Олимпиада СПбГУ по информатике 2019/20 учебного года

A	B	C	D	E	F	Sum
100	100	100	40	6	5	351

Task A ()

```
#define _GLIBCXX_DEBUG
#include <bits/stdc++.h>
using namespace std;
typedef long long ll;
//#include <ext/pb_ds/assoc_container.hpp>
//#include <ext/pb_ds/tree_policy.hpp>
// typedef tree<int,null_type,less<int>,rb_tree_tag,tree_order_statistics_node_update>ordered_set;
//find_by_order()
//order_of_key()
#define vi vector<int>
#define vll vector<ll>
#define rep(i,n) for (int i=0;i<(n);i++)
#define all(x) (x).begin(),(x).end()
#define pii pair<int,int>
#define pll pair<ll,ll>
#define fi first
#define se second
#define mii map<int,int>
#define mll map<ll,ll>
#define si set<int>
#define sll set<ll>
#define vvi vector< vi >
#define vsi vector<si >
#define pb push_back

const int MAXN=1e6+100;
const ll INF=1e9;
const ll INFLL=1e18;
const ll mod1=1e9+7;

signed main(){
    ios_base::sync_with_stdio(0);
    cin.tie(0);
  //  freopen("a.in","r",stdin);
    ll n;
    cin>>n;
    ll ans=0;
    ll f=2;
    ll cur=n/2;
    ans=n/2;
    for (int i=0;i<30;i++)
    {
        cur=(cur+n)/2;
        ans=max(cur,ans);
    }
    cout<<ans;



}
```

Task B ()

```
#define _GLIBCXX_DEBUG
#include <bits/stdc++.h>
using namespace std;
typedef long long ll;
//#include <ext/pb_ds/assoc_container.hpp>
//#include <ext/pb_ds/tree_policy.hpp>
// typedef tree<int,null_type,less<int>,rb_tree_tag,tree_order_statistics_node_update>ordered_set;
//find_by_order()
//order_of_key()
#define vi vector<int>
#define vll vector<ll>
#define rep(i,n) for (int i=0;i<(n);i++)
#define all(x) (x).begin(),(x).end()
#define pii pair<int,int>
#define pll pair<ll,ll>
#define fi first
#define se second
#define mii map<int,int>
#define mll map<ll,ll>
#define si set<int>
#define sll set<ll>
#define vvi vector< vi >
#define vsi vector<si >
#define pb push_back

const int MAXN=1e6+100;
const ll INF=1e9;
const ll INFLL=1e18;
const ll mod1=1e9+7;

bool comp(pair<double,double > a,pair<double,double > b )
{
    return atan2(-a.se,a.fi)<atan2(-b.se,b.fi);
}
signed main(){
    ios_base::sync_with_stdio(0);
    cin.tie(0);
   // freopen("a.in","r",stdin);
    int k;
    cin>>k;
    if (k==6)
    {
        vector<pair<double,double > > c(6);
        rep(i,6)
        cin>>c[i].fi>>c[i].se;
        double x=0,y=0;
        for (int i=0;i<6;i++)
        {
            x+=c[i].fi,y+=c[i].se;
        }
        x/=6,y/=6;
        for (int i=0;i<6;i++)
            c[i].fi-=x,c[i].se-=y;
        sort(all(c),comp);
        for (int i=0;i<6;i++)
            c[i].fi+=x,c[i].se+=y;
        for (int i=0;i<6;i++)
        {
            double a,b;
            a=c[i].fi,b=c[i].se;
            if (i%2==0)
                cout<<setprecision(30)<<a<<" "<<b<<'\n';
        }
    }
    else
    {
        vector<pair<double,double> > a(3);
        rep(i,3)
        cin>>a[i].fi>>a[i].se;
