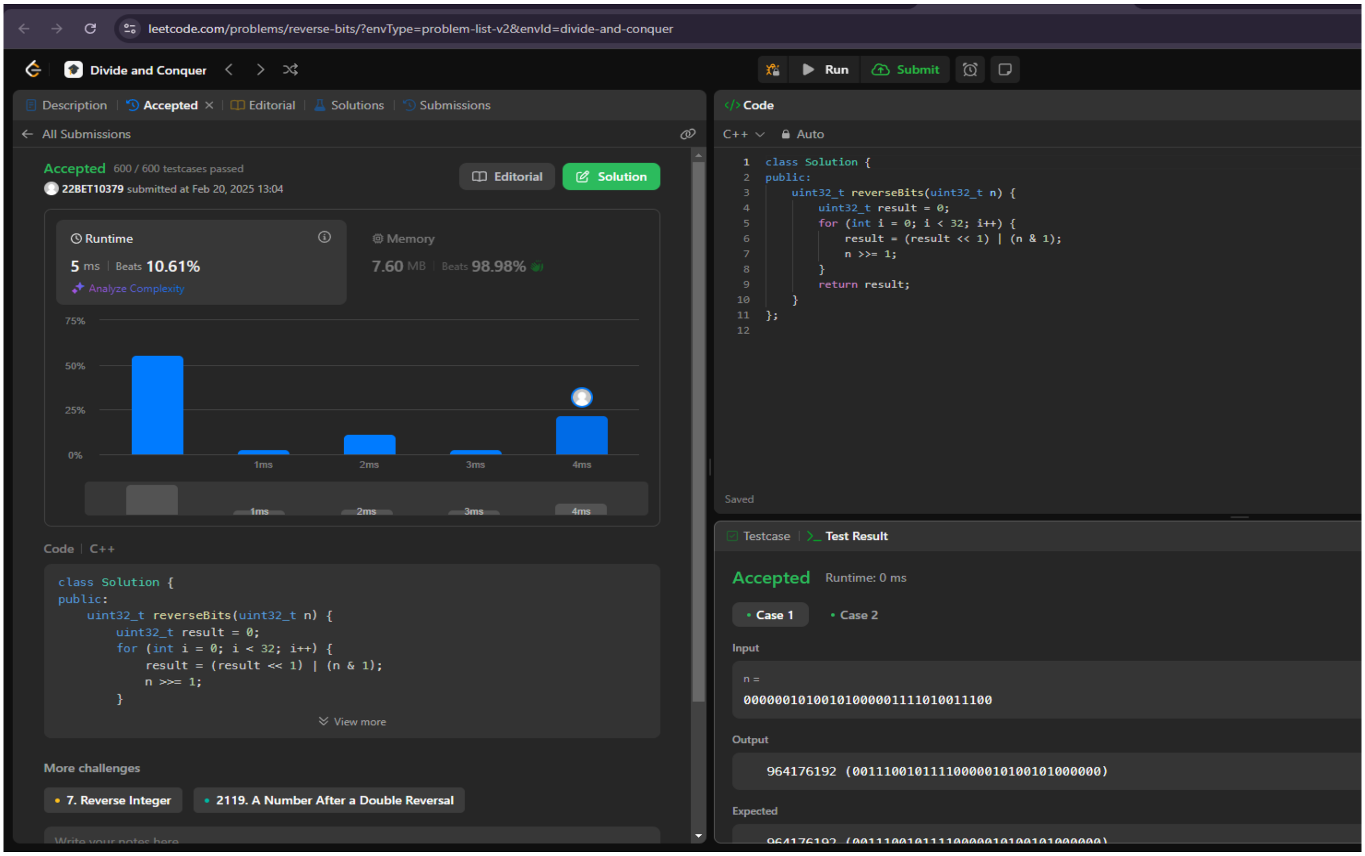
Problem Statement: You are given a 32-bit unsigned integer n. Your task is to reverse the bits of n and return the result as an unsigned integer.

1. **Objective:** Reverse the order of bits in the given 32-bit unsigned integer.

