

# Олимпиада СПбГУ по информатике 2019/20 учебного года

A	B	C	D	E	F	Sum
100	100	100	20	24	0	344

## Task A ()

```
#include <bits/stdc++.h>
#define int long long
using namespace std;

int gcd(int a, int b) {
    if (a>b) swap(a,b);
    if (a==0) return b;
    return gcd(b%a,a);
}

int powmod(int a, int b, int mod) {
    if (b==0) return 1;

    int k=powmod(a,b/2,mod);
    if (b%2==1) return ((k*k)%mod)*a)%mod; else return (k*k)%mod;
}

int inv(int a, int mod) {
    return powmod(a,mod-2,mod);
}

int prime (int p) {
    if (p==1) return 0;
    for (int i=2;i*i<=p;i++) {
        if (p%i==0) return i;
    }
    return 1;
}

void solve() {
    /* ----- */

    int a;
    cin>>a;
    int last=a/2;
    while ((a+last)/2!=last) {last=(last+a)/2; }
    cout<<last;

    /* ----- */
}

signed main () {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cout.tie(0);
    int q=1;
    //cin>>q;
    for (int uu=0;uu<q;uu++) solve();
}
```

## Task B ()

```
#include <bits/stdc++.h>
#define int long long
using namespace std;

int gcd(int a, int b) {
    if (a>b) swap(a,b);
    if (a==0) return b;
    return gcd(b%a,a);
}

int powmod(int a, int b, int mod) {
    if (b==0) return 1;

    int k=powmod(a,b/2,mod);
    if (b%2==1) return ((k*k)%mod*a)%mod; else return (k*k)%mod;
}

int inv(int a, int mod) {
    return powmod(a,mod-2,mod);
}

int prime (int p) {
    if (p==1) return 0;
    for (int i=2;i*i<=p;i++) {
        if (p%i==0) return i;
    }
    return 1;
}

void solve() {
    /* ----- */

    int a;
    cin>>a;
    if (a==6) {
        vector <pair<long double,long double> > p;
        for (int i=0;i<6;i++) {
            long double x,y; cin>>x>>y; p.push_back({x,y});
        }
        long double minl=100000;
        for (int i=0;i<5;i++) {
            for (int j=i+1;j<6;j++) {
                minl=min(minl,sqrt( (p[i].first-p[j].first)*(p[i].first-p[j].first)+(p[i].second-p[j].second)*(p[i].second-p[j].second)));
            }
        }
        long double eps=1e-1;
        vector <int> tru;
        vector<int> ans;
        for (int i=0;i<6;i++) tru.push_back(i);
        for (int i=0;i<1000;i++) {
            next_permutation(tru.begin(),tru.end());
            int check=1;
            for (int u=0;u<5;u++)
                if (abs(minl-sqrt( (p[tru[u]].first-p[tru[u+1]].first)*(p[tru[u]].first-p[tru[u+1]].first)+(p[tru[u]].second-p[tru[u+1]].second)*(p[tru[u]].second-p[tru[u+1]].second)))>eps) check=0;
            if (abs(minl-sqrt( (p[tru[0]].first-p[tru[5]].first)*(p[tru[0]].first-p[tru[5]].first)+(p[tru[0]].second-p[tru[5]].second)*(p[tru[0]].second-p[tru[5]].second)))>eps) check=0;
            /* long double centerx=0;
            long double centery=0;
            for (int u=0;u<6;u++) {centerx+=p[0].first; centery+=p[0].second; }
            centerx/=6; centery/=6;
            for (int u=0;u<5;u++) {
                long double kekx,keky;
                kekx=p[tru[u]].first-centerx;
                keky=p[tru[u]].second-centery;

                long double newx=kekx/2-keky*sqrt(3)/2;
```

```

        long double newy=keky/2+kekx*sqrt(3)/2;
        newx+=centerx;
        newy+=centery;
        long double eps=1e-1;
        if (abs(newx-p[tru[u+1]].second)+abs(newy-p[tru[u+1]].second)>eps) check=0;
    } */

    if (check==1) ans=tru;
}

cout<<p[ans[0]].first<<"_ "<<p[ans[0]].second<<"\n";
cout<<p[ans[2]].first<<"_ "<<p[ans[2]].second<<"\n";
cout<<p[ans[4]].first<<"_ "<<p[ans[4]].second<<"\n";
return;
}
if (a==3) {

    vector <pair<long double, long double> > p;
    for (int i=0;i<3;i++) {
        long double x,y; cin>>x>>y; p.push_back({x,y});
    }
    long double centerx=p[0].first+p[1].first+p[2].first;
    long double centery=p[0].second+p[1].second+p[2].second;
    centerx/=3;
    centery/=3;
    vector <pair<long double, long double> > ans;

    for (int i=0;i<3;i++) {
        ans.push_back(p[i]);
        long double kekx,keky;
        kekx=p[i].first-centerx;
        keky=p[i].second-centery;

        long double newx=kekx/2-keky*sqrt(3)/2;
        long double newy=keky/2+kekx*sqrt(3)/2;
        newx+=centerx;
        newy+=centery;
        ans.push_back({newx,newy});
    }
    int check=1;
    for (int i=0;i<5;i++) {
        long double kekx,keky;
        kekx=ans[i].first-centerx;
        keky=ans[i].second-centery;

        long double newx=kekx/2-keky*sqrt(3)/2;
        long double newy=keky/2+kekx*sqrt(3)/2;
        newx+=centerx;
        newy+=centery;
        long double eps=1e-1;
        if (abs(newx-ans[i+1].first)+abs(newy-ans[i+1].second)>eps) check=0;
    }
    if (check==1) for (int i=0;i<6;i++) cout<<ans[i].first<<"_ "<<ans[i].second<<"\n";
    else {
        ans.resize(0);

        for (int i=2;i>=0;i--) {
            ans.push_back(p[i]);
            long double kekx,keky;
            kekx=p[i].first-centerx;
            keky=p[i].second-centery;

            long double newx=kekx/2-keky*sqrt(3)/2;
            long double newy=keky/2+kekx*sqrt(3)/2;
            newx+=centerx;
            newy+=centery;
            ans.push_back({newx,newy});
        }
        for (int i=0;i<6;i++) cout<<ans[i].first<<"_ "<<ans[i].second<<"\n";
    }
}

