

Олимпиада СПбГУ по информатике 2018/19 учебного года

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A	B	C	D	E	F	Sum
100	100	100	60	35	7	402

Task A (100)

```
#include <iostream>
#include <vector>
#include <algorithm>
#include <set>
#include <map>
#include <cmath>
#include <deque>
#include <iomanip>
#include <fstream>
#include <random>
typedef long long ll;
typedef long double ld;
const int N = int(1e5) + 111;
const int INF = int(1e9) + 111;
const int MOD = int(1e9) + 7;
#define pb push_back
#define x first
#define y second
#define all(a) a.begin(), a.end()
#define rall(a) a.rbegin(), a.rend()
#define sz(a) int(a.size())

using namespace std;
mt19937 rnd(time(0));
bool check(int n) {
    for (int i = 0; i < 10; i++) {
        if ((1 << i) == n)
            return 1;
    }
    return 0;
}

int main() {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    //ifstream cin("input.txt");
    //ofstream cout("input.txt");
    int n, m;
    cin >> n >> m;
    if (m % n != 0) {
        cout << "No";
    }
    else {
        if (check(m / n))
            cout << "Yes";
        else
            cout << "No";
    }
}
```

Task B (100)

```
#include <iostream>
#include <vector>
#include <algorithm>
#include <set>
#include <map>
#include <cmath>
#include <deque>
#include <iomanip>
#include <fstream>
#include <random>
#include <string>
typedef long long ll;
typedef long double ld;
const int N = int(1e5) + 111;
const int INF = int(1e9) + 111;
const int MOD = int(1e9) + 7;
#define pb push_back
#define x first
#define y second
#define all(a) a.begin(), a.end()
#define rall(a) a.rbegin(), a.rend()
#define sz(a) int(a.size())

using namespace std;
mt19937 rnd(time(0));
bool check1(string s) {
    for (int i = 1; i < sz(s); i++) {
        if (s[i - 1] == 'o' && s[i] == 'r' || s[i] == 'o' && s[i - 1] == 'r')
            return 1;
    }
    return 0;
}
bool check2(string s) {
    for (int i = 1; i < sz(s) - 1; i++) {
        if (s[i - 1] == 'o' && s[i + 1] == 'r')
            return 1;
    }
    return 0;
}
int main() {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    //ifstream cin("input.txt");
    //ofstream cout("input.txt");
    int n;
    cin >> n;
    string s;
    cin >> s;
    if (check1(s) || check2(s)) {
        cout << "Yes";
        return 0;
    }
    else
        cout << "No";
}
```

Task C (100)

```
#include <iostream>
#include <vector>
#include <algorithm>
#include <set>
#include <map>
#include <cmath>
#include <deque>
#include <iomanip>
#include <fstream>
#include <random>
#include <string>
typedef long long ll;
typedef long double ld;
const int N = int(1e5) + 111;
const int INF = int(1e9) + 111;
const int MOD = int(1e9) + 7;
#define pb push_back
#define x first
#define y second
#define all(a) a.begin(), a.end()
#define rall(a) a.rbegin(), a.rend()
#define sz(a) int(a.size())

using namespace std;
mt19937 rnd(time(0));
int n;
vector<vector<int>>> g;
vector<int> used, cnt, cntmax;
void dfs(int v) {
    used[v] = 1;
    int t = 1;
    for (auto u : g[v]) {
        if (!used[u])
            dfs(u);
        cntmax[v] = max(cntmax[v], cnt[u]);
        t += cnt[u];
    }
    cnt[v] = t;
}
int main() {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    //ifstream cin("input.txt");
    //ofstream cout("input.txt");
    cin >> n;
    g.resize(n);
    used.resize(n);
    cnt.resize(n);
    cntmax.resize(n);
    for (int i = 0; i < n - 1; i++) {
        int v, u;
        cin >> v >> u;
        v--, u--;
        g[v].pb(u);
        g[u].pb(v);
    }
    dfs(0);
    for (int i = 0; i < n; i++) {
        cout << max(cntmax[i], n - cnt[i]) + 1 << " ";
    }
}
```