2. **Code:**

```
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);
            n >>= 1;
        }
        return result;
    }
};
```

3. **Result:**



leetcode.com/problems/reverse-bits/?envType=problem-list-v2&envId=divide-and-conquer

Accepted 600 / 600 testcases passed
22BET10379 submitted at Feb 20, 2025 13:04

Runtime
5 ms | Beats 10.61%
Analyze Complexity

Memory
7.60 MB | Beats 98.98%

Code | C++

```
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);
            n >>= 1;
        }
```

View more

More challenges
• 7. Reverse Integer
• 2119. A Number After a Double Reversal

Write your notes here

```
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);
            n >>= 1;
        }
        return result;
    }
};
```

Accepted Runtime: 0 ms

• Case 1 • Case 2

Input

```
n =
00000010100101000001111010011100
```

Output

```
964176192 (00111001011110000010100101000000)
```

Expected

```
964176192 (00111001011110000010100101000000)
```

Problem 1.4.3: Number of 1 bits

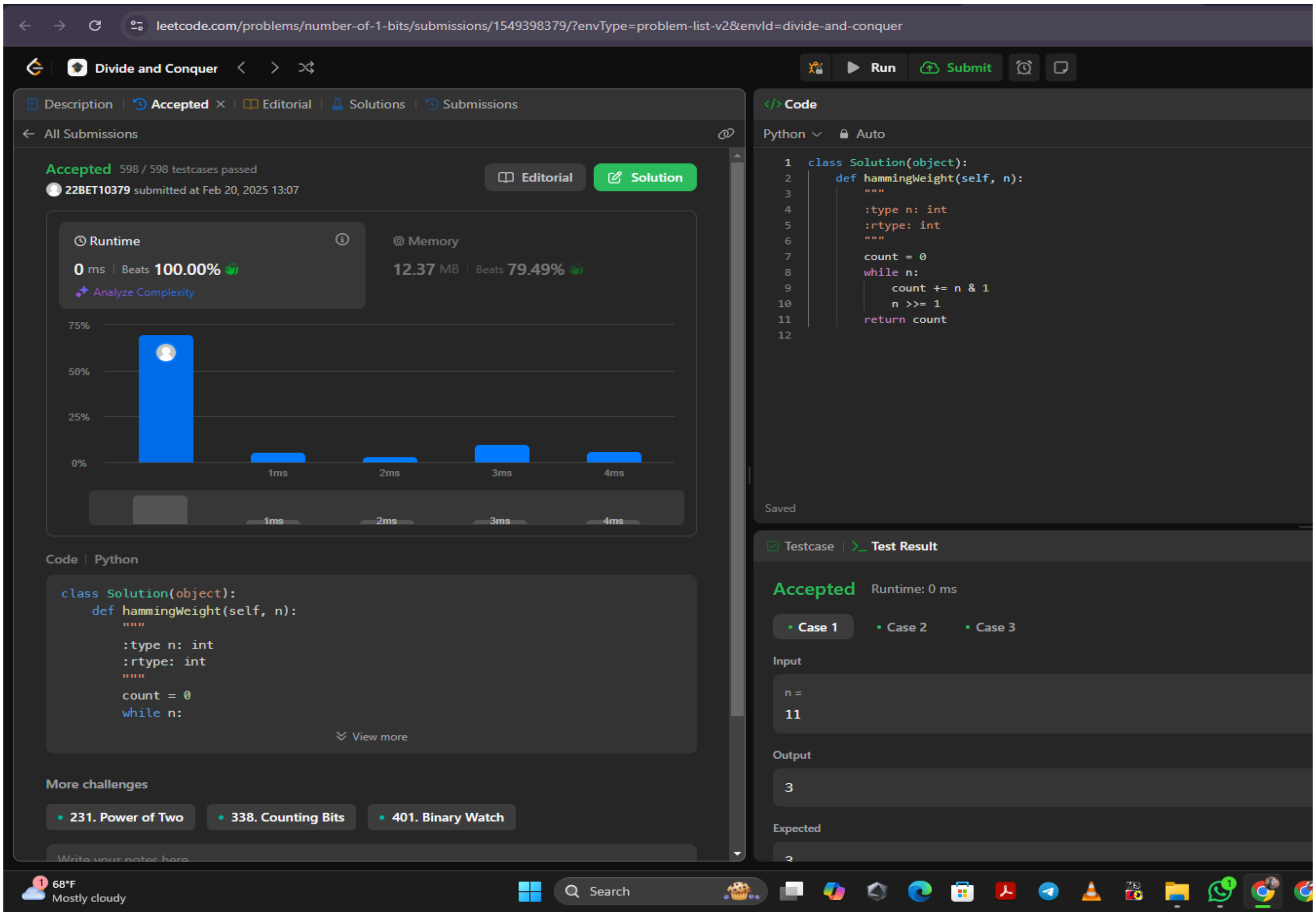
Problem Statement: You are given a 32-bit unsigned integer n. Your task is to return the number of '1' bits it has, also known as the **Hamming Weight**.