        double x=(a[0].fi+a[1].fi+a[2].fi)/3,y=(a[0].se+a[1].se+a[2].se)/3;
        vector<pair<double,double> > ans(6);
        for (int i=0;i<3;i++)
```

```
            ans[2*i]=a[i];
        for (int i=2;i>=0;i--)
        {
            double x1=a[i].fi,y1=a[i].se;
            double X=2*x-x1,Y=2*y-y1;
            if (i==2)
            ans[1]={X,Y};
            if (i==1)
            ans[5]={X,Y};
            if (i==0)
            ans[3]={X,Y};
        }
        rep(i,6)
        cout<<setprecision(30)<<ans[i].fi<<" "<<ans[i].se<<'\n';
    }



}
```

Task C ()

```
#define _GLIBCXX_DEBUG
#include <bits/stdc++.h>
using namespace std;
typedef long long ll;
//#include <ext/pb_ds/assoc_container.hpp>
//#include <ext/pb_ds/tree_policy.hpp>
// typedef tree<int,null_type,less<int>,rb_tree_tag,tree_order_statistics_node_update>ordered_set;
//find_by_order()
//order_of_key()
#define vi vector<int>
#define vll vector<ll>
#define rep(i,n) for (int i=0;i<(n);i++)
#define all(x) (x).begin(),(x).end()
#define pii pair<int,int>
#define pll pair<ll,ll>
#define fi first
#define se second
#define mii map<int,int>
#define mll map<ll,ll>
#define si set<int>
#define sll set<ll>
#define vvi vector< vi >
#define vsi vector<si >
#define pb push_back

const int MAXN=1e6+100;
const ll INF=1e9;
const ll INFLL=1e18;
const ll mod1=1e9+7;


signed main(){
    ios_base::sync_with_stdio(0);
    cin.tie(0);
   // freopen("a.in","r",stdin);
    string t;
    cin>>t;
    ll ans=0;
    int q;
    cin>>q;
    while (q--)
    {
        string s;
        cin>>s;
        int n=s.size(),m=t.size();
        int mx=INF;
        for (int i=1;i<=n;i++)
        {
            int cur=0;
            int cur1=i-1;
            int cnt=0;
            while (cur<m)
            {
                if (cur1<n)
                {
                    if (s[cur1]==t[cur])
                        cur1++,cur++;
                    else
                    {
                        cur++,cnt++;
                    }
                }
                else
                    cur++,cnt++;
            }
            mx=min(mx,cnt);
        }
   /*      for (int i=0;i<=n;i++)
        {
            for (int j=0;j<=m;j++)
                cout<<dp[i][j]<<" ";
            cout<<'\n';
```

```
        } */
        // cout<<mx<<' '<<s<<'\n';
        ans+=mx;

    }
    cout<<ans;



}
```

Task D ()

```
//#define _GLIBCXX_DEBUG
#include <bits/stdc++.h>
using namespace std;
typedef long long ll;
//#include <ext/pb_ds/assoc_container.hpp>
//#include <ext/pb_ds/tree_policy.hpp>
// typedef tree<int,null_type,less<int>,rb_tree_tag,tree_order_statistics_node_update>ordered_set;
//find_by_order()
//order_of_key()
#define vi vector<int>
#define vll vector<ll>
#define rep(i,n) for (int i=0;i<(n);i++)
#define all(x) (x).begin(),(x).end()
#define pii pair<int,int>
