



WORKSHEET 6

Student Name: Harsh Chauhan UID: 21BCS10053

Subject Name: IT Skills (DSA)





Question 1. FAMILY TREE

```
Language: C++14
  1 #include <bits/stdc++.h>
       using namespace std;
  5 #define 11 long long
  6 #define ld long double
  7 #define pb push_back
  8 #define pf push_front
9 #define mp make pair
10 #define all(v) v.begin(), v.end()
11 #define test() int t; cin >> t; while(t--)
 12 #define nl cout << endl
14 ll n, m, src, dst, cnt, r;
15 vector<ll> adj[100001];
16 ll A[100001], B[100001];
17 ll ln[100001], nn[100001];
18 ll res = -123456789;
20 · void dfs(ll u){
21 · for(int i: adj[u]){
22     ln[i] = max(ln[u], A[i]);
23     nn[i] = min(nn[u], A[i]);
24     dfs(i);
22
23
24
25
26 }
27
28 - main(){
29 ios_
               ios_base::sync_with_stdio(0);
               cin.tie(0); cout.tie(0);
if(fopen("inp.inp", "r")){
   freopen("inp.inp", "r", stdin);
   freopen("out.out", "w", stdout);
 30
31
```

```
36
        cin >> n;
37
        for(int i = 1; i <= n; i++) cin >> A[i];
        for(int i = 1; i \le n; i++){
38
           cin >> B[i];
            if(B[i] != -1) adj[B[i]].pb(i);
40
41
42
        ln[r] = -123456789;
44
        nn[r] = 123456789;
45
        dfs(r);
        for(int i = 1; i \le n; i++) res = max(res, ln[i] - nn[i]);
        cout << res;
48 }
```







```
Status: ✓ Correct Answer

Time: Memory:
0.03s 10.7M
```

Question 2. SHORTEST PATH IN BINARY TREES

```
Status: ✓ Correct Answer

Submission ID: 84941030

Time: Memory: 0.20s 5.4M
```













Question 3. BLACK AND WHITE TREE





```
Language: C++14
  2 using namespace std;
  3 #define fast ios_base::sync_with_stdio(false);cin.tie(0);cout.tie(0);
 4 #define tt int ct;cin>>ct;while(ct--)
 5 #define MAX 100005
     typedef long long 11;
 8 int n,a[MAX];
 9 vector<int> ad[MAX];
10 int dp[MAX][2][2];
11 void dfs(int u,int par){
12 for(auto it : ad[u]){
17 - for(int i=0;i<2;i++){
18 for(int j=0;j<2;j++){
19 int odd = a[u]^i^j;
20 int cc = j;
21 int dp1[2],dp2[2];
 22 memset(dp2,0x3f,sizeof(dp2));
 23 dp2[0] = 0;
24 for(auto v : ad[u]){
25 if(v != par){
26 swap(dp1[0],dp2[0]);
27 swap(dp1[1],dp2[1]);
28 memset(dp2,0x3f,sizeof(dp2));
30 dp2[0] = min(dp2[0],dp1[0]+dp[v][cc][0]);
31 dp2[1] = min(dp2[1],dp1[1]+dp[v][cc][0]);
 33 dp2[0] = min(dp2[0],dp1[1]+dp[v][cc][1]);
     dp2[1] = min(dp2[1],dp1[0]+dp[v][cc][1]);
```