1. **Objective:** Count the number of '1' bits in the 32-bit binary representation of n.

2. **Code:**

```
class Solution(object):
    def hammingWeight(self, n):
        """
        :type n: int
        :rtype: int
        """
        count = 0
        while n:
            count += n & 1
            n >>= 1
        return count
```

3. **Result:**



leetcode.com/problems/number-of-1-bits/submissions/1549398379/?envType=problem-list-v2&envId=divide-and-conquer

Accepted 598 / 598 testcases passed

22BET10379 submitted at Feb 20, 2025 13:07

Runtime 0 ms | Beats 100.00%

Memory 12.37 MB | Beats 79.49%

Code | Python

```
class Solution(object):
    def hammingWeight(self, n):
        """
        :type n: int
        :rtype: int
        """
        count = 0
        while n:
            count += n & 1
            n >>= 1
        return count
```

Accepted Runtime: 0 ms

Input

n =
11

Output

3

Expected

3

Problem 1.3.4: Max Subarray

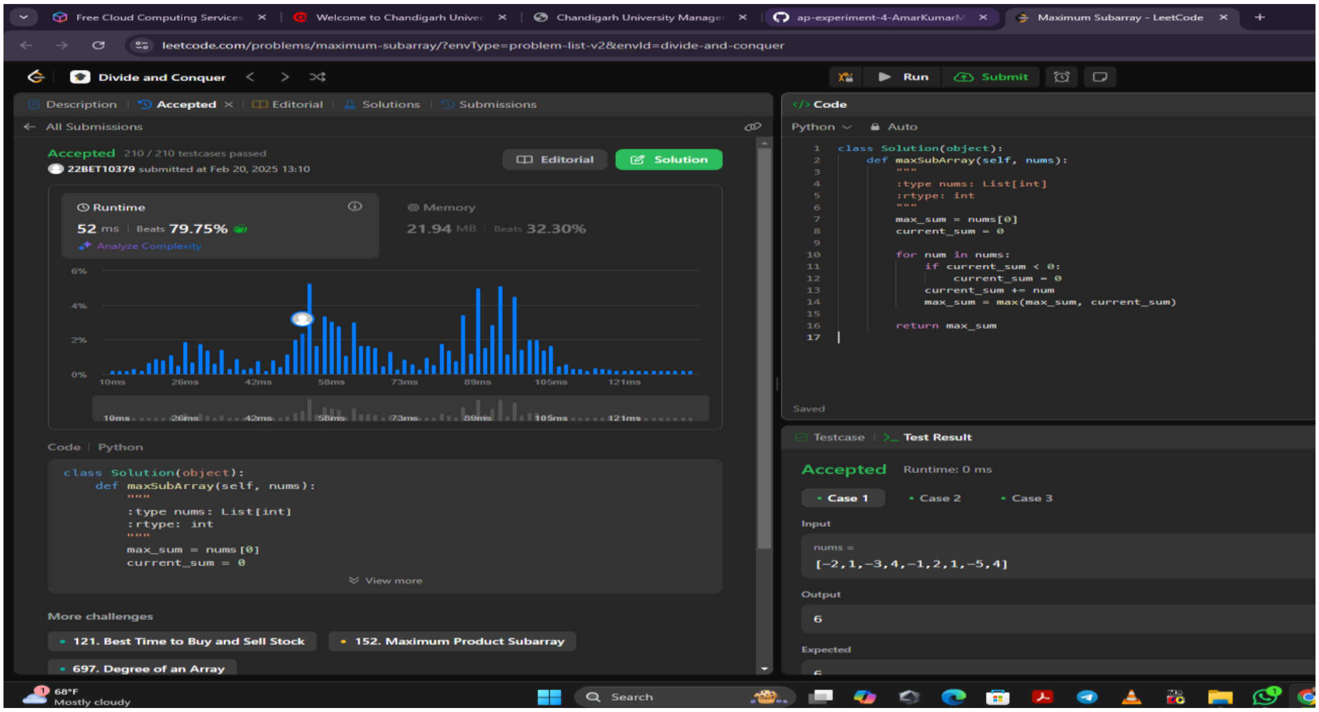
Problem Statement: Given an integer array nums, find the contiguous subarray (containing at least one number) which has the largest sum and return its sum.