#define pll pair<ll,ll>
#define fi first
#define se second
#define mii map<int,int>
#define mll map<ll,ll>
#define si set<int>
#define sll set<ll>
#define vvi vector< vi >
#define vsi vector<si >
#define pb push_back
#define int long long
const int MAXN=1e6+100;
const ll INF=1e18;
const ll INFLL=1e18;
const ll mod1=1e9+7;
int n,m;
int x,y,xxxx,yyyy;
pair<int,int> a[1000][1000];
vector<int> d[1000*1000];
vector<int> xx={0,0,1,-1,1,1,-1,-1};
vector<int> yy={1,-1,0,0,1,-1,1,-1};
void bfs(int s)
{
    for (int i=0;i<n*m;i++)
        d[i]=vector<int> (9,INF);
    d[s][4]=0;
    set<pair<int,pair<int,pii>>> q;
    q.insert({0,{s,{0,0}}});
    while (!q.empty())
    {
      //  cout<<d[0][4]<<'\n';
        pair<int,pair<int,pii>> f=(*q.begin());
        q.erase(f);
     //   cout<<f.fi<<' '<<f.se.fi<<' '<<f.se.se.fi<<" "<<f.se.se.se<<' ';
        int xxx=f.se.fi/m,yyy=f.se.fi%m;
   /*     if (f.se.se.fi+1+(f.se.se.se+1)*3!=4)
        {
            if (d[f.se.fi][4]>d[f.se.fi][f.se.se.fi+1+(f.se.se.se+1)*3])
                d[f.se.fi][4]=d[f.se.fi][f.se.se.fi+1+(f.se.se.se+1)*3],q.insert({d[f.se.fi][4],{f
                    .se.fi,{0,0}}});
        } */
        if (d[f.se.fi][f.se.se.fi+1+(f.se.se.se+1)*3]<f.fi)
            continue;
        for (int i=0;i<8;i++)
        {
            if (xxx+xx[i]>=0&&xxx+xx[i]<n&&yyy+yy[i]>=0&&yyy+yy[i]<m)
            {
            //    cout<<"From: "<<xxx<<" "<<yyy<<'\n';
            //    cout<<"To: "<<xxx+xx[i]<<" "<<yyy+yy[i]<<'\n';
            //    cout<<"Vector: "<<-a[xxx][yyy].fi+xx[i]<<" "<<-a[xxx][yyy].se+yy[i]<<'\n';
            //    cout<<"Cost: "<<d[f.se]<<' '<<d[(xxx+xx[i])*m+yyy+yy[i]]<<" "<<d[f.se]+abs(a[xxx
                ][yyy].fi-xx[i])+abs(a[xxx][yyy].se-yy[i])<<'\n';
            // cout<<xx[i]<<" "<<yy[i]<<" "<<d[f.se]<<" "<<abs(a[xxx][yyy].fi-xx[i])<<" "<<abs(
                a[xxx][yyy].se-yy[i])<<" "<<d[f.se]+abs(a[xxx][yyy].fi-xx[i])+abs(a[xxx][yyy].
                se-yy[i])<<" "<<(xxx+xx[i])<<" "<<yyy+yy[i]<<'\n';

                if (d[(xxx+xx[i])*m+yyy+yy[i]][xx[i]+1+3*(yy[i]+1)]>d[f.se.fi][f.se.se.fi+1+(f.se.
                    se.se+1)*3]+abs(a[xxx][yyy].fi-xx[i])+abs(a[xxx][yyy].se-yy[i])){
```

```
                    d[(xxx+xx[i])*m+yyy+yy[i]][xx[i]+1+3*(yy[i]+1)]=d[f.se.fi][f.se.se.fi+1+(f.se.
                        se.se+1)*3]+abs(a[xxx][yyy].fi-xx[i])+abs(a[xxx][yyy].se-yy[i]);
                    q.insert({d[(xxx+xx[i])*m+yyy+yy[i]][xx[i]+1+3*(yy[i]+1)],{(xxx+xx[i])*m+yyy+
                        yy[i],{xx[i],yy[i]}}});
                }
                if ((d[(xxx+xx[i])*m+yyy+yy[i]][xx[i]+1+3*(yy[i]+1)]>d[f.se.fi][f.se.se.fi+1+(f.se
                    .se.se+1)*3]+ abs(xx[i])+abs(yy[i]))&&(f.se.se.fi!=0||f.se.se.se!=0)){
                    d[(xxx+xx[i])*m+yyy+yy[i]][xx[i]+1+3*(yy[i]+1)]=d[f.se.fi][f.se.se.fi+1+(f.se.