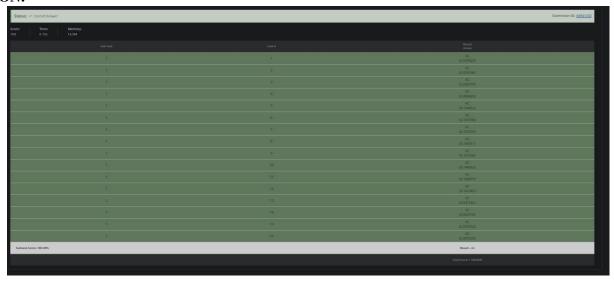
```
35 } }
36 dp[u][i][j] = dp2[odd]+j;
37 } }
38 return;
39 }
40 void solve(){
41 cin>>n;
42 for(int i=0;i<n;i++){
43 cin>>a[i];
44 }
45
46 for(int i=0;i<n-1;i++){
47 ad[i].clear();
48 }
49 for(int i=0;i<n-1;i++){
50 int u,v; cin>>u>v; u--;v--;
51 ad[u].emplace_back(v);
52 ad[v].emplace_back(u);
53 }
54
55 dfs(0,-1);
56
67 int ans = min(dp[0][0][0],dp[0][0][1]);
57 if(ans > n){
68 printf("-1\n");
69 }
61 else{
62 printf("%d\n",ans);
63 }
64 return;
65 }
65 int32_t main() {
67 fast
68 #ifndef ONLINE_JUDGE
67 freopen("input.txt","r",stdin);
67 freopen("input.txt","r",stdout);
67 #endif
```







```
70 freopen("output.txt","w",stdout);
71 #endif
72 - tt{
73 solve();
74 }
75 return 0;
76 }
```





Language: C++14



Question 4. SECRET TREE

```
1 #include <bits/stdc++.h>
                   #define PRECISION 9
                using namespace std;
using ll = long long;
using ld = long double;
define fr first
                 8 #define sc second
9 using pi2 = pair<int, int>;
10 using pl2 = pair<ll, ll>;
                11 #define all(v) v.begin(), v.end()
12 #define unq(v) sort( all(v) ); v.erase( unique( all(v) ), v.end() );
                16 void Main(){
                        int t; cin >> t;
while (t--){
                             int n; cin >> n,
for (int i = 2; i <= n; i++){
    for (int j = 2; j <= n; j++){
        if (i=-j){ continue; }
        cout << "?" << 3 << ' ' << 1 << ' ' << i << ' ' << p << endl << flush;</pre>
                23
24
25
26
                                      int res; cin >> res;
if (res){ adj[i].push_back(j); cnt[j] += 1; }
                27
28
29
                             }
for (int i = 2; i <= n; i++){ adj[1].push_back(i); cnt[i] += 1; }
queue<int> q; q.push(1);
                              vector<pi2> v;
                              while (!q.empty()){
                                 cnt[nxt] -= 1;
                              if (cnt[nxt] == 0){ v.push_back({now, nxt}); q.push(nxt); }
                  cout << "!" << endl << flush;
                  for (pi2 p : v){ cout << p.fr << ' ' << p.sc << endl << flush; }
40
                  cout << flush;
42
                  for (int i = 1; i <= n; i++){ adj[i].clear(); cnt[i] = 0; }
46
      int main(){
            ios_base::sync_with_stdio(0);
            cin.tie(0); cout.tie(0);
cout.setf(ios::fixed);
48
49
50
            cout.precision(PRECISION);
            Main();
```









Question 5. BLACK AND RED VERTICES OF TREE





```
i†(black[x] and other_red and !color[v]) mark[v] = 1;
35 other_red+=red[x];
   other_black+=black[x];
38 for(int x:adj[v]) if(x!=p) dfs_mark(x, v);
41 void dfs_cnt(int v, int p) {
42 for(int x:adj[v]) if(x!=p) {
43 dfs_cnt(x, v);
45 if(color[v]) cnt[v] = 0;
46 - else {
47 cnt[v] = 1;
48 for(int x:adj[v]) if(x!=p) {
49 cnt[v] = (cnt[v] * (cnt[x] + 1)) % mod;
50
54 void dfs_cnt_na(int v, int p) {
55 - for(int x:adj[v]) if(x!=p) {
56 dfs_cnt_na(x, v);
58 if(color[v]==0 and !mark[v]) {
59 cnt_na[v] = 1;
60 for(int x:adj[v]) if(x!=p) {
61 cnt_na[v] = (cnt_na[v] * (cnt_na[x] + 1)) % mod;
64 else cnt_na[v] = 0;
66
67 signed main() {
68 ios_base::sync_with_stdio(0); cin.tie(0);
69
```

```
71 while(tc--) {
72 cin>>n;
73 reset();
74 for(int i=0; i<n-1; i++) {
 76 v--; u--;
77 adj[u].push_back(v);
78 adj[v].push_back(u);
80 for(int i=0; i<n; i++) cin>>color[i];
81 dfs_rb(0, 0);
82 // cout << "black: "; for(int i=0; i<n; i++) cout << black[i] << " "; cout << '\n'; 83 // cout << "red: "; for(int i=0; i<n; i++) cout << red[i] << " "; cout << '\n';
84 dfs_mark(0, 0);

85 // cout << "mark: "; for(int i=0; i<n; i++) cout << mark[i] << " "; cout << '\n';

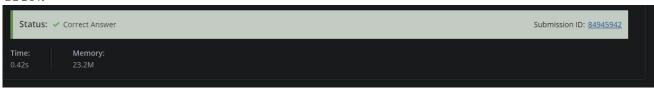
86 dfs_cnt(0, 0);

87 //cout << "cnt: "; for(int i=0; i<n; i++) cout << cnt[i] << " "; cout << '\n';
88 dfs_cnt_na(0, 0);
89
90 11 sumal1 = 0;
91 for(int i=0; i<n; i++) {
92 sumall+=cnt[i];
93 sumall%=mod;
97 sumnotmark+=cnt_na[i];
98 sumnotmark%=mod;
99
100 ll ans = (sumall - sumnotmark + mod)%mod;
103 return 0;
```













