Experiment 4

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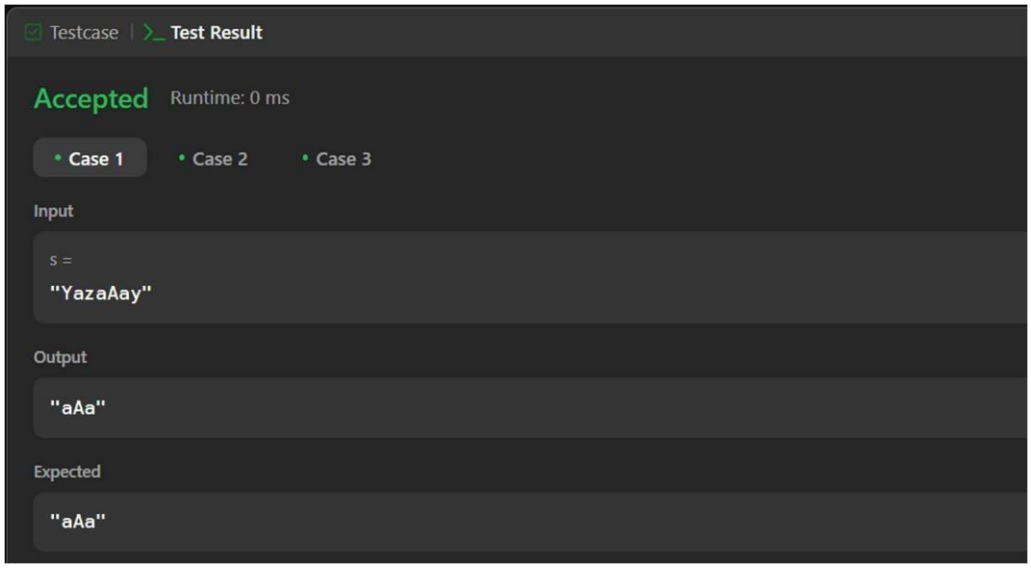
Semester: 6th **Date of Performance:14-2-25**
Subject Name: Advanced Programming Lab-2 **Subject Code: 22ITP-351**

Problem 1. Given a string s, return the longest substring of s that is nice. If there are multiple, return the substring of the earliest occurrence. If there are none, return an empty string.

Code:

```
#include <unordered_set> #include
<string>
using namespace std;

class Solution { public:     string
longestNiceSubstring(string s) {
      if (s.length() < 2) return "";

      unordered_set<char> charSet(s.begin(), s.end());

      for (int i = 0; i < s.length(); 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.length() >= right.length()) ? left : right;
      }

      return s;
   }
};
```

Output:

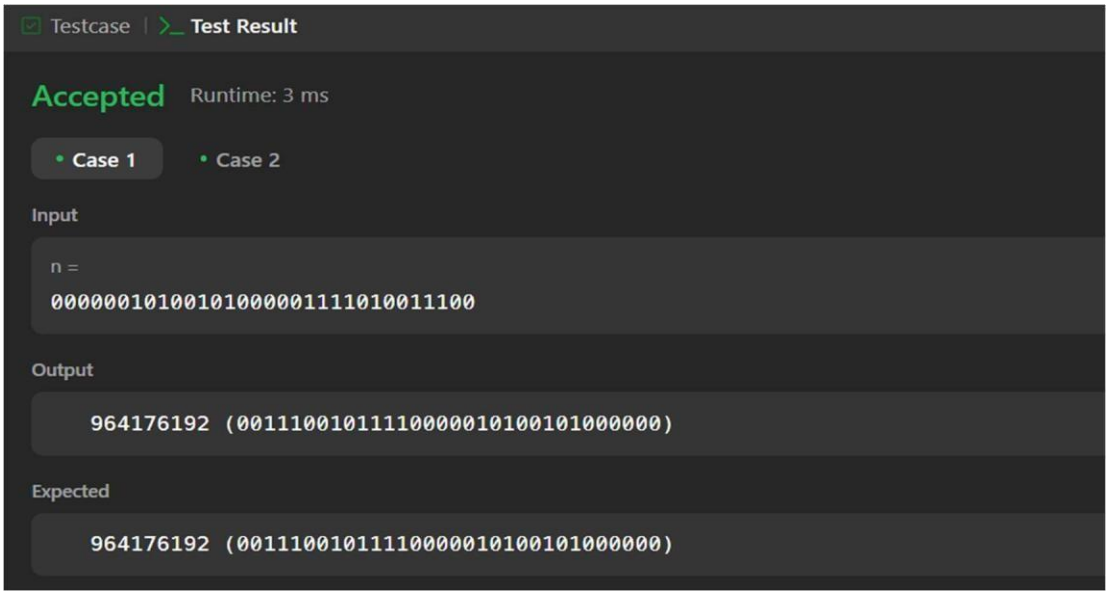


Problem 2. Reverse bits of a given 32 bits unsigned integer.

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;
```

Output:

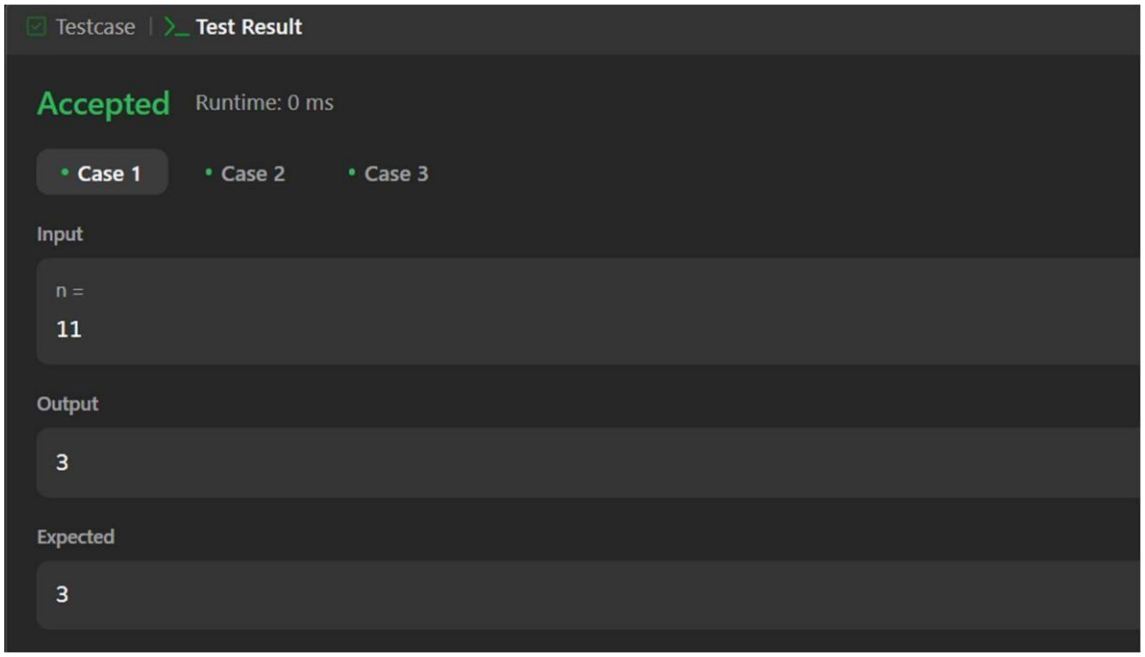


Problem 3. Given a positive integer n, write a function that returns the number of set bits in its binary representation (also known as the Hamming weight).

Code:

```
#include <cstdint>

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

Output:



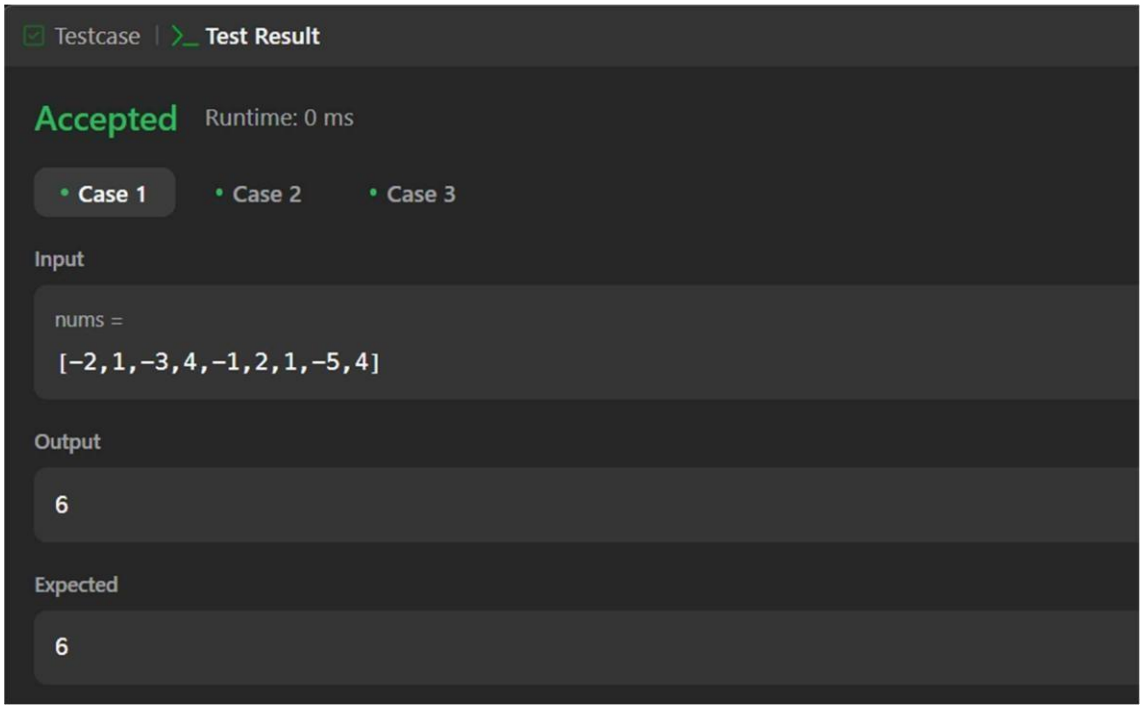
Problem 4. Given an integer array nums, find the subarray with the largest sum, and return *its sum*.

Code:

```
#include <vector>
#include <algorithm>

using namespace std;

class Solution { public:
    int maxSubArray(vector<int>& nums) {
        int maxsum = nums[0];
int currsum = 0;

        for (int num : nums) {
if (currsum < 0) {
                currsum = 0;
            }
            currsum += num;
            maxsum = max(maxsum, currsum);
        }

        return maxsum;
    }
```

};

Output:



Problem 5. Write an efficient algorithm that searches for a value target in an m x n integer matrix. This matrix has the following properties:

- Integers in each row are sorted in ascending from left to right.
- Integers in each column are sorted in ascending from top to bottom.

Code:

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

       int rows = matrix.size(); int cols =
       matrix[0].size(); int left = 0, right
       = rows * cols - 1;

       while (left <= right) { int mid =
          left + (right - left) / 2;
          int row = mid / cols;
          int col = mid % cols;