Task D (60)

```
#include <iostream>
#include <vector>
#include <algorithm>
#include <set>
#include <map>
#include <cmath>
#include <deque>
#include <iomanip>
#include <fstream>
#include <random>
#include <string>
typedef long long ll;
typedef long double ld;
const int N = int(1e5) + 111;
const int INF = int(1e9) + 111;
const int MOD = int(1e9) + 7;
#define pb push_back
#define x first
#define y second
#define all(a) a.begin(), a.end()
#define rall(a) a.rbegin(), a.rend()
#define sz(a) int(a.size())

using namespace std;
mt19937 rnd(time(0));
void solvesplit3(string word) {
    string a = "a", b = "b", c = "c";
    for (int i = 0; i < 6; i++)
        a += word[i];
    for (int i = 3; i < 9; i++)
        b += word[i];
    for (int i = 0; i < 3; i++)
        c += word[i];
    for (int i = 6; i < 9; i++)
        c += word[i];
    cout << a << "_" << b << "_" << c << endl;
}
void solvesplit5(string word) {
    string a = "a", b = "b", c = "c", d = "a", e = "b";
    for (int i = 0; i < 6; i++)
        a += word[i];
    for (int i = 3; i < 9; i++)
        b += word[i];
    for (int i = 0; i < 3; i++)
        c += word[i];
    for (int i = 6; i < 9; i++)
        c += word[i];
    d = a;
    e = b;
    cout << a << "_" << b << "_" << c << "_" << d << "_" << e << endl;
}

void solvesplit(int t, int n, int p) {
    string word;
    cin >> word;
    if (n == 3)
        solvesplit3(word);
    else if (n == 5)
        solvesplit5(word);
}

string solvemerge3() {
    string a, b;
    cin >> a >> b;
    string word;
    if (a[0] > b[0])
        swap(a, b);
    if (a[0] == 'b') {
        word = b.substr(1, 3);
        for (int i = 1; i < sz(a); i++)
```

```

        word += a[i];
    }
    else if (a[0] == 'a') {
        for (int i = 1; i < sz(a); i++)
            word += a[i];
        for (int i = 4; i < sz(b); i++)
            word += b[i];
    }
    return word;
}

string solvemerge5() {
    string x, y, z, a = "t", b = "t";
    cin >> x >> y >> z;
    if (x[0] == 'a')
        a = x;
    if (y[0] == 'a')
        a = y;
    if (z[0] == 'a')
        a = z;
    if (x[0] == 'c')
        b = x;
    if (y[0] == 'c')
        b = y;
    if (z[0] == 'c')
        b = z;
    if (a[0] == 'a') {
        if (x[0] == 'b')
            b = x;
        if (y[0] == 'b')
            b = y;
        if (z[0] == 'b')
            b = z;
    }
    else {
        if (x[0] == 'b')
            a = x;
        if (y[0] == 'b')
            a = y;
        if (z[0] == 'b')
            a = z;
    }
    string word;
    if (a[0] > b[0])
        swap(a, b);
    if (a[0] == 'b') {
        word = b.substr(1, 3);
        for (int i = 1; i < sz(a); i++)
            word += a[i];
    }
    else if (a[0] == 'a') {
        for (int i = 1; i < sz(a); i++)
            word += a[i];
        for (int i = 4; i < sz(b); i++)
            word += b[i];
    }
    return word;
}

void solvemerge(int t, int n, int p) {
    bool f = 1;
    string word;
    if (n == 3)
        cout << solvemerge3() << endl;
    else if (n == 5)
        cout << solvemerge5() << endl;
}

int main() {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    //ifstream cin("input.txt");
    //ofstream cout("input.txt");
    int t, n, p;
    string type;
    cin >> type;
    cin >> t >> n >> p;
}

```

```
    if (type == "split")
        for (int i = 0; i < t; i++) {
            solvesplit(t, n, p);
        }
    else
        for (int i = 0; i < t; i++) {
            solvemerge(t, n, p);
        }
}
```