Question 6. COMMON ANCESTORS

```
Language: C++14

#include <bits/stdc++.h>

using namespace std;

const int MX = 1e6 + 10;

int seg[4 * MX], lazy[4 * MX], beg[MX], fin[MX], dep[MX], cnt;

vector<int> adj[2][MX];

void updateMode(int idx, int v) {
    seg[idx] += v;
    lazy[idx] += v;

    return;
}

return;

full (lazy[idx]) {
    updateMode(lft, lazy[idx]);
    updateMode(lft, lazy[idx]);
    updateMode(lft, lazy[idx]);
    lazy[idx] = 0;
}

void updateMode(ift, lazy[idx]);

lazy[idx] = 0;
}

void updateMode(ift, lazy[idx]);

if (s > e || e < st || s > ed) return;

if (s == st && e == ed) {
    updateMode(idx, v);
}
```







```
return;
}
return;
}
int main() {
ios::sync_with_stdio(false);
cin.tie(a);
cont.tie(a);

int t;
cin >> t;

while (t--) {
    cnt = 0;
    int n;
    cin >> n;

    for (int i = 0; i <= 4 * n; i++) {
        seg[i] = lary[i] = e;

        if (i <= n);
        adj[o][i].clear();
        adj[o][i].clear();
        }

for (int j = 0; j < 2; j++) {
        for (int i = 1; i <= n; i++) {
            int p;
            cin >> p;
            adj[o][p != -1 ? p : 0].push_back(i);
        }
        dfse(a, a);
        int ans = e;
        dfsi(a, a, ans);
        cout << ans - 1 << endl;
        return e;

000
```

```
Status: Correct Answer

Submission ID: 84946415

Time: Memory:
1.23s 185.2M
```



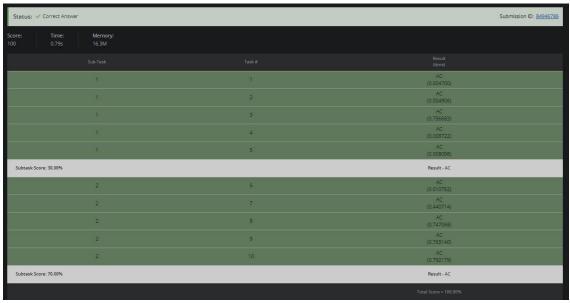




Question 7. SUBTREE REMOVAL







Question 8. ALTERNATING DIAMETER







 Status: ✓ Correct Answer
 Submission ID: 84947044

 Score:
 Time:
 Memory:

 100
 0.15s
 5.3M

 Sub-Task
 Task #
 Result (time)

 1
 1
 (0.05095)

 1
 2
 (0.07577)

 1
 3
 (0.076191)

 1
 4
 (0.147099)

 1
 5
 AC (0.073409)

 Subtask Score: 100.00%
 Result - AC