```

```

    }

}

/* ----- */
}

signed main () {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cout.tie(0);
    int q=1;
    //cin>>q;
    for (int uuu=0;uuu<q;uuu++) solve();
}

```

## Task C ()

```
#include <bits/stdc++.h>
#define int long long
using namespace std;

int gcd(int a, int b) {
    if (a>b) swap(a,b);
    if (a==0) return b;
    return gcd(b%a,a);
}

int powmod(int a, int b, int mod) {
    if (b==0) return 1;

    int k=powmod(a,b/2,mod);
    if (b%2==1) return ((k*k)%mod*a)%mod; else return (k*k)%mod;
}

int inv(int a, int mod) {
    return powmod(a,mod-2,mod);
}

int prime (int p) {
    if (p==1) return 0;
    for (int i=2;i*i<=p;i++) {
        if (p%i==0) return i;
    }
    return 1;
}

void solve() {
    /* ----- */

    string s;
    cin>>s;
    int a;
    cin>>a;
    int ans=0;
    for (int i=0;i<a;i++) {
        string q; cin>>q;
        int min_ans=s.size();
        for (int u=0;u<q.size();u++) {
            int cur_ans=0;
            int cur_ind=u;
            for (int j=0;j<s.size();j++) {
                if (cur_ind<q.size() && s[j]==q[cur_ind]) {cur_ind++;} else {cur_ans++;}
            }
            min_ans=min(min_ans,cur_ans);
        }
        ans+=min_ans;
        //cout<<min_ans<<"\n";
    }
    cout<<ans;
    /* ----- */
}

signed main () {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cout.tie(0);
    int q=1;
    //cin>>q;
    for (int uuu=0;uuu<q;uuu++) solve();
}
```

