

Bugged Coders

1 Data sctrucutres

1.1 Segment tree

```

1 int nums[]={1,3,4,5,7};
2 struct segmentTree{
3     int l, r,sum;
4     segmentTree *nodeLeft,*nodeRight;
5     segmentTree(int a, int b){
6         l=a;
7         r=b;
8         int m=(l+r)/2;
9         if(l!=r){
10             nodeLeft=new segmentTree(l,m);
11             nodeRight=new segmentTree(m+1,r);
12             sum=nodeLeft->sum+nodeRight->sum;
13         }
14         else sum=nums[l];
15     }
16     int query(int a, int b){
17         if(b<l || a>r) return 0;
18         if(a<=l && r<=b) return sum;
19         return nodeLeft->query(a,b)+nodeRight->query(a,b);
20     }
21     void update(int pos, int v){
22         if(l!=r){
23             int m=(l+r)/2;
24             if(pos<=m) nodeLeft->update(pos,v);
25             else nodeRight->update(pos,v);
26             sum=nodeLeft->sum+nodeRight->sum;
27         }
28         else sum=v;
29     }
30 };

```

1.2 Segment tree- Lazy Propagation

```

1 int nums[]={1,3,5,7,9,11};
2 struct segmentTree{

```

```

3     int l, r,sum,lazy;
4     segmentTree *nodeLeft,*nodeRight;
5     segmentTree(int a, int b){
6         l=a;
7         r=b;
8         int m=(l+r)/2;
9         lazy=0;
10        if(l!=r){
11            nodeLeft=new segmentTree(l,m);
12            nodeRight=new segmentTree(m+1,r);
13            sum=nodeLeft->sum+nodeRight->sum;
14        }
15        else sum=nums[l];
16    }
17    int query(int a, int b){
18        if(nodeLeft!=nullptr && lazy!=0) nodeLeft->lazy=lazy;
19        if(nodeRight!=nullptr && lazy!=0) nodeRight->lazy=lazy;
20        sum+=(r-l+1)*lazy;lazy=0;
21        if(b<l || a>r) return 0;
22        if(a<=l && r<=b) return sum;
23        return nodeLeft->query(a,b)+nodeRight->query(a,b);
24    }
25    int update(int a, int b, int v){
26        int increment=0;
27        if(b<l || a>r) return 0;
28        if(a<=l && r<=b){
29            if(nodeLeft!=nullptr) nodeLeft->lazy+=lazy;
30            if(nodeRight!=nullptr) nodeRight->lazy+=lazy;
31            increment=(r-l+1)*v;
32            sum+=increment;
33            return increment;
34        }
35        increment=nodeLeft->update(a,b,v)+nodeRight->update(a,b,v);
36        sum+=increment;
37        return increment;
38    }
39 };

```

1.3 Disjoin Set

```

1 //Se usa para detectar ciclos en un grafo no dirigido convexo & en el
  algoritmo de Krustal.
2 vector<pair<int,int>>ds;

```

```

3 void init(int n){
4     ds.assign(n+1,{-1,0});
5 }
6 int find(int x){
7     if(-1==ds[x].first) return x;
8     return ds[x].first=find(ds[x].first);
9 }
10 bool unionDs(int x, int y){
11     int px=find(x),py=find(y);
12     int &rx=ds[px].second,&ry=ds[py].second;
13     if(px==py) return false;
14     else{
15         if(rx>ry) ds[py].first=px;
16         else{
17             ds[px].first=py;
18             if(rx==ry) ry+=1;
19         }
20     }
21     return true;
22 }

```

1.4 Sparse Table

```

1 //Se usa para RMQ porque se puede hacer en O(1), no acepta updates
2 vector<int>lg;
3 vector<vector<int>>st;
4 int *nums;
5 void init(int n){
6     int logn=(int) log2(n)+1;
7     lg.assign(n+1,0);
8     st.assign(logn,vector<int>(n+1));
9     for(int i=0;i<n;i++) st[0][i]=nums[i];
10    lg[1]=0;
11    for(int i=2;i<=n;i++) lg[i]=lg[i/2]+1;
12    for(int i=1;i<logn;i++)
13        for(int j=0;j+(1<<i)<n;j++)st[i][j]=min(st[i-1][j],st[i-1][j
14        +(1<<(i-1))]);
15 }
16 int query(int a,int b){
17     int logn=lg[(b-a+1)];
18     cout<<st[logn][a]<<endl;
19     return min(st[logn][a],st[logn][b-(1<<logn)+1]);
20 }

