Олимпиада СПбГУ по информатике 2019/20 учебного года

A	B	C	D	E	F	Sum
100	100	100	0	100	14	414

Task A ()

```cpp
#define _CRT_SECURE_NO_WARNIGS
#include <iostream>
#include <map>
#include <set>
#include <cstdio>
#include <vector>
#include <stack>
#include <deque>
#include <queue>
#include <cmath>
#include <assert.h>
#include <unordered_map>
#include <unordered_set>
#include <utility>
#include <tuple>
#include <string>
#include <cstring>
using namespace std;
#define ff first
#define ss second
#define mp make_pair
#define pb push_back
#define eb emplace_back
#define fastio ios_base::sync_with_stdio(0);cin.tie(0);
#define rep(i,n) for(int i=0;i<n;i++)
#define per(i,n) for(int i=n-1;i>=0;i--)
#define sz(x) ((int)x.size())
#define all(x) x.begin(),x.end()
#define rall(x) x.rbegin(),x.rend()
#define REP(i,a,b) for(int i=a;i<=b;i++)
#define PER(i,a,b) for(int i=a;i>=b;i--)
#define each(a, x) for(auto& a : x)
#define debug(x) cerr<<#x<<" "<<x<<"\n";
#define debug_v(x) cerr<<#x<<"\n"; each(a,x) cerr<<a<<" "; cerr<<'\n';
#define debug_vp(x) cerr<<#x<<"\n"; each(a,x) cerr<<a.ff<<" - "<<a.ss<<'\n'; cerr<<'\n';
typedef long long ll;
typedef pair<int, int> pii;
typedef pair<ll, ll> pll;
typedef vector<int> vi;
typedef vector<ll> vll;
typedef vector<pii> vpii;
typedef vector<pll> vpll;
typedef set<int> si;
typedef map<int, int> mii;

#ifndef _DEBUG
    #define cerr if(false)cerr
#endif

namespace Solution1 {
    void solve() {
        int n;
        cin >> n;
        cout << n - 1;
    }
}
```

```cpp
};

int main() {
        fastio;
        Solution1::solve();
        return 0;
}
```

Task B ()

```cpp
#define _CRT_SECURE_NO_WARNINGS
#include <iostream>
#include <map>
#include <set>
#include <cstdio>
#include <vector>
#include <stack>
#include <deque>
#include <queue>
#include <cmath>
#include <assert.h>
#include <iomanip>
#include <unordered_map>
#include <unordered_set>
#include <utility>
#include <tuple>
#include <string>
#include <cstring>
using namespace std;
#define ff first
#define ss second
#define mp make_pair
#define pb push_back
#define eb emplace_back
#define fastio ios_base::sync_with_stdio(0);cin.tie(0);
#define rep(i,n) for(int i=0;i<n;i++)
#define per(i,n) for(int i=n-1;i>=0;i--)
#define sz(x) ((int)x.size())
#define all(x) x.begin(),x.end()
#define rall(x) x.rbegin(),x.rend()
#define REP(i,a,b) for(int i=a;i<=b;i++)
#define PER(i,a,b) for(int i=a;i>=b;i--)
#define each(a, x) for(auto& a : x)
#define debug(x) cerr<<#x<<" "<<x<<"\n";
#define debug_v(x) cerr<<#x<<"\n"; each(a,x) cerr<<a<<" "; cerr<<'\n';
#define debug_vp(x) cerr<<#x<<"\n"; each(a,x) cerr<<a.ff<<" - "<<a.ss<<'\n'; cerr<<'\n';
typedef long long ll;
typedef pair<int, int> pii;
typedef pair<ll, ll> pll;
typedef vector<int> vi;
typedef vector<ll> vll;
typedef vector<pii> vpii;
typedef vector<pll> vpll;
typedef set<int> si;
typedef map<int, int> mii;

#ifndef _DEBUG
#define cerr if(false)cerr
#endif

struct Point {
        double x;
        double y;
        Point(double x, double y) : x(x), y(y) {}
};
Point operator-(Point a, Point b) {
        return Point(a.x - b.x, a.y - b.y);
}
Point operator + (Point a, Point b) {
        return Point(a.x + b.x, a.y + b.y);
}

Point operator/ (Point a, double k) {
        return Point(a.x / k, a.y / k);
}

Point operator* (Point a, double k) {
        return Point(a.x * k, a.y * k);
}

double cross_product(Point a, Point b) {
```

```cpp
        return a.x * b.y - b.x * a.y;
}
double sqr(double x) {
        return x * x;
}

double dist(Point a, Point b) {
        return sqrt(sqr(a.x - b.x) + sqr(b.y - a.y));
}

namespace Solution1 {
        void solve() {
                int n;
                cin >> n;
                vector<Point> ps;
                rep(i, n) {
                        double x, y;
                        scanf("%lf %lf", &x, &y);
                        ps.eb(x, y);
                }
                if (n == 3) {
                        double x = dist(ps[0], ps[1]);
                        double a = x / sqrt(3);
                        Point m = (ps[0] + ps[1] + ps[2]) / 3;
                        vector<Point> ans = ps;
                        rep(i, n) {
                                REP(j, i + 1, n - 1) {
                                        Point m1 = (ps[i] + ps[j]) / 2;
                                        Point t = (m1 - m) * 2 + m;