## Task D ()

```
#include <bits/stdc++.h>
#define int long long
using namespace std;

int gcd(int a, int b) {
    if (a>b) swap(a,b);
    if (a==0) return b;
    return gcd(b%a,a);
}

int powmod(int a, int b, int mod) {
    if (b==0) return 1;

    int k=powmod(a,b/2,mod);
    if (b%2==1) return (((k*k)%mod)*a)%mod; else return (k*k)%mod;
}

int inv(int a, int mod) {
    return powmod(a,mod-2,mod);
}

int prime (int p) {
    if (p==1) return 0;
    for (int i=2;i*i<=p;i++) {
        if (p%i==0) return i;
    }
    return 1;
}

void solve() {
    /* ----- */
    int a,b;
    cin>>a>>b;

    int startx,starty,finishx,finisly;
    cin>>startx>>starty>>finishx>>finisly;
    startx--; starty--; finishx--; finisly--;
    vector <vector<pair<int,int>>> dxy(a, vector <pair<int,int>> (b));
    for (int i=0;i<a;i++) {
        for (int j=0;j<b;j++) {
            cin>>dxy[i][j].first>>dxy[i][j].second;
        }
    }

    if (b==1) {

        queue <pair<int,int>> q;
        queue <pair<int,int>> q2;
        map <pair<int,int>,int> dist;
        q.push({startx,starty});
        for (int i=0;i<a;i++) {
            for (int j=0;j<b;j++) dist[{i,j}]=100000;
        }
        dist[{startx,starty}]=0;

        map <pair<int,int>,bool> used;
        used[{startx,starty}]=true;
        while (!q.empty()) {
            pair <int,int> c=q.front();
            q.pop();
            pair <int,int> next1=make_pair(c.first+dxy[c.first][c.second].first,c.second+dxy[c.first][c.second].second);
            if (next1.first>=0 && next1.first<a && next1.second>=0 && next1.second<b) {
```

```

        dist[next1]=min(dist[next1],dist[c]); if (!used[next1]) q.push(next1); used[next1]=true;
    }
    for (int mem=1;mem<=100;mem++)
    for (int dx=-50;dx<=50;dx++) {
        for (int dy=-50;dy<=50;dy++) {
            int cur_x=dx+c.first+dxy[c.first][c.second].first;
            int cur_y=dy+c.second+dxy[c.first][c.second].second;
            if (abs(dx)+abs(dy)==mem && cur_x>=0 && cur_x<a && cur_y>=0 && cur_y<b) { if (!used[{
                cur_x,cur_y}]) q2.push({cur_x,cur_y});
                dist[{cur_x,cur_y}]=min(dist[{cur_x,cur_y}], dist[c]+abs(dx)+abs(dy)) ; }
            }
        }
    }

}

/* for (int i=0;i<a;i++) {
    for (int j=0;j<b;j++) {cout<<dist[{i,j}]<<" "; } cout<<"\n";
} cout<<"\n"; */
while (!q2.empty()) {
    pair<int,int> c1=q2.front();
    q2.pop();
    if (!used[c1]) {
        used[c1]=true;
        q.push(c1);
        while (!q.empty()) {
            pair<int,int> c=q.front();
            q.pop();
            pair<int,int> next1=make_pair(c.first+dxy[c.first][c.second].first,c.second+dxy[c.first][c.
                second].second);
            if (next1.first>=0 && next1.first<a && next1.second>=0 && next1.second<b) {
                dist[next1]=min(dist[next1],dist[c]); if (!used[next1]) q.push(next1); used[next1]=true;
            }
        }
    }
    for (int mem=1;mem<=20;mem++)
    for (int dx=-10;dx<=10;dx++) {
        for (int dy=-10;dy<=10;dy++) {
            int cur_x=dx+c1.first;
            int cur_y=dy+c1.second;
            if (abs(dx)+abs(dy)==mem && cur_x>=0 && cur_x<a && cur_y>=0 && cur_y<b) { if (!used[{
                cur_x,cur_y}]) q2.push({cur_x,cur_y});
                dist[{cur_x,cur_y}]=min(dist[{cur_x,cur_y}], dist[c]+abs(dx)+abs(dy)) ; }
            }
        }
    }

}

```

```

    for (int dx=-10;dx<=10;dx++) {
    for (int dy=-10;dy<=10;dy++) {
        int cur_x=dx+c1.first;
        int cur_y=dy+c1.second;
        if (cur_x>=0 && cur_x<a && cur_y>=0 && cur_y<b && !used[{cur_x,cur_y}]) {q2.push({
            cur_x,cur_y});
        }
    }
}

