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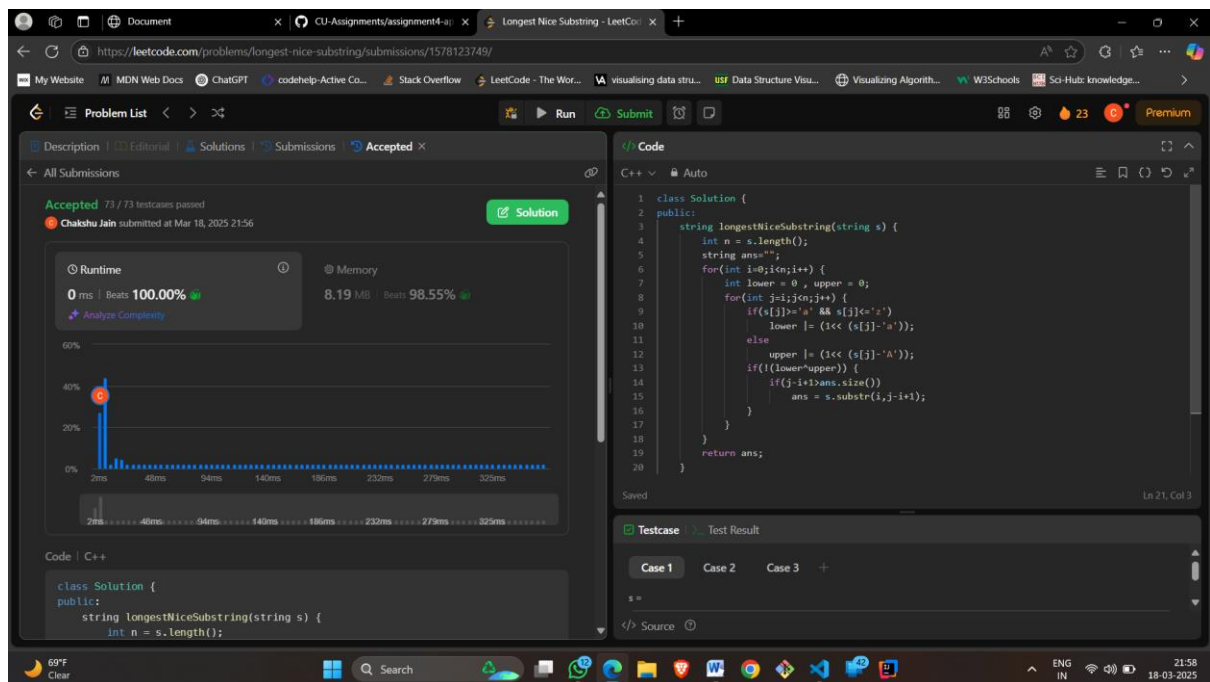
Section-608/B

AP ASSIGNMENT

1. Longest Nice substring :

```
class Solution {  
public:  
    string longestNiceSubstring(string s) {  
        int n = s.length();  
        string ans="";  
        for(int i=0;i<n;i++) {  
            int lower = 0 , upper = 0;  
            for(int j=i;j<n;j++) {  
                if(s[j]>='a' && s[j]<='z')  
                    lower |= (1<< (s[j]-'a'));  
                else  
                    upper |= (1<< (s[j]-'A'));  
                if(!(lower^upper)) {  
                    if(j-i+1>ans.size())  
                        ans = s.substr(i,j-i+1);  
                }  
            }  
        }  
        return ans;  
    }  
}
```

};



2.Reverse bits :

class Solution {

public:

uint32_t reverseBits(uint32_t n) {

uint32_t ans=0;

for (int i = 0; i < 32; i++) {

ans = ans<<1;

if(n&1){

ans=ans|1;

}

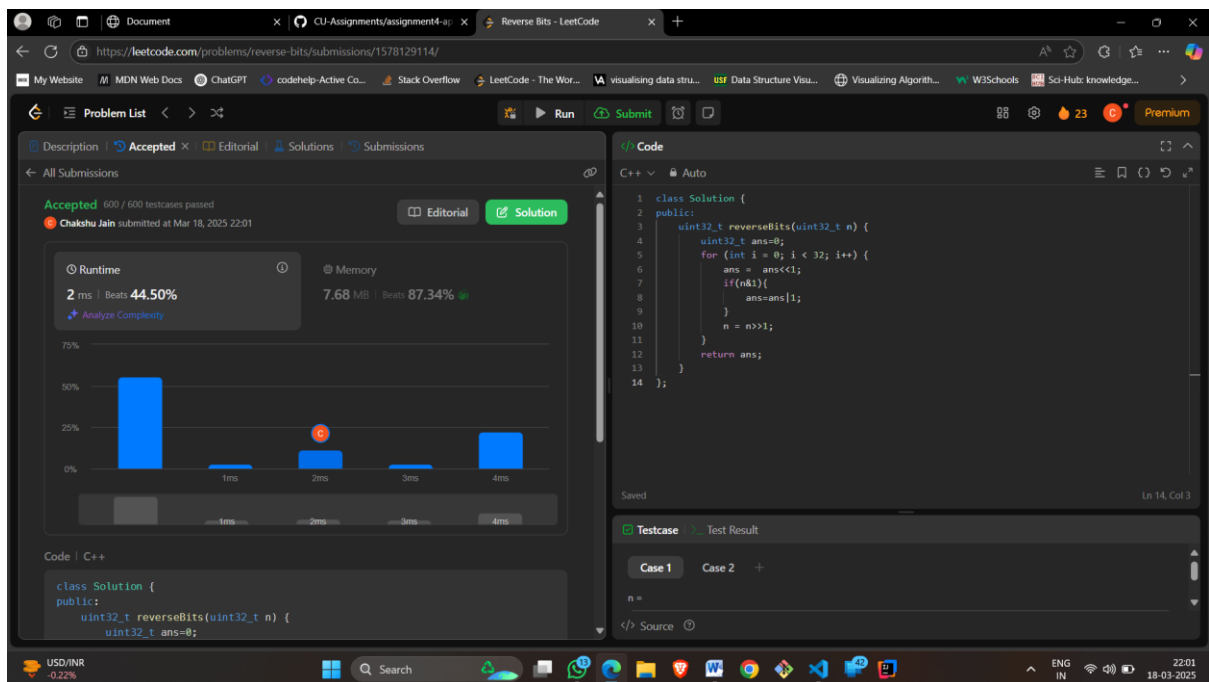
n = n>>1;

}

return ans;

}

};



3.Number of 1-bits:

```
class Solution {
```

```
public:
```

```
int hammingWeight(uint32_t n) {
```

```
    int res = 0;
```

```
    for (int i = 0; i < 32; i++) {
```

```
        if ((n >> i) & 1) {
```

```
            res += 1;
```

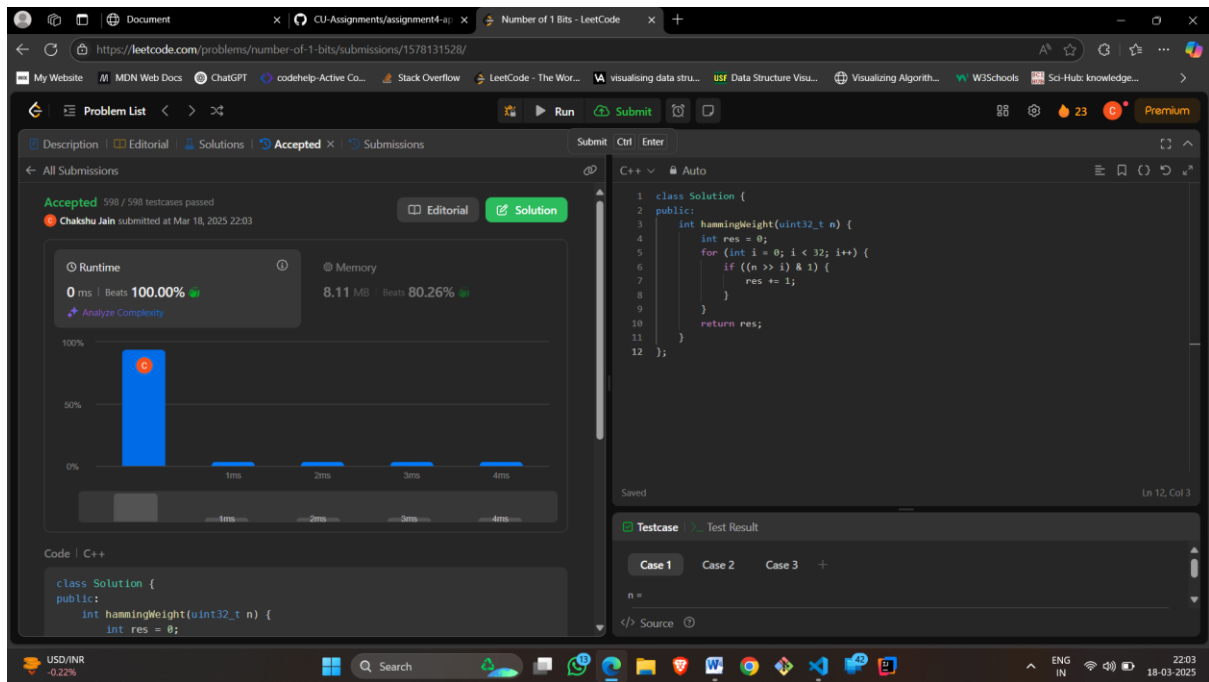
```
        }
```

```
    }
```

```
    return res;
```

```
}
```

```
};
```



4.maximum of subbarray:

```
class Solution {
```

```
public:
```

```
    int maxSubArray(vector<int>& nums) {
```

```
        int res = nums[0];
```

```
        int total = 0;
```

```
        for (int n : nums) {
```

```
            if (total < 0) {
```

```
                total = 0;
```

```
            }
```

```
            total += n;
```

```
            res = max(res, total);
```

```
        }
```

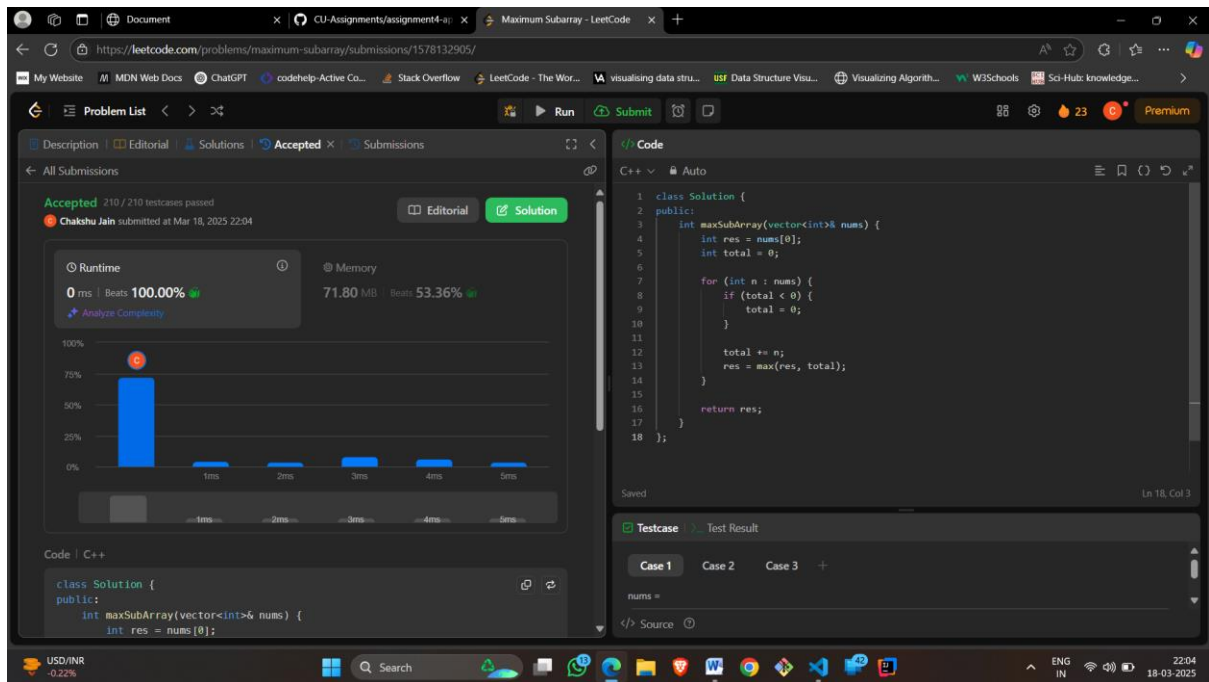
```
        return res;
```

```

}

};

```



5. Search a 2D matrix :

```

class Solution {
public:
    bool searchMatrix(vector<vector<int>>& matrix, int target) {

        for (int i = 0; i < matrix.size(); i++) {

            for (int j = 0; j < matrix[i].size(); j++) {

                if (matrix[i][j] == target) {

                    return true;

                }

            }

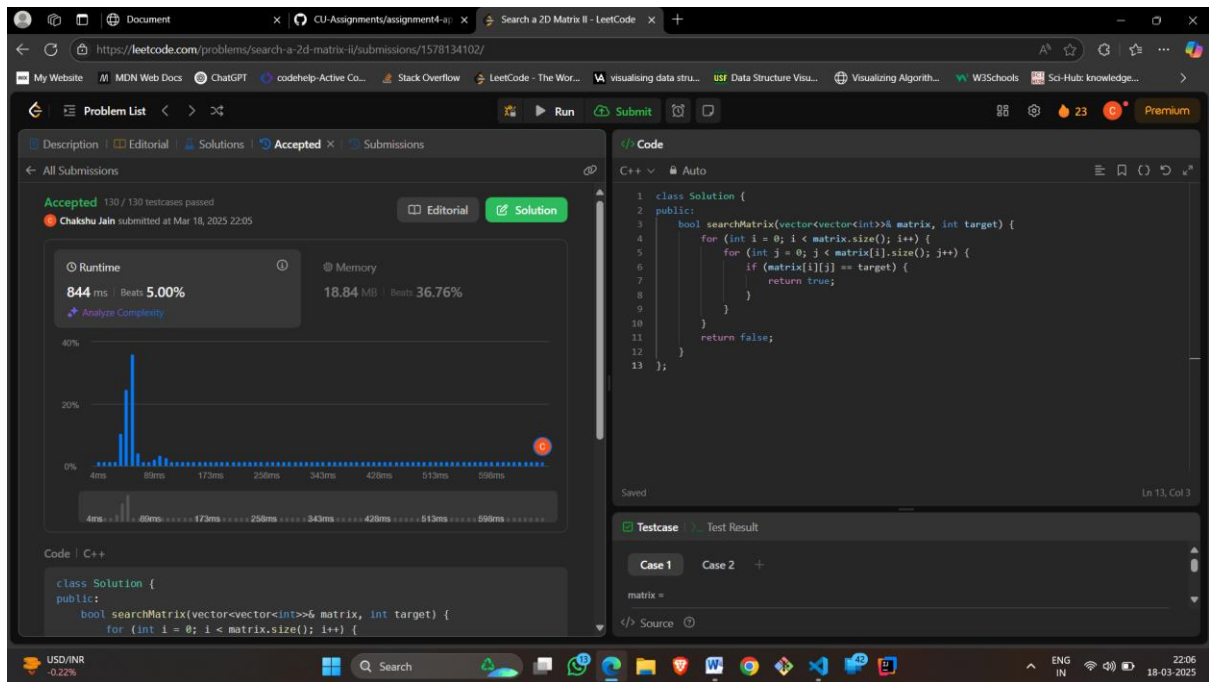
        }

        return false;

    }

};

```



6.super pow:

class Solution {

const int base = 1337;

int powmod(int a, int k) //a^k mod 1337 where 0 <= k <= 10

{

a %= base;

int result = 1;

for (int i = 0; i < k; ++i)

result = (result * a) % base;

return result;

}

public:

int superPow(int a, vector<int>& b) {

if (b.empty()) return 1;

int last_digit = b.back();

b.pop_back();

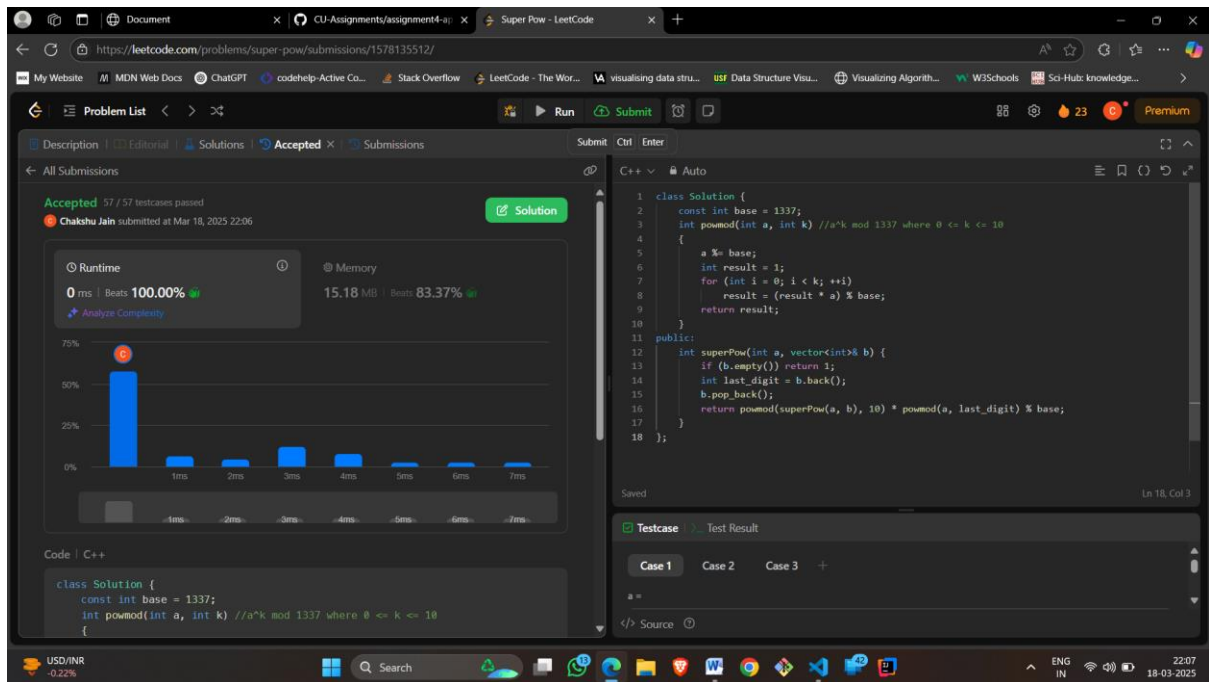
return powmod(superPow(a, b), 10) * powmod(a, last_digit) % base;

```

}

};

```



7.beautiful array :

```
class Solution {
```

```
public:
```

```
int partition(vector<int> &v, int start, int end, int mask)
```

```
{
```

```
int j = start;
```

```
for(int i = start; i <= end; i++)
```

```
{
```

```
if((v[i] & mask) != 0)
```

```
{
```

```
swap(v[i], v[j]);
```

```
j++;
```

```
}
```

```
}
```

```
return j;
```

```
}
```

```
void sort(vector<int> &v, int start, int end, int mask)
```

```
{
```

```
    if(start >= end) return;
```

```
    int mid = partition(v, start, end, mask);
```

```
    sort(v, start, mid - 1, mask << 1);
```

```
    sort(v, mid, end, mask << 1);
```

```
}
```

```
vector<int> beautifulArray(int N) {
```

```
    vector<int> ans;
```

```
    for(int i = 0; i < N; i++) ans.push_back(i + 1);
```

```
    sort(ans, 0, N - 1, 1);
```

```
    return ans;
```

```
}
```

```
};
```

The screenshot shows a LeetCode submission for the 'Beautiful Array' problem. The submission is accepted, with a runtime of 0ms and memory usage of 9.42 MB. The code is in C++ and implements a recursive sorting function. The code is as follows:

```
class Solution {
public:
    int partition(vector<int> &v, int start, int end, int mask)
    {
        if(start >= end) return;
        int mid = partition(v, start, end, mask);
        sort(v, start, mid - 1, mask << 1);
        sort(v, mid, end, mask << 1);
    }

    vector<int> beautifulArray(int N) {
        vector<int> ans;
        for(int i = 0; i < N; i++) ans.push_back(i + 1);
        sort(ans, 0, N - 1, 1);
        return ans;
    }
};
```


8.the skyline problem:

```
class Solution {
public:
    vector<vector<int>> getSkyline(vector<vector<int>>& buildings) {
        vector<vector<int>> ans;
        multiset<int> pq{0};

        vector<pair<int, int>> points;

        for(auto b: buildings){
            points.push_back({b[0], -b[2]});
            points.push_back({b[1], b[2]});
        }

        sort(points.begin(), points.end());

        int ongoingHeight = 0;

        // points.first = x coordinate, points.second = height
        for(int i = 0; i < points.size(); i++){
            int currentPoint = points[i].first;
            int heightAtCurrentPoint = points[i].second;

            if(heightAtCurrentPoint < 0){
                pq.insert(-heightAtCurrentPoint);
            } else {
                pq.erase(pq.find(heightAtCurrentPoint));
            }
        }
    }
};
```

```

    }

    // after inserting/removing heightAtI, if there's a change

    auto pqTop = *pq.rbegin();

    if(ongoingHeight != pqTop){

        ongoingHeight = pqTop;

        ans.push_back({currentPoint, ongoingHeight});

    }

}

return ans;

}

};

```

The screenshot displays the LeetCode interface for the 'The Skyline Problem'. The submission is marked as 'Accepted' with 44/44 test cases passed. The performance metrics show a runtime of 15 ms (beating 65.98% of solutions) and a memory usage of 28.85 MB (beating 44.41% of solutions). A bar chart visualizes the runtime distribution for all test cases. The C++ code is shown in the editor, featuring a priority queue to manage the current skyline height and a vector to store the final skyline points.

9.Reverse pairs :

class Solution

```

{

    int get_pairs(vector<int>& vct , long long int x)

```

```

{
    //sort(vct.begin() , vct.end());

    int size = vct.size();

    int low = 0;

    int high = size - 1;

    int ans = -1;

    while(low <= high)
    {
        int mid = high - (high - low) / 2;

        int ele = vct[mid];

        if(ele > x)
        {
            ans = mid;

            high = mid - 1;
        }

        else
        {
            low = mid + 1;
        }
    }

    if(ans == -1) return 0;

    return vct.size() - ans;
}

```

```

// void print_vector(vector<int>& nums)

// {

//     cout<<endl;

```

```
// for(auto it : nums)

// {

//     cout<<" "<<it;

// }

// cout<<endl;

// }
```

public:

```
int reversePairs(vector<int>& nums)

{

    vector<int> vct;

    int counter = 0;

    for(auto it : nums)

    {

        long long int x = 1LL * 2 * it;

        counter += get_pairs(vct , x);

        int low = 0;

        int high = vct.size();

        int ans = vct.size();

        while(low < high)

        {

            int mid = low + (high - low) / 2;

            if(vct[mid] >= it)

            {

                ans = mid;

                high = mid;

            }

        }

    }

}
```

```

else

{

    low = mid + 1;

}

}

vct.insert(vct.begin() + ans , it);

//print_vector(vct);

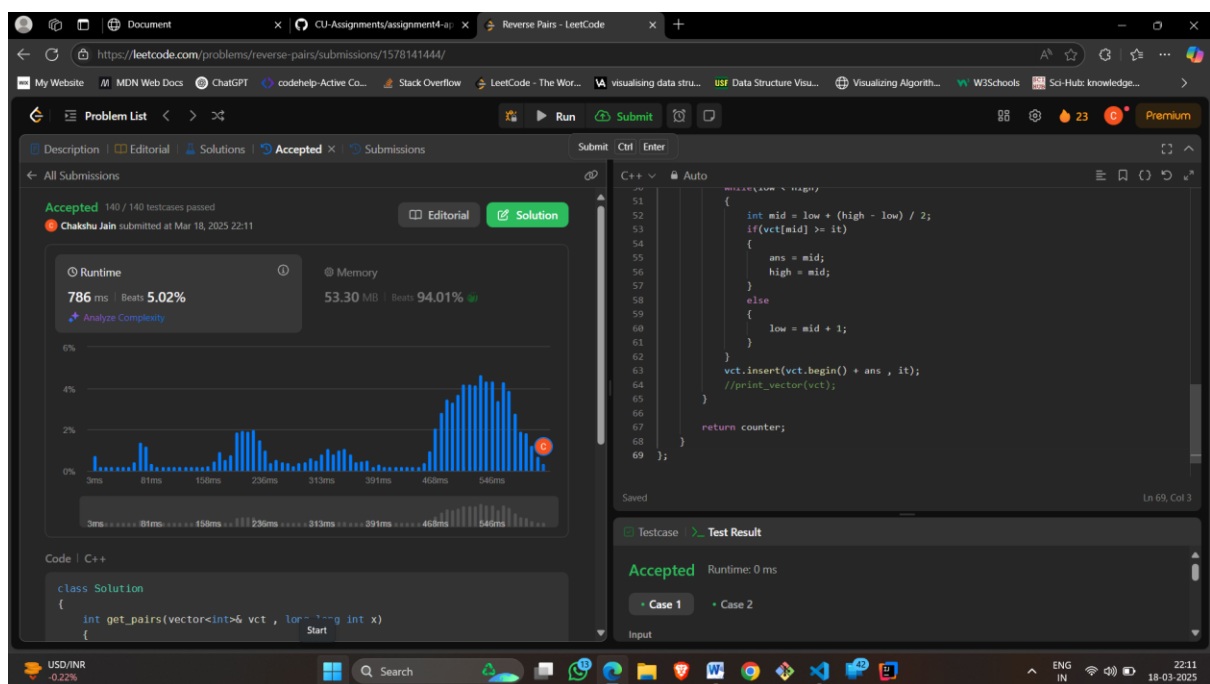
}

return counter;

}

};

```



10.longest increasing substring :

class Solution {

public:

vector<int>tree;

```

void update(int node,int st,int end,int i,int val){

    if(st==end){

        tree[node]=max(tree[node],val);

        return;

    }

    int mid=(st+end)/2;

    if(i<=mid){

        update(node*2,st,mid,i,val);

    }else{

        update(node*2+1,mid+1,end,i,val);

    }

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

}

int query(int node,int st,int end,int x,int y){

    if(x>end || y<st) return -1e9;

    if(st>=x && end<=y){

        return tree[node];

    }

    int mid=(st+end)/2;

    int left=query(2*node,st,mid,x,y);

    int right=query(2*node+1,mid+1,end,x,y);

    return max(left,right);

}

int lengthOfLIS(vector<int>& nums, int k) {

    int n=nums.size();

    if(n==1) return 1;

    int m=*max_element(nums.begin(),nums.end());

```

```

tree.clear();

tree.resize(4*m+10);

for(int i=n-1;i>=0;i--){

    int l=nums[i]+1,r=min(nums[i]+k,m);

    int x=query(1,0,m,l,r);

    if(x==-1e9) x=0;

    update(1,0,m,nums[i],x+1);

}

return tree[1];

}

};

```

The screenshot shows a LeetCode submission for the problem "Longest Increasing Subsequence II". The submission is accepted, with a runtime of 71 ms (beats 76.13%) and memory usage of 59.67 MB (beats 81.69%). The code is written in C++ and uses a segment tree to handle range queries and updates efficiently.

Runtime: 71 ms | Beats 76.13%
Memory: 59.67 MB | Beats 81.69%

Code (C++):

```

class Solution {
public:
    vector<int> tree;
    void update(int node, int st, int end, int i, int val) {
        if(st == end) {
            tree[node] = val;
            return;
        }
        int mid = (st + end) / 2;
        if(i <= mid) {
            update(2*node+1, st, mid, i, val);
        } else {
            update(2*node+2, mid+1, end, i, val);
        }
        tree[node] = max(tree[2*node+1], tree[2*node+2]);
    }
    int query(int node, int st, int end, int l, int r) {
        if(st > end) return -1e9;
        if(st == end) return tree[node];
        int mid = (st + end) / 2;
        if(l <= mid & r >= mid) {
            return tree[node];
        }
        int left = query(2*node+1, st, mid, l, r);
        int right = query(2*node+2, mid+1, end, l, r);
        return max(left, right);
    }
    int lengthOfLIS(vector<int>& nums, int k) {
        int n = nums.size();
        if(n == 1) return 1;
        int m = *max_element(nums.begin(), nums.end());
        tree.clear();
        tree.resize(4*m+10);
        for(int i = n-1; i >= 0; i--) {
            int l = nums[i]+1, r = min(nums[i]+k, m);
            int x = query(1, 0, m, l, r);
            if(x == -1e9) x = 0;
            update(1, 0, m, nums[i], x+1);
        }
        return tree[1];
    }
};

```