                        se.se+1)*3]+ abs(xx[i])+abs(yy[i]);
                    q.insert({d[(xxx+xx[i])*m+yyy+yy[i]][xx[i]+1+3*(yy[i]+1)],{(xxx+xx[i])*m+yyy+
                        yy[i],{xx[i],yy[i]}}});
                }

            }
        }
    }
}
signed main(){
    ios_base::sync_with_stdio(0);
    cin.tie(0);
  //  freopen("a.in","r",stdin);
    cin>>n>>m;
  /*  if (n==3&&m==5)
    {
        cout<<4;
        return 0;
    } */
    cin>>x>>y>>xxxx>>yyyy;
    x--,y--,xxxx--,yyyy--;
    for (int i=0;i<n;i++)
    {
        for (int j=0;j<m;j++)
            cin>>a[i][j].fi>>a[i][j].se;
    }
    bfs(y+x*m);
   /* for (int f=0;f<9;f++)
    {
        cout<<f<<'\n';
        for (int i=0;i<n;i++)
        {
            for (int j=0;j<m;j++)
                cout<<d[j+i*m][f]<<' ';
            cout<<'\n';
        }
    } */
    int ans=INF;
    for (int i=0;i<9;i++)
        ans=min(ans,d[yyyy+xxxx*m][i]);
    cout<<ans;




}
```

Task E ()

```
#define _GLIBCXX_DEBUG
#include <bits/stdc++.h>
using namespace std;
typedef long long ll;
//#include <ext/pb_ds/assoc_container.hpp>
//#include <ext/pb_ds/tree_policy.hpp>
// typedef tree<int,null_type,less<int>,rb_tree_tag,tree_order_statistics_node_update>ordered_set;
//find_by_order()
//order_of_key()
#define vi vector<int>
#define vll vector<ll>
#define rep(i,n) for (int i=0;i<(n);i++)
#define all(x) (x).begin(),(x).end()
#define pii pair<int,int>
#define pll pair<ll,ll>
#define fi first
#define se second
#define mii map<int,int>
#define mll map<ll,ll>
#define si set<int>
#define sll set<ll>
#define vvi vector< vi >
#define vsi vector<si >
#define pb push_back

const int MAXN=1e6+100;
const ll INF=1e9;
const ll INFLL=1e18;
const ll mod1=1e9+7;

signed main(){
    int n,m,b;
    cin>>n>>m>>b;
    vector<pii > a(b);
    rep(i,b)
    cin>>a[i].fi>>a[i].se;
    cout<<"?␣"<<1000<<"␣"<<1000<<"␣"<<2000<<"␣"<<2000<<endl;
    int x,y;
    cin>>x>>y;
    if (x==1000)
    {
        cout<<"!␣"<<2000-a[0].fi+1<<"␣"<<2000-a[0].se+1<<endl;
        return 0;
    }
    else
    {
        cout<<"!␣"<<1000-a[0].fi+1<<"␣"<<1000-a[0].se+1<<endl;
        return 0;
    }




}
```

Task F ()

```
//#define _GLIBCXX_DEBUG
#include <bits/stdc++.h>
using namespace std;
typedef long long ll;
//#include <ext/pb_ds/assoc_container.hpp>
//#include <ext/pb_ds/tree_policy.hpp>
// typedef tree<int,null_type,less<int>,rb_tree_tag,tree_order_statistics_node_update>ordered_set;
//find_by_order()
//order_of_key()
#define vi vector<int>
#define vll vector<ll>
#define rep(i,n) for (int i=0;i<(n);i++)
#define all(x) (x).begin(),(x).end()
#define pii pair<int,int>
#define pll pair<ll,ll>
#define fi first
#define se second
#define mii map<int,int>
#define mll map<ll,ll>
#define si set<int>
#define sll set<ll>
#define vvi vector< vi >
#define vsi vector<si >
#define pb push_back

const int MAXN=1e6+100;
const ll INF=1e9;
const ll INFLL=1e18;
const ll mod1=1e9+7;
int par[7],ranks[7],parr[7];
int dp[7][3];
vvi g;
int n,m;
void make_set(int s)
{
ranks[s]=0;
par[s]=s;
}
vector<int> d;
int find_set(int s)
{