1. **Objective:** Identify the contiguous subarray within the given array that has the maximum sum.

2. **Code:**

```
class Solution(object):
    def maxSubArray(self, nums):
        """
        :type nums: List[int]
        :rtype: int
        """
        max_sum = nums[0]
        current_sum = 0

        for num in nums:
            if current_sum < 0:
                current_sum = 0
            current_sum += num
            max_sum = max(max_sum, current_sum)

        return max_sum
```

3. **Result:**



Accepted 210 / 210 testcases passed
22BET10379 submitted at Feb 20, 2025 13:10

Runtime 52 ms | Beats 79.75%

Memory 21.94 MB | Beats 32.30%

Code | Python

```
class Solution(object):
    def maxSubArray(self, nums):
        """
        :type nums: List[int]
        :rtype: int
        """
        max_sum = nums[0]
        current_sum = 0
```

```
class Solution(object):
    def maxSubArray(self, nums):
        """
        :type nums: List[int]
        :rtype: int
        """
        max_sum = nums[0]
        current_sum = 0

        for num in nums:
            if current_sum < 0:
                current_sum = 0
            current_sum += num
            max_sum = max(max_sum, current_sum)

        return max_sum
```

Accepted Runtime: 0 ms

Input

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

Output

6

Expected

6

Problem 1.4.5: Beautiful Array

Problem Statement: An array nums of length n is beautiful if:

nums is a permutation of the integers in the range [1, n].