Task E (35)

```
#include <iostream>
#include <vector>
#include <algorithm>
#include <set>
#include <map>
#include <cmath>
#include <deque>
#include <iomanip>
#include <fstream>
#include <random>
#include <string>
typedef long long ll;
typedef long double ld;
const int N = int(1e5) + 111;
const int INF = int(1e9) + 111;
const int MOD = int(1e9) + 7;
const ll LINF = ll(1e18) + 111;
const ld EPS = 1e-9;
#define pb push_back
#define x first
#define y second
#define all(a) a.begin(), a.end()
#define rall(a) a.rbegin(), a.rend()
#define sz(a) int(a.size())

using namespace std;
mt19937 rnd(time(0));

struct Point {
    ld x, y;
    Point(ld _x, ld _y) : x(_x), y(_y) {};
    Point() : x(0), y(0) {};
};

bool comp(pair<Point, int> a, pair<Point, int> b) {
    if (a.x.x < 0 && b.x.x >= 0)
        return 1;
    if (a.x.x >= 0 && b.x.x < 0)
        return 0;
    if (a.x.x < 0 && b.x.x < 0) {
        return a.x.x * a.x.x + a.x.y * a.x.y > b.x.x * b.x.x + b.x.y * b.x.y;
    }
    return a.x.x < b.x.x || a.x.x == b.x.x && a.x.y < b.x.y;
}

bool eqv(ld a, ld b) {
    return abs(a - b) < EPS;
}

int main() {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    //ifstream cin("input.txt");
    //ofstream cout("input.txt");
    int n;
    Point P, Q;
    cin >> n;
    vector<pair<Point, int>> v;
    for (int i = 0; i < n; i++) {
        ld x, y;
        cin >> x >> y;
        v.pb({ { x, y }, i });
    }
    cin >> P.x >> P.y >> Q.x >> Q.y;
    for (int i = 0; i < n; i++) {
        v[i].x.x -= P.x;
        v[i].x.y -= P.y;
    }
    Q.x -= P.x, Q.y -= P.y, P.x = 0, P.y = 0;
    if (Q.x == 0 && Q.y > 0) {
```

```

        for (int i = 0; i < n; i++) {
            swap(v[i].x.x, v[i].x.y);
            v[i].x.x *= -1;
        }
    }
    else
        if (Q.x == 0 && Q.y < 0) {
            for (int i = 0; i < n; i++) {
                swap(v[i].x.x, v[i].x.y);
            }
        }
        else if (Q.y == 0 && Q.x < 0) {
            for (int i = 0; i < n; i++) {
                v[i].x.x *= -1;
            }
        }
    }
    else
        if (Q.x != 0 && Q.y != 0) {
            ld t = atan2(Q.y, Q.x);
            ld cs = cos(t);
            ld sn = sin(t);
            //cout << cs << " " << sn << endl;
            for (int i = 0; i < n; i++) {
                bool f = 1/tan(t) * v[i].x.x < v[i].x.y;
                /*if (rnd()%4==0) {
                    swap(v[i].x.x, v[i].x.y);
                    v[i].x.y *= -1;
                }*/
                v[i].x.x *= cs;
                v[i].x.y *= sn;
                v[i].x.y -= v[i].x.x*tan(t);
            }
        }
    }
    sort(rall(v), comp);
    ld maxx = v[0].x.x;
    ld miny = LINF;
    ld ans = 0;
    for (int i = 0; i < n; i++) {
        if (eqv(maxx, v[i].x.x)) {
            if (abs(miny) > abs(v[i].x.y)) {
                miny = v[i].x.y;
                ans = v[i].y;
            }
        }
    }
    /*for (int i = 0; i < n; i++) {
        cout << v[i].x.x << " " << v[i].x.y << endl;
    }*/

    for (int i = 0; i < n; i++) {
        if (eqv(maxx, v[i].x.x))
            if (!eqv(miny, 0) && eqv(miny, -v[i].x.y)) {
                cout << -1;
                return 0;
            }
    }

    int t = 0;
    for (int i = 0; i < n; i++) {
        if (eqv(maxx, v[i].x.x) && eqv(miny, v[i].x.y))
            t++;
    }
    if (t > 1)
        cout << -1;
    else
        cout << ans + 1;
}

```


Task F (7)

```
#include <iostream>
#include <vector>
#include <algorithm>
#include <set>
#include <map>
#include <cmath>
#include <deque>
#include <iomanip>
#include <fstream>
#include <random>
#include <string>
typedef long long ll;
typedef long double ld;
const int N = int(1e5) + 111;
const int INF = int(1e9) + 111;
const int MOD = int(1e9) + 7;
const ll LINF = ll(1e18) + 111;
const ld EPS = 1e-9;
#define pb push_back
#define x first
#define y second
#define all(a) a.begin(), a.end()
#define rall(a) a.rbegin(), a.rend()
#define sz(a) int(a.size())

using namespace std;
mt19937 rnd(time(0));
vector<pair<ll, ll>> v;
vector<ll> b, r;
ll n, k;
ll ans = 0;
vector<ll> res;
void rec(int i, ll tr, ll tb, ll cur) {
    if (i == n) {
        ans = max(ans, cur);
        return;
    }
    res[i] = max(cur, res[i]);
    if (tr <= r[i] + k)
        rec(i + 1, max(0ll, tr + k - v[i].x), max(0ll, tb - v[i].y), cur + max(0ll, min(tr + k, v[i].x) - max(0ll, min(tb, v[i].y))));
    if (tb <= b[i] + k)
        rec(i + 1, max(0ll, tr - v[i].x), max(0ll, tb + k - v[i].y), cur + max(0ll, min(tr, v[i].x) - max(0ll, min(tb + k, v[i].y))));
}
int main() {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    //ifstream cin("input.txt");
    //ofstream cout("input.txt");
    cin >> n >> k;
    v.resize(n);
    res.resize(n);
    b.resize(n), r.resize(n);

    ll tr = 0, tb = 0;
    for (int i = 0; i < n; i++) {
        cin >> v[i].x >> v[i].y;
        tr += v[i].x;
        tb += v[i].y;
    }
    for (int i = 0; i < n; i++) {
        r[i] = tr;
        b[i] = tb;
        tr -= v[i].x;
        tb -= v[i].y;
    }
}
```

```
    rec(0, 0, 0, 0);  
    cout << ans;  
}
```