

Олимпиада СПбГУ по информатике 2018/19 учебного года

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A	B	C	D	E	F	Sum
100	100	100	0	44	7	351

Task A (100)

```
#include <bits/stdc++.h>

using namespace std;
typedef long long ll;
typedef long double ld;

int main()
{
    ios_base::sync_with_stdio(false);
    cin.tie(NULL);
    //freopen("input.txt", "r", stdin);
    //freopen("output.txt", "w", stdout);
    int n, m;
    cin >> n >> m;
    while(n < m) n *= 2;
    if(n == m) cout << "Yes";
    else cout << "No";
    return 0;
}
```

Task B (100)

```
#include <bits/stdc++.h>

using namespace std;
typedef long long ll;
typedef long double ld;

int main()
{
    ios_base::sync_with_stdio(false);
    cin.tie(NULL);
    //freopen("input.txt", "r", stdin);
    //freopen("output.txt", "w", stdout);
    int n;
    string s;
    cin >> n >> s;
    for(int i = 0; i < n - 1; i++) {
        if(s[i] == 'o' && s[i + 1] == 'r') {
            cout << "Yes";
            return 0;
        }
        if(s[i] == 'r' && s[i + 1] == 'o') {
            cout << "Yes";
            return 0;
        }
    }
    for(int i = 0; i < n - 2; i++) {
        if(s[i] == 'o' && s[i + 2] == 'r') {
            cout << "Yes";
            return 0;
        }
    }
    cout << "No";
    return 0;
}
```

Task C (100)

```
#include <bits/stdc++.h>

using namespace std;
typedef long long ll;
typedef long double ld;

const int maxn = 1e5 + 10;

int n, ans[maxn], used[maxn], parent[maxn], cnt[maxn];
vector<int> g[maxn];

void dfs(int v, int par) {
    used[v] = 1;
    parent[v] = par;
    for(int i = 0; i < (int)g[v].size(); i++) {
        if(g[v][i] == par) continue;
        dfs(g[v][i], v);
        cnt[v] += cnt[g[v][i]];
    }
    cnt[v]++;
}

void dfs2(int v, int par) {
    used[v] = 1;
    if(v == 0) {
        int maxx = 0;
        for(int i = 0; i < (int)g[v].size(); i++)
            maxx = max(maxx, cnt[g[v][i]]);
        ans[v] = maxx + 1;
        for(int i = 0; i < (int)g[v].size(); i++)
            dfs2(g[v][i], v);
        return;
    }
    int maxx = 0, sum = 0;
    for(int i = 0; i < (int)g[v].size(); i++) {
        if(g[v][i] == par) continue;
        else {
            sum += cnt[g[v][i]];
            maxx = max(maxx, cnt[g[v][i]]);
        }
    }
    maxx = max(maxx, n - 1 - sum);
    ans[v] = maxx + 1;
    for(int i = 0; i < (int)g[v].size(); i++) {
        if(g[v][i] == par) continue;
        dfs2(g[v][i], v);
    }
}

int main()
{
    ios_base::sync_with_stdio(false);
    cin.tie(NULL);
    //freopen("input.txt", "r", stdin);
    //freopen("output.txt", "w", stdout);
    cin >> n;
    for(int i = 0; i < n - 1; i++) {
        int u, v;
        cin >> u >> v;
        u--; v--;
        g[u].push_back(v);
        g[v].push_back(u);
    }
    dfs(0, -1);
    fill(used, used + maxn, 0);
    dfs2(0, -1);
    for(int i = 0; i < n; i++) cout << ans[i] << ' ';
    return 0;
}
```

Task D (—)

