Олимпиада СПбГУ по информатике 2018/19 учебного года

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A	B	C	D	E	F	Sum
100	100	100	60	21	24	405

Task A (100)

```
#include <iostream>

using namespace std;

#define pb push_back
#define fi(n) for (int i = 0; i < n; ++i)

int main()
{
    //freopen("input.txt", "w", stdin);
    //freopen("output.txt", "r", stdout);

    ios_base::sync_with_stdio(0);
    cin.tie(0);

    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 <iostream>

using namespace std;

#define pb push_back
#define fi(n) for (int i = 0; i < n; ++i)

int main()
{
    //freopen("input.txt", "w", stdin);
    //freopen("output.txt", "r", stdout);

    ios_base::sync_with_stdio(0);
    cin.tie(0);

    int n;
    cin >> n;
    string s;
    cin >> 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 = 1; i < n - 1; ++i) {
        if (s[i - 1] == 'o' && s[i + 1] == 'r') {
            cout << "Yes";
            return 0;
        }
    }
    cout << "No";
    return 0;
}
```

Task C (100)

```cpp
#include <iostream>
#include <vector>

using namespace std;

#define pb push_back
#define fi(n) for (int i = 0; i < n; ++i)

int n;
vector<int> ans;
vector<bool> used;
vector<int> dp;

void dfs(int v, vector<vector<int> > &g) {
    used[v] = true;
    dp[v] = 1;
    for (int u : g[v]) {
        if (!used[u]) {
            dfs(u, g);
            dp[v] += dp[u];
            ans[v] = max(ans[v], dp[u] + 1);
        }
    }
    ans[v] = max(ans[v], n - dp[v] + 1);
}

int main()
{
    //freopen("input.txt", "w", stdin);
    //freopen("output.txt", "r", stdout);

    ios_base::sync_with_stdio(0);
    cin.tie(0);

    cin >> n;
    vector<vector<int> > g(n);
    for (int i = 0; i < n - 1; ++i) {
        int a, b;
        cin >> a >> b;
        --a;
        --b;
        g[a].pb(b);
        g[b].pb(a);
    }
    ans.resize(n);
    used.resize(n);
    dp.resize(n);
    dfs(0, g);
    for (int res : ans) {
        cout << res << "␣";
    }
    return 0;
}
```

Task D (60)

```
#include <iostream>
#include <vector>
#include <algorithm>
#include <cmath>

using namespace std;

#define pb push_back
#define fi(n) for (int i = 0; i < n; ++i)

long long MOD = 26;

int main()
{
    //freopen("input.txt", "w", stdin);
    //freopen("output.txt", "r", stdout);

   // ios_base::sync_with_stdio(0);
    //cin.tie(0);
   // cout << (int)'p' << " " << (int)'a' << " " << (int)'s';
    string type;
    cin >> type;
    //cout << (int)'m' << " " << (int)'h' << " " << (int)'r' << endl;;
    if (type == "split") {
        int t, n, p;
        cin >> t >> n >> p;
        //cout << t;
        //cerr << 0;
        for (int q = 0; q < t; ++q) {
            string s;
            cin >> s;
            string s1 = "a", s2 = "b", s3 = "c", s4 = "a", s5 = "b";
            for (int i = 0; i < (int)s.length(); ++i) {
                if (i % 3 == 0) {
                    s1 += s[i];
                    s4 += s[i];
                } else if (i % 3 == 1) {
                    s2 += s[i];
                    s5 += s[i];
                } else {
                    s3 += s[i];
                }
            }
            //cerr << 0;
            int sum = 0;
            for (int i = 0; i < (int)s.length(); ++i) {
                sum += (int)s[i] - 'a';
                if (i % 3 == 2) {
                    sum %= MOD;
                    s1 += 'a' + (char)sum;
                    s2 += 'a' + (char)sum;
                    s3 += 'a' + (char)sum;
                    s4 += 'a' + (char)sum;
                    s5 += 'a' + (char)sum;
                    sum = 0;
                }
            }
            //cerr << 0;
            cout << s1 << "␣" << s2 << "␣" << s3;
            if (n > 3) {
                cout << "␣" << s4 << "␣" << s5;
            }
            cout << endl;
            //cerr << 1;
        }
        //cerr << 3;
    } else {
        int t, n, p;
        cin >> t >> n >> p;
        for (int q = 0; q < t; ++q) {
            string s1, s2;
            cin >> s1 >> s2;
            if (n == 5) {
                string s3;
                cin >> s3;
                if (s1[0] == s2[0]) {
                    if (s2[0] != s3[0]) {
                        s2 = s3;
                    }
                }
            }
            vector<char> s(9, '.');
            int sum1 = (int)s1[4] - (int)s1[1] - (int)s2[1] +  'a', sum2 = s1[5] - (int)s1[2] - (
                int)s2[2] + 'a', sum3 = s1[6] - (int)s1[3] - (int)s2[3] +  'a';
           // cout << sum1 << " " << sum2 << " " << sum3 << "  ";
            while (sum1 < 0) {
                sum1 += MOD;
            }
            while (sum2 < 0) {
                sum2 += MOD;
            }
            while (sum3 < 0) {
                sum3 += MOD;
            }
            //cout << sum1 << " " << sum2 << " " << sum3 << "  ";
            if (s1[0] == 'a') {
                s[0] = s1[1];
                s[3] = s1[2];
                s[6] = s1[3];
            }
            if (s2[0] == 'a') {
                s[0] = s2[1];
                s[3] = s2[2];
                s[6] = s2[3];
            }
            if (s1[0] == 'b') {
                s[1] = s1[1];
                s[4] = s1[2];
                s[7] = s1[3];
            }
            if (s2[0] == 'b') {
                s[1] = s2[1];
                s[4] = s2[2];
                s[7] = s2[3];
            }
            if (s1[0] == 'c') {
                s[2] = s1[1];
                s[5] = s1[2];
                s[8] = s1[3];
            }
            if (s2[0] == 'c') {
                s[2] = s2[1];
                s[5] = s2[2];
                s[8] = s2[3];
            }
            sum1 += 'a';
            sum2 += 'a';
            sum3 += 'a';
            if (s[0] == '.') {
                s[0] = (char)sum1;
                s[3] = (char)sum2;
                s[6] = (char)sum3;
            }
            if (s[1] == '.') {
                s[1] = (char)sum1;
                s[4] = (char)sum2;
                s[7] = (char)sum3;
            }
            if (s[2] == '.') {
                s[2] = (char)sum1;
                s[5] = (char)sum2;
                s[8] = (char)sum3;
            }
            for (char c : s) {
                cout << c;
            }
            cout << endl;
        }
    }
    return 0;
}
```