          if (matrix[row][col] == target)
             return true;
```

```
            else if (matrix[row][col] < target)
                left = mid + 1;
            else right = mid
        - 1; } return false;
    }
```

Output:

Problem 6. Write an efficient algorithm that searches for a value target in an m x n integer matrix matrix. This matrix has the following properties:

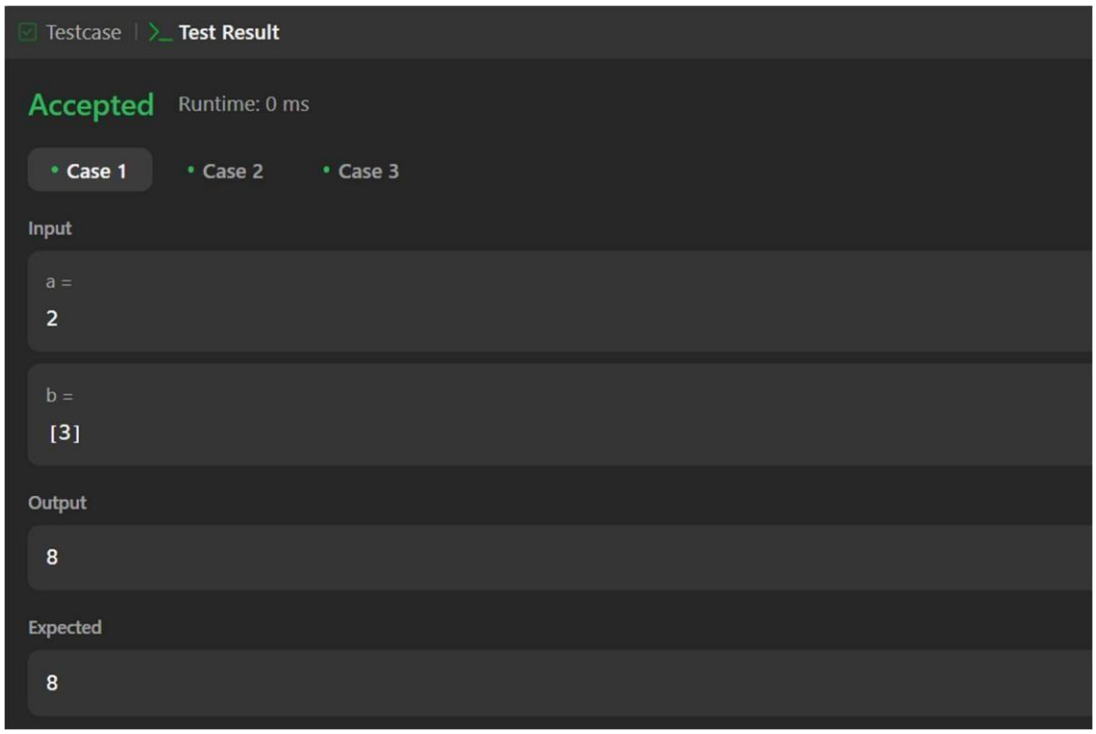
- Integers in each row are sorted in ascending from left to right.
- Integers in each column are sorted in ascending from top to bottom.

Code:

```
#include <vector>

using namespace std;

class Solution {
public:
    const int MOD = 1337;

    int modPow(int a, int exp, int mod)
{       int result = 1;         a %= mod;
while (exp > 0) {           if (exp % 2
== 1)
```

```
                result = (result * a) % mod;
        a = (a * a) % mod;
            exp /= 2;
        }
        return result;
    }

    int superPow(int a, vector<int>& b) {
        if (b.empty()) return 1;

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

        int part1 = modPow(a, lastDigit, MOD);
        int part2 = modPow(superPow(a, b), 10, MOD);

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

Output:

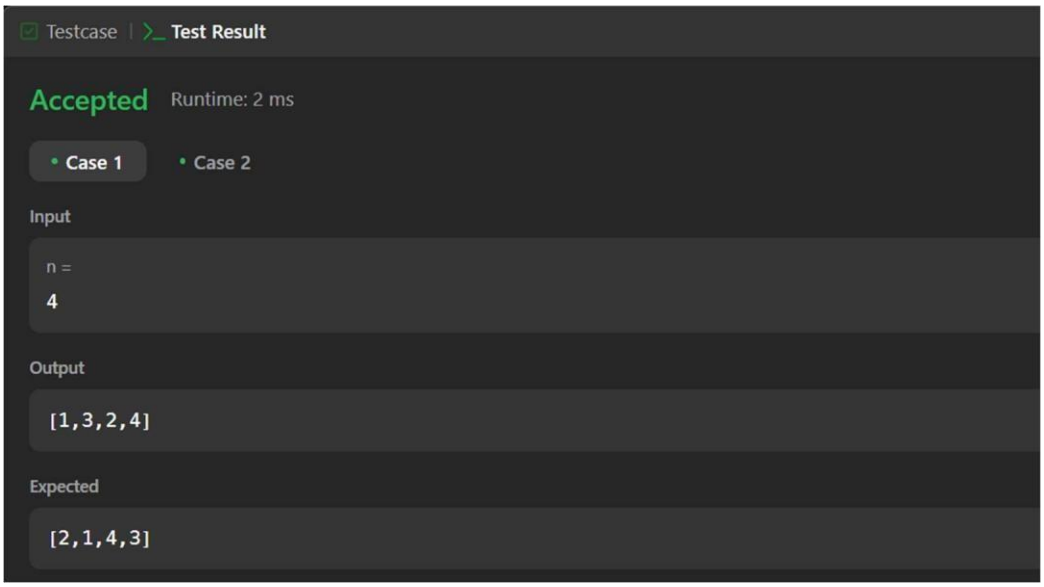


Problem 7. Given the integer n, return *any* ***beautiful*** *array* nums *of length* n. There will be at least one valid answer for the given n.