```

1.5 Treap

```

1 #include <bits/stdc++.h>
2 using namespace std;
3 typedef struct Node *pitem;
4 struct Node{
5     int x,y;
6     pitem l,r;
7     Node(int v) x(v),y(rand()),l(nullptr),r(nullptr);
8 };
9 vector<int> rank; //1)optiona 2)intialize this array n+1
10 pair<pitem,pitem> split(pitem root,int value){
11     pitem b=root->r;
12     if(!root) return {nullptr,nullptr};
13     if(root->x==value){
14         pitem b=root->r;
15         root->r=nullptr;
16     }
17     else{
18         if(root->x>value) return split(root->l,value);
19         else return split(root->r,value);
20     }
21     return {root,b};
22 }
23 void leftRotation(pitem x,int value){
24     pitem y,a,b,c;
25     tie(x,y)=split(x,value);
26     tie(y,c)=split(y,y->y);
27     a=x->l;b=y->l;
28     x->r=c;x->l=y;
29     y->l=a;y->r=b;
30     swap(x->x,y->x);swap(x->y,y->y);
31 }
32 void rightRotation(pitem x,int value){
33     pitem y=a,b,c;
34     tie(x,c)=split(x,value);
35     tie(y,b)=split(y,y->y);
36     a=y->l;
37     x->r=y;
38     y->l=b;y->r=c;
39     x->l=a;
40     swap(x->x,y->x);swap(x->y,y->y);
41 }

```

```

42 void insert(pitem root,int value){
43     if(!root){
44         root=new Node(value);
45         return;
46     }
47     insert((root->x>value?root->l,root->r),value);
48     if(root->l && root->l->y>root->y) leftRotation(root,root->y);
49     if(root->r && root->r->y>root->y) leftRotation(root,root->y);
50 }
51 //optional
52 int dfs(pitem root){
53     if(root->l) rank[root->x]+=dfs(root->l);
54     if(root->r) rank[root->x]+=dfs(root->r);
55     return rank[root->x]+1;
56 }

```

2 DP

2.1 Digit DP

```

1  ll dp[20][20][3];
2  ll n,k,d;
3  vector<int>num;
4  ll bk(int i, int len, int t){
5      if(len>k) return 0;
6      if(i==n){
7          if(len==k) return 1;
8          return 0;
9      }
10     ll &res=dp[i][len][t];
11     if(res!=-1) return res;
12     res=0;
13     int tope;
14     if(t==0) tope=num[i];
15     else tope=9;
16     for(int j=0;j<=tope;j++){
17         int newt=t;
18         int newlen=len;
19         if(t==0 && j<tope) newt=1;
20         if(d==j) newlen++;
21         if(newlen<=k)res+=bk(i+1,newlen,newt);
22     }
23     return res;

```

```

24 }
25 ll rep(int a){
26     num.clear();
27     while(a>0){
28         num.push_back(a%10);
29         a/=10;
30     }
31     reverse(num.begin(),num.end());
32     n=num.size();
33     memset(dp,-1,sizeof(dp));
34     return bk(0,0,0);
35 }

```

3 Graph

3.1 Krustal

```

1  // Este algoritmo sirve para buscar MST de un grafo convexo no dirigido
2  vector<tuple<int,int,int>>edges;
3  int n,m;
4  //Insertar Disjoin set
5  int kruskal(){
6      sort(edges.begin(),edges.end());
7      int res=0;
8      for(int i=0;i<m;i++){
9          int c,a,b;
10         tie(c,a,b)=edges[i];
11         if(unionDs(a,b)==false) continue;
12         else res+=c;
13     }
14     return res;
15 }