Task E (21)

```
#include <iostream>
#include <vector>
#include <algorithm>
#include <cmath>

using namespace std;

#define pb push_back
#define fi(n) for (int i = 0; i < n; ++i)

long long INF = 2e9;

struct Point {
    long long x, y;
};


int main()
{
    //freopen("input.txt", "w", stdin);
    //freopen("output.txt", "r", stdout);

    ios_base::sync_with_stdio(0);
    cin.tie(0);

    int n;
    cin >> n;
    vector<Point> v(n);
    fi(n) {
        cin >> v[i].x >> v[i].y;
    }
    Point p, q;
    cin >> p.x >> p.y >> q.x >> q.y;
    Point big1, big2;
    if (q.x - p.x == 0) {
        big1.x = q.x;
        big2.x = q.x;
        if (q.y - p.y < 0) {
            long long ma = INF;
            fi(n) {
                ma = min(ma, v[i].y);
            }
            --ma;
            big2.y = -INF;
            big1.y = -INF + 1;
        } else {
            long long ma = -INF;
            fi(n) {
                ma = max(ma, v[i].y);
            }
            ++ma;
            big2.y = INF;
            big1.y = INF - 1;
        }
    } else if (q.y - p.y == 0) {
        big1.y = q.y;
        big2.y = q.y;
        if (q.x - p.x < 0) {
            long long ma = INF;
            fi(n) {
                ma = min(ma, v[i].x);
            }
            --ma;
            big2.x = -INF;
            big1.x = -INF + 1;
        } else {
            long long ma = -INF;
            fi(n) {
                ma = max(ma, v[i].x);
            }
            ++ma;
            big2.x = INF;
            big1.x = INF - 1;
        }
    } else  if (abs(q.x - p.x) >= abs(q.y - p.y)) {
        if (q.x - p.x > 0) {
            long long ma = -INF;
            fi(n) {
                ma = max(ma, v[i].x);
            }
            ++ma;
            ma = INF;
            long long dx = q.x - p.x, dy = q.y - p.y;
            ma -= p.x;

            long long k = ma / dx + (ma % dx == 0);
            big2.x = p.x + k * dx;
            big2.y = p.y + k * dy;
            big1.x = big2.x - dx;
            big1.y = big2.y - dy;
        } else {
            long long ma = INF;
            fi(n) {
                ma = min(ma, v[i].x);
            }
            --ma;
            ma = INF;
            ma -= p.x;
            long long dx = q.x - p.x, dy = q.y - p.y;
            long long k = abs(ma) / abs(dx) + (abs(ma) % abs(dx) == 0);
            big2.x = p.x + k * dx;
            big2.y = p.y + k * dy;
            big1.x = big2.x - dx;
            big1.y = big2.y - dy;
        }
    } else {
        if (q.y- p.y > 0) {
            long long ma = -INF;
            fi(n) {
                ma = max(ma, v[i].y);
            }
            ++ma;
            ma = INF;
            ma -= p.y;
            long long dx = q.x - p.x, dy = q.y - p.y;
            long long k = ma / dy + (ma % dy == 0);
            big2.x = p.x + k * dx;
            big2.y = p.y + k * dy;
            big1.x = big2.x - dx;
            big1.y = big2.y - dy;
        } else {
            long long ma = INF;
            fi(n) {
                ma = min(ma, v[i].y);
            }
            --ma;
            ma = -INF;
            ma -= p.y;
            long long dx = q.x - p.x, dy = q.y - p.y;
            long long k = abs(ma) / abs(dy) + (abs(ma) % abs(dy) == 0);
            big2.x = p.y + k * dx;
            big2.y = p.y + k * dy;
            big1.x = big2.x - dx;
            big1.y = big2.y - dy;
        }
    }
    long long dist = 9e18;
    int num = -1;
    //cerr << big1.x << " " << big1.y << " " << big2.x << " " << big2.y << " ";
   // vector<int> ans;
    fi(n) {
       long long dx = abs(big2.x - v[i].x), dy =abs(big2.y - v[i].y);
       /*if (dx > 2e9 + 10 || dy > 2e9 + 10) {
            continue;
       }*/
       long long cur = dx * dx + dy * dy;
       if (cur < dist) {
            dist = cur;
            num = i;
            //ans.clear();
            //ans.pb(i);
       } else if (cur == dist) {
           //ans.pb(i);
           long long cur1 = (big1.x - v[i].x) * (big1.x - v[i].x) + (big1.y - v[i].y) * (big1.y -
               v[i].y);
           long long cur2 = (big1.x - v[num].x) * (big1.x - v[num].x) + (big1.y - v[num].y) * (
               big1.y - v[num].y);
           if (cur1 == cur2) {
               num = -2;
           }
       }
    }
    cout << num + 1;
   /* if ((int)ans.size() == 0)
        cout << num + 1;
    else {
        for (int i : ans) {

        }
    }*/
    return 0;
}
```