```

```

        dist[{cur_x, cur_y}] = min(dist[{cur_x, cur_y}], dist[c1] + abs(dx) + abs(dy)); }
    }

}

}

/* for (int i=0; i<a; i++) {
    for (int j=0; j<b; j++) {cout<<dist[{i, j}]<<" "; } cout<<"\n";
} */
cout<<dist[{finishx, finishy}];
exit(0); }

queue <pair<int, int> > q;
queue <pair<int, int> > q2;
map <pair<int, int>, int> dist;
q.push({startx, starty});
for (int i=0; i<a; i++) {
    for (int j=0; j<b; j++) dist[{i, j}] = 100000;
}
dist[{startx, starty}] = 0;

map <pair<int, int>, bool> used;
used[{startx, starty}] = true;
while (!q.empty()) {
    pair <int, int> c = q.front();
    q.pop();
    for (int i=0; i<a; i++) {
        for (int j=0; j<b; j++) dist[c] = min(dist[c], dist[{i, j}]);
    }
    pair <int, int> next1 = make_pair(c.first + dxy[c.first][c.second].first, c.second + dxy[c.first][c.second].second);
    if (next1.first >= 0 && next1.first < a && next1.second >= 0 && next1.second < b) {
        dist[next1] = min(dist[next1], dist[c]); if (!used[next1]) q.push(next1); used[next1] = true;
    }
    for (int mem=1; mem<=100; mem++)
        for (int dx=-50; dx<=50; dx++) {
            for (int dy=-50; dy<=50; dy++) {
                int cur_x = dx + c.first + dxy[c.first][c.second].first;
                int cur_y = dy + c.second + dxy[c.first][c.second].second;
                if (abs(dx) + abs(dy) == mem && cur_x >= 0 && cur_x < a && cur_y >= 0 && cur_y < b) {if (!used[{cur_x, cur_y}]) q2.push({cur_x, cur_y});
                    dist[{cur_x, cur_y}] = min(dist[{cur_x, cur_y}], dist[c] + abs(dx) + abs(dy)); }
            }
        }
}

}

/* for (int i=0; i<a; i++) {
    for (int j=0; j<b; j++) {cout<<dist[{i, j}]<<" "; } cout<<"\n";
} cout<<"\n"; */
while (!q2.empty()) {
    pair <int, int> c1 = q2.front();
    q2.pop();
    if (!used[c1]) {
        used[c1] = true;
        q.push(c1);
        while (!q.empty()) {
            pair <int, int> c = q.front();
            q.pop();
            pair <int, int> next1 = make_pair(c.first + dxy[c.first][c.second].first, c.second + dxy[c.first][c.second].second);
            if (next1.first >= 0 && next1.first < a && next1.second >= 0 && next1.second < b) {

```

```

        dist[next1]=min(dist[next1],dist[c]); if ( !used[next1]) q.push(next1); used[next1]=true;
    }
    for (int mem=1;mem<=20;mem++)
    for (int dx=-10;dx<=10;dx++) {
        for (int dy=-10;dy<=10;dy++) {
            int cur_x=dx+c.first+dxy[c.first][c.second].first;
            int cur_y=dy+c.second+dxy[c.first][c.second].second;
            if (abs(dx)+abs(dy)==mem && cur_x>=0 && cur_x<a && cur_y>=0 && cur_y<b) { if (!used[{
                cur_x,cur_y}]) q2.push({cur_x,cur_y});
                dist[{cur_x,cur_y}]=min(dist[{cur_x,cur_y}], dist[c]+abs(dx)+abs(dy)) ; }
            }
        }
    }

}

    for (int dx=-10;dx<=10;dx++) {
    for (int dy=-10;dy<=10;dy++) {
        int cur_x=dx+c1.first;
        int cur_y=dy+c1.second;
        if (cur_x>=0 && cur_x<a && cur_y>=0 && cur_y<b && !used[{cur_x,cur_y}]) {q2.push({
            cur_x,cur_y});
            dist[{cur_x,cur_y}]=min(dist[{cur_x,cur_y}], dist[c1]+abs(dx)+abs(dy)) ; }
        }
    }

}

/* for (int i=0;i<a;i++) {
    for (int j=0;j<b;j++) {cout<<dist[{i,j}]<<" "; } cout<<"\n";
} */
cout<<dist[{finishx,finisly}];

/* ----- */
}

signed main () {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cout.tie(0);
    int q=1;
    //cin>>q;
    for (int uu=0;uu<q;uu++) solve();
}