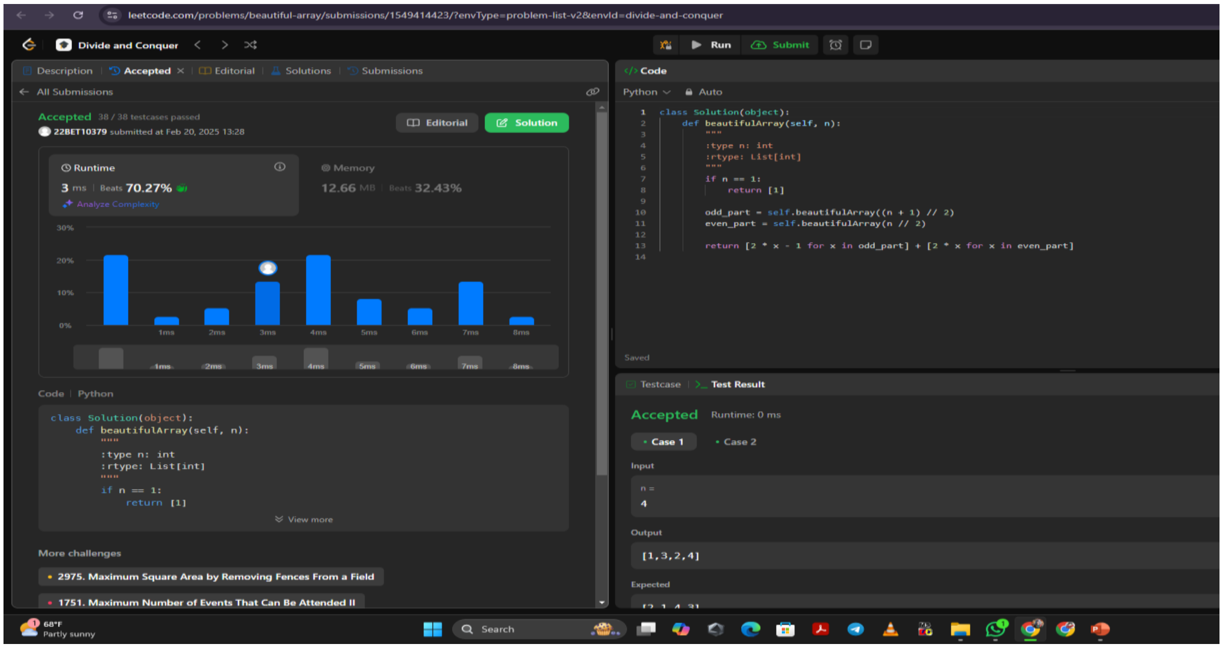
For every 0 <= i < j < n, there is no index k with i < k < j where 2 * nums[k] == nums[i] + nums[j].

1. **Objective:** Given the integer n, return any beautiful array nums of length n. There will be at least one valid answer for the given n.

2. **Code:**

```
class Solution(object):
    def beautifulArray(self, n):
        """
        :type n: int
        :rtype: List[int]
        """
        if n == 1:
            return [1]

        odd_part = self.beautifulArray((n + 1) // 2)
        even_part = self.beautifulArray(n // 2)

        return [2 * x - 1 for x in odd_part] + [2 * x for x in even_part]
```

3.Result:



leetcode.com/problems/beautiful-array/submissions/1549414423/?envType=problem-list-v2&envId=divide-and-conquer

Accepted 38 / 38 testcases passed
22BET10379 submitted at Feb 20, 2025 13:28

Runtime
3 ms | Beats 70.27%
Analyze Complexity

Memory
12.66 MB | Beats 32.43%

Code | Python

```
class Solution(object):
    def beautifulArray(self, n):
        """
        :type n: int
        :rtype: List[int]
        """
        if n == 1:
            return [1]
```

More challenges
- 2975. Maximum Square Area by Removing Fences From a Field
- 1751. Maximum Number of Events That Can Be Attended II

Code
Python Auto

```
class Solution(object):
    def beautifulArray(self, n):
        """
        :type n: int
        :rtype: List[int]
        """
        if n == 1:
            return [1]

        odd_part = self.beautifulArray((n + 1) // 2)
        even_part = self.beautifulArray(n // 2)

        return [2 * x - 1 for x in odd_part] + [2 * x for x in even_part]
```