Task F (24)

```cpp
#include <iostream>
#include <vector>
#include <algorithm>
#include <cmath>

using namespace std;

#define pb push_back
#define fi(n) for (int i = 0; i < n; ++i)

const int INF = 1e9;

int main()
{
    //freopen("input.txt", "w", stdin);
    //freopen("output.txt", "r", stdout);

   // ios_base::sync_with_stdio(0);
    //cin.tie(0);

    int n, k;
    cin >> n >> k;
    vector<pair<int, int> > v(n);
    fi(n) {
        cin >> v[i].first >> v[i].second;
    }
    vector<vector<vector<int> > > dp(n + 1, vector<vector<int> > (n * k + 1, vector<int> (n * k + 1, -1)));
    dp[0][0][0] = 0;
    for (int i = 0; i < n; ++i) {
        for (int j = 0; j <= n * k; ++j) {
            for (int p = 0; p <= n * k && p + k <= n * k; ++p) {
                if (dp[i][j][p] == -1) {
                    continue;
                }
                int r = j, b = p;
                b += k;
               int good = dp[i][j][p];
                if (r > v[i].first) {
                    good += v[i].first;
                    r -= v[i].first;
                } else {
                    good += r;
                    r = 0;
                }
                if (b > v[i].second) {
                    good += v[i].second;
                    b -= v[i].second;
                } else {
                    good += b;
                    b = 0;
                }
               // cerr <<i << " " << j << " " << p << " " <<  r << " " << b << " " << good << endl;
                dp[i + 1][r][b] = max(dp[i + 1][r][b], good);
            }
        }
        for (int p = 0; p <= n * k; ++p) {
            for (int j = 0; j <= n * k && j + k <= n * k; ++j) {
                if (dp[i][j][p] == -1) {
                    continue;
                }
                int r = j, b = p;
                r += k;
                int good = dp[i][j][p];
                //cerr <<i << " " << j << " " << p << " " <<  r << " " << b << " " << good << endl;

                if (r > v[i].first) {
                    good += v[i].first;
                    r -= v[i].first;
                } else {
                    good += r;
                    r = 0;
                }
                if (b > v[i].second) {
                    good += v[i].second;
                    b -= v[i].second;
                } else {
                    good += b;
                    b = 0;
                }
                //cerr <<i << " " << j << " " << p << " " <<  r << " " << b << " " << good << endl;
                dp[i + 1][r][b] = max(dp[i + 1][r][b], good);
            }
        }
    }
     /*for (int i = 0; i <= n; ++i) {
        for (int j = 0; j <= n * k; ++j) {
            for (int p = 0; p <= n * k; ++p) {
                cout << dp[i][j][p] << " ";
            }
            cout << endl;
        }
    }*/
    int res = 0;
    for (int i = 0; i <= n * k; ++i) {
        for (int j = 0; j <= n *k; ++j) {
            res = max(res, dp[n][i][j]);
        }
    }
    cout << res;
    return 0;
}
```