Task E (44)

```
#include <bits/stdc++.h>

using namespace std;
typedef long long ll;
typedef long double ld;

const int maxn = 1e5 + 10;
const ld pi = 3.1415926535897932384626433832795;

int n, cnt[maxn];
ld x[maxn], y[maxn];
vector <pair <ld, ld> > v;

ld f(ld x1, ld y1, ld x2, ld y2) {
    return (x1 - x2) * (x1 - x2) + (y1 - y2) * (y1 - y2);
}

int f1(ld x1, ld y1, ld x2, ld y2) {
    ld k = (y1 - y2) / (x1 - x2);
    ld b = y1 - k * x1;

    for(int i = 0; i < n; i++) {
        bool flag = true;
        for(int j = 0; j < n; j++) {
            if(i == j) continue;
            ld r1 = f(x[i], y[i], x2, y2) - f(x[j], y[j], x2, y2);
            ld r2 = 0;
            if(x2 > x1)
                r2 = f(x[i], y[i], x2 + 1, k * (x2 + 1) + b) - f(x[j], y[j], x2 + 1, k * (x2 + 1) + b);
            else
                r2 = f(x[i], y[i], x2 - 1, k * (x2 - 1) + b) - f(x[j], y[j], x2 - 1, k * (x2 - 1) + b);
            if(r1 <= r2) {
                flag = false;
                break;
            }
        }
        if(flag) {
            return (i + 1);
        }
    }
    return -1;
}

int f2(ld x1, ld y1, ld x2, ld y2) {
    ld k = (y1 - y2) / (x1 - x2);
    ld b = y1 - k * x1;
    if(x1 < x2) {
        ld xx = 0;
        for(int i = 0; i < n; i++)
            xx = max(xx, x[i]);
        for(ld i = xx; i <= xx + 300000; i++) {
            ld minn = 1e18;
            for(int j = 0; j < n; j++)
                minn = min(minn, f(x[j], y[j], i, k * i + b));
            for(int j = 0; j < n; j++) {
                if(f(x[j], y[j], i, k * i + b) == minn) cnt[j]++;
            }
        }
    }
    else {
        ld xx = 1e18;
        for(int i = 0; i < n; i++)
            xx = min(xx, x[i]);
        for(ld i = xx - 300000; i <= xx; i++) {
            ld minn = 1e18;
            for(int j = 0; j < n; j++)
                minn = min(minn, f(x[j], y[j], i, k * i + b));
            for(int j = 0; j < n; j++) {

```

```

        if(f(x[j], y[j], i, k * i + b) == minn) cnt[j]++;
    }
}
int mx = 0, kol = 0, ind = 0;
for(int i = 0; i < n; i++) {
    if(cnt[i] == mx) kol++;
    if(cnt[i] > mx) {
        mx = cnt[i];
        kol = 1;
        ind = i + 1;
    }
}
if(kol == 1)
    return ind;
else
    return -1;
}

int main()
{
    ios_base::sync_with_stdio(false);
    cin.tie(NULL);
    //freopen("input.txt", "r", stdin);
    //freopen("output.txt", "w", stdout);
    ld x1, y1, x2, y2;
    /*while(true) {
        n = 2;
        x[0] = rand() % 10;
        y[0] = rand() % 10;
        x[1] = rand() % 10;
        y[1] = rand() % 10;
        x1 = rand() % 10;
        y1 = rand() % 10;
        x2 = x1;
        y2 = y1;
        while(x1 == x2 && y1 == y2) {
            x2 = rand() % 10;
            y2 = rand() % 10;
        }
        if(f1(x1, y1, x2, y2) != f2(x1, y1, x2, y2)) {
            cout << x[0] << ' ' << y[0] << endl;
            cout << x[1] << ' ' << y[1] << endl;
            cout << x1 << ' ' << y1 << endl;
            cout << x2 << ' ' << y2 << endl;
            cout << f1(x1, y1, x2, y2) << ' ' << f2(x1, y1, x2, y2) << endl;
            return 0;
        }
    }*/
    cin >> n;
    for(int i = 0; i < n; i++) {
        cin >> x[i] >> y[i];
        v.push_back(make_pair(x[i], y[i]));
    }
    cin >> x1 >> y1 >> x2 >> y2;
    if(n == 1) {
        cout << 1;
        return 0;
    }

    if(y1 == y2) {
        if(n == 2) {
            ld k1 = (y1 - y[0]) * (y1 - y[0]);
            ld k2 = (y1 - y[1]) * (y1 - y[1]);
            if(x[0] == x[1]) {
                if(k1 == k2)
                    cout << -1;
                else {
                    if(k1 > k2)
                        cout << 2;
                    else
                        cout << 1;
                }
            }
        } else {