Saved

Testcase | Test Result

Accepted Runtime: 0 ms

Case 1 Case 2

Input

```
n =
4
```

Output

```
[1,3,2,4]
```

Expected

```
[2,1,4,3]
```

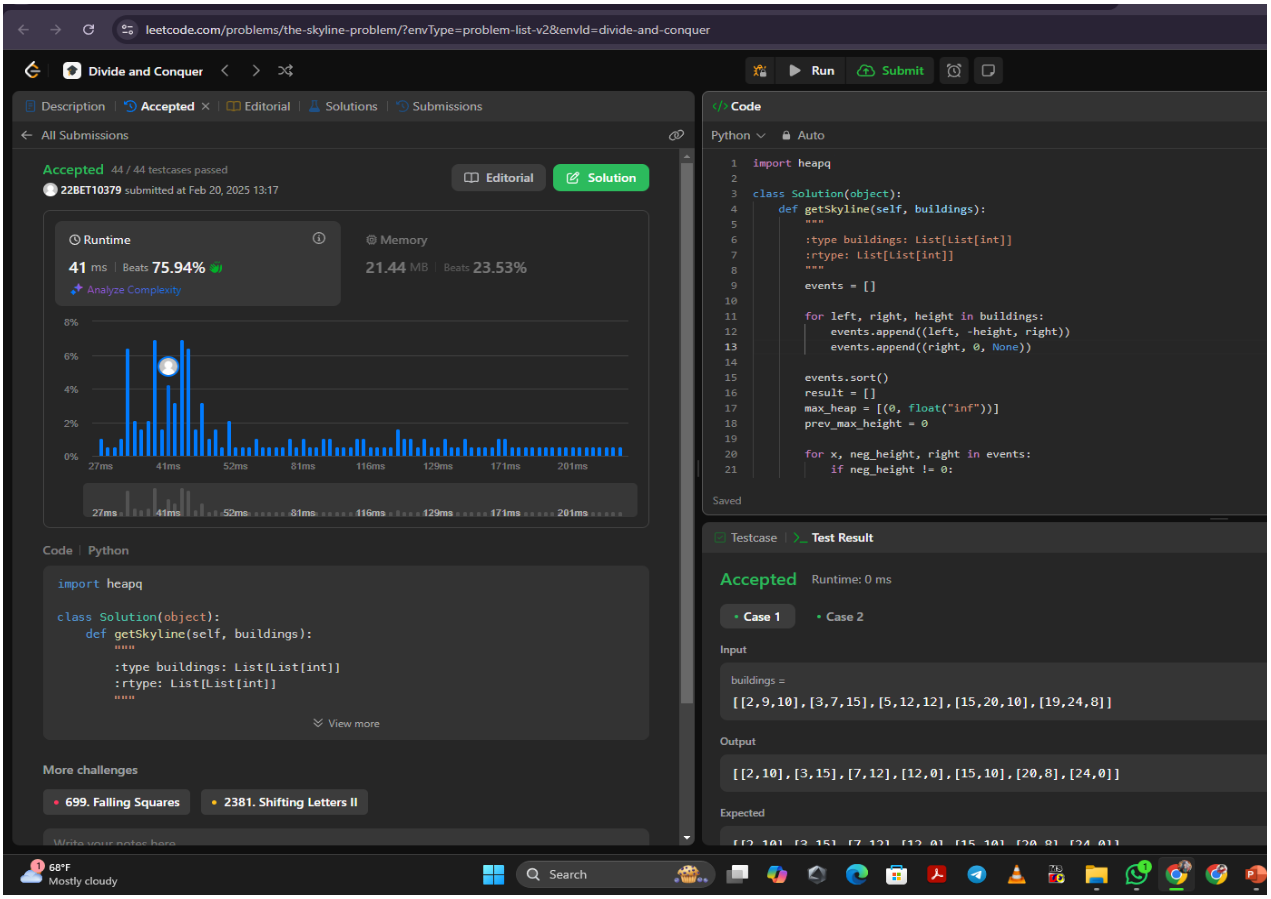
Problem 1.4.6: The Skyline Problem

Problem Statement: Given a list of buildings, where each building is represented as a triplet [L,R,H][L, R, H][L,R,H] (with LLL as the left x-coordinate, RRR as the right x-coordinate, and HHH as the height), your task is to output the skyline formed by these buildings. The skyline is a list of "key points" [x,y][x, y][x,y] that represent where the height of the skyline changes. Key points should be output in sorted order by the x-coordinate.