if (par[s]==s)
return s;
return par[s]=find_set(par[s]);
}

void union_sets(int u,int v)
{
u=find_set(u);
v=find_set(v);
if (u!=v)
{
if (ranks[u]<ranks[v])
swap(u,v);
par[v]=u;
if (ranks[u]==ranks[v])
ranks[u]++;
}
}
void dfs(int s,int p)
{
    parr[s]=p;
    for (auto to:g[s])
    {
        if (to==p)
            continue;
        dfs(to,s);
    }
}
void bfs(int s)
{
    d=vector<int> (n,INF);
```

```
    queue<int> q;
    q.push(s);
    d[s]=0;
    while (!q.empty())
    {
        int f=q.front();
        q.pop();
        for (auto to:g[f])
        {
            if (d[to]==INF)
            {
                d[to]=d[f]+1;
                q.push(to);
            }
        }
    }
}
void prec()
{
    for (int i=0;i<n;i++)
        dp[i][0]=parr[i];
    for (int i=1;i<3;i++)
    {
        for (int j=0;j<n;j++)
            dp[j][i]=dp[dp[j][i-1]][i-1];
    }
}
int lca(int a,int b)
{
    if (d[a]<d[b])
        swap(a,b);
    for (int i=2;i>=0;i--)
    {
        if (d[a]-d[b]>=(1<<i))
            a=dp[a][i];
    }
    if (a==b)
        return a;
    for (int i=2;i>=0;i--)
    {
        if (dp[a][i]!=dp[b][i])
            a=dp[a][i],b=dp[b][i];
    }
    return parr[a];
}
signed main(){
    ios_base::sync_with_stdio(0);
    cin.tie(0);
   // freopen("a.in","r",stdin);
    vector <int> anss={};
    cin>>n>>m;
 /*   if (n==6)
    {
        for (int i=1;i<=m;i++)
            cout<<anss[i]<<" ";
        return 0;
    } */
    ll f=1;
    for (int i=0;i<n-1;i++)
        f*=n*(n);
    vector <int> ans((n*n*n-n)/6+2,0);
    //vector <vector <int> > anss
  //  cout<<f<<'\n';
    for (int mask=0;mask<f;mask++)
    {
      for (int i=0;i<n;i++)
        {
            make_set(i);
        }
        bool ok=true;
        g=vvi(n);
        int wm=mask;
        for (int i=0;i<n-1;i++)
            {
```

```
                int x=wm%(n*n);
                wm/=(n*(n));
                int u=x%(n),v=x/n;
               if (u>=v)
               {
                    ok=false;
                    break;
               }
                if (find_set(u)==find_set(v))
                {
                     ok=false;
                     break;
                }
                else
                {
                     union_sets(u,v);
                     g[u].pb(v);
                     g[v].pb(u);
                }
            }
        int x=find_set(0);
        for (int i=1;i<n;i++)
        {
            if (find_set(i)!=x)
            {
                ok=false;
                break;
            }
        }
        if (ok)
        {
           dfs(0,0);
           bfs(0);
           prec();
           int sum=0;
         //  cout<<"ahahha\n";
           for (int i=0;i<n;i++)
           {
               for (int j=i+1;j<n;j++){
               // cout<<d[i]+d[j]-2*d[lca(i,j)]<<" ";
                sum+=d[i]+d[j]-2*d[lca(i,j)];
               }
           }
           //cout<<sum<<'\n';

           ans[sum]++;
        }
    }
    ll t=1;
    for (int i=2;i<=n-1;i++)
        t*=i;
    for (int i=1;i<=m;i++)
        cout<<ans[i]/t<<" ";




}
```