```

3.2 Kosaraju's (SCC)

```

1  //Sirve para encontrar los SCC
2  struct Kosaraju{
3      int s;
4      vector<vector<int>> g,gr;
5      vector<int> visited,ids,topologic_sort;
6      Kosaraju(int n){
7          s=n;
8          g.assign(n+1,vector<int>());

```

```

9      gr.assign(n+1,vector<int>());
10     visited.assign(n+1,0);
11     ids.assign(n+1,0);
12 }
13 void addEdge(int a,int b){
14     g[a].push_back(b);
15     gr[b].push_back(a);
16 }
17 void dfs(int u){
18     if(visited[u]!=0) return;
19     visited[u]=1;
20     for(int node:g[u])dfs(node);
21     topologic_sort.push_back(u);
22 }
23 void dfsr(int u,int id){
24     if(visited[u]!=0) return;
25     visited[u]=1;
26     ids[u]=id;
27     for(int node:gr[u])dfsr(node,id);
28 }
29 void algo(){
30     for(int i=1;i<=s;i++) if(visited[i]==0) dfs(i);
31     fill(visited.begin(),visited.end(),0);
32     reverse(topologic_sort.begin(),topologic_sort.end());
33     int id=0;
34     for(int i=0;i<topologic_sort.size();i++){
35         if(visited[topologic_sort[i]]==0)dfsr(topologic_sort[i],id
36         ++);
37     }
38     int search(int node){
39         return ids[node];
40     }
41 };

```

3.3 2 Sat

```

1 //Se usa para los problems en los cuales tengamos dos dosible variables
2 struct twoSat{
3     int s;
4     vector<vector<int>>> g,gr;
5     vector<int> visited,ids,topologic_sort,val;
6     twoSat(int n){

```

```

7         s=n;
8         g.assign(n*2+1,vector<int>());
9         gr.assign(n*2+1,vector<int>());
10        visited.assign(n*2+1,0);
11        ids.assign(n*2+1,0);
12        val.assign(n+1,0);
13    }
14    void addEdge(int a,int b){
15        g[a].push_back(b);
16        gr[b].push_back(a);
17    }
18    void addOr(int a,bool ba,int b,bool bb){
19        addEdge(a+(ba?s:0),b+(bb?0:s));
20        addEdge(b+(bb?s:0),a+(ba?0:s));
21    }
22    void addXor(int a,bool ba,int b,bool bb){
23        addOr(a,ba,b,bb);
24        addOr(a,!ba,b,!bb);
25    }
26    void addAnd(int a,bool ba,int b,bool bb){
27        addXor(a,!ba,b,bb);
28    }
29    void dfs(int u){
30        if(visited[u]!=0) return;
31        visited[u]=1;
32        for(int node:g[u])dfs(node);
33        topologic_sort.push_back(u);
34    }
35    void dfsr(int u,int id){
36        if(visited[u]!=0) return;
37        visited[u]=1;
38        ids[u]=id;
39        for(int node:gr[u])dfsr(node,id);
40    }
41    bool algo(){
42        for(int i=0;i<s*2;i++) if(visited[i]==0) dfs(i);
43        fill(visited.begin(),visited.end(),0);
44        reverse(topologic_sort.begin(),topologic_sort.end());
45        int id=0;
46        for(int i=0;i<topologic_sort.size();i++){
47            if(visited[topologic_sort[i]]==0)dfsr(topologic_sort[i],id
48            ++);

```

```
49     for(int i=0;i<s;i++){
50         if(ids[i]==ids[i+s]) return false;
51         val[i]=(ids[i]>ids[i+s]?0:1);
52     }
53     return true;
54 }
55 };
```

4 Strings

4.1 KMP

```
1 vector<int> kmp(string s){
2     int n=s.size();
3     vector<int>pi(n);
4     for(int i=1;i<n;i++){
5         int j=pi[i-1];
6         while(j>0 && s[i]!=s[j])j=pi[j-1];
7         if(s[i]==s[j]) j++;
8         pi[i]=j;
9     }
10    return pi;
11 }
```

5 Math

6 Geometry

7 Others