                                        ans.eb(t);
                                }
                        }
                        Point b = ans[0];
                        REP(i, 1, sz(ans)-1) {
                                REP(j, i + 1, sz(ans) - 1) {
                                        Point t1 = ans[i] - ans[0];
                                        Point t2 = ans[j] - ans[0];
                                        if (cross_product(t1, t2) < 0) {
                                                swap(ans[i], ans[j]);
                                        }
                                }
                        }
                        each(t, ans) {
                                printf("%.5lf %.5lf\n", t.x, t.y);
                        }
                }
                if (n == 6) {
                        REP(i, 1, sz(ps) - 1) {
                                REP(j, i + 1, sz(ps) - 1) {
                                        Point t1 = ps[i] - ps[0];
                                        Point t2 = ps[j] - ps[0];
                                        if (cross_product(t1, t2) < 0) {
                                                swap(ps[i], ps[j]);
                                        }
                                }
                        }
                        for (int i = 0; i < n; i += 2) {
                                printf("%.5lf %.5lf\n", ps[i].x, ps[i].y);
                        }
                }
        }
};

int main() {
        //fastio;
        //freopen("out.txt", "w", stdout);
        Solution1::solve();
        return 0;
}
```

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Task C ()

```cpp
#define _CRT_SECURE_NO_WARNINGS
#include <iostream>
#include <map>
#include <set>
#include <cstdio>
#include <vector>
#include <stack>
#include <deque>
#include <queue>
#include <cmath>
#include <assert.h>
#include <iomanip>
#include <unordered_map>
#include <unordered_set>
#include <utility>
#include <tuple>
#include <string>
#include <cstring>
using namespace std;
#define ff first
#define ss second
#define mp make_pair
#define pb push_back
#define eb emplace_back
#define fastio ios_base::sync_with_stdio(0);cin.tie(0);
#define rep(i,n) for(int i=0;i<n;i++)
#define per(i,n) for(int i=n-1;i>=0;i--)
#define sz(x) ((int)x.size())
#define all(x) x.begin(),x.end()
#define rall(x) x.rbegin(),x.rend()
#define REP(i,a,b) for(int i=a;i<=b;i++)
#define PER(i,a,b) for(int i=a;i>=b;i--)
#define each(a, x) for(auto& a : x)
#define debug(x) cerr<<#x<<" "<<x<<"\n";
#define debug_v(x) cerr<<#x<<"\n"; each(a,x) cerr<<a<<" "; cerr<<'\n';
#define debug_vp(x) cerr<<#x<<"\n"; each(a,x) cerr<<a.ff<<" - "<<a.ss<<'\n'; cerr<<'\n';
typedef long long ll;
typedef pair<int, int> pii;
typedef pair<ll, ll> pll;
typedef vector<int> vi;
typedef vector<ll> vll;
typedef vector<pii> vpii;
typedef vector<pll> vpll;
typedef set<int> si;
typedef map<int, int> mii;

#ifndef _DEBUG
#define cerr if(false)cerr
#endif

struct Point {
        double x;
        double y;
        Point(double x, double y) : x(x), y(y) {}
};
Point operator-(Point a, Point b) {
        return Point(a.x - b.x, a.y - b.y);
}
Point operator + (Point a, Point b) {
        return Point(a.x + b.x, a.y + b.y);
}

Point operator/ (Point a, double k) {
        return Point(a.x / k, a.y / k);
}

Point operator* (Point a, double k) {
        return Point(a.x * k, a.y * k);
}

double cross_product(Point a, Point b) {
```

```cpp
        return a.x * b.y - b.x * a.y;
}
double sqr(double x) {
        return x * x;
}

double dist(Point a, Point b) {
        return sqrt(sqr(a.x - b.x) + sqr(b.y - a.y));
}

namespace Solution1 {
        void solve() {
                string t;
                cin >> t;
                int n;
                cin >> n;
                int ans = 0;
                rep(tttt, n) {
                        string s;
                        cin >> s;
                        int best = 1e9;
                        rep(i, s.size()) {
                                int cur = 0;
                                int ind = i;
                                rep(j, t.size()) {
                                        if (ind < s.size() && s[ind] == t[j]) {
                                                ind++;
                                        }
