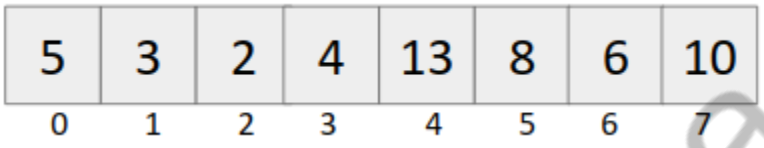
Segment Tree - Max

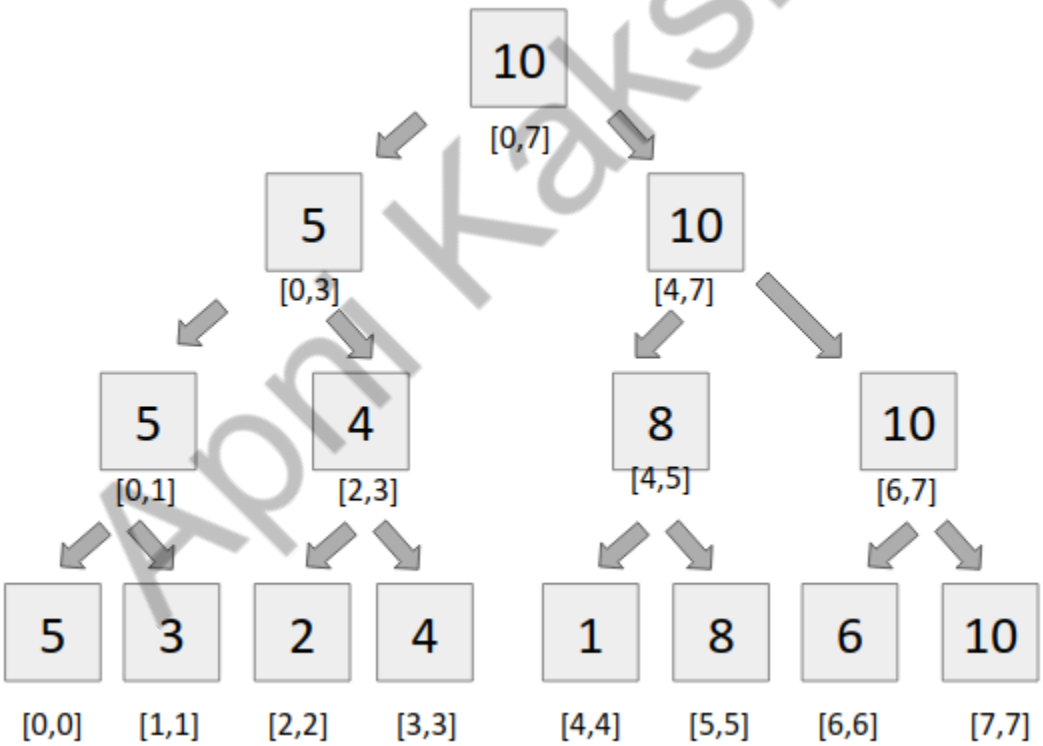
Problem

Build a segment tree with max build, query and update.

Example



Structure



Approach

Building a segment tree

It is very simple to build a segment tree, we use divide and conquer approach to build the segment tree.

Query

For query, we see two types of segments

- Complete overlapping segments - When our st Partial overlapping segments and en lies completely in the range [l,r], it is called complete overlapping segment.
- Partial overlapping segments - When our st and en does not lie completely in the range [l,r], it is called partial overlapping segment.

Code

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

#define int long long
#define endl "\n"
const int N = 1e5+2, MOD = 1e9+7;

int tree[4*N], a[N];

void build(int node, int st, int en){
    if(st == en){
        tree[node] = a[st];
        return;
    }

    int mid = (st + en)/2;
    build(2*node, st, mid);
    build(2*node+1, mid+1, en);

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

```
int query(int node, int st, int en, int l, int r){
    if(en < l || st > r){
        return MOD;
    }

    if(l <= st && en <= r)
        return tree[node];

    int mid = (st + en)/2;
    int q1 = query(2*node, st, mid, l, r);
    int q2 = query(2*node+1, mid+1, en, l, r);

    return max(q1, q2);
}

void update(int node, int st, int en, int idx, int val){
    if(st == en){
        a[st] = val;
        tree[node] = val;
        return;
    }

    int mid = (st+en)/2;
    if(idx <= mid){
        update(2*node, st, mid, idx, val);
    }
    else{
        update(2*node+1, mid+1, en, idx, val);
    }

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

signed main(){
    int n,m;
    cin >> n >> m;

    for(int i=0; i<n; i++){
        cin >> a[i];
    }
```

```
    build(1,0,n-1);

    while(m--){
        int type;
        cin >> type;
        if(type == 1){
            int idx,val;
            cin >> idx >> val;
            update(1,0,n-1,idx,val);
        }
        else{
            int l,r;
            cin >> l >> r;
            int ans = query(1,0,n-1,l,r-1);
            cout << ans << endl;
        }
    }
    return 0;
}
```