1. **Objective:** Determine the key points that form the outer contour (skyline) when the buildings are viewed from a distance.
2. **Code:**

```
import heapq

class Solution(object):
    def getSkyline(self, buildings):
        """
        :type buildings: List[List[int]]
        :rtype: List[List[int]]
        """
        events = []

        for left, right, height in buildings:
            events.append((left, -height, right))
            events.append((right, 0, None))

        events.sort()
        result = []
        max_heap = [(0, float("inf"))]
        prev_max_height = 0

        for x, neg_height, right in events:
            if neg_height != 0:
                heapq.heappush(max_heap, (neg_height, right))
            while max_heap[0][1] <= x:
                heapq.heappop(max_heap)

            current_max_height = -max_heap[0][0]

            if current_max_height != prev_max_height:
                result.append([x, current_max_height])
                prev_max_height = current_max_height

        return result
```

3. Result:



leetcode.com/problems/the-skyline-problem/?envType=problem-list-v2&envId=divide-and-conquer

Accepted 44 / 44 testcases passed
22BET10379 submitted at Feb 20, 2025 13:17

Runtime
41 ms | Beats 75.94%
Analyze Complexity

Memory
21.44 MB | Beats 23.53%

Code | Python

```
import heapq

class Solution(object):
    def getSkyline(self, buildings):
        """
        :type buildings: List[List[int]]
        :rtype: List[List[int]]
        """
```

More challenges

- 699. Falling Squares
- 2381. Shifting Letters II

Write your notes here

```
import heapq

class Solution(object):
    def getSkyline(self, buildings):
        """
        :type buildings: List[List[int]]
        :rtype: List[List[int]]
        """
        events = []

        for left, right, height in buildings:
            events.append((left, -height, right))
            events.append((right, 0, None))

        events.sort()
        result = []
        max_heap = [(0, float("inf"))]
        prev_max_height = 0

        for x, neg_height, right in events:
            if neg_height != 0:
```

Saved

Accepted Runtime: 0 ms

Case 1 Case 2

Input

buildings =
[[2,9,10],[3,7,15],[5,12,12],[15,20,10],[19,24,8]]

Output

[[2,10],[3,15],[7,12],[12,0],[15,10],[20,8],[24,0]]

Expected

[[2,10],[3,15],[7,12],[12,0],[15,10],[20,8],[24,0]]

Problem 1.4.6: Reverse Pairs

Problem Statement: Given an integer array nums, return the number of reverse pairs in the array.

1. Objective: A reverse pair is a pair (i, j) where:

0 <= i < j < nums.length and

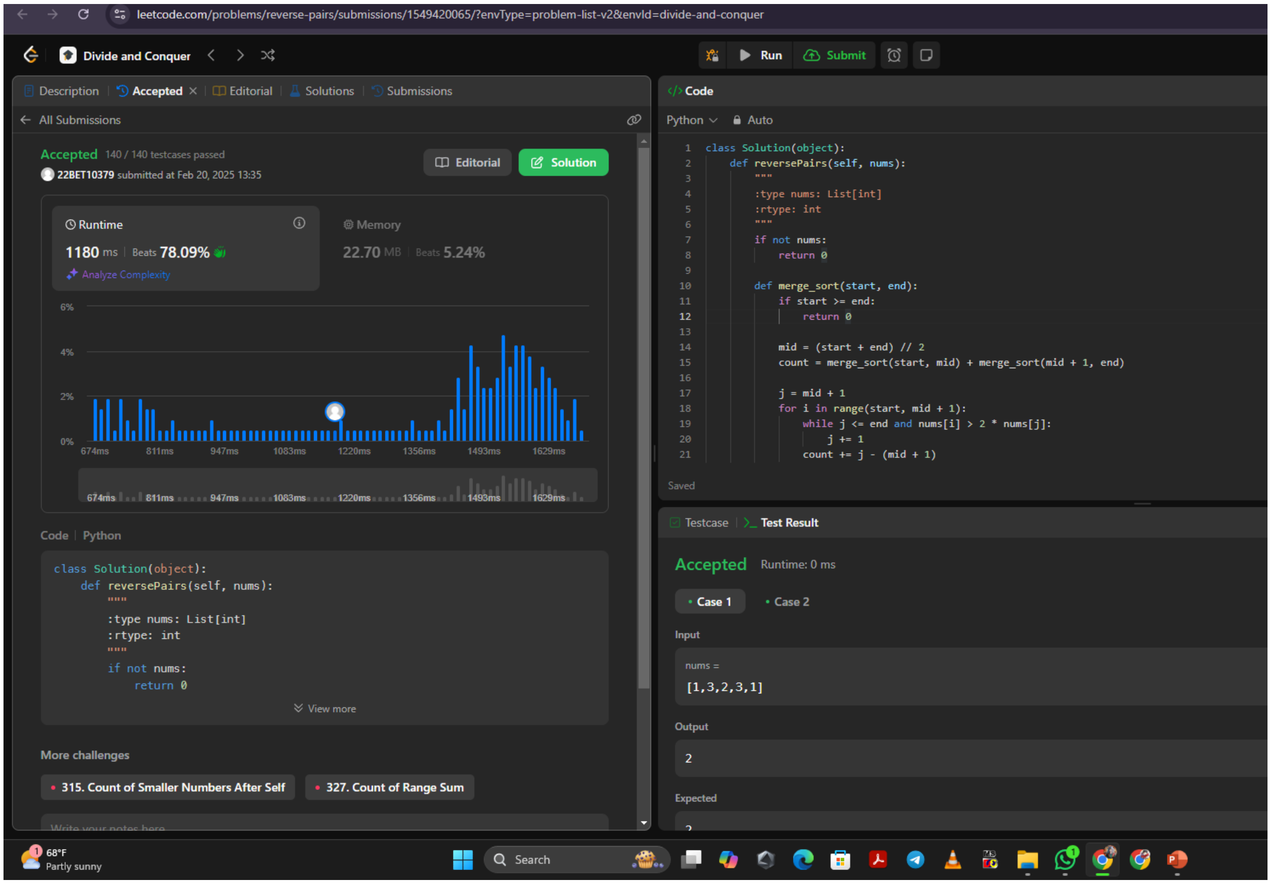
nums[i] > 2 * nums[j].