```

```

        if(x[1] - x[0] > 0)
            cout << 2;
        else
            cout << 1;
    }
    return 0;
}
sort(v.begin(), v.end());
ld minn = 1e18, xx = 0, yy = 0;
int kol = 0;
for(int i = n - 1; i >= 0; i--) {
    if(v[i].first != v[n - 1].first) break;
    ld cur = (y1 - v[i].second) * (y1 - v[i].second);
    if(cur == minn) kol++;
    if(cur < minn) {
        minn = cur;
        kol = 1;
        xx = v[i].first;
        yy = v[i].second;
    }
}
if(kol > 1)
    cout << -1;
for(int i = n - 1; i >= 0; i--) {
    if(x[i] == xx && y[i] == yy) {
        cout << i + 1;
        return 0;
    }
}
return 0;
}

if(x1 == x2) {
    while(true) {

    }
}

ld k = (y1 - y2) / (x1 - x2);
ld b = y1 - k * x1;

/*for(int i = 0; i < n; i++) {
    bool flag = true;
    for(int j = 0; j < n; j++) {
        if(i == j) continue;
        ld r1 = f(x[i], y[i], x2, y2) - f(x[j], y[j], x2, y2);
        ld r2 = 0;
        if(x2 > x1)
            r2 = f(x[i], y[i], x2 + 1, k * (x2 + 1) + b) - f(x[j], y[j], x2 + 1, k * (x2 + 1) + b);
        else
            r2 = f(x[i], y[i], x2 - 1, k * (x2 - 1) + b) - f(x[j], y[j], x2 - 1, k * (x2 - 1) + b);
        if(r1 <= r2) {
            flag = false;
            break;
        }
    }
    if(flag) {
        cout << i + 1;
        return 0;
    }
}
cout << -1;
return 0;*/

if(y1 < y2) {
    for(ld i = y2; i <= y2 + 300000; i++) {
        ld minn = 1e18;
        for(int j = 0; j < n; j++)
            minn = min(minn, f(x[j], y[j], (i - b) / k, i));
        for(int j = 0; j < n; j++) {

```

```

        if(f(x[j], y[j], (i - b) / k, i) == minn) cnt[j]++;
    }
}
} else {
    for(ld i = y2 - 300000; i <= y2; i++) {
        ld minn = 1e18;
        for(int j = 0; j < n; j++)
            minn = min(minn, f(x[j], y[j], (i - b) / k, i));
        for(int j = 0; j < n; j++) {
            if(f(x[j], y[j], (i - b) / k, i) == minn) cnt[j]++;
        }
    }
}
int mx = 0, kol = 0, ind = 0;
for(int i = 0; i < n; i++) {
    if(cnt[i] == mx) kol++;
    if(cnt[i] > mx) {
        mx = cnt[i];
        kol = 1;
        ind = i + 1;
    }
}
if(kol == 1)
    cout << ind;
else
    cout << -1;
return 0;
}

```


Task F (7)

```
#include <bits/stdc++.h>

using namespace std;

const int maxn = 1e6;

int n, k, a[maxn], b[maxn], ans;

int f(int x) {
    int k1 = 0, k2 = 0, res = 0;
    for(int i = 0; i < n; i++) {
        if((x & (1 << i)) == (1 << i))
            k2 += k;
        else
            k1 += k;
        res += min(k1, a[i]) + min(k2, b[i]);
        k1 = max(0, k1 - a[i]);
        k2 = max(0, k2 - b[i]);
    }
    return res;
}

int main()
{
    cin >> n >> k;
    for(int i = 0; i < n; i++)
        cin >> a[i] >> b[i];
    ans = 0;
    for(int mask = 0; mask < (1 << n); mask++)
        ans = max(ans, f(mask));
    cout << ans;
    return 0;
}
```