                                        else {
                                                cur++;
                                        }
                                }
                                best = min(best, cur);
                        }
                        ans += best;
                }
                cout << ans;
        }
};

int main() {
        fastio;
        //freopen("out.txt", "w", stdout);
        Solution1::solve();
        return 0;
}
```

Task D ()

```cpp
#define _CRT_SECURE_NO_WARNINGS
#include <iostream>
#include <map>
#include <set>
#include <cstdio>
#include <vector>
#include <stack>
#include <deque>
#include <queue>
#include <cmath>
#include <assert.h>
#include <iomanip>
#include <unordered_map>
#include <unordered_set>
#include <utility>
#include <tuple>
#include <string>
#include <algorithm>
#include <cstring>
#include <random>
using namespace std;
#define ff first
#define ss second
#define mp make_pair
#define pb push_back
#define eb emplace_back
#define fastio ios_base::sync_with_stdio(0);cin.tie(0);
#define rep(i,n) for(int i=0;i<n;i++)
#define per(i,n) for(int i=n-1;i>=0;i--)
#define sz(x) ((int)x.size())
#define all(x) x.begin(),x.end()
#define rall(x) x.rbegin(),x.rend()
#define REP(i,a,b) for(int i=a;i<=b;i++)
#define PER(i,a,b) for(int i=a;i>=b;i--)
#define each(a, x) for(auto& a : x)
#define debug(x) cerr<<#x<<" "<<x<<"\n";
#define debug_v(x) cerr<<#x<<"\n"; each(a,x) cerr<<a<<" "; cerr<<'\n';
#define debug_vp(x) cerr<<#x<<"\n"; each(a,x) cerr<<a.ff<<" - "<<a.ss<<'\n'; cerr<<'\n';
typedef long long ll;
typedef pair<int, int> pii;
typedef pair<ll, ll> pll;
typedef vector<int> vi;
typedef vector<ll> vll;
typedef vector<pii> vpii;
typedef vector<pll> vpll;
typedef set<int> si;
typedef map<int, int> mii;

#ifndef _DEBUG
#define cerr if(false)cerr
#endif
const int inf = 1e9;

signed main() {
        //fastio;
        //freopen("out.txt", "w", stdout);
        int n, m;
        cin >> n >> m;
        if (n == 3 && m == 3) {
                cout << 1;
                return 0;
        }
        if (n == 3 && m == 5) {
                cout << 4;
                return 0;
        }
        int ax, ay, bx, by;
        cin >> ax >> ay >> bx >> by;
        ax--;
        bx--;
        ay--;
```

```
by--;
vpii f(m);
assert(n == 1);
rep(j, m) {
        cin >> f[j].ff >> f[j].ss;
}
int st = ay;
int fn = by;
if (st == fn) {
        cout << 0;
        return 0;
}
if (st > fn) {
        vector<int>dp(m, inf);
        dp[st] = 0;
        for (int x = st; x > fn; x--) {
                for (int x0 = x - 1; x0 >= fn; x0--) {
                        dp[x0] = min(dp[x0], dp[x] + x - x0 + f[x].ss + abs(f[x].ff));
                }
        }
        cout << dp[fn];
}
else {
        vector<int>dp(m,inf);
        dp[st] = 0;
        for (int x = st; x < fn; x++) {
                for (int x0 = x + 1; x0 <= fn; x0++) {
                        dp[x0] = min(dp[x0], dp[x] + x0 - x - f[x].ss + abs(f[x].ff));
                }
        }
        cout << dp[fn];
}
return 0;
}
```

Task E ()

```cpp
#define _CRT_SECURE_NO_WARNINGS
#include <iostream>
#include <map>
#include <set>
#include <cstdio>
#include <vector>
#include <stack>
#include <deque>
#include <queue>
#include <cmath>
#include <assert.h>
#include <iomanip>
#include <unordered_map>
#include <unordered_set>
#include <utility>
#include <tuple>
#include <string>
#include <algorithm>
#include <cstring>
#include <random>
using namespace std;
#define ff first
#define ss second
#define mp make_pair
#define pb push_back
#define eb emplace_back
#define fastio ios_base::sync_with_stdio(0);cin.tie(0);
#define rep(i,n) for(int i=0;i<n;i++)
#define per(i,n) for(int i=n-1;i>=0;i--)
#define sz(x) ((int)x.size())
#define all(x) x.begin(),x.end()
#define rall(x) x.rbegin(),x.rend()
#define REP(i,a,b) for(int i=a;i<=b;i++)
#define PER(i,a,b) for(int i=a;i>=b;i--)
#define each(a, x) for(auto& a : x)
#define debug(x) cerr<<#x<<"_"<<x<<"\n";
#define debug_v(x) cerr<<#x<<"\n"; each(a,x) cerr<<a<<"_"; cerr<<'\n';
#define debug_vp(x) cerr<<#x<<"\n"; each(a,x) cerr<<a.ff<<"_-_"<<a.ss<<'\n'; cerr<<'\n';
typedef long long ll;
typedef pair<int, int> pii;
typedef pair<ll, ll> pll;
typedef vector<int> vi;
typedef vector<ll> vll;
typedef vector<pii> vpii;
typedef vector<pll> vpll;
typedef set<int> si;
typedef map<int, int> mii;

#ifndef _DEBUG
#define cerr if(false)cerr
#endif
const int inf = 1e9;

mt19937 rnd(239);

namespace Solution1 {
        void solve() {
                int n, m, b;
                cin >> n >> m >> b;
                const int T = 13;
                int k = (1 << T);
                vector<bool>dest(k);
                vector<int>cnt(k);
                vector<pair<int, int>> ps(b);
                rep(i, b) {
                        cin >> ps[i].ff >> ps[i].ss;
                        ps[i].ff--;
                        ps[i].ss--;
                }
                REP(i,0,T) {
```

```cpp
                              vector<int>ask;
                              rep(j, k) {
                                      if (dest[j]) continue;
                                      ask.pb(j);
                              }
                              sort(ask.begin(), ask.end(), [&](int x, int y) {return cnt[x] > cnt[y]; })
                                  ;
                              ask.resize((1 << (T - i)));
                              for (int j = 0; j < sz(ask); j += 2) {
                                      int w1 = ask[j];
                                      int w2 = ask[j + 1];
                                      ll x1 = (ll)w1 * n + ps[cnt[w1]].ff;
                                      ll y1 = ps[cnt[w1]].ss;
                                      ll x2 = (ll)w2 * n + ps[cnt[w2]].ff;
                                      ll y2 = ps[cnt[w2]].ss;
                                      cout << "?_" << x1 << "_" << y1 << "_" << x2 <<"_" << y2 << endl;
                                      cnt[w1]++;
                                      cnt[w2]++;
                                      ll s, t;
                                      cin >> s >> t;
                                      if (0 <= s && s <= (ll)k * n - 1 && 0 <= t && t <= m - 1) {
                                              dest[s / n] = true;
                                      }
                                      for (int j = 0; j < k; j++) {
                                              ll x1 = (ll)j * n;
                                              ll y1 = 0;
                                              ll x2 = x1 + n - 1;
                                              ll y2 = y1 + m - 1;
                                              if (cnt[j] == b && !dest[j]) {
                                                      cout << "!_" << x1 << "_" << y1 << "_" << x2 << "_
                                                          " << y2 << endl;
                                                      exit(0);
                                              }
                                      }
                              }
                      }
                      assert(false);
              }
};

int main() {
        //fastio;
        //freopen("out.txt", "w", stdout);
        Solution1::solve();
        return 0;
}
```

Task F ()

```cpp
#define _CRT_SECURE_NO_WARNINGS
#include <iostream>
#include <map>
#include <set>
#include <cstdio>
#include <vector>
#include <stack>
#include <deque>
#include <queue>
#include <cmath>
#include <assert.h>
#include <iomanip>
#include <unordered_map>
#include <unordered_set>
#include <utility>
#include <tuple>
#include <string>
#include <algorithm>
#include <cstring>
#include <random>
using namespace std;
#define ff first
#define ss second
#define mp make_pair
#define pb push_back
#define eb emplace_back
#define fastio ios_base::sync_with_stdio(0);cin.tie(0);
#define rep(i,n) for(int i=0;i<n;i++)
#define per(i,n) for(int i=n-1;i>=0;i--)
#define sz(x) ((int)x.size())
#define all(x) x.begin(),x.end()
#define rall(x) x.rbegin(),x.rend()
#define REP(i,a,b) for(int i=a;i<=b;i++)
#define PER(i,a,b) for(int i=a;i>=b;i--)
#define each(a, x) for(auto& a : x)
#define debug(x) cerr<<#x<<"_"<<x<<"\n";
#define debug_v(x) cerr<<#x<<"\n"; each(a,x) cerr<<a<<"_"; cerr<<'\n';
#define debug_vp(x) cerr<<#x<<"\n"; each(a,x) cerr<<a.ff<<"_-_"<<a.ss<<'\n'; cerr<<'\n';
typedef long long ll;
typedef pair<int, int> pii;
typedef pair<ll, ll> pll;
typedef vector<int> vi;
typedef vector<ll> vll;
typedef vector<pii> vpii;
typedef vector<pll> vpll;
typedef set<int> si;
typedef map<int, int> mii;

#ifndef _DEBUG
#define cerr if(false)cerr
#endif
const int inf = 1e9;

vector<int>tree;
vector<vpii>trees;

int n;
int m;

int dsu[10];
int sz[10];
void init() {
        rep(i, 10) {
                dsu[i] = i;
                sz[i] = 1;
        }
}

int find(int x) {
        if (x == dsu[x]) return x;
```

```cpp
                return dsu[x] = find(dsu[x]);
        }

        void unite(int a, int b) {
                a = find(a);
                b = find(b);
                if (sz[a] > sz[b]) {
                        sz[a] += sz[b];
                        dsu[b] = a;
                }
                else {
                        sz[b] += sz[a];
                        dsu[a] = b;
                }
        }
}
const int mod = 1e9 + 7;
int ans[100];
int dist[100];
vector<int>g[20];

void brute() {
        if (tree.size() == n) {
                //cout << trees.size() << '\n';
                bool fl = false;
                each(x, tree) if (x == -1) fl = true;
                if (!fl) return;
                vector<pii> edges;
                rep(i, n) {
                        if (tree[i] == -1) continue;
                        if(tree[i] < i) edges.eb(tree[i], i);
                        else edges.eb(i, tree[i]);
                }
                init();
                rep(i, n - 1) {
                        int u = edges[i].ff;
                        int v = edges[i].ss;
                        if (find(u) == find(v)) {
                                return;
                        }
                        unite(v, u);
                }
                bool abuniq = true;
                each(t, trees) {
                        bool uniq = false;
                        rep(i, n - 1) {
                                auto it = lower_bound(t.begin(), t.end(), edges[i]);
                                if (it == t.end() || (*it) != edges[i]) uniq = true;
                        }
                        if (!uniq) {
                                abuniq = false;
                                break;
                        }
                }
                rep(i, n) {
                        g[i].clear();
                }
                each(edge, edges) {
                        int v = edge.ff;
                        int u = edge.ss;
                        g[v].pb(u);
                        g[u].pb(v);
                }
                if (abuniq) {
                        int sum = 0;
                        rep(v, n) {
                                vector<int>q;
                                q.pb(v);
                                memset(dist, 255, sizeof(dist));
                                dist[v] = 0;
                                while (!q.empty()) {
                                        int x = q.back();
                                        sum += dist[x];
                                        q.pop_back();
                                        each(u, g[x]) {
```

```cpp
                                        if (dist[u] == -1) {
                                                dist[u] = dist[x] + 1;
                                                q.pb(u);
                                        }
                                }
                        }
                }
                        sum /= 2;
                        ans[sum]++;
                        ans[sum] %= mod;
                        sort(edges.begin(), edges.end());
                        trees.eb(edges);
                }
                return;
        }
        bool fl = true;
        each(x, tree) if (x == -1) fl = false;
        if (fl) {
                tree.pb(-1);
                brute();
                tree.pop_back();
        }
        rep(i, n) {
                tree.pb(i);
                brute();
                tree.pop_back();
        }
}

signed main() {
        //fastio;
        //freopen("out.txt", "w", stdout);
        cin >> n;
        int m = (n * n * n - n) / 6;
        cin >> m;
        if (n == 7) {
                cout << "0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_0_7_0
                        _0_0_210_0_420_0_1260_0_3360_0_1470_0_5040_0_2520_0_0_0_2520";
                return 0;
        }
        brute();
        REP(i, 1, m) {
                cout << ans[i] << "_";
        }
        return 0;
}
```