2. Code

```
class Solution(object):
    def reversePairs(self, nums):
        """
        :type nums: List[int]
        :rtype: int
        """
        if not nums:
            return 0
```

```
def merge_sort(start, end):
      if start >= end:
        return 0

      mid = (start + end) // 2
      count = merge_sort(start, mid) + merge_sort(mid +
1, end)

      j = mid + 1
      for i in range(start, mid + 1):
        while j <= end and nums[i] > 2 * nums[j]:
          j += 1
        count += j - (mid + 1)

      temp = []
      i, j = start, mid + 1
      while i <= mid and j <= end:
        if nums[i] <= nums[j]:
          temp.append(nums[i])
          i += 1
        else:
          temp.append(nums[j])
          j += 1
      while i <= mid:
        temp.append(nums[i])
        i += 1
      while j <= end:
        temp.append(nums[j])
        j += 1

      nums[start:end+1] = temp
      return count

    return merge_sort(0, len(nums) - 1)
```

3.Result



Accepted 140 / 140 testcases passed

22BET10379 submitted at Feb 20, 2025 13:35

Runtime 1180 ms | Beats 78.09%

Memory 22.70 MB | Beats 5.24%

Code | Python

```python
class Solution(object):
    def reversePairs(self, nums):
        """
        :type nums: List[int]
        :rtype: int
        """
        if not nums:
            return 0

        def merge_sort(start, end):
            if start >= end:
                return 0

            mid = (start + end) // 2
            count = merge_sort(start, mid) + merge_sort(mid + 1, end)

            j = mid + 1
            for i in range(start, mid + 1):
                while j <= end and nums[i] > 2 * nums[j]:
                    j += 1
                count += j - (mid + 1)
```

Accepted Runtime: 0 ms

Case 1 Case 2

Input

nums =
[1,3,2,3,1]

Output

2

Expected

2

4. Learning Outcomes:

- Understanding Reverse Pairs: Identifying pairs where nums[i] > 2 * nums[j].
- Merge Sort Usage: Applying divide and conquer for efficient counting.
- Optimized Counting: Using a two-pointer technique during merging.
- Time Complexity: Improving from O(n²) (brute force) to O(n log n) (merge sort).
- Sorting for Pair Counting: Leveraging sorted subarrays to count efficiently.
- Practical Applications: Useful in inversions counting, range queries, and stock market analysis.