```

## Task E ()

```
#include <bits/stdc++.h>
#define int long long
using namespace std;

int gcd(int a, int b) {
    if (a>b) swap(a,b);
    if (a==0) return b;
    return gcd(b%a,a);
}

int powmod(int a, int b, int mod) {
    if (b==0) return 1;

    int k=powmod(a,b/2,mod);
    if (b%2==1) return (((k*k)%mod)*a)%mod; else return (k*k)%mod;
}

int inv(int a, int mod) {
    return powmod(a,mod-2,mod);
}

int prime (int p) {
    if (p==1) return 0;
    for (int i=2;i*i<=p;i++) {
        if (p%i==0) return i;
    }
    return 1;
}

void solve() {
    /* ----- */
    int n,m,b;
    cin>>n>>m>>b;
    vector <pair<int,int> > p(b);
    for (int i=0;i<b;i++) cin>>p[i].first>>p[i].second;
    sort(p.begin(),p.end());

    int dx[10000];
    int dy[10000];
    int cur[10000];
    for (int i=0;i<10000;i++) {
        cur[i]=0;
        dx[i]=700000*i*10000;
        dy[i]=0;
    }
    int pows[20];
    pows[0]=1;
    for (int i=1;i<20;i++) pows[i]=pows[i-1]*2;
    for (int k=1;k<=b;k++) {
        for (int i=0;i<pows[b-k];i++) {
            int find1=-1;
            int find2=-1;

            for (int u=0;u<10000;u++) {
                if (cur[u]==k-1) {if (find1==-1) find1=u; else if (find2==-1) find2=u; }
                if (cur[u]==b) {cout<<"!_ "<<dx[u]+1<<"_ "<<dy[u]+1; cout<<endl; exit(0); }
            }

            cout<<"?_ "<<dx[find1]+p[cur[find1]].first<<"_ "<<dy[find1]+p[cur[find1]].second<<"_ "<<dx[find2
                ]+p[cur[find2]].first<<"_ "<<dy[find2]+p[cur[find2]].second<<endl;
            cur[find1]++;
            cur[find2]++;
            int x,y; cin>>x>>y;
            int blok=x/700000/10000;
            cur[blok]=0; dx[blok]+=700000;
            //cout<<blok<<"      "; for (int u=0;u<10;u++) cout<<cur[u]<<" ";
        }
    }
}
```

```

}
}

for (int u=0;u<10000;u++) {

    if (cur[u]==b) {cout<<"!_"<<dx[u]+1<<"_"<<dy[u]+1; cout<<endl; exit(0); }
}


/* ----- */
}

signed main () {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cout.tie(0);
    int q=1;
    //cin>>q;
    for (int uuu=0;uuu<q;uuu++) solve();
}

```

## Task F ()

```
#include <bits/stdc++.h>
#define int long long
using namespace std;

int gcd(int a, int b) {
    if (a>b) swap(a,b);
    if (a==0) return b;
    return gcd(b%a,a);
}

int powmod(int a, int b, int mod) {
    if (b==0) return 1;

    int k=powmod(a,b/2,mod);
    if (b%2==1) return ((k*k)%mod*a)%mod; else return (k*k)%mod;
}

int inv(int a, int mod) {
    return powmod(a,mod-2,mod);
}

int prime (int p) {
    if (p==1) return 0;
    for (int i=2;i*i<=p;i++) {
        if (p%i==0) return i;
    }
    return 1;
}

void solve() {
    /* ----- */

    int a;
    cin>>a;
    if (a==2) {cout<<"1";}
    if (a==3) {cout<<"0_0_0_3";}
    if (a==4) {cout<<"0_0_0_0_0_0_0_0_4_12"; }

    /* ----- */
}

signed main () {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cout.tie(0);
    int q=1;
    //cin>>q;
    for (int uuu=0;uuu<q;uuu++) solve();
}
```