Code:

```
#include <vector>

using namespace std;

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

Output:



Problem 8. 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).

Code:

```
#include <cstdint>
```

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

Output:

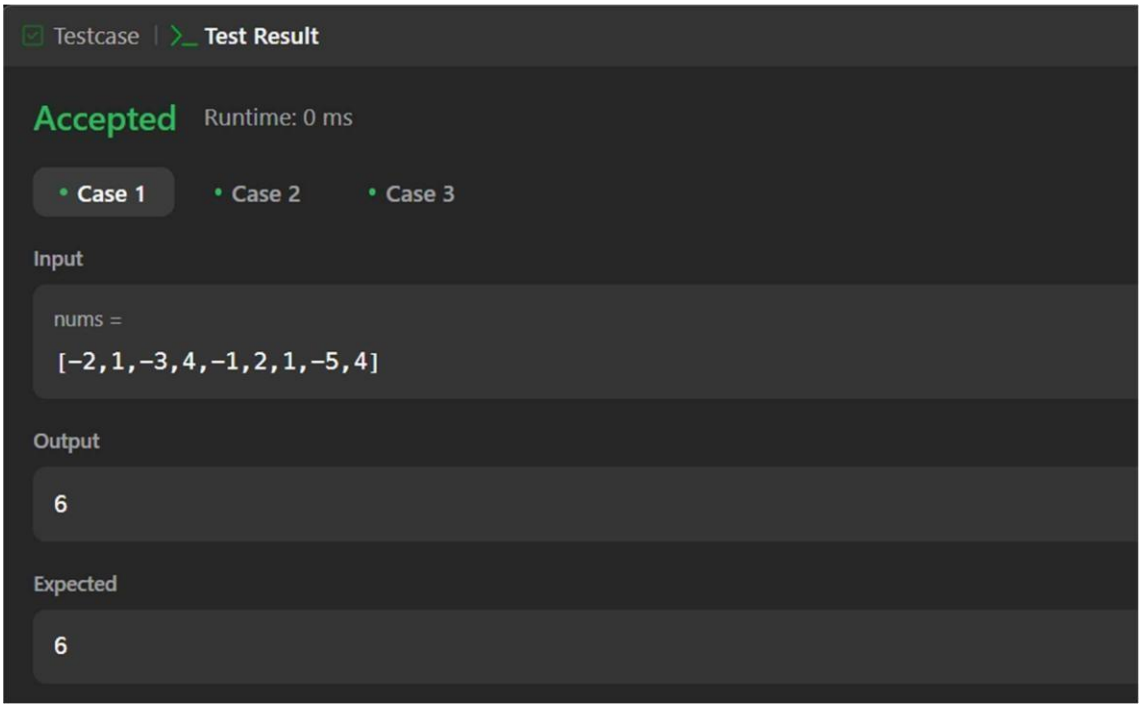
Problem 9. Given an integer array nums, find the subarray with the largest sum, and return *its sum*.

Code:

```
#include <vector>
#include <algorithm>

using namespace std;

class Solution {
public:
    int maxSubArray(vector<int>& nums) {
```

```
        int maxsum = nums[0];
    int currsum = 0;

        for (int num : nums) {
    if (currsum < 0) {
                currsum = 0;
            }
            currsum += num;
            maxsum = max(maxsum, currsum);
        }

        return maxsum;
    }
};
```

Output:



Problem 10. Write an efficient algorithm that searches for a value target in an m x n integer matrix. This matrix has the following properties:

- Integers in each row are sorted in ascending from left to right.
- Integers in each column are sorted in ascending from top to bottom.

Code:

```
#include <vector>

using namespace std;
```

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

        int rows = matrix.size();
int cols = matrix[0].size();
        int left = 0, right = rows * cols - 1;

        while (left <= right) {             int
mid = left + (right - left) / 2;
int row = mid / cols;
            int col = mid % cols;

            if (matrix[row][col] == target) return true;
else if (matrix[row][col] < target) left = mid + 1;
            else right = mid - 1;
        }

        return false;
    }
};
```

Output: