Department of Computer Science & Engineering
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NAAC GRADE A+
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WORKSHEET 5

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DOMAIN CAMP: 16-01-2023 to 28-01-2023
Subject Name: IT Skills (DSA)

UID: 21BCS8129
Section/Group: DWWC-77

Question 1. PRODUCT OF THE LAST K NUMBERS

```cpp
class ProductOfNumbers {
public:
    // vector 'v' will store the prefix products
    vector<int>v;
    ProductOfNumbers() {

    }

    void add(int num) {
        // if num is 0 clear the vector
        if(num==0) {
            v.clear();
            return;
        }

        // otherwise push the prefix product
        if(v.empty()) {
            v.push_back(num);
        }
        else {
            v.push_back(v.back()*num);
        }
    }

    int getProduct(int k) {
        // if k is exceeding the size of the vector that means 0 must have appeared in the stream. 0 has appeared that
        // so product must be 0
        if(k>v.size()) {
            return 0;
        }

        // otherwise find the product of the last k elements
        if(k==v.size()) {
            return v[k-1];
        }
        return v.back()/(v[v.size()-k-1]);
    }
};
```

Console

Run   Submit

Question 2. IMPLEMENT QUEUE USING STACKS

✓ Accepted

Next question

• 233. Number of Digit One

More challenges

• 225. Implement Stack using Queues

| All statuses ⌄ | All languages ⌄ |

Accepted   C++
few seconds ago

```cpp
class MyQueue {
public:
    stack<int> s1;
    stack<int> s2;

    MyQueue() {

    }

    void push(int x) {
        while(!s2.empty()) {
            s1.push(s2.top());
            s2.pop();
        }
        s1.push(x);
    }

    int pop() {
        while(!s1.empty()) {
            s2.push(s1.top());
            s1.pop();
        }
        int x = s2.top();
        s2.pop();
```

```cpp
        return x;
    }

    int peek() {
        while(!s1.empty()) {
            s2.push(s1.top());
            s1.pop();
        }
        int x = s2.top();
        return x;
    }

    bool empty() {
        if(!s2.empty() || !s1.empty()) {
            return false;
        }
        return true;
    }
};

/**
 * Your MyQueue object will be instantiated and called as such:
 * MyQueue* obj = new MyQueue();
 * obj->push(x);
 * int param_2 = obj->pop();
```
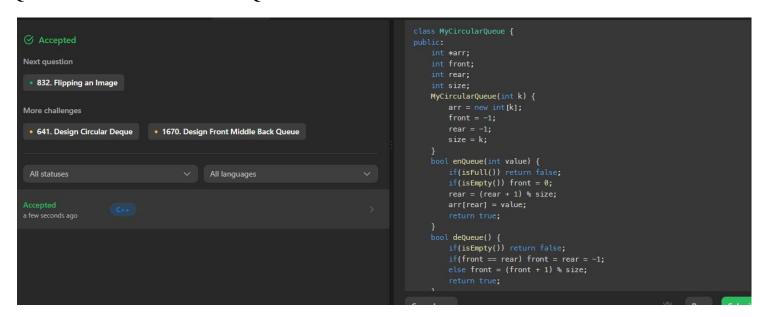
Question 3. DESIGN CIRCULAR QUEUE

```
⊘ Accepted

Next question

• 832. Flipping an Image

More challenges

• 641. Design Circular Deque        • 1670. Design Front Middle Back Queue

All statuses              ∨       All languages          ∨

Accepted                                                          >
a few seconds ago          C++
```

```cpp
class MyCircularQueue {
public:
    int *arr;
    int front;
    int rear;
    int size;
    MyCircularQueue(int k) {
        arr = new int[k];
        front = -1;
        rear = -1;
        size = k;
    }
    bool enQueue(int value) {
        if(isFull()) return false;
        if(isEmpty()) front = 0;
        rear = (rear + 1) % size;
        arr[rear] = value;
        return true;
    }
    bool deQueue() {
        if(isEmpty()) return false;
        if(front == rear) front = rear = -1;
        else front = (front + 1) % size;
        return true;
    }
```

```cpp
        return true;
    }
    int Front() {
        if(isEmpty()) return -1;
        return arr[front];
    }
    int Rear() {
        if(isEmpty()) return -1;
        return arr[rear];
    }
    bool isEmpty() {
        return front == -1;
    }
    bool isFull() {
        return ((rear + 1) % size) == front;
    }
};
```
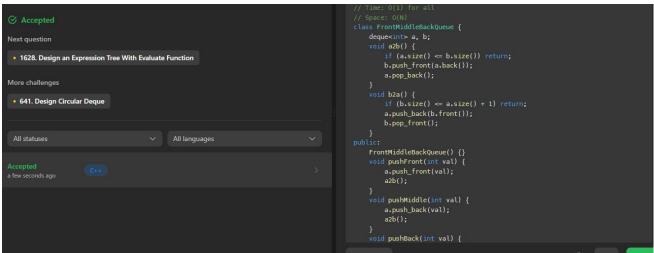
Question 4. DESIGN FRONT MIDDLE BACK QUEUE

Accepted

Next question

• 1628. Design an Expression Tree With Evaluate Function

More challenges

• 641. Design Circular Deque

All statuses   All languages

Accepted   C++
a few seconds ago

```cpp
// Time: O(1) for all
// Space: O(N)
class FrontMiddleBackQueue {
    deque<int> a, b;
    void a2b() {
        if (a.size() <= b.size()) return;
        b.push_front(a.back());
        a.pop_back();
    }
    void b2a() {
        if (b.size() <= a.size() + 1) return;
        a.push_back(b.front());
        b.pop_front();
    }
public:
    FrontMiddleBackQueue() {}
    void pushFront(int val) {
        a.push_front(val);
        a2b();
    }
    void pushMiddle(int val) {
        a.push_back(val);
        a2b();
    }
    void pushBack(int val) {
```

```cpp
    void pushBack(int val) {
        b.push_back(val);
        b2a();
    }
    int popFront() {
        if (a.empty() && b.empty()) return -1;
        int ans;
        if (a.empty()) {
            ans = b.front();
            b.pop_front();
        } else {
            ans = a.front();
            a.pop_front();
            b2a();
        }
        return ans;
    }
    int popMiddle() {
        if (a.empty() && b.empty()) return -1;
        int ans;
        if (a.size() == b.size()) {
            ans = a.back();
            a.pop_back();
        } else {
            ans = b.front();
            b.pop_front();
        }
        return ans;
    }
    int popBack() {
        if (a.empty() && b.empty()) return -1;
        int ans = b.back();
        b.pop_back();
        a2b();
        return ans;
    }
```

Question 5. BOOK EXERCISES

```cpp
Language: C++14

1   #include <iostream>
2   using namespace std;
3   #include<bits/stdc++.h>
4   int main() {
5       // your code goes here
6       ios_base::sync_with_stdio(false);
7       cin.tie(NULL);
8       int n;
9       cin>>n;
10      stack<pair<pair<int,string>,int>> st1;
11      for(int i=0;i<n;i++){
12          int x;
13          cin>>x;
14          string str;
15          if(x!=-1 ){
16              cin>>str;
17          }else if(x==-1){
18              cout<<st1.top().second<<" "<<st1.top().first.second<<endl;
19              st1.pop();
20              continue;
21          }
22          if (x==0){
23              continue;
24          }
25          if(!st1.empty() and st1.top().first.first<x ){
26              st1.top().second++;
27              continue;
28          }
29
30          pair<int,string> p = make_pair(x,str);
31          pair<pair<int,string>,int> whole_pair= make_pair(p,0);
32          st1.push(whole_pair);
33      }
34      return 0;
35  }
```

0:0

SOLUTION:

Status: ✔ Correct Answer   Submission ID: 84843119

Time: Memory:
0.82s   27.3M

Question 6. SUBARRAY SUM

```cpp
Language: C++14

1   #include <bits/stdc++.h>
2   using namespace std;
3
4   #define ll long long
5   #define rep(i,a,b) for(int i = a; i <= b; ++i)
6   #define repr(i,a,b) for(int i = a; i>=b; --i)
7   #define all(a) a.begin(), a.end()
8   #define pb push_back
9   #define N 1005
10  #define ii pair <int, int>
11  #define se second
12  #define fi first
13  #define bit(i) (i & (-i))
14  #define base 29
15  #define mod 1000000007ll
16
17  int o1[4] = { 0, 1, 0, -1 };
18  int o2[4] = { -1, 0, 1, 0 };
19
20  string yno[2] = { "NO\n", "YES\n" };
21
22  void print(vector <int>& a) {
23      for (int i : a) cout << i << ' ';
24      cout << endl;
25  }
26
27  void print(ii a) {
28      cout << a.first << ' ' << a.second << endl;
29  }
30
31  void print(int a[], int n) {
32      rep(i, 1, n) cout << a[i] << ' ';
33      cout << endl;
34  }
```

```cpp
34  }
35
36  int p[200005];
37
38  void init() {
39      rep(i, 1, 200000) {
40          p[i] = p[i - 1] + i;
41          p[i] %= mod;
42      }
43  }
44
45  void solve() {
46      int n;
47      cin >> n;
48      vector <int> a(n + 2);
49      rep(i, 1, n) {
50          cin >> a[i];
51      }
52      vector <int> l(n + 2), r(n + 2);
53      stack <int> s;
54      rep(i, 1, n) {
55          while (s.size() && a[s.top()] < a[i]) {
56              s.pop();
57          }
58          if (s.size()) {
59              l[i] = s.top();
60          }
61          else l[i] = 0;
62          s.push(i);
63      }
64      s = stack <int>();
65      repr(i, n, 1) {
66          while (s.size() && a[s.top()] <= a[i]) {
67              s.pop();
68          }
69          if (s.size()) {
70              r[i] = s.top();
```

```
 70              r[i] = s.top();
 71          }
 72          else r[i] = n + 1;
 73          s.push(i);
 74      }
 75      ll ans = 0;
 76      rep(i, 1, n) {
 77          ll t = (1ll * a[i] * (i - l[i])) % mod;
 78          t = t * ((1ll * p[r[i] - i]) % mod);
 79          ans += t;
 80          ans %= mod;
 81          t = (1ll * a[i] * (i - l[i])) % mod;
 82          t = t * ((1ll * (r[i] - i) * (n + 1 - r[i])) % mod);
 83          ans += t;
 84          ans %= mod;
 85      }
 86      cout << ans << endl;
 87  }
 88
 89  int main() {
 90      ios_base::sync_with_stdio(false); cin.tie(0);
 91  #ifndef ONLINE_JUDGE
 92  #endif
 93      init();
 94      int t = 1;
 95      cin >> t;
 96      while (t--) {
 97          solve();
 98      }
 99      return 0;
100  }
```
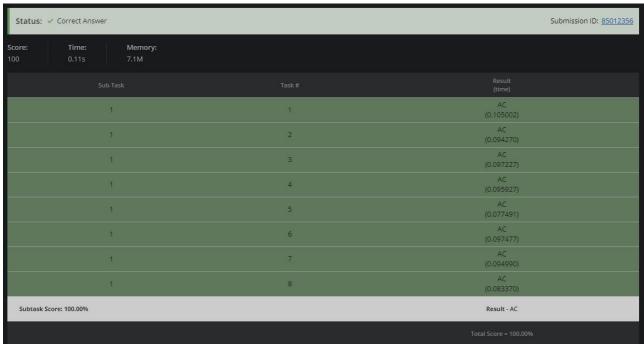
SOLUTION:

Status: ✔ Correct Answer		Submission ID: 85012356

Score: 100	Time: 0.11s	Memory: 7.1M

Sub-Task	Task #	Result (time)
1	1	AC (0.105002)
1	2	AC (0.094270)
1	3	AC (0.097227)
1	4	AC (0.095927)
1	5	AC (0.077491)
1	6	AC (0.097477)
1	7	AC (0.094990)
1	8	AC (0.083370)
Subtask Score: 100.00%		Result - AC
		Total Score = 100.00%

Question 7. ABSOLUTE MIN MAX

```cpp
Language: C++14

1    #include <bits/stdc++.h>
2
3    using namespace std;
4    using ll=long long;
5
6    #define pb push_back
7
8    ll ans,n;
9    ll arr[250002];
10   vector<ll> li[250002];
11
12   struct fenwick
13   {
14       std::vector<ll> tree;
15
16       void init(ll n)
17       {
18           ll i;
19           tree.resize(n+5);
20           for(i=0;i<=n;i++)
21           {
22               tree[i]=0;
23           }
24       }
25
26       void upd(ll i,ll v)
27       {
28           for(++i;i<=n;i+=(i&(-i)))
29           {
30               tree[i]+=v;
31           }
32       }
33
34       ll calc(ll i)
35       {
36           ll sum=0;
37           for(++i;i>0;i-=(i&(-i)))
38           {
39               sum+=tree[i];
40           }
41           return sum;
42       }
43
44       ll calc(ll l,ll r)
45       {
46           return calc(r)-calc(l-1);
```

```cpp
46           return calc(r)-calc(l-1);
47       }
48   };
49
50   void solve()
51   {
52       stack<ll> stck;
53       ll i;
54       ll nxt[n+5];
55       fenwick tr;
56       tr.init(n+5);
57       for(i=0;i<=n;i++)
58       {
59           li[i].clear();
60       }
61       for(i=0;i<n;i++)
62       {
63           while(!stck.empty() && arr[stck.top()]<=arr[i])
64           {
65               stck.pop();
66           }
67           if(stck.empty())
68           {
69               tr.upd(i,1);
70           }
71           else
72           {
73               li[stck.top()].pb(i);
74           }
75           stck.push(i);
76       }
77       while(!stck.empty()){stck.pop();}
78       for(i=n-1;i>=0;i--)
79       {
80           while(!stck.empty() && arr[stck.top()]>=arr[i])
81           {
82               stck.pop();
83           }
84           if(stck.empty())
85           {
86               nxt[i]=n;
87           }
88           else
89           {
90               nxt[i]=stck.top();
91           }
92           stck.push(i);
93       }
94       for(i=0;i<n;i++)
```
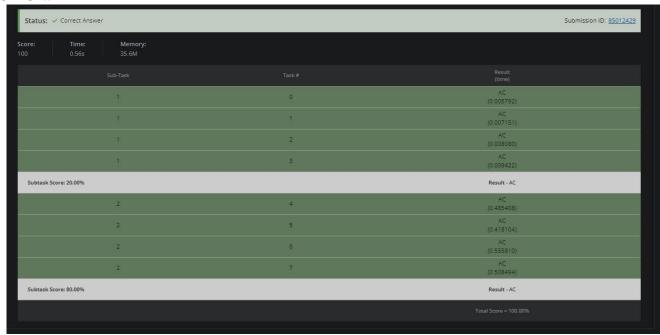
```
 94        for(i=0;i<n;i++)
 95        {
 96            for(ll j:li[i])
 97            {
 98                tr.upd(j,1);
 99            }
100            ans+=tr.calc(i,nxt[i]-1);
101        }
102        return ;
103    }
104
105    int main()
106    {
107        ios_base::sync_with_stdio(false);
108        cin.tie(NULL);
109        ll testcases, i, cur;
110        cin >> testcases;
111        while (testcases--)
112        {
113            cin >> n;
114            ans = 0;
115            for (i = 0; i < n; i++)
116            {
117                cin >> arr[i];
118            }
119            solve();
120            reverse(arr, arr + n);
121            solve();
122            cur = 1;
123            for (i = 1; i < n; i++)
124            {
125                if (arr[i - 1] == arr[i])
126                {
127                    cur++;
128                }
129                else
130                {
131                    ans -= (cur * (cur + 1)) / 2;
132                    cur = 1;
133                }
134            }
135            ans -= (cur * (cur + 1)) / 2;
136            cout << ans << "\n";
137        }
138        return 0;
139    }
```

SOLUTION:

	Status: ✓ Correct Answer		Submission ID: 85012429
Score: 100	**Time:** 0.56s	**Memory:** 35.6M	

Sub-Task	Task #	Result (time)
1	0	AC (0.005792)
1	1	AC (0.007151)
1	2	AC (0.008080)
1	3	AC (0.009422)
Subtask Score: 20.00%		**Result - AC**
2	4	AC (0.485408)
2	5	AC (0.418104)
2	6	AC (0.555810)
2	7	AC (0.508494)
Subtask Score: 80.00%		**Result - AC**
		Total Score = 100.00%

Question 8. WEAK IN THE MIDDLE

```cpp
#include <bits/stdc++.h>
using namespace std;

void solve() {
    int n;
    cin >> n;
    vector<int> t(n, 0);
    stack<tuple<int, int, int>> st;

    for(int i = 0; i < n; ++i) {
        int a, end_time = 0;
        cin >> a;

        while(st.size() >= 2) {
            auto x = st.top();
            st.pop();
            auto y = st.top();
            if(get<0>(x) < min(get<0>(y), a))
                t[get<2>(x)] = end_time = 1 + max(get<1>(x), end_time);
            else {
                st.push(x);
                break;
            }
        }

        st.push({a, end_time, i});
    }

    for(int T : t) cout << T << ' ';
    cout << '\n';
}

int main() {
    ios_base :: sync_with_stdio(false);
    cin.tie(0);
    int t;
    cin >> t;
    while(t--) solve();
    return 0;
}
```

SOLUTION:

Score:	Time:	Memory:
100	0.02s	5.4M

Sub-Task	Task #	Result (time)
1	0	AC (0.003946)
1	1	AC (0.003859)
Subtask Score: 20.00%		Result - AC
2	2	AC (0.017489)
2	3	AC (0.015301)
2	4	AC (0.014220)
2	5	AC (0.015795)
2	6	AC (0.014426)
Subtask Score: 80.00%		Result - AC
		Total Score = 100.00%