目录

[杂物 3](#_Toc512379825)

[平板电视 4](#_Toc512379826)

[Dancing Links 5](#_Toc512379827)

[一点DP的 8](#_Toc512379828)

[决策单调性优化 8](#_Toc512379829)

[斜率优化 9](#_Toc512379830)

[四边形不等式优化 9](#_Toc512379831)

[数位DP 10](#_Toc512379832)

[插头DP 10](#_Toc512379833)

[字符串的 12](#_Toc512379834)

[KMP|最小表示法 12](#_Toc512379835)

[字典树 12](#_Toc512379836)

[AC自动机 13](#_Toc512379837)

[后缀数组 14](#_Toc512379838)

[后缀自动机 15](#_Toc512379839)

[后缀自动机+主席树合并 17](#_Toc512379840)

[马拉车 18](#_Toc512379841)

[回文自动机 20](#_Toc512379842)

[二分hash 21](#_Toc512379843)

[一些hashset|hashmap 22](#_Toc512379844)

[后缀平衡树 22](#_Toc512379845)

[数据结构 25](#_Toc512379846)

[按秩合并并查集(+整体二分) 25](#_Toc512379847)

[二维树状数组 25](#_Toc512379848)

[树状数组 不大于k的最大值 26](#_Toc512379849)

[BIT\_差分 26](#_Toc512379850)

[二维线段树 26](#_Toc512379851)

[扫描线 矩形周长并 28](#_Toc512379852)

[主席树 29](#_Toc512379853)

[区间不重复数字个数和第k个是哪位 29](#_Toc512379854)

[可持久化数组(主席树维护) 30](#_Toc512379855)

[树套树 31](#_Toc512379856)

[CDQ分治(套线段树) 32](#_Toc512379857)

[SPLAY 33](#_Toc512379858)

[SPLAY启发式合并 35](#_Toc512379859)

[LCT 37](#_Toc512379860)

[KD树 39](#_Toc512379861)

[莫队 41](#_Toc512379862)

[树上莫队(套分块) 41](#_Toc512379863)

[回滚莫队套分块 42](#_Toc512379864)

[带修改莫队 43](#_Toc512379865)

[维护凸包 44](#_Toc512379866)

[线性基(套路) 45](#_Toc512379867)

[图论 46](#_Toc512379868)

[二分图匹配 46](#_Toc512379869)

[最短路 47](#_Toc512379870)

[差分约束系统 48](#_Toc512379871)

[01分数规划 49](#_Toc512379872)

[最小生成树(曼哈顿在后面) 50](#_Toc512379873)

[强连通分量tarjin 50](#_Toc512379874)

[支配树 51](#_Toc512379875)

[网络流 52](#_Toc512379876)

[最小费用流 54](#_Toc512379877)

[上下界网络流 55](#_Toc512379878)

[上下界费用流 56](#_Toc512379879)

[树分治 58](#_Toc512379880)

[部分树上dp 59](#_Toc512379881)

[2-sat 59](#_Toc512379882)

[dfs序 60](#_Toc512379883)

[dfs序\_换根的讨论233 61](#_Toc512379884)

[树链剖分 62](#_Toc512379885)

[树链剖分求LCA 63](#_Toc512379886)

[离线tarjin求LCA 63](#_Toc512379887)

[倍增 64](#_Toc512379888)

[最大团 64](#_Toc512379889)

[最小树形图 65](#_Toc512379890)

[一般图最大匹配 带花树 65](#_Toc512379891)

[数学相关 67](#_Toc512379892)

[逆元 67](#_Toc512379893)

[博弈：NIM,SG 67](#_Toc512379894)

[FFT、NTT、FWT、FMT 67](#_Toc512379895)

[子集卷积(的分治套路) 69](#_Toc512379896)

[高斯消元 70](#_Toc512379897)

[矩阵树定理|拉格朗日插值 71](#_Toc512379898)

[Polya定理| Burnside引理 72](#_Toc512379899)

[Miller\_Rabin素性测试+pollard\_rho因数分解 72](#_Toc512379900)

[中国剩余定理(不一定互质) 73](#_Toc512379901)

[Prime-counting function 73](#_Toc512379902)

[欧拉降幂公式 75](#_Toc512379903)

[其他的东西 75](#_Toc512379904)

[自适应 simpson积分 75](#_Toc512379905)

[(我全都不会的)积性函数 75](#_Toc512379906)

[超麻烦的类欧几里得 77](#_Toc512379907)

[不会的计算几何 79](#_Toc512379908)

[求凸包(旋转卡壳,最近最远点对) 79](#_Toc512379909)

#pragmacomment(linker,"/STACK:102400000,102400000")

#include <cstdio>

#include <iostream>

#include <algorithm>

#include <vector>

#include <set>

#include <map>

#include <string>

#include <cstring>

#include <stack>

#include <queue>

#include <cmath>

#include <ctime>

#include <utility>

#include <cassert>

using namespace std;

#define REP(I,N) for (I=0;I<N;I++)

#define rREP(I,N) for (I=N-1;I>=0;I--)

#define rep(I,S,N) for (I=S;I<N;I++)

#define rrep(I,S,N) for (I=N-1;I>=S;I--)

#define FOR(I,S,N) for (I=S;I<=N;I++)

#define rFOR(I,S,N) for (I=N;I>=S;I--)

#define dbg(x) cout <<#x<<" = "<<x<<" ; "

#define dbgln(x) cout <<#x<<" = "<<x<<endl

typedef unsigned long long ULL;

typedef long long LL;

const int INF=0x3f3f3f3f;

const LL INFF=0x3f3f3f3f3f3f3f3fll;

const LL M=1e9+7;

const LL maxn=1e6+7;

const double eps=0.00000001;

LL gcd(LL a, LL b) {return b?gcd(b,a%b):a;}

template<typename T>inline T abs(T a) {return a>0?a:-a;}

template<typename T>inline T powMM(T a, T b) {

T ret=1;

for (; b; b>>=1ll,a=(LL)a\*a%M)

if (b&1) ret=(LL)ret\*a%M;

return ret;

}

头文件在上面~~~~~~

杂物

**首先是没啥用的两个板子**

**void msort(int le,int ri) {//逆序对**

**if (le==ri) return;**

**int mid=(le+ri)>>1,i=le,j=mid+1,k=i;**

**msort(le,mid); msort(j,ri);**

**while (i<=mid||j<=ri) {**

**if (i==mid+1) {b[k++]=a[j++]; ans+=mid-i+1;}**

**else if (j==ri+1) b[k++]=a[i++];**

**else if (a[i]<=a[j]) b[k++]=a[i++];**

**else {b[k++]=a[j++]; ans+=mid-i+1;}**

**}**

**for (i=le; i<=ri; i++) a[i]=b[i];**

**}**

**void fqsort(int l,int r) {//O(n)第k大数**

**int le=l,ri=r,m;**

**m=a[le];**

**while (le<ri) {**

**while (le<ri&&a[ri]<=m) ri--;**

**a[le]=a[ri];**

**while (le<ri&&a[le]>=m) le++;**

**a[ri]=a[le];**

**}**

**if (le==k) printf("%d\n",m);**

**else if (le>k) fqsort(l,le-1);**

**else fqsort(le+1,r);**

**}**

**普通输入挂**

template<class T>

bool read\_d(T &num) {

char in; bool IsN=false;

in=getchar();

if (in==EOF) return false;

while (in!= '-'&&(in<'0'||in>'9')) in=getchar();

if (in=='-') {IsN=1; num=0;}

else num=in-'0';

while (in=getchar(),in>='0'&&in<='9')

num=num\*10+in-'0';

if (IsN) num=-num;

return 1;

}

template<class T>

bool read\_f(T &num) {

char in; bool IsN=false,IsD=false;

T Dec=0.1;

in=getchar();

if (in==EOF) return false;

while (in!='-'&&in!='.'&&(in<'0'||in>'9'))

in=getchar();

if (in=='-') {IsN=1; num=0;}

else if (in=='.') {IsD=1; num=0;}

else num=in-'0';

if (!IsD) while (in=getchar(),in>='0'&&in<='9')

num=num\*10+in-'0';

if (in=='.') while (in=getchar(),in>='0'&&in<='9')

{num+=Dec\*(in-'0'); Dec\*=0.1;}

if (IsN) num=-num;

return 1;

}

**fread输入挂(namespace的就是fread=-=)**

char buffer[36000000],\*buf=buffer;

char write[7000000],\*ed=write;

void read(int &x){

for(x=0;\*buf<48;++buf);

while(\*buf>=48)x=x\*10+\*buf-48,++buf;

}

void read(int &x){

for(x=0;(\*buf<'0'||\*buf>'9')&&\*buf!='-';++buf);

int flag=0;if (\*buf=='-') flag=1,buf++;

while('0'<=\*buf&&\*buf<='9')

x=x\*10+\*buf-48,++buf;

if (flag) x=-x;

}

int pp[20];

void print(LL x){

if (!x) \*ed++='0';

else {

int now=0,i;

while (x) pp[now++]=x%10,x/=10;

while (now) \*ed++=pp[--now]+48;

}\*ed++='\n';

}

fread(buffer,1,36000000,stdin);

fwrite(write,1,ed-write,stdout);

**其他挂**

**扩栈**

#ifdef OPENSTACK

int size = 256 << 20; // 256MB

char \*p = (char\*)malloc(size) + size;

#if (defined \_WIN64) or (defined \_\_unix)

\_\_asm\_\_("movq %0, %%rsp\n" :: "r"(p));

#else

\_\_asm\_\_("movl %0, %%esp\n" :: "r"(p));

#endif

#endif

注意最后加exit(0);

**玄学加速挂**

#pragma comment(linker, "/stack:200000000")

#pragma GCC optimize("Ofast,no-stack-protector")

#pragma GCC

target("sse,sse2,sse3,ssse3,sse4,popcnt,abm,mmx,avx,tune=native")

然后加上并行计算(计组)

#pragma GCC optimize("Ofast,no-stack-protector")

#pragma GCC target("avx")

**普通C(n,n)DP**

int i,j;

C[0][1]=C[1][1]=1;

FOR(j,2,Cmax) {

C[0][j]=1;

FOR(i,1,j) C[i][j]=(C[i-1][j-1]+C[i][j-1])%M;

}

平板电视

1. **红黑树**

#include<cstdio>

#include<ext/pb\_ds/assoc\_container.hpp>

#include<ext/pb\_ds/tree\_policy.hpp>

using namespace std;

using namespace \_\_gnu\_cxx;

using namespace \_\_gnu\_pbds;

typedef tree<int,null\_type,less<int>,rb\_tree\_tag,tree\_order\_statistics\_node\_update> rbtree;

/\*

定义一颗红黑树

int 关键字类型

null\_type无映射(低版本g++为null\_mapped\_type)

less<int>从小到大排序

rb\_tree\_tag 红黑树（splay\_tree\_tag）

tree\_order\_statistics\_node\_update结点更新

插入t.insert();

删除t.erase();

Rank:t.order\_of\_key();

第K值:t.find\_by\_order();

前驱:t.lower\_bound();

后继t.upper\_bound();

a.join(b)b并入a 前提是两棵树的key的取值范围不相交

a.split(v,b)key小于等于v的元素属于a，其余的属于b

T.lower\_bound(x) >=x的min的迭代器

T.upper\_bound((x) >x的min的迭代器

T.find\_by\_order(k) 有k个数比它小的数

\*/

rbtree T;

rbtree::iterator it;

1. **Rope**

#include<ext/rope>

using namespace std;

using namespace \_\_gnu\_cxx;

/\*

1）运算符：rope支持operator += -= + - < ==

2）输入输出：可以用<<运算符由输入输出流读入或输出。

3）长度/大小：调用length()，size()都可以哦

4）插入/添加等：

append(const string&)

substr(start,length)

push\_back(x);//在末尾添加x

insert(pos,x);//在pos插入x，自然支持整个char数组的一次插入

erase(pos,x);//从pos开始删除x个

copy(pos,len,x);//从pos开始到pos+len为止用x代替

replace(pos,x);//从pos开始换成x

substr(pos,x);//提取pos开始x个

at(x)/[x];//访问第x个元素

\*/

rope<int> V;

1. **二项堆(这里是dijkstra)**

#include<iostream>

#include<cstdio>

#include<cstring>

#include<ext/pb\_ds/priority\_queue.hpp>

#define ll long long

#define pa pair<ll,int>

#define llinf 9000000000000000000LL

using namespace std;

using namespace \_\_gnu\_pbds;

typedef \_\_gnu\_pbds::priority\_queue<pa,greater<pa>,pairing\_heap\_tag > heap;

int n,m,cnt,last[1000005];

int T,rxa,rxc,rya,ryc,rp;

heap::point\_iterator id[1000005];

int x,y,z;

ll dis[1000005];

struct data {int to,next,v;} e[10000005];

inline int read() {

int x=0,f=1; char ch=getchar();

while (ch<'0'||ch>'9') {if (ch=='-')f=-1; ch=getchar();}

while (ch>='0'&&ch<='9') {x=x\*10+ch-'0'; ch=getchar();}

return x\*f;

}

void insert(int u,int v,int w) {

e[++cnt].to=v; e[cnt].next=last[u]; last[u]=cnt; e[cnt].v=w;

}

void dijkstra() {

heap q;

for (int i=1; i<=n; i++)dis[i]=llinf;

dis[1]=0; id[1]=q.push(make\_pair(0,1));

while (!q.empty()) {

int now=q.top().second; q.pop();

for (int i=last[now]; i; i=e[i].next)

if (e[i].v+dis[now]<dis[e[i].to]) {

dis[e[i].to]=e[i].v+dis[now];

if (id[e[i].to]!=0)

q.modify(id[e[i].to],make\_pair(dis[e[i].to],e[i].to));

else id[e[i].to]=q.push(make\_pair(dis[e[i].to],e[i].to));

}

}

}

int main() {

n=read(); m=read();

T=read(); rxa=read(); rxc=read(); rya=read(); ryc=read(); rp=read();

int a,b;

for (int i=1; i<=T; i++) {

x=((ll)x\*rxa+rxc)%rp;

y=((ll)y\*rya+ryc)%rp;

a=min(x%n+1,y%n+1);

b=max(y%n+1,y%n+1);

insert(a,b,100000000-100\*a);

}

for (int i=1; i<=m-T; i++) {

x=read(),y=read(),z=read();

insert(x,y,z);

}

dijkstra();

printf("%lld",dis[n]);

return 0;

}

Dancing Links

1. **不可重复**

//数独

struct DLX{

const static int maxn=1e5+7;

const static int maxd=1e4+7;

int n,m,size;

int U[maxn],D[maxn],R[maxn],L[maxn],col[maxn],row[maxn];

int H[maxd],S[maxd];//S:cnt

int ans[maxn];

void init(int \_n,int \_m){

n=\_n;m=\_m;int i;

FOR(i,0,m) {

S[i]=0;

U[i]=D[i]=i;

L[i]=i-1,R[i]=i+1;

}R[m]=0;L[0]=m;

size=m;

FOR(i,0,n) H[i]=-1;

}

void link(int r,int c){

S[col[++size]=c]++;row[size]=r;

D[size]=D[c];U[D[c]]=size;

D[c]=size;U[size]=c;

if (H[r]<0) H[r]=L[size]=R[size]=size;

else{

R[size]=R[H[r]];

L[R[H[r]]]=size;

L[size]=H[r];

R[H[r]]=size;

}

}

void remove(int c){

L[R[c]]=L[c];R[L[c]]=R[c];

for (int i=D[c];i!=c;i=D[i])

for (int j=R[i];j!=i;j=R[j])

U[D[j]]=U[j],D[U[j]]=D[j],S[col[j]]--;

}

void resume(int c){

for (int i=U[c];i!=c;i=U[i])

for (int j=L[i];j!=i;j=L[j])

U[D[j]]=D[U[j]]=j,S[col[j]]++;

L[R[c]]=R[L[c]]=c;

}

char g[maxn];

bool dance(int pos){

if (R[0]==0) {

int i,j;

REP(i,pos)

g[(ans[i]-1)/16]=(ans[i]-1)%16+'A';

REP(i,16)

{REP(j,16) putchar(g[i\*16+j]);puts("");}

return 1;

}

int c=R[0];

for (int i=R[0];i;i=R[i])

if (S[i]<S[c]) c=i;

remove(c);

for (int i=D[c];i!=c;i=D[i]){

ans[pos]=row[i];

for (int j=R[i];j!=i;j=R[j]) remove(col[j]);

if (dance(pos+1)) return 1;

for (int j=L[i];j!=i;j=L[j]) resume(col[j]);

}resume(c);

return 0;

}

}dlx;

char g[27][27];

int n,m;

void add(int x,int y,int k){

int r=(x\*16+y)\*16+k;

dlx.link(r,16\*16\*0+x\*16+y+1);

dlx.link(r,16\*16\*1+x\*16+k);

dlx.link(r,16\*16\*2+y\*16+k);

dlx.link(r,16\*16\*3+(x/4\*4+y/4)\*16+k);

}

int main(){

int i,j,k;

while (~scanf("%s",g[0])){

rep(i,1,16) scanf("%s",g[i]);

dlx.init(16\*16\*16,16\*16\*4);

REP(i,16) REP(j,16) FOR(k,1,16)

if (g[i][j]=='-'||g[i][j]=='A'-1+k)

add(i,j,k);

static int x=0;

if (x) puts("");else x=1;

dlx.dance(0);

}

}

1. **可重复**

//暴力枚举,n个覆盖m; 注意一定要init

struct DLX {

const static int maxn=1e5+7;

const static int maxd=1e4+7;

int n,m,size;

int U[maxn],D[maxn],R[maxn],L[maxn];

int col[maxn],row[maxn];

int H[maxd],S[maxd];//S:cnt

int ans[maxn];

void init(int \_n,int \_m) {

n=\_n; m=\_m; int i;

FOR(i,0,m) {

S[i]=0;

U[i]=D[i]=i;

L[i]=i-1,R[i]=i+1;

} R[m]=0; L[0]=m;

size=m;

FOR(i,0,n) H[i]=-1;

}

void link(int r,int c) {

S[col[++size]=c]++; row[size]=r;

D[size]=D[c]; U[D[c]]=size;

D[c]=size; U[size]=c;

if (H[r]<0) H[r]=L[size]=R[size]=size;

else {

R[size]=R[H[r]];

L[R[H[r]]]=size;

L[size]=H[r];

R[H[r]]=size;

}

}

void remove(int c) {

for (int i=D[c]; i!=c; i=D[i])

L[R[i]]=L[i],R[L[i]]=R[i];

}

void resume(int c) {

for (int i=U[c]; i!=c; i=U[i])

L[R[i]]=R[L[i]]=i;

}

bool v[maxd];

int f() {

//估价函数,如果max的话其实可以直接cnt{R[]}

int ret=0;

for (int c=R[0]; c; c=R[c]) v[c]=1;

for (int c=R[0]; c; c=R[c]) if (v[c]) {

ret++; v[c]=0;

for (int i=D[c]; i!=c; i=D[i])

for (int j=R[i]; j!=i; j=R[j])

v[col[j]]=0;

}

return ret;

}

int cnt;

void dance(int pos) {

if (pos+f()>=cnt) return;

if (R[0]==0) {cnt=min(cnt,pos); return;}

int c=R[0];

for (int i=R[0]; i; i=R[i])

if (S[i]<S[c]) c=i;

for (int i=D[c]; i!=c; i=D[i]) {

ans[pos]=row[i];

remove(i);

for (int j=R[i]; j!=i; j=R[j]) remove(j);

dance(pos+1);

for (int j=L[i]; j!=i; j=L[j]) resume(j);

resume(i);

}

}

} dlx;

int n,m;

int check(int x,int y,int a,int b,double d) {

return (x-a)\*(x-a)+(y-b)\*(y-b)<d\*d;

}

int x1[maxn],x2[maxn],y1[maxn],y2[maxn];

int main() {

int T;

scanf("%d",&T);

while (T--) {

int k,i;

scanf("%d%d%d",&n,&m,&k);

FOR(i,1,n) scanf("%d%d",&x1[i],&y1[i]);

FOR(i,1,m) scanf("%d%d",&x2[i],&y2[i]);

double l=0,r=1500;

while (r-l>1e-7) {

int i,j;

double mid=(l+r)/2;

dlx.init(m,n);

FOR(i,1,n)

FOR(j,1,m)

if (check(x1[i],y1[i],x2[j],y2[j],mid))

dlx.link(j,i);

dlx.cnt=k+1;

dlx.dance(0);

if (dlx.cnt>k) l=mid;

else r=mid;

} printf("%.6f\n",l);

}

}

# 一点DP的

决策单调性优化

**//决策单调性优化可以处理所有斜率优化的题**

**//题意:sum{A[l]->A[k],{1<=l<r<=n,k是l->r的路径上最近的标记点}}**

**//做法:DP; 注意有时DP[0]甚至DP[1]都要预处理的**

**//注意先写好DP方程**

**//注意DP方程上代表的意义!**

**//注意不能转移的地方!一定continue,否则可能破坏可以优化的性质**

**//我的理解:从左往右来看,如果l++,那么切的点只会向右移动,xl,xr是指转折点可能出现的位置;**

**//CDQ分治,传递下去了解可能存在的区间**

**//每次更新的是mid节点**

**//bfs,dfs均可,时间均为log(莫队不影响,莫队时间可证明nlogn)**

**//CF868F题意:切区间k段,每段数字出现个数sigma{n(n-1)/2}最小的个数**

LL L1[maxn],L2[maxn],R1[maxn],R2[maxn];//前缀和之和,小技巧

LL getL(int l,int r) { //一个求l->r的点到l的sum和

return (L2[r]-L2[l])-L1[l]\*(r-l);

}

LL getR(int l,int r) {

return (R2[l]-R2[r])-R1[r]\*(r-l);

}

LL pre[maxn],dp[maxn];

struct node {

int l,r,xl,xr;

};

LL cnt,sum,sum\_sum;

queue<node> Q;

void changel(LL val,int seg) {

sum\_sum+=sum\*seg\*2;

sum\_sum-=cnt\*val\*seg\*2;

cnt+=seg; sum+=val\*seg;

}

void changer(LL val,int seg) {

sum\_sum-=sum\*seg\*2;

sum\_sum+=cnt\*val\*seg\*2;

cnt+=seg; sum+=val\*seg;

}

int \_l,\_r;

LL A[maxn];

void changeto(int l,int r) {

while (\_r<r) \_r++,changer(A[\_r],1);

while (\_l>l) \_l--,changel(A[\_l],1);

while (\_l<l) changel(A[\_l],-1),\_l++;

while (\_r>r) changer(A[\_r],-1),\_r--;

}

void solve(int n) {

int i;

Q.push(node{1,n,0,n-1});

while (Q.size()) {

auto F=Q.front(); Q.pop();

int l=F.l,r=F.r,L=F.xl,R=F.xr;//l,r,check\_l,check\_r

int m=(l+r)/2,M=L;

LL &now=dp[m];

FOR(i,L,min(m-1,R)) {

//这里changeto不会改变复杂度

LL msum=(m-i)\*getL(m,n);

LL rsum=(n-m+1)\*(getR(i+1,m)+i\*(A[m]-A[i]));

if (now>pre[i]-msum-rsum)

now=pre[i]-msum-rsum,M=i;

}

if (l<m) Q.push(node{l,m-1,L,M});

if (r>m) Q.push(node{m+1,r,M,R});

}

}

//DP[i]:i\_chosen; contains [i]->[i]; [i]->R(i+1->n)

//update:m [i-m]->[i], [i-m]->[m-n] [i-m]->[i-m]

int T;

int n,m,k;

int i,j;

int main() {

while (~scanf("%d%d",&n,&k)) {

FOR(i,1,n) scanf("%lld",&A[i]);

A[0]=A[1]; A[n+1]=A[n];

FOR(i,1,n) L1[i]=A[i]-A[i-1]+L1[i-1];

FOR(i,1,n) L2[i]=L2[i-1]+L1[i];

rFOR(i,1,n) R1[i]=A[i+1]-A[i]+R1[i+1];

rFOR(i,1,n) R2[i]=R2[i+1]+R1[i];

\_l=1; \_r=0; sum=sum\_sum=cnt=0;

changeto(1,n);

FOR(i,0,n) dp[i]=sum\_sum;

// FOR(i,1,n) printf("%lld ",dp[i]);puts(" <- start\_DP");

FOR(i,1,k) {

int i;

FOR(i,0,n) pre[i]=dp[i];

solve(n);

// FOR(m,1,n) FOR(i,0,m-1){

//// changeto(i+1,m);

//// cal:-=[m,n]->[i](differ)+[i+1-m](to m)

//// cal:-=[i+1,m]->[m,n](to m)

// LL msum=(m-i)\*getL(m,n);

// LL rsum=(n-m+1)\*(getR(i+1,m)+i\*(A[m]-A[i]));

// dp[m]=min(dp[m],pre[i]-msum-rsum);

// }

// FOR(i,1,n) printf("%lld ",dp[i]);puts(" <- DP");

}

LL ans=dp[0];

FOR(i,1,n) ans=min(ans,dp[i]);

printf("%lld\n",ans);

}

}

斜率优化

**//HDU 3480//斜率优化**

**//题意:一堆数字,切成k份,每块的代价为(max-min)^2**

**//dp方程:dp[i][j]=min{dp[k][j-1]+(a[i]-a[k+1])^2};**

**//dp方程:**

**//dp[i][j]=min{dp[k][j-1]+a[k+1]^2-2\*a[i]\*a[k+1]}+a[i]^2**

**//k=(dp[k][j-1](pre)+a[k+1]^2)/(a[k+1]),常数2\*a[i]**

**//斜率优化本质是维护一个下凸壳**

int n,m,i,j,k,t;

int a[maxn],pre[maxn],dp[maxn];

int head,tail;

int Q[maxn];//id

inline int getY(int id){

return pre[id]+a[id+1]\*a[id+1];

}

inline int getX(int id){

return a[id+1];

}

int main(){

int T,X=0;

scanf("%d",&T);

while (T--){

scanf("%d%d",&n,&m);

FOR(i,1,n) scanf("%d",&a[i]);

sort(a+1,a+1+n);

int qi,qj,qk;

FOR(i,1,n) dp[i]=(a[i]-a[1])\*(a[i]-a[1]);

FOR(j,2,m){

FOR(i,1,n) pre[i]=dp[i];

head=tail=0;

dp[0]=0;Q[tail++]=0;

FOR(i,1,n){

while (head+1<tail){

qi=Q[head],qj=Q[head+1];

if (getY(qj)-getY(qi)<=2\*a[i]\*(getX(qj)-getX(qi))) head++;

else break;

}qi=Q[head];

dp[i]=pre[qi]+(a[i]-a[qi+1])\*(a[i]-a[qi+1]);

while (head+1<tail){

qi=Q[tail-2];qj=Q[tail-1];qk=i;

int y1=getY(qj)-getY(qi),x1=getX(qj)-getX(qi);

int y2=getY(qk)-getY(qj)x2=getX(qk)-getX(qj);

if (y2\*x1<=y1\*x2) tail--;//y2/x2>y1/x1

else break;

}Q[tail++]=i;

}

}

printf("Case %d: %d\n",++X,dp[n]);

}

}

四边形不等式优化

**//HDU 3516//四边形不等式优化**

**//题意:给定一个从左上往右下的图，只能往下往右连，求一个构造使得所有的边长度总和最小**

**//dp方程:**

**//dp[i][j]=max{dp[i][k]+dp[k+1][j]+x[k+1]-x[i]+y[k]-y[j]};**

**//能用：满足:**

**//w[i][j]+w[i'][j']<=w[i][j']+w[i'][j];**

**//w[i'][j']<=w[i][j],那么决策区间包含**

struct node{

int x,y;

}a[maxn];

int n,m,i,j,k,t;

int dp[maxn][maxn],pos[maxn][maxn];

int main(){

while (~scanf("%d",&n)){

FOR(i,1,n) scanf("%d%d",&a[i].x,&a[i].y),pos[i][i]=i;

FOR(i,1,n) FOR(j,i+1,n) dp[i][j]=INF;

FOR(t,1,n-1){

FOR(i,1,n-t){

j=i+t;

FOR(k,pos[i][j-1],min(j-1,pos[i+1][j])){

int now=dp[i][k]+dp[k+1][j]+a[k+1].x-a[i].x+a[k].y-a[j].y;

if (dp[i][j]>now){

dp[i][j]=now;

pos[i][j]=k;

}

}

}

}

printf("%d\n",dp[1][n]);

}

}

数位DP

**//当板子了**

**//这道题是连续的差最大是1**

**//需要注意时间空间限制,有时需要hash**

**//注意取模时底下calc也要取-\_-**

LL f[27][17][2];

int value[27];

LL calc(int x,int prev,int not\_0,int flag) {

if (x==0) return 1;

if (!flag&&f[x][prev][not\_0]!=-1)

return f[x][prev][not\_0];

LL ret=0; int i,maxi=9;

if (flag) maxi=min(maxi,value[x]);

FOR(i,0,maxi) {

// if (not\_0||i)//这是与lead\_0有关的写法

if (not\_0&&abs(prev-i)<2) continue;

else ret+=calc(x-1,i,not\_0||i,flag&&(i==maxi));

} if (!flag) f[x][prev][not\_0]=ret;

return ret;

}LL calc(LL x) {

int length=0;

while (x) value[++length]=x%10,x/=10;

return calc(length,0,0,1);

} LL calc(LL l,LL r) {

return calc(r)-calc(l-1);

}

int n,m;

int i,j;

int T;

int main() {

memset(f,0xff,sizeof(f));

FOR(i,1,10000)

if (calc(i,i)) printf("%d ",i);

puts("");

LL l,r;

scanf("%lld%lld",&l,&r);

printf("%lld\n",calc(l,r));

}

插头DP

没什么可说的，不会写

template<typename T1,typename T2> struct hashmap {

const static int seed=999991;

const static int maxn=1e6+7;

struct node {

T1 key; T2 val; int next;

node() {};

node(T1 k,T2 v,int n):key(k),val(v),next(n) {};

} T[maxn]; //更好地空间局部性?(雾)

int head[seed],size;

void clear() {

memset(head,-1,sizeof(head));

size=0;

}

void insert(T1 pos,T2 val) {

int x=pos%seed;

T[size]=node(pos,val,head[x]);

head[x]=size++;

}

T2 &operator [](T1 x) {

for (int i=head[x%seed]; ~i; i=T[i].next)

if (T[i].key==x) return T[i].val;

insert(x,0);

return T[size-1].val;

}

};

hashmap<int,LL> MP[2];

int T;

inline int getpos(int x,int k) {

return (x>>(k+k))&3;

} inline int setpos(int x,int k,int v) {

return (x&~(3<<(k+k)))|(v<<(k+k));

} inline void remark(int k) {

static int val[7];

memset(val,0xff,sizeof(val));

}

char A[27][27];

int ex,ey;//012:#()

int main() {

T=1;

while (T--) {

int n,m;

int i,j,k;

scanf("%d%d",&n,&m);

FOR(i,1,n) scanf("%s",A[i]+1);

FOR(i,1,n) FOR(j,1,m) if (A[i][j]=='.') ex=i,ey=j;

int now=0,nxt=1;

MP[now].clear(); MP[now].insert(0,1);

FOR(i,1,n) {

FOR(j,1,m) {

MP[nxt].clear();

for (int it=0; it<MP[now].size; it++) {

int k=MP[now].T[it].key; LL w=MP[now].T[it].val;

int L=getpos(k,j-1),U=getpos(k,j);

if (A[i][j]=='\*') {//update0

if (!L&&!U) MP[nxt][k]+=w;

} else if (A[i][j]) {//update1

if (!L&&!U) {

int K=setpos(k,j-1,1);

K=setpos(K,j,2);

MP[nxt][K]+=w;

} else if ((!L)^(!U)) {

int K=setpos(k,j-1,U);

K=setpos(K,j,L);

MP[nxt][K]+=w;

MP[nxt][k]+=w;

} else if (L&&U) {

int K=setpos(k,j-1,0);

K=setpos(K,j,0);

if (L!=U) {

if (L==2||(i==ex&&j==ey))

MP[nxt][K]+=w;

} else {

if (L==1) {

int cnt=1;

for (int l=j+1; l<=m; l++) {

int x=getpos(K,l);

if (x==1) cnt++;

if (x==2) cnt--;

if (!cnt) {K=setpos(K,l,1); break;}

} MP[nxt][K]+=w;

} else if (L==2) {

int cnt=-1;

for (int l=j-2; l>=0; l--) {

int x=getpos(K,l);

if (x==1) cnt++;

if (x==2) cnt--;

if (!cnt) {K=setpos(K,l,2); break;}

} MP[nxt][K]+=w;

}

}

}

}

} now^=1; nxt^=1;

}//shift

MP[nxt].clear();

for (int it=0; it<MP[now].size; it++) {

int k=MP[now].T[it].key; LL w=MP[now].T[it].val;

if (!getpos(k,m)) MP[nxt][k<<2]+=w;

}

now^=1; nxt^=1;

} static int x;

printf("%lld",MP[now][0]);

}

}

# 字符串的

KMP|最小表示法

//记得border是个等差数列

int fail[maxn];

int check(char a[],int n){

fail[0]=fail[1]=0;

int i,j;

FOR(i,2,n){

j=fail[i-1];

while (j&&a[j+1]!=a[i]) j=fail[j];

if (a[j+1]==a[i]) fail[i]=j+1;

else fail[i]=0;

}if (n%(n-fail[n])==0) return n/(n-fail[n]);

return 1;

}

//最小表示暴力法

int getmin(char a[],int n){//1-start

int i,j,l;

FOR(i,1,n) a[i+n]=a[i];

i=1,j=2;

while (i<=n&&j<=n){

REP(l,n) if (a[i+l]!=a[j+l]) break;

if (l==n) break;

if (a[i+l]>a[j+l]) swap(i,j);

j=max(j+l+1,i+1);

}return i;

}

int n,m;

int i,j,k;

char a[maxn],b[maxn];

int main(){

while (~scanf("%s",a+1)){

n=strlen(a+1);

int now=getmin(a,n);

printf("%d %d ",now,check(a+now-1,n));

FOR(i,1,n) a[i]=-a[i];

now=getmin(a,n);

printf("%d %d\n",now,check(a+now-1,n));

}

}

字典树

//dfs格式

bool okay[maxn\*20];

bool mark[maxn\*20];

int nxt[maxn\*20][2];

bool rev[21];

int cnt;

void insert(int x,int now,int dep){

bool mark=x&(1<<dep);

if (dep==-1) {okay[now]=1; return;}

if (!nxt[now][mark]) nxt[now][mark]=++cnt;

insert(x,nxt[now][mark],dep-1);

okay[now]=okay[nxt[now][0]]&&okay[nxt[now][1]];

}

void reverse(int x,int dep){

if (dep==-1) return;

bool mark=x&(1<<dep);

rev[dep]^=mark;

reverse(x,dep-1);

}

int query(int x,int now,int dep){

if (now==0||dep==-1) return x;

if (rev[dep]^mark[now])

swap(nxt[now][0],nxt[now][1]),mark[now]^=1;

if (okay[nxt[now][0]])

return query(x|(1<<dep),nxt[now][1],dep-1);

return query(x,nxt[now][0],dep-1);

}

**//求i<j<k&&i^j<j^k的三元组个数**

**//维护val //left,right各一个**

int T,n;

LL ans;

int i,j;

int a[maxn\*32];

int nxt[maxn\*32][2];

LL num[maxn\*32],last[maxn\*32];

LL sum[maxn][32][2];//只有这位。。。

int cnt,now;

int main() {

scanf("%d",&T);

while (T--) {

ans=0;

cnt=0;

scanf("%d",&n);

FOR(i,1,n) scanf("%d",&a[i]);

FOR(i,1,n) {

rREP(j,32) {

int mark=((a[i]&(1<<j))!=0);

sum[i][j][0]=sum[i-1][j][0];

sum[i][j][1]=sum[i-1][j][1];

sum[i][j][mark]++;

}

}

rFOR(i,1,n) {

now=0;

rREP(j,32) {

int mark=((a[i]&(1<<j))!=0);

if (nxt[now][mark^1])

ans+=last[nxt[now][mark^1]]

-num[nxt[now][mark^1]]\*sum[i][j][mark];

if (!nxt[now][mark]) break;

now=nxt[now][mark];

}

now=0;

rREP(j,32) {

int mark=((a[i]&(1<<j))!=0);

if (!nxt[now][mark]) nxt[now][mark]=++cnt;

now=nxt[now][mark];

last[now]+=sum[i-1][j][mark^1];//这点之前

num[now]++;

}

}

printf("%lld\n",ans);

FOR(i,0,cnt) num[i]=last[i]=nxt[i][0]=nxt[i][1]=0;

FOR(i,1,n) REP(j,32)

sum[i][j][0]=sum[i][j][1]=0;

}

}

AC自动机

**//HDU2896,匹配多串**

struct ACM {

int next[505\*140][98],fail[505\*140],tot;

vector<int> have[maxn];

void init() {tot=0; memset(next[0],0,sizeof(next[0]));}

void insert(char a[],int id) {

int i,n=strlen(a),p=0;

REP(i,n) {

int c=a[i]-33;

if (!next[p][c]) {

next[p][c]=++tot;

have[tot].clear();

memset(next[tot],0,sizeof(next[tot]));

}

p=next[p][c];

}

have[p].push\_back(id);

} int Q[maxn],front,end;

void buildAC() {

front=end=0;

Q[end++]=0;

while (front!=end) {

int x=Q[front++],c;

REP(c,98) if (next[x][c]) {

if (!x) fail[next[x][c]]=0;

else {

int p=fail[x];

while (p&&!next[p][c]) p=fail[p];

if (next[p][c])

fail[next[x][c]]=next[p][c];

else fail[next[x][c]]=0;

}

Q[end++]=next[x][c];

}

for (int v:have[fail[x]])

have[x].push\_back(v);

}

} void query(char a[],int ans[],int &tot) {

tot=0;

int p=0;

int n=strlen(a),i;

REP(i,n) {

int c=a[i]-33;

while (p&&!next[p][c]) p=fail[p];

p=next[p][c];

for (int v:have[p]) ans[tot++]=v;

}

}

} AC;

int T,i,j,n,m,total;

char s[maxn];

int ans[505],tot;

int main() {

while (~scanf("%d",&n)) {

total=0;

AC.init();

REP(i,n) {

scanf("%s",s);

AC.insert(s,i+1);

}

AC.buildAC();

scanf("%d",&m);

REP(i,m) {

scanf("%s",s);

AC.query(s,ans,tot);

if (tot==0) continue;

printf("web %d:",i+1);

sort(ans,ans+tot);

ans[tot]=0;

REP(j,tot)

if (ans[j]!=ans[j+1]) printf(" %d",ans[j]);

puts("");

total++;

}

printf("total: %d\n",total);

}

}

后缀数组

**HDU6138,前缀+公共子串**

**int wa[maxn],wb[maxn],wv[maxn],ws1[maxn];**

**int cmp(int \*r,int a,int b,int l) {**

**return r[a]==r[b]&&r[a+l]==r[b+l];**

**}**

**//sa->pos(后缀排名->pos)**

**void da(int \*r,int \*sa,int n,int m) {**

**r[n++]=0;//使rank从1开始(sa[0]=n)**

**int i,j,p,\*x=wa,\*y=wb,\*t;**

**REP(i,m) ws1[i]=0;//pre-cmp**

**REP(i,n) ws1[x[i]=r[i]]++;//r->x**

**rep(i,1,m) ws1[i]+=ws1[i-1];**

**rREP(i,n) sa[--ws1[x[i]]]=i;//sort(计数排序)**

**for (j=1,p=1; p<n; j<<=1,m=p) { //j->2^x**

**p=0; rep(i,n-j,n) y[p++]=i; //最后j个是不用加(显然)**

**REP(i,n) if (sa[i]>=j) y[p++]=sa[i]-j;//后缀顺序**

**REP(i,n) wv[i]=x[y[i]];//x+y->wv(由于后缀顺序)**

**REP(i,m) ws1[i]=0;**

**REP(i,n) ws1[wv[i]]++;**

**rep(i,1,m) ws1[i]+=ws1[i-1];**

**rREP(i,n) sa[--ws1[wv[i]]]=y[i];//sort(计数排序)**

**t=x,x=y,y=t;**

**p=1; x[sa[0]]=0;**

**rep(i,1,n) x[sa[i]]=cmp(y,sa[i-1],sa[i],j)?p-1:p++;**

**}**

**}**

**int rnk[maxn],height[maxn];**

**void calheight(int \*r,int \*sa,int n) {**

**int i,j,k=0;**

**FOR(i,1,n) rnk[sa[i]]=i;**

**REP(i,n) {**

**if (k) k--;**

**j=sa[rnk[i]-1];**

**while (r[i+k]==r[j+k]) k++;**

**height[rnk[i]]=k;**

**}**

**}**

**int n,m;**

**int i,j,k;**

**char a[maxn];**

**int s[maxn],st[maxn];**

**int sa[maxn],id[maxn];**

**int val[maxn];**

**int tot,now,ans;**

**int main() {**

**int T;**

**scanf("%d",&T);**

**while (T--) {**

**scanf("%d",&n);**

**tot=0;**

**FOR(i,1,n) {**

**scanf("%s",a);**

**int len=strlen(a);**

**st[tot]=len;**

**REP(j,len) id[tot]=i,s[tot++]=a[j]-'a'+1;**

**s[tot++]='z'-'a'+i+1;**

**}**

**s[tot]=0;**

**da(s,sa,tot,26+n+1);**

**calheight(s,sa,tot);**

**now=0;**

**FOR(i,1,tot) {**

**val[i]=max(val[i],now);**

**now=min(now,height[i+1]);**

**if (st[sa[i]])**

**now=max(now,height[i+1]),val[i]=INF;**

**}**

**now=0;**

**rFOR(i,1,tot) {**

**val[i]=max(val[i],now);**

**now=min(now,height[i]);**

**if (st[sa[i]]) {**

**now=max(now,height[i]);**

**val[i]=max(val[i],st[sa[i]]);**

**}**

**}**

**scanf("%d",&m);**

**REP(i,m) {**

**int x,y,i;**

**scanf("%d%d",&x,&y);**

**now=0;**

**ans=0;**

**FOR(i,1,tot) {**

**if (id[sa[i]]==x&&st[sa[i]])**

**now=max(now,st[sa[i]]);**

**if (id[sa[i]]==y)**

**ans=max(ans,min(now,val[i]));**

**now=min(now,height[i+1]);**

**if (id[sa[i]]==x)**

**now=max(now,height[i+1]);**

**}**

**now=0;**

**rFOR(i,1,tot) {**

**if (id[sa[i]]==x&&st[sa[i]])**

**now=max(now,st[sa[i]]);**

**if (id[sa[i]]==y)**

**ans=max(ans,min(now,val[i]));**

**now=min(now,height[i]);**

**if (id[sa[i]]==x)**

**now=max(now,height[i]);**

**}**

**printf("%d\n",ans);**

**}**

**FOR(i,1,tot) val[i]=st[i]=0;**

**}**

**}**

后缀自动机

**// 1题意:至少在k个子串中出现的子串数量**

**// 2题意:sigma{循环后匹配cnt}**

**// 这里的len不可以直接使用~ 原因是这里的len指的是原串len**

**// fail过后,len是可以直接使用的~ (会fail到确定的节点上)**

**// 这个fail的含义是说后缀相同,向前拓展的val(一个一个拓展len差项)**

**// sam反向不为拓扑序!注意自己进行拓扑排序**

**// 更新时注意len的限制!(因为更新时可能根本没有考虑前缀len)**

**// 注意nq在更新时更新时val和q是相等的,也就是说,维护值时nq要完全和q一样**

**// sum{len[x]-len[fail[x]]}=不同串个数,每个串代表fail->this的len**

**// 每个串的位置建议存的时候就保留下来~ 要不就有点麻烦了**

**// 复制出来的虚拟节点在计算次数时不参与计算~**

**// 也就是说计算相同串个数时,复制出来的只是个虚拟的节点**

**// query时在末尾加个0可以去掉很多的判断!**

**// 加空字符时注意len,这个len有两个作用:避免topo排错,减少add特判**

**// 加的不是root,就是个空字符,dfs的话只能dfs一个串!从后往前递推可行**

**// 如果是在一颗树上建,那么直接计数排序按len排是错的!一定注意!**

**// 注意看子串时的重复~**

**// 小技巧:由于每个节点对应的len是一定的,如果想要找l->r对应串可以倍增来找到对应的串**

**// 用fail建后缀树时,压缩路径第一个位置为pos[i]-len[fail[i]]**

**// 注意一件事:我这样做是并不能保证len[fail]!=len的**

**// 只有bfs trie可以保证,这样来进行按fail排序建立后缀树**

**// dfs trie的时间复杂度是trie叶结点深度和=\_=!证明..直接当多个**

**// 只有bfs能稳定的保证复杂度,但是好像没人这样卡人**

struct SAM{

int next[maxn][26],fail[maxn],len[maxn];

int cnt,last;

void init(){

cnt=last=0;fail[0]=-1;len[0]=0;

memset(next[0],0,sizeof(next[0]));

}

void add(int c){

int np=++cnt,p=last;

memset(next[np],0,sizeof(next[np]));

len[np]=len[p]+1;

for (;p!=-1&&!next[p][c];p=fail[p]) next[p][c]=np;

if (p==-1) fail[np]=0;

else {

int q=next[p][c];

if (len[p]+1==len[q]) fail[np]=q;

else{

int nq=++cnt;len[nq]=len[p]+1;

memcpy(next[nq],next[q],sizeof(next[q]));

fail[nq]=fail[q];

fail[np]=fail[q]=nq;

for (;p!=-1&&next[p][c]==q;p=fail[p])

next[p][c]=nq;

}

}

last=np;

}

// 1:trie上建树,启发式合并set

map<int,int> have[maxn];

int Next[maxn][26],Last[maxn],tot;

void add(char a[],int id){

int n=strlen(a),i,p=0;last=0;

REP(i,n) {

int c=a[i]-'a';

if (Next[p][c]) p=Next[p][c],last=Last[p];

else add(c),Last[p=Next[p][c]=++tot]=last;

have[last][id]++;

}

}

void merge(map<int,int> &A,map<int,int> &B){

if (A.size()<B.size()) swap(A,B);

for (auto now:B) A[now.first]+=now.second;

B.clear();//delete &B;

}

vector<int> edge[maxn];

LL Ans[maxn];

void DFS(int x,int k){

for (int v:edge[x]){DFS(v,k);merge(have[x],have[v]);}

if (have[x].size()>=k) for (auto v:have[x])

Ans[v.first]+=(LL)v.second\*(len[x]-len[fail[x]]);

}

void solve(int k){

int i;

FOR(i,0,cnt) edge[i].clear();

FOR(i,1,cnt) edge[fail[i]].push\_back(i);

DFS(0,k);

}

// 2:在query前进行了cnt[np]++和沿fail增加

set<int> A;int CNT[maxn];

LL query(char a[]){

int i;LL ret=0;

int n=strlen(a),p=0,l=0;A.clear();

REP(i,n+n-1){

int c=a[i%n]-'a';

if (next[p][c]) l++,p=next[p][c];

else {

while (p!=-1&&!next[p][c]) p=fail[p];

if (p==-1) p=l=0;

else l=len[p]+1,p=next[p][c];

}while (len[fail[p]]>=n) p=fail[p],l=len[p];

if (l>=n){

if (A.count(p)) continue;

A.insert(p);

ret+=CNT[p];

}

// if (l>=n) printf("i=%2d ret+id(%2d); l=%2d; +=%d\n",i,p,l,CNT[p]);

}return ret;

}

void print(){

int i;

FOR(i,1,cnt) {

}

}

char a[maxn];

void dfs(int x=0,int len=0){

int i;

for (auto v:have[x])

printf("%2d(%2d) ",v.first,v.second);

puts("");

// printf("%-3d(fail:%-3d,len=%-2d):%s\n",x,fail[x],this->len[x],a);

REP(i,26){

if (next[x][i]){

a[len]=i+'a';

dfs(next[x][i],len+1);

a[len]=0;

}

}

}

}sam;

int n,m,T;

int i,j,k;

char a[maxn];

int main(){

scanf("%d%d",&n,&k);

sam.init();

FOR(i,1,n){

scanf("%s",a);

sam.add(a,i);

}sam.solve(k);

// sam.dfs();sam.print();

FOR(i,1,n) printf("%I64d ",sam.Ans[i]);

}

后缀自动机+主席树合并

**//查询某串部分在串l->r的最大出现次数及位置**

**//SAM(这个套路)**

**//做法:求出后缀树然后直接找到对应位置merge**

int nxt[maxn][27],pre[maxn],len[maxn];

int CNT,last;

void add(int c) {

int np=++CNT,p=last;

len[np]=len[p]+1;

for (; p&&!nxt[p][c]; p=pre[p]) nxt[p][c]=np;

if (!p) pre[np]=1;

else {

int q=nxt[p][c];

if (len[p]+1==len[q]) pre[np]=q;

else {

int nq=++CNT; len[nq]=len[p]+1;

memcpy(nxt[nq],nxt[q],sizeof(nxt[q]));

pre[nq]=pre[q];

pre[np]=pre[q]=nq;

for (; p&&nxt[p][c]==q; p=pre[p]) nxt[p][c]=nq;

}

}

last=np;

}

//segtree

int cnt;

struct node {

pair<int,int> val;//bigger

int l,r;

} tree[maxn\*25];

int root[maxn];

inline pair<int,int> add(pair<int,int> A,pair<int,int> B) {

return make\_pair(A.first+B.first,A.second);

}

inline pair<int,int> better(pair<int,int> A,pair<int,int> B) {

if (A.first==B.first) return A.second<B.second?A:B;

return A.first>B.first?A:B;

}

inline void insert(int &x,int val,int l,int r) {

if (!x) x=++cnt;

if (l==r) {

tree[x].val.first++;

tree[x].val.second=l;

return;

}

int mid=(l+r)/2;

if (val<=mid) insert(tree[x].l,val,l,mid);

else insert(tree[x].r,val,mid+1,r);

tree[x].val=better(tree[tree[x].l].val,

tree[tree[x].r].val);

}

inline int Merge(int x,int y,int l,int r) {

if (!x||!y) return x|y;

int z=++cnt;

if (l==r) {

tree[z].val=add(tree[x].val,tree[y].val);

return z;

}

int mid=(l+r)/2;

tree[z].l=Merge(tree[x].l,tree[y].l,l,mid);

tree[z].r=Merge(tree[x].r,tree[y].r,mid+1,r);

tree[z].val=better(tree[tree[z].l].val,

tree[tree[z].r].val);

return z;

}

inline pair<int,int> query(int x,int l,int r,int L,int R) {

if (!x) return make\_pair(0,0);

if (l<=L&&R<=r) return tree[x].val;

int mid=(L+R)/2;

pair<int,int> ret=make\_pair(0,0);

if (mid>=l)

ret=better(ret,query(tree[x].l,l,r,L,mid));

if (r>mid)

ret=better(ret,query(tree[x].r,l,r,mid+1,R));

return ret;

}

int father[21][maxn],pos[maxn];//倍增求father

inline int getfather(int l,int r) {

int L=(r-l+1),ret=pos[r],i;

rFOR(i,0,20) if (len[father[i][ret]]>=L)

ret=father[i][ret];

return ret;

}

int n,m,q;

int i,j,k;

char s[maxn];

int S[maxn],K[maxn];

int main() {

scanf("%s",s);

last=++CNT;

n=strlen(s);

REP(i,n) add(s[i]-'a'),pos[i+1]=last;

add(26);

scanf("%d",&m);

FOR(k,1,m) {

scanf("%s",s);

n=strlen(s);

REP(i,n) add(s[i]-'a'),insert(root[last],k,1,m);

add(26);

}

FOR(i,1,CNT) S[len[i]]++;

FOR(i,1,CNT) S[i]+=S[i-1];

FOR(i,1,CNT) K[S[len[i]]--]=i;

rFOR(i,1,CNT) {

if (pre[K[i]]) root[pre[K[i]]]=

Merge(root[pre[K[i]]],root[K[i]],1,m);

}

FOR(i,1,CNT) father[0][i]=pre[i];

FOR(j,1,20) FOR(i,1,CNT)

father[j][i]=father[j-1][father[j-1][i]];//倍增

scanf("%d",&q);

while (q--) {

int l,r,pl,pr;

scanf("%d%d%d%d",&l,&r,&pl,&pr);

int x=getfather(pl,pr);

pair<int,int> ans=query(root[x],l,r,1,m);

if (ans.first==0) printf("%d 0\n",l);

else printf("%d %d\n",ans.second,ans.first);

}

}

马拉车

**//p是每个点为中心的延伸最长回文子串长度，-1就是原串以这个点为中心的长度**

**//看到题先去想这种方法，再说其他方法**

**int n,m;**

**char s[maxn],str[maxn];**

**int len1,len2,p[maxn],ans;**

**void init() {**

**ans=0;**

**int i;**

**str[0]='+';**

**str[1]='%';**

**REP(i,len1+1) {**

**str[i\*2+2]=s[i];**

**str[i\*2+3]='%';**

**}**

**len2=len1\*2+2;**

**}**

**// 主要是说已经对称匹配过的不用再进行**

**void manacher() {**

**int id=0,mx=0;**

**int i;**

**FOR(i,1,len2-1) {**

**if (mx>i) p[i]=min(p[2\*id-i],mx-i);**

**else p[i]=1;**

**while (str[i+p[i]]==str[i-p[i]]) p[i]++;**

**if (p[i]+i>mx) {**

**mx=p[i]+i;**

**id=i;**

**}**

**}**

**}**

**int main() {**

**int i;**

**while (~scanf("%s",s)) {**

**len1=strlen(s);**

**init();**

**manacher();**

**REP(i,len2) ans=max(ans,p[i]);**

**printf("%d\n",ans-1);**

**}**

**}**

**//滚动的最长回文子串(写了好久)**

int a[maxn];

struct node{

int left,right;

}tree[maxn\*4\*8];

int val[maxn\*4\*8],lazy[maxn\*4\*8];

void change(int x,int i){

val[x]=max(val[x],i);

lazy[x]=max(lazy[x],i);

}

void pushdown(int x){

if (lazy[x]){

change(x<<1,lazy[x]);

change(x<<1|1,lazy[x]);

lazy[x]=0;

}

}

void build(int x,int l,int r){

tree[x].left=l;tree[x].right=r;

val[x]=lazy[x]=0;

if (l==r) return;

int mid=(l+r)/2;

build(x<<1,l,mid);

build(x<<1|1,mid+1,r);

}

void update(int x,int l,int r,LL val){

int L=tree[x].left,R=tree[x].right;

if (l<=L&&R<=r){

change(x,val);

return;

}

pushdown(x);

int mid=(L+R)/2;

if (mid>=l) update(x<<1,l,r,val);

if (r>mid) update(x<<1|1,l,r,val);

}

int query(int x,int pos){

int L=tree[x].left,R=tree[x].right;

if (L==R) return val[x];

pushdown(x);

int mid=(L+R)/2;

if (mid>=pos) return query(x<<1,pos);

return query(x<<1|1,pos);

}

int n,m;

char s[maxn\*2],str[maxn\*4];

int len1,len2,p[maxn\*8];

//p是每个点为中心的延伸最长回文子串长度，-1就是原串以这个点为中心的长度

int i,j,k;

int del1[maxn\*8],del2[maxn\*8];

int ans[maxn\*8];

int main(){

scanf("%d",&n);

scanf("%s",s);

rep(i,n,n\*2) s[i]=s[i-n];

//init();

int i;

len1=strlen(s);

str[0]='+';str[1]='%';

REP(i,len1+1){

str[i\*2+2]=s[i];

str[i\*2+3]='%';

}

len2=len1\*2+2;

//manacher();

int id=0,mx=0;

FOR(i,1,len2-1){

if (mx>i) p[i]=min(p[2\*id-i],mx-i);

else p[i]=1;

while (str[i+p[i]]==str[i-p[i]]) p[i]++;

if (p[i]+i>mx){

mx=p[i]+i;

id=i;

}

}

REP(i,len2) p[i]--;//manacher

//solve

REP(i,len2) {

if ((p[i]&1)==(n&1)) p[i]=min(p[i],n);

else p[i]=min(p[i],n-1);

}

build(1,1,len2\*2);

REP(i,len2){

del1[i-p[i]]=max(del1[i-p[i]],p[i]);

if (i+p[i]-n\*2>=0) del2[i+p[i]-n\*2]=max(del2[i+p[i]-n\*2],p[i]);

if (i+p[i]-n\*2<i-p[i]&&i-p[i]>0){

update(1,max(0,i+p[i]-n\*2)+1,max(0,i-p[i])+1,p[i]);

}

}

mx=0;

REP(i,len2){

if (str[i]!='%'&&str[i]!='+') mx-=2;

mx=max(mx,del1[i]);

ans[i]=max(ans[i],mx);

}

mx=0;

rREP(i,len2\*2){

if (str[i]!='%'&&str[i]!='+') mx-=2;

mx=max(mx,del2[i]);

ans[i]=max(ans[i],mx);

}

REP(i,len2) ans[i]=max(ans[i],query(1,i+1));

REP(i,n) printf("%d\n",max(ans[i\*2+1],ans[i\*2+2]));

}

回文自动机

//next是将字符拼接到两端产生的字符串!

//一定注意这一点!

//也就是说,如果从上到下累积的话,可以很容易的将其与位置联系到一起!

//注意last是可以在线的,但是如果加了个其他的可以从fail上爬的,

//在讨论外边也要向上爬,或者一次过后就保存下来下次接着使用

//对于sans,diff,slink:

//sans是把之前的series\_ans保留下来

//diff相同时,sans一定会与上一个相同(由于对称的特殊性)

//所以只需改变diff改变时的ans即可

struct Ptree{

int next[maxn][27];//空间可优化

int fail[maxn];

// cnt:这个所代表的字符串个数(下到上所有),num:上到下的length

// int cnt[maxn],num[maxn];

int len[maxn];//长度

int diff[maxn];//length(this-fail)

int slink[maxn];//diff不同的fail,共log个

// slink用来算sans,sabs转移得到ans //用来求的是分成串的个数

int S[maxn];//字符

int last;//上一个字符节点

int n,tot;//n表示字符位置

int newnode(int l){

memset(next[tot],0,sizeof(next[tot]));

// cnt[tot]=num[tot]=0;

len[tot]=l;//不是1...

return tot++;

}

void init(){

tot=0;last=n=0;

newnode(0);newnode(-1);

S[n]=-1;//减少特判

fail[0]=1;

}

int getfail(int x){

while(S[n-len[x]-1]!=S[n]) x=fail[x];

return x;

}

void add(int c){

c-='a';

S[++n]=c;

int cur=getfail(last);

if (!next[cur][c]){

int now=newnode(len[cur]+2);

fail[now]=next[getfail(fail[cur])][c];

next[cur][c]=now;//这里一定要在fail后边=\_=

diff[now]=len[now]-len[fail[now]];

if (diff[now]==diff[fail[now]])

slink[now]=slink[fail[now]];

else slink[now]=fail[now];

// num[now]=num[fail[now]]+1;

}

last=next[cur][c];

// cnt[last]++;

}

// void count(){//count完cnt才对

// int i;

// rREP(i,tot) cnt[fail[i]]+=cnt[i];

// }

}T;

int n,m;

int i,j,k;

char a[maxn],b[maxn];

LL f[maxn],sans[maxn];//g:sum; f:sum of sum

int main(){

scanf("%s",a);

n=strlen(a);

if (n%2) return 0\*puts(0);

T.init();m=0;

REP(i,n/2) b[++m]=a[i],b[++m]=a[n-i-1];

f[0]=1;

FOR(i,1,n){

T.add(b[i]);

for (int v=T.last;T.len[v]>0;v=T.slink[v]){

sans[v]=f[i-(T.len[T.slink[v]]+T.diff[v])];

if (T.diff[v]==T.diff[T.fail[v]])

(sans[v]+=sans[T.fail[v]])%=M;

if (!(i&1)) (f[i]+=sans[v])%=M;//f[x]

}

}printf("%I64d\n",f[n]);

// REP(i,T.tot) printf("%c",T.S[i]+'a');puts(" (S)");

// REP(i,T.tot) printf("%2d ",i);puts(" i");

// REP(i,T.tot) printf("%2d ",T.S[i]);puts(" S");

// REP(i,T.tot) printf("%2d ",T.fail[i]);puts(" fail");

// REP(i,T.tot) printf("%2d ",T.cnt[i]);puts(" cnt");

// REP(i,T.tot) printf("%2d ",T.len[i]);puts(" len");

// REP(i,T.tot) printf("%2d ",f[i]);puts(" f");

// REP(i,T.tot) printf("%2d ",sans[i]);puts(" g");

}

二分hash

**// 题意:求上下拼接后的最长回文串长度(很坑)**

struct hashset{

const static int seed=1e7+7;

const static int maxn=2e6+7;

struct node{

int x,y;int next;

node(){};

node(int \_x,int \_y,int n):x(\_x),y(\_y),next(n){};

}T[maxn];//更好地空间局部性?(雾)

int head[seed],size;

void clear(){

memset(head,-1,sizeof(head));

size=0;

}

void insert(int x,int y){

int& h=head[x%seed];

for (int i=h;~i;i=T[i].next)

if (T[i].x==x&&T[i].y==y) return;

T[size]=node(x,y,h);h=size++;

}

bool count(int x,int y){

for (int i=head[x%seed];~i;i=T[i].next)

if (T[i].x==x&&T[i].y==y) return 1;

return 0;

}

}have;

struct hash{

int px[maxn],val[maxn],p;

void setp(int P,int n=200000){

int i;px[0]=1;p=P;

FOR(i,1,n) px[i]=(LL)px[i-1]\*p%M;

}

void set(char a[],int n){

int i;val[0]=0;

FOR(i,1,n) val[i]=((LL)val[i-1]\*p+a[i-1])%M;

}

int get(int l,int r){

l++;r++;

int ret=val[r]-(LL)val[l-1]\*px[r-l+1]%M;

(ret<0)&&(ret+=M);return ret;

}

}HA,RB;

void manacher(char A[],int p[],int len){

int id=0,mx=0,i;

rep(i,1,len){

if (mx>i) p[i]=min(p[2\*id-i],mx-i);

else p[i]=1;

while (A[i+p[i]]==A[i-p[i]]) p[i]++;

if (p[i]+i>mx) mx=p[i]+i,id=i;

}

}

int n,i;

int s[maxn];

char a[maxn],b[maxn],A[maxn\*2],B[maxn\*2];

int PA[maxn\*2],PB[maxn\*2];//id

int len,ans;

int main(){

scanf("%d",&n);

scanf("%s%s",a,b+1);

a[n]='(';b[0]=')';n++;

A[len]='+';B[len]='-';len++;

A[len]='%';B[len]='%';len++;

REP(i,n){

A[len]=a[i];B[len]=b[i];len++;

A[len]='%'; B[len]='%'; len++;

}A[len]='\*';B[len]='/';len++;

n=len;

manacher(A,PA,len);

manacher(B,PB,len);

HA.setp(19);RB.setp(19);

HA.set(A,n);reverse(B,B+n);RB.set(B,n);

reverse(B,B+n);

rep(i,1,n){

//min(i-1-PA[i]+1,n-1-i-PA[i]+1)+1

//PA和PB的判断相同 (只需一个最大即可)

PA[i]=max(PA[i],PB[i]);

int l=0,r=min(i-PA[i],n-1-i-PA[i])+1;//r:not

while (l+1<r){

int mid=(l+r)/2;

int hash\_A=HA.get(i-PA[i]-mid+1,i-PA[i]);

int hash\_B=RB.get(n-(i+PA[i]+mid),n-1-(i+PA[i]));

if (hash\_A==hash\_B) l=mid;

else r=mid;

}ans=max(ans,PA[i]+l);

}printf("%d\n",ans-1);

}

一些hashset|hashmap

template<typename T1,typename T2> struct hashmap{

const static int seed=999991;

const static int maxn=1e6+7;

struct node{

T1 key;T2 val;int next;

node(){};

node(T1 k,T2 v,int n):key(k),val(v),next(n){};

}T[maxn];//更好地空间局部性?(雾)

int head[seed],size;

void clear(){

memset(head,-1,sizeof(head));

size=0;

}

void insert(T1 pos,T2 val){

int x=pos%seed;

T[size]=node(pos,val,head[x]);

head[x]=size++;

}

T2 &operator [](T1 x){

for (int i=head[x%seed];~i;i=T[i].next)

if (T[i].key==x) return T[i].val;

insert(x,0);

return T[size-1].val;

}

};

//用于字典树啥的空间优化

struct linknode{

struct node{

int key,val;int next;

node(){};

node(int k,int v,int n):key(k),val(v),next(n){};

}T[maxn];//更好地空间局部性?(雾)

int head[maxn],size;

void clear(){

memset(head,-1,sizeof(head));

size=0;

}

int get(int x,int y){

for (int i=head[x];~i;i=T[i].next)

if (T[i].key==y) return T[i].val;

return 0;

}

void insert(int pos,int key,int val){

T[size]=node(key,val,head[pos]);

head[pos]=size++;

}

};

后缀平衡树

//替罪羊树...这道题卡splay,treap

//题意：加字符，减字符，query子串个数

//做法：建后缀自动机+LCT；right集个数或者后缀顺序建平衡树然后树上query

//https://www.nowcoder.net/acm/contest/59/C

const double alpha=0.7;//奇了怪了..为啥0.7-0.8改改还T的

struct sat{

struct node{

int son[2];

node(){son[0]=son[1]=0;}

}T[maxn];

ULL rank[maxn];int size[maxn],val[maxn];

int pre[maxn];char c[maxn];

int cnt,root,last;

inline bool cmp(int x,int y){

return c[x]<c[y]||

(c[x]==c[y]&&rank[pre[x]]<rank[pre[y]]);

}

int tot;

int f[maxn];

void getrank(int x){

if (T[x].son[0]) getrank(T[x].son[0]);

f[++tot]=x;//不能加if (val[x]);原因我也不知道

if (T[x].son[1]) getrank(T[x].son[1]);

}

void rerank(int &x,int l,int r,ULL L,ULL R){

x=0;if (l>r) return;

ULL mid=(L+R)/2;int m=(l+r)/2;

x=f[m];rank[x]=mid;

rerank(T[x].son[0],l,m-1,L,mid-1);

rerank(T[x].son[1],m+1,r,mid+1,R);

size[x]=val[x]+size[T[x].son[0]]+size[T[x].son[1]];

}

void rebuild(int &x,ULL l,ULL r){

if (!x) return;

tot=0;getrank(x);

rerank(x,1,tot,l,r);

}

void ins(int &x,ULL l,ULL r){

ULL mid=(l+r)/2;

if (!x) {x=cnt;rank[x]=mid;return;}

size[x]++;

int p=cmp(x,cnt);

int &son=T[x].son[p];

if (p==0) ins(son,l,mid-1);

else ins(son,mid+1,r);

if (max(size[T[x].son[0]],size[T[x].son[1]])>=

size[x]\*alpha) rebuild(x,l,r);

}

void insert(char s[]){

int len=strlen(s),i;

REP(i,len){

c[++cnt]=s[i];size[cnt]=1;val[cnt]=1;

pre[cnt]=last;last=cnt;

ins(root,1ull,1ull<<63);

}

}

bool cmp(int k,char s[],int len){

for (int i=0;i<len;i++,k=pre[k]){

if (!k) return 1;

if (s[i]!=c[k]) return c[k]<s[i];

}return 0;

}

int query(char s[],int len){

int ret=0;

for (int now=root;now;){

if (!cmp(now,s,len)) now=T[now].son[0];

else {

ret+=val[now]+size[T[now].son[0]],

now=T[now].son[1];

}

}return ret;

}

int query(char s[]){

int len=strlen(s);

reverse(s,s+len);s[len]='Z'+1;s[len+1]=0;

return query(s,len+1)-query(s,len);

}

void del(int k){

int now,p;

while (k--){

for (now=root;now!=last;){

size[now]--;

p=rank[last]>rank[now];

now=T[now].son[p];

}val[last]=0;size[last]--;

last=pre[last];

}

}

}SAT;

int mask;

void decodeWithMask(char s[],int mask){

int len=strlen(s),j;

REP(j,len){

mask=(mask\*131+j)%len;

char t=s[j];

s[j]=s[mask];

s[mask]=t;

}

}

int n,m,i;

char a[3000007],op[20];

int main(){

scanf("%d",&n);

scanf("%s",a);

SAT.insert(a);

while (n--){

scanf("%s",op);

if (op[0]=='Q'){

scanf("%s",a);

decodeWithMask(a,mask);

int ans=SAT.query(a);

printf("%d\n",ans);mask^=ans;

}else if (op[0]=='D'){

scanf("%d",&i);

SAT.del(i);

}else{

scanf("%s",a);

decodeWithMask(a,mask);

SAT.insert(a);

}

}

return 0;

}

# 数据结构

按秩合并并查集(+整体二分)

**//求删去每个点后图是否存在奇环(主要是整体二分思想)**

typedef pair<int,int> pii;

#define fi first

#define se second

#define mp make\_pair

vector<pii> E[maxn<<2],have[maxn<<2],back[maxn<<2];//防爆栈

int fa[maxn],val[maxn];

pii getfa(int x){

int ret=x,color=val[ret];

while (fa[ret]!=ret) ret=fa[ret],color^=val[ret];

return mp(ret,color);

}

int sz[maxn];

int ans[maxn];

void solve(int X,int l,int r){

bool flag=0;

int i;

for(pii e:have[X]){

pii x=getfa(e.fi);

pii y=getfa(e.se);

if (x.fi==y.fi){

if (x.se==y.se){

flag=1;

break;

}

}else{

if (sz[x.fi]>sz[y.fi]) swap(x,y);

back[X].push\_back(mp(x.fi,x.se^y.se));

fa[x.fi]=y.fi;

sz[y.fi]+=sz[x.fi];

val[x.fi]^=x.se^y.se;

}

}

if (flag){

FOR(i,l,r) ans[i]=0;

}else if (l<r){

int mid=(l+r)/2;

for (pii e:E[X]){

if ((l<=e.fi&&e.fi<=mid)||(l<=e.se&&e.se<=mid))

E[X<<1].push\_back(e);

else have[X<<1].push\_back(e);

if ((mid+1<=e.fi&&e.fi<=r)||(mid+1<=e.se&&e.se<=r))

E[X<<1|1].push\_back(e);

else have[X<<1|1].push\_back(e);

}

solve(X<<1,l,mid);

solve(X<<1|1,mid+1,r);

}

for (pii u:back[X]){

sz[fa[u.fi]]-=sz[u.fi];

fa[u.fi]=u.fi;

val[u.fi]^=u.se;

}

vector<pii>().swap(E[X]);

vector<pii>().swap(have[X]);

vector<pii>().swap(back[X]);

}

int n,m;

int i;

int main()

{

int T;

scanf("%d",&T);

while (T--){

scanf("%d%d",&n,&m);

FOR(i,1,n) fa[i]=i,sz[i]=1,ans[i]=1,val[i]=1;

FOR(i,1,m){

int u,v;

scanf("%d%d",&u,&v);

if (u>v) swap(u,v);

E[1].push\_back(make\_pair(u,v));

}

solve(1,1,n);

FOR(i,1,n) printf("%d",ans[i]);puts("");

}

}

二维树状数组

**//poj2155,修改区间01,query单点01,差分来做**

int n,m;

int c[maxn][maxn];

int lowbit(int x){return x&-x;}

void update(int \_x,int \_y){

for (int x=\_x;x<=n;x+=lowbit(x))

for (int y=\_y;y<=n;y+=lowbit(y)) c[x][y]^=1;

}

int sum(int \_x,int \_y){

int ret=0;

for (int x=\_x;x;x-=lowbit(x))

for (int y=\_y;y;y-=lowbit(y)) ret^=c[x][y];

return ret;

}

int T;

char s[10];

int i,j,k;

int x1,x2,y1,y2;

int main()

{

scanf("%d",&T);

while (T--){

scanf("%d%d",&n,&m);

FOR(i,1,n) FOR(j,1,n) c[i][j]=0;

REP(i,m){

scanf("%s",s);

if (s[0]=='C'){

scanf("%d%d%d%d",&x1,&y1,&x2,&y2);

update(x1,y1);update(x2+1,y2+1);

update(x1,y2+1);update(x2+1,y1);

}else{

scanf("%d%d",&x1,&y1);

printf("%d\n",sum(x1,y1));

}

}puts("");

}

}

树状数组 不大于k的最大值

const int MAX=1000000;

inline int lowbit(int x){return x&-x;}

inline void insert(int x){

for (;x<=MAX;x+=lowbit(x)) a[x]++;

}

inline int find(int x){

while (x&&!a[x]) x^=lowbit(x);

if (!x) return 0;

int t=lowbit(x)>>1,y=a[x];

while (t){

if (y-a[x-t]) y-=a[x-t];

else{y=a[x-t];x=x-t;}

t>>=1;

}

return x;

}

BIT\_差分

LL A[maxn],B[maxn];//A\*i+B

inline int lowbit(int x){return x&-x;}

void Add(int x,LL val,LL VAL){

for (;x<=n;x+=lowbit(x)) (A[x]+=val)%=M,(B[x]+=VAL)%=M;

}

void add(int l,int r,LL val){

Add(l,val,-((l-1)\*val%M)+M);

Add(r+1,M-val,r\*val%M);

}

LL query(int x){

LL ret=0;for (int i=x;x;x-=lowbit(x)) (ret+=A[x]\*i+B[x])%=M;

return ret;

}

LL query(int l,int r){

return (query(r)-query(l-1)+M)%M;

}

二维线段树

**//单点修改区间查询min,max**

struct node{

int left,right;

}treeX[maxn\*4],treeY[maxn\*4];

int a[maxn\*4][maxn\*4];

int mx[maxn\*4][maxn\*4],mn[maxn\*4][maxn\*4];

void buildY(int x,int y,int yl,int yr){

treeY[y].left=yl,treeY[y].right=yr;

if (yl==yr){

if (treeX[x].left==treeX[x].right)

mx[x][y]=mn[x][y]=a[treeX[x].left][yl];

else{

mx[x][y]=max(mx[x<<1][y],mx[x<<1|1][y]);

mn[x][y]=min(mn[x<<1][y],mn[x<<1|1][y]);

}

return;

}

int mid=(yl+yr)/2;

buildY(x,y<<1,yl,mid);

buildY(x,y<<1|1,mid+1,yr);

mx[x][y]=max(mx[x][y<<1],mx[x][y<<1|1]);

mn[x][y]=min(mn[x][y<<1],mn[x][y<<1|1]);

}

void buildX(int x,int n,int xl,int xr){

treeX[x].left=xl,treeX[x].right=xr;

if (xl==xr){

buildY(x,1,1,n);

return;

}

int mid=(xl+xr)/2;

buildX(x<<1,n,xl,mid);

buildX(x<<1|1,n,mid+1,xr);

buildY(x,1,1,n);

}

int querymaxY(int x,int y,int yl,int yr){

int L=treeY[y].left,R=treeY[y].right;

if (yl<=L&&R<=yr){

return mx[x][y];

}

int mid=(L+R)/2,ret=0;

if (mid>=yl) ret=max(ret,querymaxY(x,y<<1,yl,yr));

if (yr>mid) ret=max(ret,querymaxY(x,y<<1|1,yl,yr));

return ret;

}

int querymaxX(int x,int xl,int xr,int yl,int yr){

int L=treeX[x].left,R=treeX[x].right;

if (xl<=L&&R<=xr){

return querymaxY(x,1,yl,yr);

}

int mid=(L+R)/2,ret=0;

if (mid>=xl) ret=max(ret,querymaxX(x<<1,xl,xr,yl,yr));

if (xr>mid) ret=max(ret,querymaxX(x<<1|1,xl,xr,yl,yr));

return ret;

}

int queryminY(int x,int y,int yl,int yr){

int L=treeY[y].left,R=treeY[y].right;

if (yl<=L&&R<=yr){

return mn[x][y];

}

int mid=(L+R)/2,ret=INF;

if (mid>=yl) ret=min(ret,queryminY(x,y<<1,yl,yr));

if (yr>mid) ret=min(ret,queryminY(x,y<<1|1,yl,yr));

return ret;

}

int queryminX(int x,int xl,int xr,int yl,int yr){

int L=treeX[x].left,R=treeX[x].right;

if (xl<=L&&R<=xr){

return queryminY(x,1,yl,yr);

}

int mid=(L+R)/2,ret=INF;

if (mid>=xl) ret=min(ret,queryminX(x<<1,xl,xr,yl,yr));

if (xr>mid) ret=min(ret,queryminX(x<<1|1,xl,xr,yl,yr));

return ret;

}

void updateY(int x,int y,int posy,int val){

int L=treeY[y].left,R=treeY[y].right;

if (L==R){

if (treeX[x].left==treeX[x].right)

mx[x][y]=mn[x][y]=val;

else{

mx[x][y]=max(mx[x<<1][y],mx[x<<1|1][y]);

mn[x][y]=min(mn[x<<1][y],mn[x<<1|1][y]);

}

return;

}

int mid=(L+R)/2;

if (mid>=posy) updateY(x,y<<1,posy,val);

else updateY(x,y<<1|1,posy,val);

mx[x][y]=max(mx[x][y<<1],mx[x][y<<1|1]);

mn[x][y]=min(mn[x][y<<1],mn[x][y<<1|1]);

}

void updateX(int x,int posx,int posy,int val){

int L=treeX[x].left,R=treeX[x].right;

if (L==R){

updateY(x,1,posy,val);

return;

}

int mid=(L+R)/2;

if (mid>=posx) updateX(x<<1,posx,posy,val);

else updateX(x<<1|1,posx,posy,val);

updateY(x,1,posy,val);

}

int n,m,q;

int i,j;

int ans;

int main(){

int T,x=0;

scanf("%d",&T);

while (T--){

scanf("%d",&n);

FOR(i,1,n)

FOR(j,1,n) scanf("%d",&a[i][j]);

buildX(1,n,1,n);

scanf("%d",&q);

printf("Case #%d:\n",++x);

while (q--){

int x,y,r;

scanf("%d%d%d",&x,&y,&r);

r/=2;

int xl=max(1,x-r),xr=min(n,x+r);

int yl=max(1,y-r),yr=min(n,y+r);

int MX=querymaxX(1,xl,xr,yl,yr);

int MN=queryminX(1,xl,xr,yl,yr);

updateX(1,x,y,(MX+MN)/2);

printf("%d\n",(MX+MN)/2);

}

}

}

扫描线 矩形周长并

int size;

int len[maxn\*2];

int n,m;

int i,j,k;

struct Seg {

struct node {

int left,right;

int len,num;

bool cl,cr;//iff

int lazy;

void update(int x) {

lazy+=x;

}

} tree[maxn\*4];

void pushup(int x) {

if (tree[x].lazy) {

tree[x].len=len[tree[x].right+1]-len[tree[x].left];

tree[x].cl=tree[x].cr=1; tree[x].num=2;

} else if (tree[x].left==tree[x].right) {

tree[x].len=0;

tree[x].cl=tree[x].cr=0; tree[x].num=0;

} else {

tree[x].len=tree[x<<1].len+tree[x<<1|1].len;

tree[x].num=tree[x<<1].num+tree[x<<1|1].num;

if (tree[x<<1].cr&&tree[x<<1|1].cl) tree[x].num-=2;

tree[x].cl=tree[x<<1].cl;

tree[x].cr=tree[x<<1|1].cr;

}

};

void build(int x,int l,int r) {

tree[x].left=l; tree[x].right=r;

tree[x].len=tree[x].lazy=0;

if (l==r) {

} else {

int mid=(l+r)/2;

build(x<<1,l,mid);

build(x<<1|1,mid+1,r);

pushup(x);

}

}

void update(int x,int l,int r,LL val) {

int L=tree[x].left,R=tree[x].right;

if (l<=L&&R<=r) {

tree[x].update(val);

pushup(x);

} else {

int mid=(L+R)/2;

if (mid>=l) update(x<<1,l,r,val);

if (r>mid) update(x<<1|1,l,r,val);

pushup(x);

}

}

int query(int x,int l,int r) { //num

int L=tree[x].left,R=tree[x].right;

if (l<=L&&R<=r) {

return tree[x].len;

} else {

int mid=(L+R)/2;

int ans;

if (mid>=l) ans+=query(x<<1,l,r);

if (r>mid) ans+=query(x<<1|1,l,r);

pushup(x);

return ans;

}

}

} T;

struct point {

int x1,x2,h;

int n;

bool operator <(const point &a)const {

if (h!=a.h) return h<a.h;

return n>a.n;

}

} a[maxn];

map<int,int> Hash;

int x1,x2,y1,y2;

int ans;

int len1,len2,num;

int main() {

while (~scanf("%d",&n)) {

if (n==0) break;

FOR(i,1,n) {

scanf("%d%d%d%d",&x1,&y1,&x2,&y2);

len[i\*2-1]=x1; len[i\*2]=x2;

a[i\*2-1].x1=x1; a[i\*2-1].x2=x2;

a[i\*2-1].n=1; a[i\*2-1].h=y1;

a[i\*2].x1=x1; a[i\*2].x2=x2;

a[i\*2].n=-1; a[i\*2].h=y2;

}

sort(a+1,a+n\*2+1);

sort(len+1,len+n\*2+1);

Hash.clear();

FOR(i,1,2\*n) Hash[len[i]]=i;

T.build(1,1,n\*2);

ans=0;

FOR(i,1,2\*n) {

len1=T.tree[1].len; num=T.tree[1].num;

T.update(1,Hash[a[i].x1],Hash[a[i].x2]-1,a[i].n);

len2=T.tree[1].len;

ans+=abs(len2-len1);

ans+=num\*(a[i].h-a[i-1].h);

}

printf("%d\n",ans);

}

}

主席树

**//静态区间第k大**

vector<int> v;//学到的hash方法

int getid(int x){return lower\_bound(v.begin(),v.end(),x)-v.begin()+1;}

int root[maxn],a[maxn],cnt;

struct Tnode{

int left,right,sum;

}T[maxn\*40];

void update(int l,int r,int &x,int y,int pos){

T[++cnt]=T[y];T[cnt].sum++;x=cnt;

if (l==r) return;

int mid=(l+r)/2;

if (mid>=pos) update(l,mid,T[x].left,T[y].left,pos);

else update(mid+1,r,T[x].right,T[y].right,pos);

}

int query(int l,int r,int x,int y,int k){

if (l==r) return l;

int mid=(l+r)/2;

int sum=T[T[y].left].sum-T[T[x].left].sum;

if (sum>=k) return query(l,mid,T[x].left,T[y].left,k);

else return query(mid+1,r,T[x].right,T[y].right,k-sum);

}

int n,m;

int i,j,k,ii;

int main()

{

scanf("%d%d",&n,&m);

FOR(i,1,n) scanf("%d",&a[i]),v.push\_back(a[i]);

sort(v.begin(),v.end());v.erase(unique(v.begin(),v.end()),v.end());

FOR(i,1,n) update(1,n,root[i],root[i-1],getid(a[i]));

REP(ii,m){

scanf("%d%d%d",&i,&j,&k);

printf("%d\n",v[query(1,n,root[i-1],root[j],k)-1]);

}

return 0;

}

区间不重复数字个数和第k个是哪位

int cnt;

struct node{

int l,r,sum;

}T[maxn\*40];

void update(int l,int r,int &x,int y,int pos,int v){

T[++cnt]=T[y],T[cnt].sum+=v,x=cnt;

if (l==r) return;

int mid=(l+r)/2;

if (mid>=pos) update(l,mid,T[x].l,T[y].l,pos,v);

else update(mid+1,r,T[x].r,T[y].r,pos,v);

}

int findsum(int l,int r,int x,int L,int R){

**//每个点记录的都是这个点往后的相同数(前面把后面短路了)**

if (L<=l&&r<=R) return T[x].sum;

int mid=(l+r)/2;

int sum=0;

if (mid>=L) sum+=findsum(l,mid,T[x].l,L,R);

if (R>mid) sum+=findsum(mid+1,r,T[x].r,L,R);

return sum;

}

int query(int l,int r,int x,int k){

if (l==r) return l;

int mid=(l+r)/2;

int sum=T[T[x].l].sum;

if (sum>=k) return query(l,mid,T[x].l,k);

else return query(mid+1,r,T[x].r,k-sum);

}

int n,m;

int i,j,k,pos;

int t,TT;

int ans[maxn],a[maxn];

int last[maxn],root[maxn];

int main()

{

scanf("%d",&TT);

FOR(t,1,TT){

scanf("%d%d",&n,&m);

FOR(i,1,n) scanf("%d",&a[i]);

FOR(i,1,n) last[a[i]]=0,root[i]=0;

cnt=0;

rFOR(i,1,n){

if (!last[a[i]]) update(1,n,root[i],root[i+1],i,1);

else {

update(1,n,root[i],root[i+1],last[a[i]],-1);

update(1,n,root[i],root[i],i,1);

}

last[a[i]]=i;

}

FOR(i,1,m){

scanf("%d%d",&j,&k);

j=(j+ans[i-1])%n+1;

k=(k+ans[i-1])%n+1;

if (j>k) swap(j,k);

pos=(findsum(1,n,root[j],j,k)+1)/2;

ans[i]=query(1,n,root[j],pos);

}

printf("Case #%d:",t);

FOR(i,1,m) printf(" %d",ans[i]);

puts("");

}

return 0;

}

可持久化数组(主席树维护)

struct Tnode{

int left,right,val;

}T[maxn\*80];

int cnt=0;

void build(int &x,int l,int r){

if (!x) x=++cnt;

if (l==r) {T[x].val=l; return;}

int mid=(l+r)/2;

build(T[x].left,l,mid);

build(T[x].right,mid+1,r);

}

void update(int &x,int y,int pos,int val,int l,int r){

T[++cnt]=T[y];x=cnt;

if (l==r) {T[x].val=val; return;}

int mid=(l+r)/2;

if (mid>=pos) update(T[x].left,T[y].left,pos,val,l,mid);

else update(T[x].right,T[y].right,pos,val,mid+1,r);

}

int query(int x,int pos,int l,int r){

if (l==r) return T[x].val;

int mid=(l+r)/2;

if (mid>=pos) return query(T[x].left,pos,l,mid);

else return query(T[x].right,pos,mid+1,r);

}

int root[maxn];

int n,m;

int i,j,k,t;

int a,b,ans;

inline int getfather(int x){

int t=query(root[i],x,1,n);

if (t==x) return x;

int fa=getfather(t);

update(root[i],root[i],x,fa,1,n);

return fa;

}

int main()

{

scanf("%d%d",&n,&m);

build(root[0],1,n);

FOR(i,1,m){

scanf("%d",&k);

root[i]=root[i-1];

if (k==1){

scanf("%d%d",&a,&b);

a^=ans;b^=ans;

int x=getfather(a),y=getfather(b);

if (x==y) continue;

update(root[i],root[i],x,y,1,n);

}else if (k==2){

scanf("%d",&t);

t^=ans;

root[i]=root[t];

}else{

scanf("%d%d",&a,&b);

int x=getfather(a),y=getfather(b);

a^=ans;b^=ans;

if (x==y) puts("1"),ans=1;

else puts("0"),ans=0;

}

}

return 0;

}

树套树

**// zoj2112动态第k大(这个是类似kuangbin大佬的做法按点建树，我按权值多个log...)**

struct node{

int l,r,cnt;

node(){l=r=cnt=0;}

}T[2500010];

int cnt;

int SIZE;

inline int lowbit(int x){

return x&(-x);

}

void Update(int &x,int y,int l,int r,int pos,int val){

T[++cnt]=T[y];T[cnt].cnt+=val;x=cnt;

if (l==r) return;

int mid=(l+r)/2;

if (mid>=pos) Update(T[x].l,T[y].l,l,mid,pos,val);

else Update(T[x].r,T[y].r,mid+1,r,pos,val);

}

int n,m;

int root[maxn];

void update(int x,int pos,int val){

while (x<=n){

Update(root[x],root[x],1,SIZE,pos,val);

x+=lowbit(x);

}

}

int ROOT[maxn];

int useL[maxn],useR[maxn];//现在的l/r

int Query(int l,int r,int L,int R,int pos,int pre\_L,int pre\_R){//颜色,pos L->R

if (l==r) return l;

int x;

int mid=(l+r)/2,nowcnt=0;

for(x=L-1;x;x-=lowbit(x)) nowcnt-=T[T[useL[x]].l].cnt;

for(x=R;x;x-=lowbit(x)) nowcnt+=T[T[useR[x]].l].cnt;

nowcnt+=T[T[pre\_R].l].cnt-T[T[pre\_L].l].cnt;

if (nowcnt>=pos){

for(x=L-1;x;x-=lowbit(x)) useL[x]=T[useL[x]].l;

for(x=R;x;x-=lowbit(x)) useR[x]=T[useR[x]].l;

return Query(l,mid,L,R,pos,T[pre\_L].l,T[pre\_R].l);

}else{

for(x=L-1;x;x-=lowbit(x)) useL[x]=T[useL[x]].r;

for(x=R;x;x-=lowbit(x)) useR[x]=T[useR[x]].r;

return Query(mid+1,r,L,R,pos-nowcnt,T[pre\_L].r,T[pre\_R].r);

}

}

int query(int L,int R,int pos){

int x;

for(x=L-1;x;x-=lowbit(x)) useL[x]=root[x];

for(x=R;x;x-=lowbit(x)) useR[x]=root[x];

return Query(1,SIZE,L,R,pos,ROOT[L-1],ROOT[R]);

}

char K[maxn],Q[20];

int A[maxn][4];

int a[maxn];

vector<int> H;

inline int getid(int x){return lower\_bound(H.begin(),H.end(),x)-H.begin()+1;}

void solve(){

scanf("%d%d",&n,&m);

int i;

FOR(i,1,n) scanf("%d",&a[i]),H.push\_back(a[i]);

REP(i,m){

scanf("%s",Q);

K[i]=Q[0];

if (K[i]=='Q') scanf("%d%d%d",&A[i][0],&A[i][1],&A[i][2]);

if (K[i]=='C') scanf("%d%d",&A[i][0],&A[i][1]),H.push\_back(A[i][1]);

}

sort(H.begin(),H.end());H.erase(unique(H.begin(),H.end()),H.end());

SIZE=H.size();

cnt=0;

FOR(i,1,n) Update(ROOT[i],ROOT[i-1],1,SIZE,getid(a[i]),1);

REP(i,m){

if (K[i]=='Q') printf("%d\n",H[query(A[i][0],A[i][1],A[i][2])-1]);//l,r,pos

if (K[i]=='C'){

update(A[i][0],getid(a[A[i][0]]),-1);

a[A[i][0]]=A[i][1];

update(A[i][0],getid(A[i][1]),1);

}

}

FOR(i,1,n) root[i]=0;

FOR(i,1,cnt) T[i]=node();

vector<int>().swap(H);

}

int main(){

T[0].cnt=T[0].l=T[0].r=0;

int T\_T;

scanf("%d",&T\_T);

while (T\_T--) solve();

}

CDQ分治(套线段树)

**// CF848C CDQ分治（区间数字出现的r-l之和）**

**//将所有操作计算成为add和del,然后solve(l,r),再去除影响**

const LL MAX=10000007;

struct node{

int l,r;

LL sum;

}T[MAX];

int cnt;

void Update(int &x,int pos,int val,int l,int r){

if (!x) x=++cnt;

T[x].sum+=val;

if (l==r) return;

int mid=(l+r)/2;

if (mid>=pos) Update(T[x].l,pos,val,l,mid);

else Update(T[x].r,pos,val,mid+1,r);

}

LL Query(int x,int l,int r,int L,int R){

if (!x||(l<=L&&R<=r)) return T[x].sum;

int mid=(L+R)/2;

LL ret=0;

if (mid>=l) ret+=Query(T[x].l,l,r,L,mid);

if (r>mid) ret+=Query(T[x].r,l,r,mid+1,R);

return ret;

}

int n,m;

int root[maxn];

inline int lowbit(int x){

return x&-x;

}

void update(int x,int pos,int val){

for (;x<=n;x+=lowbit(x)) Update(root[x],pos,val,1,n);

}

LL query(int x,int l,int r){

LL ret=0;

for (;x;x-=lowbit(x))

ret+=Query(root[x],l,r,1,n);//其实还是应该是r-(l-1)的

return ret;

}

int a[maxn];

set<int> S[maxn];

void ins(int pos,int val){//固定R (L用前缀和)

S[val].insert(pos);

set<int>::iterator it=S[val].lower\_bound(pos),itt=it;itt++;

int pre=0,suf=0;

if (it!=S[val].begin()) it--,pre=\*it;

if (itt!=S[val].end()) suf=\*itt;

if (pre) update(pos,pre,pos-pre);

if (suf) update(suf,pos,suf-pos);

if (pre&&suf) update(suf,pre,pre-suf);

}

void del(int pos,int val){

set<int>::iterator it=S[val].lower\_bound(pos),itt=it;itt++;

int pre=0,suf=0;

if (it!=S[val].begin()) it--,pre=\*it;

if (itt!=S[val].end()) suf=\*itt;

if (pre) update(pos,pre,-(pos-pre));

if (suf) update(suf,pos,-(suf-pos));

if (pre&&suf) update(suf,pre,-(pre-suf));

S[val].erase(pos);

}

int i;

int main(){

scanf("%d%d",&n,&m);

FOR(i,1,n){

scanf("%d",&a[i]);

ins(i,a[i]);

}

REP(i,m){

int k;

scanf("%d",&k);

if (k==1){

int p,x;

scanf("%d%d",&p,&x);

del(p,a[p]);

a[p]=x;

ins(p,a[p]);

}else if (k==2){

int l,r;

scanf("%d%d",&l,&r);

printf("%I64d\n",query(r,l,r));

}

}

}

SPLAY

int a[maxn],cnt;

struct splay\_tree{

struct node{

int val,min,add,size,son[2];//add=lazy

bool rev;

void init(int \_val){//开始时T[i].val==a[i-1](线性的);

val=min=max=\_val;size=1;

if (\_val==INF) max=-INF;

add=rev=son[0]=son[1]=0;

}

}T[maxn\*2];//内存池

int fa[maxn\*2],root,tot;

void pushup(int x){

T[x].min=T[x].max=T[x].val;T[x].size=1;

if (T[x].val==INF) T[x].max=-INF;

if (T[x].son[0]){

T[x].min=min(T[x].min,T[T[x].son[0]].min);

T[x].max=max(T[x].max,T[T[x].son[0]].max);

T[x].size+=T[T[x].son[0]].size;

}

if (T[x].son[1]){

T[x].min=min(T[x].min,T[T[x].son[1]].min);

T[x].max=max(T[x].max,T[T[x].son[1]].max);

T[x].size+=T[T[x].son[1]].size;

}

}

void pushdown(int x){

if (x==0) return;

if (T[x].add){

if (T[x].son[0]){

T[T[x].son[0]].val+=T[x].add;

T[T[x].son[0]].min+=T[x].add;

T[T[x].son[0]].max+=T[x].add;

T[T[x].son[0]].add+=T[x].add;

}

if (T[x].son[1]){

T[T[x].son[1]].val+=T[x].add;

T[T[x].son[1]].min+=T[x].add;

T[T[x].son[1]].max+=T[x].add;

T[T[x].son[1]].add+=T[x].add;

}

T[x].add=0;

}

if (T[x].rev){

if (T[x].son[0]) T[T[x].son[0]].rev^=1;

if (T[x].son[1]) T[T[x].son[1]].rev^=1;

swap(T[x].son[0],T[x].son[1]);

T[x].rev=0;

}

}

void rotate(int x,int kind){//zig(1->) zag(0<-)都行

int y=fa[x],z=fa[y];

T[y].son[!kind]=T[x].son[kind],fa[T[x].son[kind]]=y;

T[x].son[kind]=y,fa[y]=x;

T[z].son[T[z].son[1]==y]=x,fa[x]=z;

pushup(y);

}

void splay(int x,int goal){//node x->goal's son

if (x==goal) return;

while (fa[x]!=goal){

int y=fa[x],z=fa[y];

pushdown(z),pushdown(y),pushdown(x);

int rx=T[y].son[0]==x,ry=T[z].son[0]==y;

if (z==goal) rotate(x,rx);

else{

if (rx==ry) rotate(y,ry);

else rotate(x,rx);

rotate(x,ry);

}

}

pushup(x);

if (goal==0) root=x;

}

int select(int pos){//getnode

int u=root;

pushdown(u);

while (T[T[u].son[0]].size!=pos){//这里由于头节点有个-INF 所以不-1

if (pos<T[T[u].son[0]].size) u=T[u].son[0];

else{

pos-=T[T[u].son[0]].size+1;

u=T[u].son[1];

}

pushdown(u);

}

return u;

}

**//下面是自己写的一点常用?函数**

void update(int l,int r,int val){

int u=select(l-1),v=select(r+1);

splay(u,0);

splay(v,u);

T[T[v].son[0]].min+=val;

T[T[v].son[0]].max+=val;

T[T[v].son[0]].val+=val;

T[T[v].son[0]].add+=val;//lazy

}

void reverse(int l,int r){

int u=select(l-1),v=select(r+1);

splay(u,0);splay(v,u);

T[T[v].son[0]].rev^=1;

}

void revolve(int l,int r,int x){//l~r->循环往后x位

int u=select(r-x),v=select(r+1);

splay(u,0);splay(v,u);

int tmp=T[v].son[0];T[v].son[0]=0;

pushup(v);pushup(u);

u=select(l-1),v=select(l);

splay(u,0);splay(v,u);

fa[tmp]=v;

T[v].son[0]=tmp;

pushup(v);pushup(u);

}

void cut(int l,int r,int x){//l~r->去掉的x位置后 //HDU3487

int u=select(l-1),v=select(r+1);

splay(u,0);splay(v,u);

int tmp=T[v].son[0];

T[v].son[0]=0;

pushup(v);pushup(u);

u=select(x);v=select(x+1);

splay(u,0);splay(v,u);

fa[tmp]=v;

T[v].son[0]=tmp;

pushup(v);pushup(u);

}

int query\_min(int l,int r){

int u=select(l-1),v=select(r+1);

splay(u,0);

splay(v,u);

return T[T[v].son[0]].min;

}

void insert(int x,int val){

int u=select(x),v=select(x+1);

splay(u,0);

splay(v,u);

T[tot].init(val);

fa[tot]=v;

T[v].son[0]=tot++;

pushup(v);pushup(u);

}

void erase(int x){

int u=select(x-1),v=select(x+1);

splay(u,0);

splay(v,u);

T[v].son[0]=0;

pushup(v);pushup(u);

}

void exchange(int l1,int r1,int l2,int r2){//r1-l1+1?=r2-l2+1 OK

if (l1>l2){swap(l1,l2);swap(r1,r2);}

int u=select(l1-1),v=select(r1+1);

splay(u,0);splay(v,u);

int tmp=T[v].son[0];T[v].son[0]=0;

pushup(v);pushup(u);

l2-=T[tmp].size;r2-=T[tmp].size;

int \_u=select(l2-1),\_v=select(r2+1);

splay(\_u,0);splay(\_v,\_u);

fa[tmp]=\_v;

swap(T[\_v].son[0],tmp);

pushup(\_v);pushup(\_u);

u=select(l1-1),v=select(l1);

splay(u,0);splay(v,u);

fa[tmp]=v;

T[v].son[0]=tmp;

pushup(v);pushup(u);

}

int dfs(int x,int k){//小于k的值个数,会被卡

if (x==0) return 0;

if (T[x].min!=INF&&T[x].min>=k) return 0;

if (T[x].max!=-INF&&T[x].max<k) return T[x].size;

int ret=T[x].val<k;

if (T[x].son[0]) ret+=dfs(T[x].son[0],k);

if (T[x].son[1]) ret+=dfs(T[x].son[1],k);

return ret;

}

**//小于k的值个数,会被卡 应该套主席树(但是太长，两个log)**

int query(int l,int r,int k){

int u=select(l-1),v=select(r+1);

splay(u,0);splay(v,u);

return dfs(T[v].son[0],k);

}

int build(int l,int r){

if (l>r) return 0;

if (l==r) return l;

int mid=(l+r)/2;

T[mid].son[0]=build(l,mid-1);

T[mid].son[1]=build(mid+1,r);

fa[T[mid].son[0]]=fa[T[mid].son[1]]=mid;

pushup(mid);

return mid;

}

void init(int n){

tot=0;

int i;//0是虚的;

T[tot++].init(INF);//空的

T[tot++].init(INF);//前后两个-INF节点

FOR(i,1,n) T[tot++].init(a[i]);

T[tot++].init(INF);

root=build(1,tot-1);

fa[root]=0;

fa[0]=0;T[0].son[1]=root;T[0].size=0;

}

void print(int now=-1){

if (now==-1) now=root;

pushdown(now);

if (T[now].son[0]) print(T[now].son[0]);

if (T[now].val!=-INF){

if (cnt++) printf(" ");

printf("%d",T[now].val);

}

if (T[now].son[1]) print(T[now].son[1]);

pushup(now);

}

}T;

SPLAY启发式合并

**//HDU6133，一棵树的合并**

struct splaytree{

struct node{

LL val,sum;

int son[2],size;

void init(LL \_val){

val=sum=\_val;size=1;

son[0]=son[1]=0;

}

}T[maxn];//编号是对应的

int fa[maxn];

int root;

inline void pushup(int x){

T[x].sum=T[x].val;

T[x].size=1;

if (T[x].son[0]){

T[x].sum+=T[T[x].son[0]].sum;

T[x].size+=T[T[x].son[0]].size;

}

if (T[x].son[1]){

T[x].sum+=T[T[x].son[1]].sum;

T[x].size+=T[T[x].son[1]].size;

}

}

void rotate(int x,int kind){

int y=fa[x],z=fa[y];

T[y].son[!kind]=T[x].son[kind],fa[T[x].son[kind]]=y;

T[x].son[kind]=y,fa[y]=x;

T[z].son[T[z].son[1]==y]=x,fa[x]=z;

pushup(y);

}

void splay(int x,int goal){

if (x==goal) return;

while (fa[x]!=goal){

int y=fa[x],z=fa[y];

int rx=T[y].son[0]==x,ry=T[z].son[0]==y;

if (z==goal) rotate(x,rx);

else{

if (rx==ry) rotate(y,ry);

else rotate(x,rx);

rotate(x,ry);

}

}

pushup(x);

if (goal==0) root=x;

}

LL insert(int x){//x为原先位置

int u=root,f=0;

while (u){

f=u;

if (T[x].val<T[u].val) u=T[u].son[0];

else u=T[u].son[1];

}

if (T[x].val<T[f].val) T[f].son[0]=x;

else T[f].son[1]=x;

fa[x]=f;

splay(x,0);

return T[T[x].son[0]].sum+T[x].val\*(T[T[x].son[1]].size+1);

}

LL dfs(int x){

int l=T[x].son[0],r=T[x].son[1];

LL ret=0;

T[x].init(T[x].val);

if (l) ret+=dfs(l);

ret+=insert(x);

if (r) ret+=dfs(r);

return ret;

}

LL merge(int x,int y,LL tmp,LL ret){

if (x==y) return tmp;

splay(x,0);splay(y,0);

if (T[x].size>T[y].size) swap(x,y),swap(tmp,ret);

root=y;

ret+=dfs(x);

return ret;

}

int getkth(int x,int k){//未验证,抄的前面那个板子

int u=root;

while (T[T[u].son[0]].size!=k){

if (k<T[T[u].son[0]].size) u=T[u].son[0];

else{

k-=T[T[u].son[0]].size+1;

u=T[u].son[1];

}

}

return T[x].val;

}

}T;

int n,m;

vector<int> edge[maxn];

LL ans[maxn];

int val[maxn];

void dfs(int x,int fa){

ans[x]=val[x];

for (int v:edge[x]){

if (v==fa) continue;

dfs(v,x);

ans[x]=T.merge(x,v,ans[x],ans[v]);

}

}

int i,j,k;

int main(){

int TT;

scanf("%d",&TT);

while (TT--){

scanf("%d",&n);

FOR(i,1,n) scanf("%d",&val[i]);

REP(i,n-1){

int u,v;

scanf("%d%d",&u,&v);

edge[u].push\_back(v);

edge[v].push\_back(u);

}

FOR(i,1,n) T.T[i].init(val[i]);

dfs(1,0);

FOR(i,1,n) printf("%lld ",ans[i]);

puts("");

FOR(i,1,n) T.fa[i]=0;

FOR(i,1,n) ans[i]=0,vector<int>().swap(edge[i]);

}

}

LCT

**//确认没写错，加边减边，改边权，查第二大值**

**//修改边权:把边当成点,mark一下,然后左右端点连边即可**

struct LCT{

struct node{

int son[2],val,size;

int max,add,cnt1;//max

int ans,lazy,cnt2;//second

bool rev;

void init(int \_val){

son[0]=son[1]=rev=add=0;

max=val=\_val;

size=1;

cnt1=1;cnt2=0;

ans=lazy=-INF;

}

}T[maxn];

bool root[maxn];

int fa[maxn];

void Reverse(int x){

T[x].rev^=1;

swap(T[x].son[0],T[x].son[1]);

}

void Add(int x,int val){

T[x].max+=val;

T[x].add+=val;

T[x].val+=val;

if (T[x].ans!=-INF) T[x].ans+=val;;

if (T[x].lazy!=-INF) T[x].lazy+=val;

}

void Change(int x,int val){//先change

T[x].max=val;

T[x].add=0;

T[x].val=val;

T[x].ans=-INF;

T[x].cnt2=-INF;

T[x].cnt1=T[x].size;

T[x].lazy=val;

}

void Update(int x,int val,int num){

if (T[x].max==val) T[x].cnt1+=num;

else if (T[x].max<val){

T[x].ans=T[x].max;

T[x].cnt2=T[x].cnt1;

T[x].max=val;

T[x].cnt1=num;

}

else if (T[x].ans==val) T[x].cnt2+=num;

else if (T[x].ans<val){

T[x].ans=val;

T[x].cnt2=num;

}

}

void pushup(int x){

T[x].size=1;

T[x].max=T[x].val;

T[x].ans=T[x].lazy=-INF;

T[x].cnt1=1;T[x].cnt2=0;

if (T[x].son[0]){

Update(x,T[T[x].son[0]].max,T[T[x].son[0]].cnt1);

Update(x,T[T[x].son[0]].ans,T[T[x].son[0]].cnt2);

T[x].size+=T[T[x].son[0]].size;

}

if (T[x].son[1]){

Update(x,T[T[x].son[1]].max,T[T[x].son[1]].cnt1);

Update(x,T[T[x].son[1]].ans,T[T[x].son[1]].cnt2);

T[x].size+=T[T[x].son[1]].size;

}

}

void pushdown(int x){

if (T[x].rev){

if (T[x].son[0]) Reverse(T[x].son[0]);

if (T[x].son[1]) Reverse(T[x].son[1]);

T[x].rev=0;

}

if (T[x].add){

if (T[x].son[0]) Add(T[x].son[0],T[x].add);

if (T[x].son[1]) Add(T[x].son[1],T[x].add);

T[x].add=0;

}

if (T[x].lazy!=-INF){

if (T[x].son[0]) Change(T[x].son[0],T[x].lazy);

if (T[x].son[1]) Change(T[x].son[1],T[x].lazy);

T[x].lazy=-INF;

}

}

void rotate(int x,int kind){

int y=fa[x],z=fa[y];

T[y].son[!kind]=T[x].son[kind],fa[T[x].son[kind]]=y;

T[x].son[kind]=y,fa[y]=x;

if (root[y]) {root[x]=true;root[y]=false;}

else T[z].son[T[z].son[1]==y]=x;

fa[x]=z;

pushup(y);

}

void Prechange(int x){

if (!root[x]) Prechange(fa[x]);

pushdown(x);

}

void splay(int x){//to root

Prechange(x);

while (!root[x]){

int y=fa[x],z=fa[y];

int rx=T[y].son[0]==x,ry=T[z].son[0]==y;

if (root[y]) rotate(x,rx);

else{

if (rx==ry) rotate(y,ry);

else rotate(x,rx);

rotate(x,ry);

}

}

pushup(x);

}

int access(int x){//只有这条链上的是mark的

int y=0;

for (;x;x=fa[x]){

splay(x);

root[T[x].son[1]]=true;

T[x].son[1]=y;

root[y]=false;

y=x;

pushup(x);

}

return y;

}

bool judge(int u,int v){

while (fa[u]) u=fa[u];

while (fa[v]) v=fa[v];

return u==v;

}

void makeroot(int x){

access(x);

splay(x);

Reverse(x);

}

bool link(int u,int v){

if (judge(u,v)) return 1;

makeroot(u);

fa[u]=v;

return 0;

}

bool cut(int u,int v){

makeroot(u);

splay(v);

fa[T[v].son[0]]=fa[v];

fa[v]=0;

root[T[v].son[0]]=true;

T[v].son[0]=0;

pushup(v);

return 0;

}

bool add(int u,int v,int val){

makeroot(u);

access(v);

splay(v);

Add(v,val);

return 0;

}

bool change(int u,int v,int val){

makeroot(u);

access(v);

splay(v);

Change(v,val);

return 0;

}

pair<int,int> ask(int u,int v){

makeroot(u);

access(v);

splay(v);

return make\_pair(T[v].ans,T[v].cnt2);

}

}T;

vector<int> edge[maxn];

void dfs(int x,int fa){

T.fa[x]=fa;

for (int v:edge[x]) if (v!=fa) dfs(v,x);

}

int n,m,TT;

int i,j,k;

int u,v;

int main(){

int x=0;

scanf("%d",&TT);

while (TT--) {

scanf("%d%d",&n,&m);

FOR(i,1,n){

int val;

scanf("%d",&val);

T.T[i].init(val);

}

FOR(i,1,n) T.root[i]=1;

REP(i,n-1){

scanf("%d%d",&u,&v);

edge[u].push\_back(v);

edge[v].push\_back(u);

}

dfs(1,0);

printf("Case #%d:\n",++x);

while(m--){

scanf("%d",&k);

int x,y;

if (k==1){

int x0,y0;

scanf("%d%d%d%d",&x,&y,&x0,&y0);

T.cut(x,y);

T.link(x0,y0);

}else if (k==2){

int val;

scanf("%d%d%d",&x,&y,&val);

T.change(x,y,val);

}else if (k==3){

int val;

scanf("%d%d%d",&x,&y,&val);

T.add(x,y,val);

}else if (k==4){

scanf("%d%d",&x,&y);

pair<int,int> t=T.ask(x,y);

if (t.first==-INF) puts("ALL SAME");

else printf("%d %d\n",t.first,t.second);

}

}

FOR(i,1,n) edge[i].clear();

}

}

KD树

**//线段树套KD树**

**//KD树,对于子树需要维护区间**

**//时间复杂度:nsqrt(n)**

**//最近距离的话,注意剪枝要减得多,用矩形限制**

**//可以通过对左右估值来确定query顺序**

namespace KDT {

const double alpha=0.75;

const int DIM=2;

struct point {

int A[DIM],max[DIM],min[DIM];

int l,r; int size;

void init() {

l=r=0; initval();

}

void initval() {

int i; size=1;

REP(i,DIM) min[i]=max[i]=A[i];

}

} T[maxn\*30]; int TOT;

int Cur;

bool cmp(int x,int y) {

return T[x].A[Cur]<T[y].A[Cur];

}

void update(int x) {

int i; T[x].initval();

int l=T[x].l,r=T[x].r;

if (l) T[x].size+=T[l].size;

if (r) T[x].size+=T[r].size;

REP(i,DIM) {

if (l) {

T[x].max[i]=max(T[x].max[i],T[l].max[i]);

T[x].min[i]=min(T[x].min[i],T[l].min[i]);

}

if (r) {

T[x].max[i]=max(T[x].max[i],T[r].max[i]);

T[x].min[i]=min(T[x].min[i],T[r].min[i]);

}

}

}

int id[maxn],tot;

void build(int &x,int l,int r,int cur) { //should have id

x=0; if (l>r) return;

int m=(l+r)/2; Cur=cur;

nth\_element(id+l,id+m,id+r+1,cmp);

x=id[m];

build(T[x].l,l,m-1,cur^1);

build(T[x].r,m+1,r,cur^1);

update(x);

}

void getid(int x) { //没有顺序=\_=

id[++tot]=x;

if (T[x].l) getid(T[x].l);

if (T[x].r) getid(T[x].r);

}

void rebuild(int &x,int cur) {

tot=0; getid(x);

build(x,1,tot,cur);

}

void insert(int &x,int now,int cur) {

if (!x) {x=now; return;}

Cur=cur;

if (cmp(now,x)) insert(T[x].l,now,cur^1);

else insert(T[x].r,now,cur^1);

update(x);

if (T[x].size\*alpha+3<max(T[T[x].l].size,T[T[x].r].size))

rebuild(x,cur);

}

void addnode(int &x,int px,int py) {

TOT++; T[TOT].A[0]=px; T[TOT].A[1]=py;

T[TOT].init(); insert(x,TOT,0);

}

int x0,y0,x1,y1;//check两个=\_=

int check(int x,int y) {

return x0<=x&&x<=x1&&y0<=y&&y<=y1;

}

int ok(point &A) {

return check(A.A[0],A.A[1]);

}

int allin(point &A) {

return x0<=A.min[0]&&A.max[0]<=x1&&

y0<=A.min[1]&&A.max[1]<=y1;

}

int allout(point &A) {

return A.max[0]<x0||x1<A.min[0]||

A.max[1]<y0||y1<A.min[1];

}

int query(int x) {

if (!x) return 0;

if (allin(T[x])) return T[x].size;

if (allout(T[x])) return 0;

int ret=0;

if (ok(T[x])) ret++;

if (T[x].size==1) return ret;

ret+=query(T[x].l);

ret+=query(T[x].r);

return ret;

}

}

const int MAX=1e9+7;

struct Tnode {

int l,r,KD\_root;

Tnode() {l=r=KD\_root=0;}

} T[maxn\*30]; int cnt;

void update(int &x,int px,int py,int pos,int L,int R) {

if (!x) x=++cnt;

KDT::addnode(T[x].KD\_root,px,py);

if (L==R) return;

int mid=(L+R)/2;

if (pos<=mid) update(T[x].l,px,py,pos,L,mid);

else update(T[x].r,px,py,pos,mid+1,R);

}

int query(int x,int k,int L,int R) {

if (!x) return 0;

if (L==R) return L;

int mid=(L+R)/2;

if (T[x].r) {

int rk=KDT::query(T[T[x].r].KD\_root);

if (rk<k) return query(T[x].l,k-rk,L,mid);

return query(T[x].r,k,mid+1,R);

} return query(T[x].l,k,L,mid);

}

char buffer[36000000],\*buf=buffer;

void read(int &x) {

for (x=0; \*buf<48; ++buf);

while (\*buf>=48)x=x\*10+\*buf-48,++buf;

}

int n,q;

int i,j,k;

int root,lastans;

int main() {

fread(buffer,1,36000000,stdin);

read(n); read(q); KDT::TOT=0;

FOR(i,1,q) {

int op;

read(op);

if (op==1) {

int x,y,v;

read(x); read(y); read(v);

x^=lastans; y^=lastans; v^=lastans;

update(root,x,y,v,0,MAX);

} else {

int x1,y1,x2,y2,k;

read(x1); read(y1); read(x2); read(y2); read(k);

x1^=lastans; y1^=lastans;

x2^=lastans; y2^=lastans;

k^=lastans;

KDT::x0=x1; KDT::y0=y1;

KDT::x1=x2; KDT::y1=y2;

lastans=query(root,k,0,MAX);

if (!lastans) puts("NAIVE!ORZzyz.");

else printf("%d\n",lastans);

}

}

}

莫队

struct node{int l,r,id;}Q[maxn];//new direction

int pos[maxn];

LL ans[maxn],flag[maxn];

int a[maxn];

bool cmp(node a,node b){

if (pos[a.l]==pos[b.l]) return a.r<b.r;

return pos[a.l]<pos[b.l];

}

int n,m,k; int i,j;

LL Ans;

int L=1,R=0;

void add(int x){

Ans+=flag[a[x]^k];

flag[a[x]]++; }

void del(int x){

flag[a[x]]--;

Ans-=flag[a[x]^k]; }

int main(){

scanf("%d%d%d",&n,&m,&k);

int sz=sqrt(n);

FOR(i,1,n){

scanf("%d",&a[i]);

a[i]^=a[i-1];

pos[i]=i/sz;

}

FOR(i,1,m){

scanf("%d%d",&Q[i].l,&Q[i].r);

Q[i].id=i;

}

sort(Q+1,Q+1+m,cmp);

flag[0]=1;

FOR(i,1,m){

while (L<Q[i].l){del(L-1);L++;}

while (L>Q[i].l){L--;add(L-1);}

while (R<Q[i].r){R++;add(R);}

while (R>Q[i].r){del(R);R--;}

ans[Q[i].id]=Ans;

}

FOR(i,1,m) printf("%I64d\n",ans[i]);

}

树上莫队(套分块)

**//http://codeforces.com/gym/100962/attachments**

**//题意是求路径上最小没出现数字**

**//主要思路是分类,每个点进出各算一次可以消除影响**

const int SIZE=500;

vector<pair<int,int> > edge[maxn];

int cl[maxn],cr[maxn],val[maxn],dfn[maxn<<1];

int tot;

int dfs(int x,int fa) {

cl[x]=++tot; dfn[tot]=x;

for (auto now:edge[x]) if (now.first!=fa) {

dfs(now.first,x);

val[now.first]=now.second;

} cr[x]=++tot; dfn[tot]=x;

}

int block[maxn<<1];

struct node {

int l,r,id;

} Q[maxn];

int cmp(node a,node b) {

if (block[a.l]==block[b.l]) return a.r<b.r;

return block[a.l]<block[b.l];

}

bool vis[maxn];

int cnt[maxn],cur[maxn];//block,now

void change(int x) {

x=dfn[x]; vis[x]^=1;

if (vis[x]) {

if (!cur[val[x]]) cnt[block[val[x]]]++;

cur[val[x]]++;

} else {

cur[val[x]]--;

if (!cur[val[x]]) cnt[block[val[x]]]--;

}

}

int ans[maxn];

int L,R;

int main() {

int n,q;

int i;

scanf("%d%d",&n,&q);

FOR(i,0,n\*2+1) block[i]=i/SIZE;

REP(i,n-1) {

int u,v,len;

scanf("%d%d%d",&u,&v,&len); len=min(len,n+1);

edge[u].push\_back(make\_pair(v,len));

edge[v].push\_back(make\_pair(u,len));

}

val[1]=n+1; dfs(1,0);

REP(i,q) {

int a,b;

scanf("%d%d",&a,&b);

if (cl[a]>cl[b]) swap(a,b);

if (cr[a]>cr[b]) Q[i].l=cl[a]+1,Q[i].r=cl[b];

else Q[i].l=cr[a],Q[i].r=cl[b];

Q[i].id=i;

}

sort(Q,Q+q,cmp);

L=1; R=0;

REP(i,q) {

while (L<Q[i].l) {change(L); L++;}

while (R>Q[i].r) {change(R); R--;}

while (L>Q[i].l) {L--; change(L);}

while (R<Q[i].r) {R++; change(R);}

int now=0;

while (cnt[now]==SIZE) now++;

now\*=SIZE;

while (cur[now]) now++;

ans[Q[i].id]=now;

}

REP(i,q) printf("%d\n",ans[i]);

}

回滚莫队套分块

**//北京区域赛**

**//分块\_状态直接记录转移,比滚动要慢**

**//回滚分块(然而我没回滚,记录了一下)**

**//queries按照左端点排序(有边的要按照我这种方式来排,否则菊花图会卡死)**

**//按右端点往右走,走到头即可**

int SIZE;

struct node {

int u,v,id,o;

node() {};

node(int \_u,int \_v,int \_id=0):u(\_u),v(\_v),id(\_id) {};

} to[maxn],re[maxn],queries[maxn];

int BID[maxn],L[maxn];

bool cmpu(node A,node B) {

if (A.u!=B.u) return A.u<B.u;

if (A.v!=B.v) return A.v>B.v;//为了避免漏掉

return A.id>B.id;

} bool cmpv(node A,node B) {

if (A.v!=B.v) return A.v<B.v;

if (A.u!=B.u) return A.u<B.u;

return A.id<B.id;

} bool cmpQ(node A,node B) {

if (A.o!=B.o) return A.o<B.o;

if (A.v!=B.v) return A.v<B.v;

if (A.u!=B.u) return A.u<B.u;

return A.id<B.id;

}

int fa[maxn],size[maxn];

LL Ans[maxn];

inline int getfa(int x) {

if (fa[x]==x) return x;

return fa[x]=getfa(fa[x]);

}

int FA[maxn],SZ[maxn],PID[maxn];

inline int getFA(int x) {

if (FA[x]==x) return x;

return FA[x]=getFA(FA[x]);

}

inline void update(int u,int pid) {

if (PID[u]!=pid) {

int f=getfa(u);

if (PID[f]!=pid) {

FA[f]=f;

PID[f]=pid;

SZ[f]=size[f];

} PID[u]=pid; FA[u]=f;

}

} int tot=0;

LL now;

int main() {

int T;

scanf("%d",&T);

while (T--) {

int n,m,q,i,j,k;

scanf("%d%d%d",&n,&m,&q);

FOR(i,0,(m+1)/SIZE) L[i]=0;

FOR(i,1,m+1) {BID[i]=i/SIZE; if (!L[i/SIZE]) L[i/SIZE]=i;}

if (q==0) SIZE=m; else SIZE=m/sqrt(q);

if (!SIZE) SIZE++;

FOR(i,1,m) {

int u,v;

scanf("%d%d",&u,&v);

if (u>v) swap(u,v);

to[i]=node(u,v);

re[i]=node(u,v);

} sort(to+1,to+m+1,cmpv);

sort(re+1,re+m+1,cmpu);

FOR(i,1,m) {

to[i].o=BID[lower\_bound(re+1,re+1+m,to[i],cmpu)-re];

re[i].o=BID[i];

}

FOR(i,1,q) {

int u,v;

scanf("%d%d",&u,&v);

if (u>v) swap(u,v);

queries[i]=node(u,v,i);

queries[i].o=BID[lower\_bound(re+1,re+1+m,queries[i],cmpu)-re];

} sort(queries+1,queries+q+1,cmpQ);

FOR(i,1,q) {

if (i==1||queries[i].o!=queries[i-1].o) { //initialize

FOR(j,1,n) fa[j]=j,size[j]=1;

j=1; now=0;

}

for (; j<=m&&to[j].v<=queries[i].v; j++) {

if (to[j].o>queries[i].o) {//sorted by l

node &e=to[j];

int x=getfa(e.u),y=getfa(e.v);

if (x==y) continue; fa[x]=y;

now+=(LL)size[x]\*size[y];

size[y]+=size[x];

}

}

LL ans=now; tot++;

for (k=L[queries[i].o]; BID[k]==queries[i].o; k++) {

if (queries[i].u<=re[k].u&&re[k].v<=queries[i].v) {

node &e=re[k];

update(e.u,tot); update(e.v,tot);

int x=getFA(e.u),y=getFA(e.v);

if (x==y) continue; FA[x]=y;

ans+=(LL)SZ[x]\*SZ[y];

SZ[y]+=SZ[x];

}

}

Ans[queries[i].id]=ans;

}

FOR(i,1,q) printf("%lld\n",Ans[i]);

}

}

带修改莫队

**//change常数大时size可以增大**

**//sort时先block,改变顺序可以降低常数**

**//n^2/3,注意常数**

**//注意change时间时排的顺序**

const int SIZE=2500;

struct queries{

int l,r,t;//pre

queries(){};

queries(int \_l,int \_r,int \_t):l(\_l),r(\_r),t(\_t){};

}Q[maxn],S[maxn];

int n,m,q;

int i,j,k;

int a[maxn];

int BLOCK[maxn];

bool cmp(queries &A,queries &B){

if (BLOCK[A.l]!=BLOCK[B.l]) return BLOCK[A.l]<BLOCK[B.l];

if (BLOCK[A.r]!=BLOCK[B.r]) return BLOCK[A.r]<BLOCK[B.r];

return (A.t<B.t)^((BLOCK[A.l]^BLOCK[A.r])&1);

}vector<int> V;

inline int getid(int x){return lower\_bound(V.begin(),V.end(),x)-V.begin()+1;}

int L,R,T;

int num[maxn],cnt[maxn];

inline void add(int pos){

int &T=num[a[pos]];

cnt[T]--;T++;cnt[T]++;

}inline void del(int pos){

int &T=num[a[pos]];

cnt[T]--;T--;cnt[T]++;

}inline void change(int pos,int val){

if (L<=pos&&pos<=R){del(pos),a[pos]=val,add(pos);}

else a[pos]=val;

}

int ans[maxn];

int main(){

scanf("%d%d",&n,&q);

FOR(i,1,n) scanf("%d",&a[i]),V.push\_back(a[i]);

FOR(i,1,q){

int op,l,r;

scanf("%d%d%d",&op,&l,&r);

if (op==1){

Q[i]=queries(l,r,i);

}if (op==2) {

S[i]=queries(l,r,a[l]);a[l]=r;

V.push\_back(a[l]);

}

}sort(V.begin(),V.end());

V.erase(unique(V.begin(),V.end()),V.end());

FOR(i,1,n) a[i]=getid(a[i]);

FOR(i,1,q) if (S[i].t) S[i].r=getid(S[i].r),S[i].t=getid(S[i].t);

FOR(i,1,max(n,q)) BLOCK[i]=i/SIZE;

sort(Q+1,Q+q+1,cmp);

L=1;R=0;T=q;cnt[0]=INF;

FOR(i,1,q) if (Q[i].t){

while (T<Q[i].t){T++;if (S[T].t) change(S[T].l,S[T].r);}

while (T>Q[i].t){if (S[T].t) change(S[T].l,S[T].t);T--;}

while (L<Q[i].l){del(L);L++;}

while (R>Q[i].r){del(R);R--;}

while (L>Q[i].l){L--;add(L);}

while (R<Q[i].r){R++;add(R);}

int now=0;

while (cnt[now]) now++;

ans[Q[i].t]=now;

}FOR(i,1,q) if (ans[i]) printf("%d\n",ans[i]);

}

维护凸包

/\*这是抄的维护上半凸壳\*/

bool Q;

struct Line {

mutable LL a,b,k;

bool operator<(const Line &o)const {

return Q?k<o.k:a<o.a;

}

};

struct convexHull:public multiset<Line> {

LL div(LL a,LL b) {

return a/b-((a^b)<0&&a%b);

}

bool getK(iterator x,iterator y) {

if (y==end()) {x->k=INFF; return 0;}

if (x->a==y->a) x->k=x->b>y->b?INFF:-INFF;

else x->k=div(y->b-x->b,x->a-y->a);

return x->k>=y->k;

}

void insPos(LL a,LL b) {

auto z=insert({a,b,0}); auto y=z++,x=y;

while (getK(y,z)) z=erase(z);

if (y!=begin()&&getK(--x,y)) getK(x,erase(y));

while ((y=x)!=begin()&&(--x)->k>=y->k)

getK(x,erase(y));

}

LL query(LL x) {

assert(size());

Q=1; auto now=lower\_bound({0,0,x}); Q=0;

return now->a\*x+now->b;

}

};

int n;

int i,j,k;

LL a[maxn],b[maxn];

LL ans[maxn];

convexHull A[maxn];

vector<int> edge[maxn];

void merge(int &x,int y) {

if (A[x].size()<A[y].size()) swap(x,y);

for (auto now:A[y]) A[x].insPos(now.a,now.b);

}

int dfs(int x,int fa) {

int ret=x;

for (auto u:edge[x]) if (u!=fa)

merge(ret,dfs(u,x));

if (A[ret].size()) ans[x]=-A[ret].query(a[x]);

else ans[x]=0;

A[ret].insPos(-b[x],-ans[x]);

return ret;

}

int main() {

scanf("%d",&n);

FOR(i,1,n) scanf("%I64d",&a[i]);

FOR(i,1,n) scanf("%I64d",&b[i]);

REP(i,n-1) {

int u,v;

scanf("%d%d",&u,&v);

edge[u].push\_back(v);

edge[v].push\_back(u);

} dfs(1,0);

FOR(i,1,n) printf("%I64d ",ans[i]);

}

线性基(套路)

struct L\_B{

LL A[63];bool have\_0;

void clear(){memset(A,0,sizeof(A));have\_0=0;}

LL XORMIN(LL x){

int i;

rREP(i,63) if ((A[i]^x)<x) x^=A[i];

return x;

}

LL XORMAX(LL x){

int i;

rREP(i,63) if ((A[i]^x)>x) x^=A[i];

return x;

}

void insert(LL x){

int i;

if (!have\_0&&!XORMIN(x)) have\_0=1;

rREP(i,63) if ((x>>i)&1){

if (!A[i]) A[i]=x;x^=A[i];

}

}

void rebuild(){

int i,j;

rREP(i,63) rREP(j,i) if ((A[i]>>j)&1) A[i]^=A[j];

}

LL querykth(LL k){

LL ret=0;int i;k-=have\_0;

REP(i,63) if (A[i]) {if(k&1) ret^=A[i];k>>=1;}

if (k) return -1;

return ret;

}

}A;

# 图论

二分图匹配

**//最小不相交路径覆盖<=>节点数-拆点以后二分图最大匹配**

**//最小相交路径覆盖<=>所有能走到的节点连边，然后节点数-拆点以后匹配**

int n,m,i,j,k,t;

vector<int>edge[N];

int used[N];

int matching[N];

/\*注意数组的标号，必须满足二分图的条件

bool dfs(int u){

int v,i;

REP(i,edge[u].size()){

v=edge[u][i];

if (!used[v]){

used[v]=1;

if (matching[v]==-1||dfs(matching[v])){

matching[v]=u;

matching[u]=v;

return 1;

}

}

}return 0;

}

int DFS(){

int ans=0;

memset(matching,-1,sizeof(matching));

int u;

FOR(u,1,n){

if (matching[u]==-1){

memset(used,0,sizeof(used));

if (dfs(u)) ans++;

}

}return ans;

}\*/

/\*注意数组的标号，必须满足二分图的条件

queue<int> Q;

int prev[N];//两格

int check[N];//matchright

int BFS(){

int ans=0;

memset(matching,-1,sizeof(matching));

memset(check,-1,sizeof(check));

FOR(i,1,n){

if (matching[i]==-1){

while (!Q.empty()) Q.pop();

Q.push(i);

prev[i]=-1;

bool flag=false;

while (!Q.empty()&&!flag){

int u=Q.front();Q.pop();

for (j=0;!flag&&j<edge[u].size();j++){

int v=edge[u][j];

if (check[v]!=i){

check[v]=i;

Q.push(matching[v]);

if (matching[v]!=-1) prev[matching[v]]=u;

else{

flag=1;

int d=u,e=v;

while (d!=-1){

int t=matching[d];

matching[d]=e;

matching[e]=d;

d=prev[d];

e=t;

}

}

}

}

}

if (matching[i]!=-1) ans++;

}

}return ans;

}\*/

int main(){

int T;

scanf("%d",&T);

while (T--){

scanf("%d%d",&n,&m);

FOR(i,1,n){

scanf("%d",&k);

edge[i].clear();

REP(j,k) scanf("%d",&t),edge[i].push\_back(t+n);

}

if (BFS()==n) puts("YES");

else puts("NO");

}

}

最短路

**Dijkstra（n^2）：**

LL n,m,x;

LL a[N+2][N+2];

LL b[N+2];

bool vis[N+2];

LL i,j,k;

LL A,B,T;

int main()

{

scanf("%lld%lld%lld",&n,&m,&x);

FOR(i,n)

FOR(j,n) a[i][j]=INF;

FOR(i,m){

scanf("%lld%lld%lld",&A,&B,&T);

a[A][B]=T;

}

FOR(i,n) {b[i]=INF;vis[i]=0;}

b[0]=INF;

b[x]=0;

int pos;

FOR(i,n){

pos=0;

FOR(j,n) if (!vis[j]&&b[j]<b[pos]) pos=j;

vis[pos]=1;

FOR(j,n) if (!vis[j]&&b[pos]+a[pos][j]<b[j]) b[j]=b[pos]+a[pos][j];

}

FOR(i,n) printf("%lld ",b[i]);

}

**Dijkstra（堆优化）：**

struct node{

int n,d;

node(){}

node(int a,int b):n(a),d(b){}

bool operator<(const node&a)const{

if (d==a.d) return n<a.n;

return d>a.d;//注意！！！

}

};

vector<node> edge[maxn];//注意这里priority\_queue是大根堆

int dis[maxn],n,m;

void dij(int s){//DIJKSTRA+HEAP

int i;

FOR(i,1,n) dis[i]=INF;

dis[s]=0;

priority\_queue<node> Q;

Q.push(node(s,dis[s]));

while (!Q.empty()){

node x=Q.top();Q.pop();

REP(i,edge[x.n].size()){

node y=edge[x.n][i];

if (dis[y.n]>x.d+y.d){

dis[y.n]=x.d+y.d;

Q.push(node(y.n,dis[y.n]));

}

}

}

}

**SPFA BFS**

vector<node> edge[maxn];

int dis[maxn],n,m;

bool vis[maxn];

int sumnum[maxn];//judge negative ring

bool spfa(int s){

int i;

FOR(i,1,n) dis[i]=INF;

FOR(i,1,n) vis[i]=0;

FOR(i,1,n) sumnum[i]=0;//judge negative ring

dis[s]=0;

deque<int> Q;//slf need

Q.push\_back(s);

// int sum=0;//lll

while (!Q.empty()){

int u=Q.front();Q.pop\_front();

// if (!Q.empty()&&sum/Q.size()<dis[u]) Q.push\_back(u);//lll

// else {vis[u]=0; sum-=dis[u];}//lll

vis[u]=0;//not lll

REP(i,edge[u].size()){

node v=edge[u][i];

if (dis[u]+v.d<dis[v.n]){

dis[v.n]=dis[u]+v.d;

if (!vis[v.n]){

vis[v.n]=1;

if (Q.empty()||dis[Q.front()]<dis[v.n]) Q.push\_back(v.n);//slf

else Q.push\_front(v.n);//slf

Q.push\_back(v.n);//not slf

// sumnum[v.n]++;//judge negative ring

// if (sumnum[v.n]>=n) return 1;//judge negative ring

// sum+=dis[v.n];//lll

}

}

}

}

// return 0;//judge negative ring

}

**SPFA DFS(只用于判负环)**

vector<node> edge[maxn];

int dis[maxn],n,m;

bool vis[maxn];

bool spfa(int u){

int i;

vis[u]=1;

REP(i,edge[u].size()){

node v=edge[u][i];

if (dis[u]+v.d<dis[v.n]){

dis[v.n]=dis[u]+v.d;

if (vis[v.n]) return 1;

else {

dis[v.n]=dis[u]+v.d;

if (spfa(v.n)) return 1;

}

}

}

vis[u]=0;

return 0;//judge negative ring

}

int s,t;

int u,v,len;

int main(){

int i,j,k;

while (~scanf("%d%d",&n,&m)){

FOR(i,1,n) edge[i].clear();

REP(i,m){

scanf("%d%d%d",&u,&v,&len);

edge[u].push\_back(node(v,len));

edge[v].push\_back(node(u,len));

}

dij(1);

FOR(i,2,n) printf("%d ",dis[i]==INF?-1:dis[i]);

puts("");

}

return 0;

}

差分约束系统

**//主要在于建图**

**//连边u->v,len <=> val(v)-val(u)<=len**

**//其他的都要化成这种形式 int n,m;**

**//最好spfa!(可能负环)**

int i,j;

struct node{

int n,d,next;

node(){}

node(int a,int b):n(a),d(b){}

bool operator<(const node &a)const{

if (d==a.d) return n<a.n;

return d>a.d;

}

}edge[150007];

int cnt=0;

int head[maxn];

void addedge(int u,int v,int len){

edge[cnt].n=v;

edge[cnt].d=len;

edge[cnt].next=head[u];

head[u]=cnt++;

};

int dis[maxn];

void dij(int s){

int i;

FOR(i,1,n) dis[i]=INF;

dis[s]=0;

priority\_queue<node> Q;

Q.push(node(s,dis[s]));

while (!Q.empty()){

node x=Q.top();Q.pop();

for(i=head[x.n];i!=-1;i=edge[i].next){

node &y=edge[i];

if (dis[y.n]>x.d+y.d){

dis[y.n]=x.d+y.d;

Q.push(node(y.n,dis[y.n]));

}

}

}

}

int u,v,len;

int main(){

while (~scanf("%d%d\n",&n,&m)){

memset(head,0xff,sizeof(head));

cnt=0;

REP(i,m){

scanf("%d%d%d",&u,&v,&len);

//val(v)-val(u)<=len

addedge(u,v,len);

}

dij(1);

printf("%d\n",dis[n]);

}

}

01分数规划

**//2017-harbin-K**

**//选出k个区间，使得这k个区间全覆盖，而且sigmaA/sigmaB最小**

**//俩log dp TLE**

**//做法：建最短路，01分数规划玄学过题**

struct node{

int n;

double d;

node(){}

node(int \_n,double \_d):n(\_n),d(\_d){};

bool operator<(const node&A)const{

if (d==A.d) return n<A.n;

return d>A.d;

}

};

struct node\_e{

int n,A,B;

double d;

node\_e(int \_n,int \_A,int \_B,double \_d):n(\_n),A(\_A),B(\_B),d(\_d){}

};

vector<node\_e> edge[maxn];

int dis[maxn];

int preA[maxn],preB[maxn];

void dij(int s,int n){

int i;

FOR(i,1,n) dis[i]=INF;

dis[s]=0;

priority\_queue<node> Q;

Q.push(node(s,dis[s]));

while (Q.size()){

node x=Q.top();Q.pop();

for (auto &y:edge[x.n]){

if (dis[y.n]>x.d+y.d){

dis[y.n]=x.d+y.d;

Q.push(node(y.n,dis[y.n]));

preA[y.n]=preA[x.n]+y.A;

preB[y.n]=preB[x.n]+y.B;

}

}

}

}

int n,t;

int S[maxn],T[maxn],A[maxn],B[maxn];

double check(double x){

int i;double allA=0,allB=0;

FOR(i,1,t+1)

edge[i].clear();

FOR(i,1,n){

if (A[i]-B[i]\*x<=0){

allA+=A[i];allB+=B[i];

edge[S[i]].emplace\_back(node\_e(T[i]+1,0,0,0));

}else edge[S[i]].emplace\_back(node\_e(T[i]+1,A[i],B[i],A[i]-B[i]\*x));

}

FOR(i,1,t)

edge[i+1].emplace\_back(node\_e(i,0,0,0));

dij(1,t+1);

allA+=preA[t+1];allB+=preB[t+1];

return allA/allB;

}

int main(){

int i,j,m,x,\_T;

scanf("%d",&\_T);

while (\_T--){

scanf("%d%d",&n,&t);

FOR(i,1,n)

scanf("%d%d%d%d",&S[i],&T[i],&A[i],&B[i]);

double ans=100;

while (1){

double now=check(ans);

if (abs(now-ans)<0.001) break;

ans=now;

}

printf("%.3lf\n",ans);

}

return 0;

}

最小生成树(曼哈顿在后面)

**//最小曼哈顿距离生成树在后面**

**//按照45度4个方向排序，最近的两个点连边即可**

**//最大曼哈顿距离生成树是维护最远的点的距离（四个方向的）**

**//Kruskal(有道分治题用的Boruvka，和这个思想也类似)**

**//注意理解并查集的内涵，每次找最短的路也可以通过其他方式来找到**

强连通分量tarjin

struct Edge {

int to,next;

Edge(int \_to=0,int \_next=-1):to(\_to),next(\_next) {};

} edge[maxn\*2];

int head[maxn],etot;

inline void addedge(int u,int v) {

edge[++etot]=Edge(v,head[u]);

head[u]=etot;

}

**//lowlink是说,遇到的min**

**//无向图:**

**//u割点:low[v]>=dfn[u];(表示能到的点都在之后)**

**//u-v割边(桥):low[v]>dfn[u];(要在u-v处得到)**

**//块:low[u]==dfn[u];(最终从stack取出x)**

**//dfs时注意fa和重边处理**

**//无向图不用vis这个东西=\_=,vis是为了避免横叉边**

vector<int> nodes[maxn];

int cnt;

int dfn[maxn],low[maxn],tot;

bool vis[maxn];//instack

int S[maxn],top;

int id[maxn];

void tarjan(int x,int fa) {

low[x]=dfn[x]=++tot;

S[++top]=x;

vis[x]=1;

for(int i=head[x]; ~i; i=edge[i].next) {

int v=edge[i].to;

if(v==fa) continue;

if(!dfn[v]) {

tarjan(v,x);

low[x]=min(low[x],low[v]);

} else if(vis[v])

low[x]=min(low[x],dfn[v]);

}

if(low[x]==dfn[x]) {

cnt++;

while(1) {

int now=S[top--];

vis[now]=0;

id[now]=cnt;

nodes[cnt].push\_back(now);

if(now==x) break;

}

}

}

int n,m;

int D[maxn],U[maxn],V[maxn];

set<pair<int,int> > H;

int ans,Ans;

int main() {

int i;

while(~scanf("%d%d",&n,&m)) {

FOR(i,1,n) head[i]=-1,dfn[i]=0;

FOR(i,1,cnt) D[i]=0;

etot=tot=cnt=0;

H.clear();

FOR(i,1,m) {

int u,v;

scanf("%d%d",&u,&v);

if(u>v) swap(u,v);

if(H.count(make\_pair(u,v))) continue;

H.insert(make\_pair(u,v));

addedge(u,v);

addedge(v,u);

U[i]=u;

V[i]=v;

}

Ans=0;

tarjan(1,0);

// FOR(i,1,n) if (!dfn[i]) tarjan(i),Ans++;

FOR(i,1,m) if(id[U[i]]!=id[V[i]]) D[id[U[i]]]++,D[id[V[i]]]++;

FOR(i,1,tot) if(D[i]==1) Ans++;

printf("%d\n",(Ans+1)/2);

}

}

支配树

**//lowlink是说,遇到的min**

**//无向图:**

**//u割点:low[v]>=dfn[u];(表示能到的点都在之后)**

**//u-v割边(桥):low[v]>dfn[u];(要在u-v处得到)**

**//块:low[u]==dfn[u];(最终从stack取出x)**

**//dfs时注意fa和重边处理**

**//有向图:**

**//DAG上的割边:u-v:cnt[u]\*cnt[v]==cnt[t](mod?)**

**//DAG上的割边是固定的,也就是说求出来以后最短路是一样长的**

**//有环割边:将边变成点,然后跑支配树即可**

**//支配树:(注意,由于可能有到达不了的节点,初始化时注意答案更新)**

**//半必经点(semi=mindep{通过非树枝边fa})定理:(semi[x]=id[temp]),**

**//temp=min(temp,dfn[pre]),dfn[x]>dfn[pre](树枝边|前向边)**

**//temp=min{temp,dfn[semi[ancestor\_pre(fa)]]}**

**//dfn[x]<dfn[pre](横叉边|后向边)**

**//必经点(idom)定理:y=id[min{dfn[z]}],z:semi\_path上的点**

**//idom[x]=semi[x],semi[x]==semi[y]**

**//idom[x]=idom[y],semi[x]!=semi[y]**

struct Edge {

int to,next;

Edge(int \_to=0,int \_next=-1):to(\_to),next(\_next) {};

} edge[maxn\*4];

int head[maxn],pre[maxn],dom[maxn],etot; //edges

inline void addedge(int head[],int u,int v) {

edge[++etot]=Edge(v,head[u]);

head[u]=etot;

}

int dfn[maxn],tot,par[maxn]; //dfs-tree

int Fa[maxn],best[maxn]; //disjoint-set

int semi[maxn],id[maxn],idom[maxn]; //dom-tree

inline int getfa(int x) {

if(Fa[x]==x) return x;

int F=getfa(Fa[x]);

if(dfn[semi[best[x]]]>dfn[semi[best[Fa[x]]]])

best[x]=best[Fa[x]];

return Fa[x]=F;

}

void dfs(int x) {

dfn[x]=++tot;

id[tot]=x;

for(int i=head[x]; ~i; i=edge[i].next) {

int v=edge[i].to;

if(!dfn[v]) par[v]=x,dfs(v);

}

}

void tarjan(int n) {

int i;

FOR(i,1,n) dom[i]=-1;

FOR(i,1,n) best[i]=semi[i]=Fa[i]=i;

rFOR(i,2,tot) {

int x=id[i];

for(int j=pre[x]; ~j; j=edge[j].next) {

int v=edge[j].to;

if(!dfn[v]) continue; //could not reach

getfa(v); //pre\_dfn:not changed

if(dfn[semi[best[v]]]<dfn[semi[x]])

semi[x]=semi[best[v]];

}

addedge(dom,semi[x],x);

Fa[x]=par[x];

x=id[i-1];

for(int j=dom[x]; ~j; j=edge[j].next) { //path

int v=edge[j].to;

getfa(v); //id[min{dfn[z]}];

if(semi[best[v]]==x) idom[v]=x;

else idom[v]=best[v];

}

}

FOR(i,2,tot) {

int x=id[i];

if(idom[x]!=semi[x]) idom[x]=idom[idom[x]];

}

}

LL n,m;

LL CNT[maxn];

LL solve() {

LL ret=(LL)tot\*(tot-1)/2;

int i;

rFOR(i,2,tot) {

int x=id[i];

CNT[x]++;

if(idom[x]==1) ret-=CNT[x]\*(CNT[x]-1)/2;

else CNT[idom[x]]+=CNT[x];

}

return ret;

}

int main() {

int i;

scanf("%d%d",&n,&m);

FOR(i,1,n) head[i]=pre[i]=-1;

FOR(i,1,n) dfn[i]=id[i]=idom[i]=0;etot=tot=0;

FOR(i,1,m) {

int u,v;

scanf("%d%d",&u,&v);

addedge(head,u,v);

addedge(pre,v,u);

}

dfs(1);

tarjan(n);

// FOR(i,1,n) printf("%2d ",par[i]);puts("");

// FOR(i,1,n) printf("%2d ",id[i]);puts("");

// FOR(i,1,n) printf("%2d ",idom[i]);puts("");

printf("%lld\n",solve());

}

网络流

**最大权闭合图**

**题意:给定一个有向图,每个点有权值,求最大权闭合图(与没选的没边相连),使得sigma(val)最大**

**做法:S->+node(val);-node->T(-val);原边->INF,与S相连的最小割即为所求**

**原因:简单割=>切的全是和S,T相连的边**

**假设最终与S相连的点正的x1,负的y1;T的正的x2,负的y2,(x2=S切,y1=T切)**

**最小割C=S切的正的+T切的负的=x2+y1(即反过来)**

**要求的val=x1-y1**

**C+val=x1+x2=定值,val=x1+x2-C**

**C最小,即最大流**

**最大密度子图**

**边数/点数最大**

**这个是转化成权闭合图的做法：**

**二分答案**

**将边看成点**

**S->边,1**

**边->连着的两点,1**

**每个点->T,val**

**求完即可**

**因为 边-k\*点>=0,二分出这个即可得到答案**

**做法二：**

**s->顶点，权值m**

**顶点之间连边，权值1**

**顶点->T，m+2\*ans-d[i](度数)**

**满流就OK**

**全局最小割**

**无向图 分成两块最小割**

**做法:O(n^3)|O(nmlogm)**

**观察到最小割一定是两块中找个点的最小割**

**那么我们考虑每次找到S->T的最小割后缩点**

**随便找最小割的方法:O(n^2)|O(mlogm)**

**得到s,t的方法:先任意找个a开始**

**定义集合A:一些点的集合**

**定义w(A,v):v到A中所有点的sum\_value**

**每次从中找出w最大的点加入A**

**最后加入的两个点记为S,T**

**S->T的最大流的大小为最末的w**

**//DINIC+当前弧优化**

struct node{

int to,cap,next;

node(int t=0,int c=0,int n=0):to(t),cap(c),next(n){}

}edge[maxn\*50];

int head[maxn];

int tot;

void addedge(int from,int to,int cap){

edge[tot].to=to;

edge[tot].next=head[from];

edge[tot].cap=cap;

head[from]=tot++;

edge[tot].to=from;

edge[tot].next=head[to];

edge[tot].cap=0;

head[to]=tot++;

}

queue<int> Q;

bool vis[maxn];

int d[maxn];

int cur[maxn];//当前弧优化

bool bfs(int s,int t){

memset(vis,0,sizeof(vis));

while (Q.size()) Q.pop();

Q.push(s);

d[s]=0;vis[s]=1;

int i;

while (!Q.empty()){

int x=Q.front();Q.pop();

for(i=head[x];i!=-1;i=edge[i].next){

if (!vis[edge[i].to]&&edge[i].cap){

vis[edge[i].to]=1;

d[edge[i].to]=d[x]+1;

Q.push(edge[i].to);

}

}

}

return vis[t];

}

int dfs(int x,int t,int flow){

if (x==t||flow==0) return flow;

int i,ret=0,f;

for (i=cur[x];i!=-1;i=edge[i].next){

if (d[x]+1==d[edge[i].to]&&

((f=dfs(edge[i].to,t,min(flow,edge[i].cap)))>0)){

edge[i].cap-=f;

edge[i^1].cap+=f;

ret+=f;

flow-=f;

cur[x]=i;

if (flow==0) break;

}

}

return ret;

}

int n,m,i;

int u,v,len,ans;

int s,t;

int main(){

while (~scanf("%d%d",&n,&m)){

memset(head,-1,sizeof(head));

ans=0;tot=0;

s=n+1;t=n+2;

FOR(i,1,n){

int a,b;

scanf("%d%d",&a,&b);

addedge(s,i,a);

addedge(i,t,b);

}

FOR(i,1,m){

scanf("%d%d%d",&u,&v,&len);

addedge(u,v,len);

addedge(v,u,len);

}

while (bfs(s,t)){

int f;

memcpy(cur,head,sizeof(head));

while (f=dfs(s,t,INF)) ans+=f;

}

printf("%d\n",ans);

}

}

**//ISAP**

struct node{

int to,cap,next;

node(int t=0,int c=0,int n=0):to(t),cap(c),next(n){}

}edge[maxn\*50];

int head[maxn];

int tot;

void addedge(int from,int to,int cap,int rcap=0){

edge[tot].to=to;edge[tot].next=head[from];

edge[tot].cap=cap;head[from]=tot++;

edge[tot].to=from;edge[tot].next=head[to];

edge[tot].cap=rcap;head[to]=tot++;

}

queue<int> Q;

int gap[maxn],dep[maxn],cur[maxn];

void bfs(int s,int t){

memset(dep,0xff,sizeof(dep));

memset(gap,0,sizeof(gap));

gap[0]=1;

dep[t]=0;

Q.push(t);

while (Q.size()){

int u=Q.front();Q.pop();

for(int i=head[u];i!=-1;i=edge[i].next){

int v=edge[i].to;

if (dep[v]!=-1) continue;

Q.push(v);

dep[v]=dep[u]+1;

gap[dep[v]]++;

}

}

}

int S[maxn];

int sap(int s,int t,int n){

bfs(s,t);

memcpy(cur,head,sizeof(head));

int top=0,u=s,ret=0;

while (dep[s]<n){

if (u==t){

int MIN=INF,inser,i;

REP(i,top) if (MIN>edge[S[i]].cap)

MIN=edge[S[i]].cap,inser=i;

REP(i,top) edge[S[i]].cap-=MIN,

edge[S[i]^1].cap+=MIN;

ret+=MIN;

top=inser;

u=edge[S[top]^1].to;

continue;

}

bool flag=0;

int v;

for (int i=cur[u];i!=-1;i=edge[i].next){

v=edge[i].to;

if (edge[i].cap&&dep[v]+1==dep[u]){

flag=1;

cur[u]=i;

break;

}

}

if (flag){

S[top++]=cur[u];

u=v;

continue;

}

int MIN=n;

for (int i=head[u];i!=-1;i=edge[i].next){

v=edge[i].to;

if (edge[i].cap&&dep[v]<MIN)

MIN=min(MIN,dep[v]),cur[u]=i;

}

gap[dep[u]]--;

if (!gap[dep[u]]) return ret;

dep[u]=MIN+1;

gap[dep[u]]++;

if (u!=s) u=edge[S[--top]^1].to;

}

return ret;

}

int n,m,s,t;

int main(){

while (~scanf("%d%d",&n,&m)){

memset(head,-1,sizeof(head));

tot=0;

s=n+1;t=n+2;

int i;

FOR(i,1,n){

int a,b;

scanf("%d%d",&a,&b);

addedge(s,i,a);

addedge(i,t,b);

}

FOR(i,1,m){

int u,v,len;

scanf("%d%d%d",&u,&v,&len);

addedge(u,v,len,len);

}

printf("%d\n",sap(s,t,n+2));

}

}

最小费用流

**//拆点后可以S向入连边,出向T连边,然后入和出就可以保持动态平衡**

**//注意观察特殊性质**

**struct node {**

**LL to,cap,cost,rev;**

**node(int t=0,int c=0,int n=0,int r=0):**

**to(t),cap(c),cost(n),rev(r) {}**

**};**

**vector<node> edge[maxn];**

**void addedge(int from,int to,LL cap,LL cost) {**

**edge[from].push\_back(node(to,cap,cost,edge[to].size()));**

**edge[to].push\_back(node(from,0,-cost,edge[from].size()-1));**

**}**

**int n,m,V;**

**LL dis[maxn];**

**bool mark[maxn];**

**int pre\_v[maxn],pre\_e[maxn];**

**deque<int> Q;**

**pair<LL,LL> mincostflow(int s,int t,LL f) {**

**LL ret=0,d;**

**int i,v;**

**while (f) {**

**memset(dis,0x3f,sizeof(dis));**

**memset(mark,0,sizeof(mark));**

**while (Q.size()) Q.pop\_front();**

**dis[s]=0;**

**Q.push\_back(s);**

**while (Q.size()) {**

**v=Q.front();**

**mark[v]=0;**

**Q.pop\_front();**

**REP(i,edge[v].size()) {**

**node &e=edge[v][i];**

**if (e.cap>0&&dis[e.to]>dis[v]+e.cost) {**

**dis[e.to]=dis[v]+e.cost;**

**pre\_v[e.to]=v;**

**pre\_e[e.to]=i;**

**if (!mark[e.to]) {**

**if (Q.empty()||dis[Q.front()]<dis[e.to])**

**Q.push\_back(e.to);**

**else Q.push\_front(e.to);**

**mark[e.to]=1;**

**}**

**}**

**}**

**}**

**if (dis[t]==INFF) break;**

**d=f;**

**for (v=t; v!=s; v=pre\_v[v])**

**d=min(d,edge[pre\_v[v]][pre\_e[v]].cap);**

**f-=d;**

**ret+=d\*dis[t];**

**for (v=t; v!=s; v=pre\_v[v]) {**

**node &e=edge[pre\_v[v]][pre\_e[v]];**

**e.cap-=d;**

**edge[v][e.rev].cap+=d;**

**}**

**if (d==0) break;**

**}**

**return make\_pair(INFF-f,ret);**

**}**

**int i,j,k;**

**int main() {**

**scanf("%d%d",&n,&m);**

**FOR(i,1,m) {**

**LL u,v,c,w;**

**scanf("%lld%lld%lld%lld",&u,&v,&c,&w);**

**addedge(u,v,c,w);**

**}**

**V=n;**

**pair<LL,LL> ans=mincostflow(1,n,INFF);**

**printf("%lld %lld",ans.first,ans.second);**

**}**

上下界网络流

**//可二分t->s边的下/上界,即可达到最大最小流**

**//最大流:t->s连边,ss->tt流,s->t正向最大流,会流掉反向建的边的流量**

**//最小流:ss->tt流,t->s连边,ss->tt流**

int n,m,q;

int i,j,k;

int ss,tt;

struct node {

int to,cap,next;

node(int \_to=0,int \_cap=0,int \_next=-1):

to(\_to),cap(\_cap),next(\_next) {}

} edge[maxn\*3];

int tot;

int head[307];

int addedge(int from,int to,int cap) {

edge[tot]=node(to,cap,head[from]);

head[from]=tot++;

edge[tot]=node(from,0,head[to]);

head[to]=tot++;

return tot-1;//反的边 cap=正的 flow

}

bool vis[307];

int d[307];

queue<int> Q;

bool bfs(int s,int t) {

memset(vis,0,sizeof(vis));

while (Q.size()) Q.pop();

Q.push(s);

d[s]=0; vis[s]=1;

int i;

while (Q.size()) {

int x=Q.front(); Q.pop();

for (i=head[x]; i!=-1; i=edge[i].next) {

if (!vis[edge[i].to]&&edge[i].cap) {

vis[edge[i].to]=1;

d[edge[i].to]=d[x]+1;

Q.push(edge[i].to);

}

}

}

return vis[t];

}

int cur[307];//当前弧优化

int dfs(int x,int t,int flow) { //dinic

if (x==t||flow==0) return flow;

int i,ret=0,f;

for (i=cur[x]; i!=-1; i=edge[i].next) {

if (d[x]+1==d[edge[i].to]&&

(f=dfs(edge[i].to,t,min(flow,edge[i].cap)))>0) {

edge[i].cap-=f;

edge[i^1].cap+=f;

ret+=f;

flow-=f;

cur[x]=i;

if (flow==0) break;

}

}

return ret;

}

int in[307],out[307];

int add(int u,int v,int low,int high) {

int ret=addedge(u,v,high-low);

out[u]+=low; in[v]+=low;

return ret;

}

int sum,flow,E[maxn],ans[maxn];//E为对应的边位置

int solve() {

memset(head,0xff,sizeof(head));

memset(in,0,sizeof(in));

memset(out,0,sizeof(out));

scanf("%d%d",&n,&m);

flow=0; sum=0; tot=0;

FOR(i,1,m) {

int u,v,low,high;

scanf("%d%d%d%d",&u,&v,&low,&high);

ans[i]=low;

E[i]=add(u,v,low,high);//E[i]很有用

}

ss=n+1; tt=n+2;

FOR(i,1,n) {

sum+=max(in[i]-out[i],0);

if (in[i]>out[i]) addedge(ss,i,in[i]-out[i]);

if (in[i]<out[i]) addedge(i,tt,out[i]-in[i]);

}

while (bfs(ss,tt)) {

int f;

memcpy(cur,head,sizeof(head));

while (f=dfs(ss,tt,INF)) flow+=f;

}

if (flow!=sum) return 0\*puts("NO");

else {

puts("YES");

FOR(i,1,m) {

ans[i]+=edge[E[i]].cap;

printf("%d\n",ans[i]);

}

}

}

int main() {

int T;

scanf("%d",&T);

while (T--) {

solve();

}

}

上下界费用流

**// Hihocoder 1424，限制很多的一道题，只是留板子**

struct node{

LL to,cap,cost,rev;

node(int t=0,int c=0,int n=0,int r=0):to(t),cap(c),cost(n),rev(r){}

};

vector<node> edge[maxn];

void addedge(int from,int to,LL cap,LL cost){

edge[from].push\_back(node(to,cap,cost,edge[to].size()));

edge[to].push\_back(node(from,0,-cost,edge[from].size()-1));

}

LL dis[maxn];

bool mark[maxn];

int pre\_v[maxn],pre\_e[maxn];

deque<int> Q;

pair<int,int> mincostflow(int s,int t,int f){

int ret=0,d;

int i,v;

while (f){

memset(dis,0x3f,sizeof(dis));

memset(mark,0,sizeof(mark));

while (Q.size()) Q.pop\_front();

dis[s]=0;Q.push\_back(s);

while (Q.size()){

v=Q.front();mark[v]=0;Q.pop\_front();

REP(i,edge[v].size()){

node &e=edge[v][i];

if (e.cap>0&&dis[e.to]>dis[v]+e.cost){

dis[e.to]=dis[v]+e.cost;

pre\_v[e.to]=v;

pre\_e[e.to]=i;

if (!mark[e.to]){

if (Q.empty()||dis[Q.front()]<dis[e.to]) Q.push\_back(e.to);

else Q.push\_front(e.to);

mark[e.to]=1;

}

}

}

}

if (dis[t]==INF) break;

d=f;

for (v=t;v!=s;v=pre\_v[v])

d=min(d,edge[pre\_v[v]][pre\_e[v]].cap);

f-=d;

ret+=d\*dis[t];

for (v=t;v!=s;v=pre\_v[v]){

node &e=edge[pre\_v[v]][pre\_e[v]];

e.cap-=d;

edge[v][e.rev].cap+=d;

}

if (d==0) break;

}

return make\_pair(INF-f,ret);

}

int n,m;

int i,j;

int VAL[57][57];

int addrow[57][57];

int addcol[57][57];

int row[57],col[57];

int in[maxn],out[maxn];

int u,v;

int s,t,S,T;

int tot;

int sum;

void add(int u,int v,int low,int high,int cost){

addedge(u,v,high-low,cost);

out[u]+=low;in[v]+=low;

}

void solve(int n){

tot=0;

FOR(i,1,n) row[i]=++tot;

FOR(i,1,n) col[i]=++tot;

s=++tot;t=++tot;

S=++tot;T=++tot;

FOR(i,1,n)

FOR(j,1,n) scanf("%d",&VAL[i][j]);

FOR(i,1,n){

int cnt=0;

FOR(j,1,n) cnt+=VAL[i][j];

add(s,row[i],cnt,cnt,0);

cnt=0;

FOR(j,1,n) cnt+=VAL[j][i];

add(s,col[i],cnt,cnt,0);

}

FOR(i,1,n){

int l,r;

scanf("%d%d",&l,&r);

add(row[i],t,l,r,0);

}

FOR(i,1,n){

int l,r;

scanf("%d%d",&l,&r);

add(col[i],t,l,r,0);

}

FOR(i,1,n)

FOR(j,1,n) addrow[i][j]=addcol[i][j]=0;

REP(i,n\*n/2){

int x0,y0,x1,y1;

scanf("%d%d%d%d",&x0,&y0,&x1,&y1);

if (VAL[x0][y0]==VAL[x1][y1]) continue;

if (VAL[x0][y0]==1){

if (y0==y1) addrow[x0][x1]++;

else addcol[y0][y1]++;

}else if (VAL[x1][y1]==1){

if (y0==y1) addrow[x1][x0]++;

else addcol[y1][y0]++;

}

}

FOR(i,1,n){

FOR(j,1,n){

if (addrow[i][j]) add(row[i],row[j],0,addrow[i][j],1);

if (addcol[i][j]) add(col[i],col[j],0,addcol[i][j],1);

}

}

sum=0;

add(t,s,0,INF,0);

FOR(i,1,tot){

sum+=max(in[i]-out[i],0);

if (in[i]>out[i]) addedge(S,i,in[i]-out[i],0);

if (in[i]<out[i]) addedge(i,T,out[i]-in[i],0);

}

pair<int,int> now=mincostflow(S,T,INF);

if (now.first!=sum) puts("-1");

else printf("%d\n",now.second);

FOR(i,1,tot) edge[i].clear();

FOR(i,1,tot) in[i]=out[i]=0;

}

int main()

{

while (~scanf("%d",&n)) solve(n);

}

树分治

**//乘积立方数个数，如果是sum直接枚举其实就好**

**//树分支正反各dfs一次可以正常求出经过一点的cnt**

LL K;

LL MUL[37];

LL getSum(LL x,LL y){

LL ret=0,i;

REP(i,K) ret=ret+(x/MUL[i]%3+y/MUL[i]%3)%3\*MUL[i];

return ret;

}

LL getDiv(LL x){

LL ret=0,i;

REP(i,K) ret=ret+(3-x/MUL[i]%3)%3\*MUL[i];

return ret;

}

LL color[maxn];

vector<int> edge[maxn];

LL ans;

int size[maxn];

bool mark[maxn];

int minweight,root;

void dfs1(int x,int fa,int n){

int weight=0;

size[x]=1;

for (int v:edge[x]){

if (v==fa||mark[v]) continue;

dfs1(v,x,n);

size[x]+=size[v];

weight=max(weight,size[v]);

}

weight=max(weight,n-size[x]);

if (weight<minweight) {root=x;minweight=weight;}

}

map<LL,int> now;

map<LL,int> MP;

void dfs2(int x,int fa,LL num){

now[getSum(color[x],num)]++;

for (int v:edge[x]){

if (v==fa||mark[v]) continue;

dfs2(v,x,getSum(num,color[x]));

}

}

void calc(int x){

MP.clear();

MP[color[x]]++;

for (int u:edge[x]){

if (mark[u]) continue;

now.clear();

dfs2(u,0,0);

for(pair<LL,int> P:now) ans+=MP[getDiv(P.first)]\*P.second;

for(pair<LL,int> P:now) MP[getSum(color[x],P.first)]+=P.second;

}

MP.clear();

}

void dfs3(int x){

mark[x]=1;

calc(x);

for (int v:edge[x]){

if (mark[v]) continue;

minweight=size[v];

dfs1(v,0,size[v]);

dfs3(root);

}

}

int n,m;

LL C[maxn];

LL P;

int main(){

int i,j;

MUL[0]=1;

FOR(i,1,33) MUL[i]=MUL[i-1]\*3;

while (~scanf("%d",&n)){

ans=0;

scanf("%d",&K);

REP(i,K) scanf("%lld",&C[i]);

FOR(i,1,n){

scanf("%lld",&P);

REP(j,K){

int t=0;

while (P%C[j]==0){

P/=C[j];

t++;

if (t==3) t=0;

}

color[i]+=MUL[j]\*t;

}

if (color[i]==0) ans++;

}

REP(i,n-1){

int u,v;

scanf("%d%d",&u,&v);

edge[u].push\_back(v);

edge[v].push\_back(u);

}

minweight=n;

dfs1(1,0,n);

dfs3(root);

printf("%lld\n",ans);

FOR(i,1,n) mark[i]=0;

FOR(i,1,n) color[i]=0;

FOR(i,1,n) vector<int>().swap(edge[i]);

}

}

部分树上dp

**从求含某条边的最小生成树截下来的代码(当然前面sort了)合并(要记得merge咋写),先sort然后从小到大讨论**

inline int Union(int u,int v,int len){

int ret=0;

while (u!=v&&(fa[u]!=u||fa[v]!=v)){

if (fa[u]==u||fa[v]!=v&&sz[u]>sz[v]) {ret=max(ret,val[v]);v=fa[v];}

else {ret=max(ret,val[u]);u=fa[u];}

}

if (u==v) return ret;

if (sz[u]>sz[v]) swap(u,v);

fa[u]=v;val[u]=len;

sz[v]+=sz[u];ans=ans+len;

return len;

}

**树上距离除k向上取整**

LL count[maxn][6];

vector<int> edge[maxn];

LL num[maxn],cnt[maxn];//端点,满足条件的次数

int k;

LL ans;

void dfs(int u,int from){

int i,j,c1,c2;

count[u][0]=1;

cnt[u]=1;

REP(i,edge[u].size()){

int v=edge[u][i];

if (from==v) continue;

dfs(v,u);

REP(c1,k)

REP(c2,k){

ans+=count[u][c1]\*count[v][c2];

if (c1+c2+1>k) ans+=count[u][c1]\*count[v][c2];

}

ans+=cnt[u]\*num[v]+num[u]\*cnt[v];

num[u]+=num[v]+count[v][k-1];

cnt[u]+=cnt[v];

REP(c1,k) count[u][c1]+=count[v][(c1-1+k)%k];

}

}

2-sat

**//重点是维护拆点后各种限制之间的关系，这个是个二分以后2-sat的**

**struct T\_SAT {**

**struct enode {**

**int to,next;**

**enode(int \_to=0,int \_next=-1):to(\_to),next(\_next) {};**

**} edge[maxn\*maxn\*2];**

**int head[maxn\*2],etot;**

**void addedge(int u,int v) {**

**edge[++etot]=enode(v,head[u]);**

**head[u]=etot;**

**}**

**int dfn[maxn\*2],low[maxn\*2],belong[maxn\*2];**

**bool vis[maxn\*2];**

**int tot,cnt;**

**int S[maxn\*2],top;**

**void dfs(int x) {**

**dfn[x]=low[x]=++tot;**

**S[++top]=x;**

**vis[x]=1;**

**for (int i=head[x]; ~i; i=edge[i].next) {**

**int v=edge[i].to;**

**if (!dfn[v]) {**

**dfs(v);**

**low[x]=min(low[x],low[v]);**

**} else if (vis[v])**

**low[x]=min(low[x],dfn[v]);**

**}**

**if (dfn[x]==low[x]) {**

**cnt++;**

**while (1) {**

**int now=S[top--];**

**vis[now]=0;**

**belong[now]=cnt;**

**if (now==x) break;**

**}**

**}**

**}**

**void init(int n) {**

**int i;**

**REP(i,2\*n) head[i]=-1;**

**etot=0;**

**}**

**bool solve(int n) {**

**int i;**

**tot=cnt=0;**

**REP(i,2\*n) dfn[i]=vis[i]=0;**

**REP(i,2\*n) if (!dfn[i]) dfs(i);**

**REP(i,n) if (belong[i]==belong[i+n]) return 0;**

**return 1;**

**}**

**} two\_sat;**

**int n,m;**

**int i,j;**

**int a1,a2,c1,c2;**

**int main() {**

**while (~scanf("%d%d",&n,&m)) {**

**two\_sat.init(n);**

**REP(i,m) {**

**scanf("%d%d%d%d",&a1,&a2,&c1,&c2);**

**if (c1==1&&c2==1) {**

**two\_sat.addedge(a1+n,a2);**

**two\_sat.addedge(a2+n,a1);**

**} else if (c1==0&&c2==1) {**

**two\_sat.addedge(a1,a2);**

**two\_sat.addedge(a2+n,a1+n);**

**} else if (c1==1&&c2==0) {**

**two\_sat.addedge(a1+n,a2+n);**

**two\_sat.addedge(a2,a1);**

**} else if (c1==0&&c2==0) {**

**two\_sat.addedge(a1,a2+n);**

**two\_sat.addedge(a2,a1+n);**

**}**

**}**

**if (two\_sat.solve(n)) puts("YES");**

**else puts("NO");**

**}**

**}**

dfs序

**//常用方法：时间戳、莫队、拆开操作**

void dfs(int u,int from){

int v,i;

in[u]=++tot;

REP(i,edge[u].size()){

v=edge[u][i];

if (v==from) continue;

dfs(v,u);

}

out[u]=tot;

}

dfs序\_换根的讨论233

**//http://codeforces.com/contest/916/problem/E**

**//改根,子树加,查,令人窒息的讨论**

LL sum[maxn<<2],lazy[maxn<<2];

void update(int x,int l,int r,LL val,int L,int R) {

if (l>r) return;

if (l<=L&&R<=r) {lazy[x]+=val; sum[x]+=(R-L+1)\*val; return;}

int mid=(L+R)/2;

if (lazy[x]) {

lazy[x<<1]+=lazy[x];

lazy[x<<1|1]+=lazy[x];

sum[x<<1]+=(mid-L+1)\*lazy[x];

sum[x<<1|1]+=(R-mid)\*lazy[x];

lazy[x]=0;

}

if (l<=mid) update(x<<1,l,r,val,L,mid);

if (mid<r) update(x<<1|1,l,r,val,mid+1,R);

sum[x]=sum[x<<1]+sum[x<<1|1];

}

LL query(int x,int l,int r,int L,int R) {

LL ret=0;

if (l>r) return 0;

if (l<=L&&R<=r) return sum[x];

int mid=(L+R)/2;

if (lazy[x]) {

lazy[x<<1]+=lazy[x];

lazy[x<<1|1]+=lazy[x];

sum[x<<1]+=(mid-L+1)\*lazy[x];

sum[x<<1|1]+=(R-mid)\*lazy[x];

lazy[x]=0;

}

if (l<=mid) ret+=query(x<<1,l,r,L,mid);

if (mid<r) ret+=query(x<<1|1,l,r,mid+1,R);

sum[x]=sum[x<<1]+sum[x<<1|1];

return ret;

}

vector<int> edge[maxn];

int fa[maxn][27];

int in[maxn],out[maxn],tot,dep[maxn];

void dfs(int x,int f,int d) {

int i;

fa[x][0]=f;

in[x]=++tot;

dep[x]=d;

rep(i,1,20) fa[x][i]=fa[fa[x][i-1]][i-1];

for (int v:edge[x]) if (v!=f) dfs(v,x,d+1);

out[x]=tot;

}

int lca(int x,int y) {

int i;

if (dep[x]<dep[y]) swap(x,y);

rREP(i,20) if (dep[x]-dep[y]>=1<<i) x=fa[x][i];

if (x==y) return x;

rREP(i,20) if (fa[x][i]!=fa[y][i]) x=fa[x][i],y=fa[y][i];

return fa[x][0];

}

int getnthfa(int x,int k) {

int i;

rREP(i,20) if ((k>>i)&1) x=fa[x][i];

return x;

}

int root;

int n,m;

int a[maxn];

int main() {

int i,j;

scanf("%d%d",&n,&m);

FOR(i,1,n) scanf("%d",&a[i]);

FOR(i,1,n-1) {

int u,v;

scanf("%d%d",&u,&v);

edge[u].push\_back(v);

edge[v].push\_back(u);

}

dfs(1,0,0);

FOR(i,1,n) update(1,in[i],in[i],a[i],1,n);

root=1;

while (m--) {

int op,u,v,x;

scanf("%d",&op);

if (op==1) {

scanf("%d",&root);

} else if (op==2) {

scanf("%d%d%d",&u,&v,&x);

int f=lca(u,v)^lca(v,root)^lca(u,root);

if (f==root) update(1,1,n,x,1,n);

else if (lca(f,root)==f) {

int t=getnthfa(root,dep[root]-dep[f]-1);

update(1,1,in[t]-1,x,1,n);

update(1,out[t]+1,n,x,1,n);

} else update(1,in[f],out[f],x,1,n);

} else if (op==3) {

int x;

LL ans;

scanf("%d",&x);

if (x==root) ans=query(1,1,n,1,n);

else if (in[x]<=in[root]&&in[root]<=out[x]) {

int t=getnthfa(root,dep[root]-dep[x]-1);

ans=query(1,1,in[t]-1,1,n)+query(1,out[t]+1,n,1,n);

} else ans=query(1,in[x],out[x],1,n);

printf("%I64d\n",ans);

}

}

}

树链剖分

**难题(区间合并)**

int tot;

struct node{

int lval,rval,ldown,lup,rdown,rup,upmx,downmx;

node():upmx(0),downmx(0){};

}tree[maxn<<2];

int a[maxn];

node merge(node L,node R){

if (L.upmx==0) return R;

if (R.upmx==0) return L;

node ret;

ret.upmx=max(L.upmx,R.upmx);

ret.downmx=max(L.downmx,R.downmx);

ret.lval=L.lval;

ret.lup=L.lup;

ret.ldown=L.ldown;

ret.rval=R.rval;

ret.rup=R.rup;

ret.rdown=R.rdown;

if (L.rval<R.lval){

ret.upmx=max(ret.upmx,L.rup+R.lup);

if (L.downmx==1) ret.lup=L.lup+R.lup;

if (R.downmx==1) ret.rup=L.rup+R.rup;

}

if (L.rval>R.lval){

ret.downmx=max(ret.downmx,L.rdown+R.ldown);

if (L.upmx==1) ret.ldown=L.ldown+R.ldown;

if (R.upmx==1) ret.rdown=L.rdown+R.rdown;

}

return ret;

}

void build(int x,int l,int r){

if (l==r){

tree[x].lval=tree[x].rval=a[l];

tree[x].lup=tree[x].ldown=tree[x].rup=tree[x].rdown=tree[x].upmx=tree[x].downmx=1;

return;

}

int mid=(l+r)/2;

build(x<<1,l,mid);

build(x<<1|1,mid+1,r);

tree[x]=merge(tree[x<<1],tree[x<<1|1]);

}

node query(int x,int l,int r,int L,int R){

node ret;

if (l<=L&&R<=r) return tree[x];

int mid=(L+R)/2;

if (mid>=l&&r>mid) return

merge(query(x<<1,l,r,L,mid),query(x<<1|1,l,r,mid+1,R));

if (mid>=l) return query(x<<1,l,r,L,mid);

return query(x<<1|1,l,r,mid+1,R);

}

int n,i,j,q;

int u,v;

vector<int> edge[maxn];

int fa[maxn],son[maxn],top[maxn],dep[maxn],id[maxn],sz[maxn];

int b[maxn];

void dfs1(int u,int depth){

int v,i,mx=-1;

son[u]=0;sz[u]=1;dep[u]=depth;

REP(i,edge[u].size()){

v=edge[u][i];

dfs1(v,depth+1);

sz[u]+=sz[v];

if (sz[v]>mx) mx=sz[v],son[u]=v;

}

}

void dfs2(int u,int x){

int v,i;

top[u]=x;id[u]=++tot;

if (son[u]) dfs2(son[u],x);

REP(i,edge[u].size()){

v=edge[u][i];

if (v==fa[u]||v==son[u]) continue;

dfs2(v,v);

}

}

int Query(int x,int y){//这里需要注意方向

node up,down;

int ret,mark1=0,mark2=0;

while (top[x]!=top[y]){

if (dep[top[x]]>dep[top[y]]){

up=merge(query(1,id[top[x]],id[x],1,tot),up);

x=fa[top[x]];

mark1=1;

}else {

down=merge(query(1,id[top[y]],id[y],1,tot),down);

y=fa[top[y]];

mark2=1;

}

}

if (dep[x]>dep[y]) up=merge(query(1,id[y],id[x],1,tot),up),mark1=1;

else down=merge(query(1,id[x],id[y],1,tot),down),mark2=1;

ret=max(up.downmx,down.upmx);

if (mark1&&mark2&&up.lval<down.lval)

ret=max(ret,up.ldown+down.lup);

return ret;

}

int T,t;

int main(){

scanf("%d",&T);

FOR (t,1,T){

scanf("%d",&n);

FOR(i,1,n) edge[i].clear();tot=0;

FOR(i,1,n) scanf("%d",&b[i]);

FOR(i,2,n){scanf("%d",&fa[i]); edge[fa[i]].push\_back(i);}

dfs1(1,1);

dfs2(1,1);

FOR(i,1,n) a[id[i]]=b[i];

build(1,1,tot);

scanf("%d",&q);

printf("Case #%d:\n",t);

while (q--){

scanf("%d%d",&u,&v);

printf("%d\n",Query(u,v));

}

if (t!=T) puts("");

}

}

树链剖分求LCA

vector<int> edge[maxn];

int sz[maxn],fa[maxn],son[maxn],top[maxn],dep[maxn],id[maxn];

int tot=0;

void dfs1(int u,int depth){

int v,i,mx=-1;

sz[u]=1;dep[u]=depth;son[u]=0;

for(int v:edge[u]){

dfs1(v,depth+1);

sz[u]+=sz[v];

if (sz[v]>mx) mx=sz[v],son[u]=v;

}

}

void dfs2(int u,int x){

int v,i;

top[u]=x;id[u]=++tot;

if (son[u]) dfs2(son[u],x);

for (int v:edge[u]){

if (v==son[u]) continue;

dfs2(v,v);

}

}

int query(int x,int y){

while (top[x]!=top[y]){

if (dep[top[x]]<dep[top[y]]) swap(x,y);

x=fa[top[x]];

}

if (dep[x]>dep[y]) swap(x,y);

return x;

}

int len(int x,int y){

return dep[x]+dep[y]-dep[query(x,y)]\*2+1;//point

}

离线tarjin求LCA

vector<int> edge[maxn];

int fa1[maxn],fa2[maxn];

inline int getfa(int \*fa,int x){

if (fa[x]==x) return x;

return fa[x]=getfa(fa,fa[x]);

}

int n,m,q;

int i,k;

int u,v;

int ans[maxn];

vector<pair<int,int> > Q[maxn];//v,id

void dfs(int x){

int i;

for (int v:edge[x]){

dfs(v);

fa2[v]=x;

}

REP(i,Q[x].size())

if (fa2[Q[x][i].first]!=Q[x][i].first)

ans[Q[x][i].second]=getfa(fa2,Q[x][i].first);

}

void solve(){

REP(i,q){

scanf("%d%d%d",&k,&u,&v);

if (k==1){

if (getfa(fa1,u)!=getfa(fa1,v)) ans[i]=-1;

else{

if (u==v) ans[i]=u;

else{

Q[u].push\_back(make\_pair(v,i));

Q[v].push\_back(make\_pair(u,i));

}

}

}else{

edge[u].push\_back(v);

fa1[v]=u;

ans[i]=0;

}

}

FOR(i,1,n) if (fa1[i]==i) dfs(i);

REP(i,q) if (ans[i]) printf("%d\n",ans[i]);

}

倍增

//记住ladder时,只在top处resize!!

void dfs(int x,int depth){

dep[x]=depth;

for (int v:edge[x]) dfs(v,depth+1);

}

int lca(int x,int y){

int i;

if (dep[x]<dep[y]) swap(x,y);

rREP(i,20) if (dep[x]-dep[y]>=1<<i) x=fa[x][i];

if (x==y) return x;

rREP(i,20) if (fa[x][i]!=fa[y][i]) x=fa[x][i],y=fa[y][i];

return fa[x][0];

}

int dis(int x,int y){

return dep[x]+dep[y]-2\*dep[lca(x,y)];

}

INIT:

FOR(i,2,n) rep(j,1,20) fa[i][j]=fa[fa[i][j-1]][j-1];

****最大团****

int n;

int ans;

int edge[maxn][maxn],cnt[maxn],vis[maxn];//vis:元素

bool dfs(int u,int pos){

int i,j;

FOR(i,u+1,n){

if (cnt[i]+pos<=ans) return 0;

if (edge[u][i]){

REP(j,pos) if (!edge[i][vis[j]]) break;

if (j==pos){

vis[pos]=i;

if (dfs(i,pos+1)) return 1;

}

}

}

if (pos>ans){

ans=pos;

return 1;

}

return 0;

}

int maxclique(){

int i;

ans=-1;

rFOR(i,1,n){

vis[0]=i;

dfs(i,1);

cnt[i]=ans;

}

return ans;

}

int main(){

int k;

int i,j;

scanf("%d%d",&n,&k);

FOR(i,1,n)FOR(j,1,n) scanf("%d",&edge[i][j]);

maxclique();

printf("%.16lf",0.5\*k\*k\*(ans-1)/ans);

}

****最小树形图****

**//不定根:新加一个节点，向所有点加一条INF的边，最后减一下即可**

**//主要思路:缩点**

**//输出路径思路:缩完点记录边,然后新建边记录等价关系**

struct node{

int u,v,val,id;//id->usedID

}edge[maxn];

int pre[maxn],len[maxn],vis[maxn],id[maxn];

struct used{

int pre,id;//original

}U[maxn\*20];//edges

int UID[maxn],used[maxn\*20];

int OK[maxn];

int solve(int root,int n,int m){

int ret=0,i,tot=m,em=m;

REP(i,m) edge[i].id=U[i].id=i;

while (1){

FOR(i,1,n) len[i]=INF,vis[i]=0,id[i]=0;

REP(i,m)

if (edge[i].u!=edge[i].v&&edge[i].val<len[edge[i].v]){

pre[edge[i].v]=edge[i].u;

len[edge[i].v]=edge[i].val;

UID[edge[i].v]=edge[i].id;

}

FOR(i,1,n) if (i!=root&&len[i]==INF) return -1;

int cnt=0;len[root]=0;

FOR(i,1,n){

if (i!=root) used[UID[i]]++;

ret+=len[i];int v;

for(v=i;vis[v]!=i&&!id[v]&&v!=root;v=pre[v]) vis[v]=i;

if (v!=root&&!id[v]){

cnt++;id[v]=cnt;

for (int u=pre[v];u!=v;u=pre[u]) id[u]=cnt;

}

}if (!cnt) break;

FOR(i,1,n) if (!id[i]) id[i]=++cnt;

REP(i,m){

int v=edge[i].v;

edge[i].u=id[edge[i].u];edge[i].v=id[edge[i].v];

if (edge[i].u==edge[i].v) edge[i--]=edge[--m];

else {U[tot].id=edge[i].id;U[tot].pre=UID[v];

edge[i].id=tot++;edge[i].val-=len[v];}

}n=cnt;root=id[root];

}

rrep(i,em,tot) if (used[i]){

used[U[i].id]++;

used[U[i].pre]--;

}

return ret;

}

int main(){

freopen("input.txt","r",stdin);

freopen("output.txt","w",stdout);

int n,m,root;

int i,j,k;

scanf("%d%d",&n,&m);

REP(i,m) scanf("%d%d%d",&edge[i].u,&edge[i].v,&edge[i].val);

REP(i,m) OK[i]=edge[i].val;

int ans=solve(1,n,m);

printf("%d\n",ans);

if (ans!=-1){

REP(i,m) if (OK[i]&&used[i]) printf("%d ",i+1),ans--;

if (ans) printf("\n%d\n",ans);

}

}

****一般图最大匹配 带花树****

//缩奇环

int n,m;

vector<int> edge[maxn];

bool inQueue[maxn];

int belong[maxn];

int getbelong(int x) {

if (belong[x]==x) return x;

return belong[x]=getbelong(belong[x]);

}

int match[maxn],nxt[maxn],mark[maxn],vis[maxn];

int cnt;

queue<int> Q;

int used[maxn];

int lca(int u,int v) {

cnt++;

while (1) {

u=getbelong(u);

if (vis[u]==cnt) return u;

vis[u]=cnt;

u=nxt[match[u]];

if (v) swap(u,v);

}

}

void merge(int u,int p) {

while (u!=p) {

int mu=match[u],v=nxt[mu];

if (getbelong(v)!=p) nxt[v]=mu;

if (mark[mu]==2) mark[mu]=1,Q.push(mu);

if (mark[v]==2) mark[v]=1,Q.push(v);

int x,y;

x=getbelong(u),y=getbelong(mu);

if (x!=y) belong[x]=y;

x=getbelong(mu),y=getbelong(v);

if (x!=y) belong[x]=y;

u=v;

}

}

void solve(int s) { //增广

int i;

FOR(i,1,n) belong[i]=i,mark[i]=nxt[i]=0;

while (Q.size()) Q.pop();

Q.push(s);

while (Q.size()) {

if (match[s]) return;

int u=Q.front();

Q.pop();

for (int v:edge[u]) {

if (match[u]==v) continue;

if (getbelong(u)==getbelong(v)) continue;

if (mark[v]==2) continue; //T型点

if (mark[v]==1) { //S型点,缩点

int p=lca(u,v);

if (getbelong(u)!=p) nxt[u]=v;

if (getbelong(v)!=p) nxt[v]=u;

merge(u,p);

merge(v,p);

} else if (!match[v]) { //增广

nxt[v]=u;

for (int x=v; x;) {

int y=nxt[x],xx=match[y];

match[x]=y;

match[y]=x;

x=xx;

}

break;

} else {

nxt[v]=u;

mark[match[v]]=1;

Q.push(match[v]);

mark[v]=2;

}

}

}

}

bool E[maxn][maxn];

int ans;

int main() {

scanf("%d%d",&n,&m);

int i;

while (m--) {

int u,v;

scanf("%d%d",&u,&v);

if (u!=v&&!E[u][v]) {

edge[u].push\_back(v);

edge[v].push\_back(u);

E[u][v]=E[v][u]=1;

}

}

memset(match,0,sizeof(match));

FOR(i,1,n) if (!match[i]) solve(i);

FOR(i,1,n) if (match[i]) ans++;

ans/=2;

printf("%d\n",ans);

FOR(i,1,n) printf("%d ",match[i]);

}

# 数学相关

逆元

LL inv[1000002];//inverse

LL fac[1000002];//Factorial

// 求出的是ax+by=1的解(a,b正负不限,而且挺小的);

// d(gcd)==1时存在逆元;(d!=1)&&(num|d)时,num\*a/d可认为逆元

// (x+p)%p为逆元

// DP:C[i][j]=(C[i-1][j-1]+C[i][j-1])%M

void exgcd(LL a,LL b,LL &d,LL &x,LL &y){

if (!b) {d=a;x=1;y=0;}

else {exgcd(b,a%b,d,y,x);y-=a/b\*x;}

}

// 前面那个线性求逆元的log版2333

int getinv(int n){

if (n==1) return 1;

return (M-M/n)\*(getinv(M%n))%M;

}

LL C(int n,int m){

return fac[n]\*inv[m]%M\*inv[n-m]%M;

}

//Lucas扩展：Kummer定理：

//C(n,k)中的p的幂次的为p进制下n-k借位次数

//e.g.求C(n,0)...C(n,n)的lcm%(1e9+7)

//做法:考虑每个素因子,n转化为p进制后,除了最后的为p-1的都可以借位

//ans=pow(p,k)的乘积

LL lucas(LL n,LL m){//注意MOD不能太大=\_=! Mlogn

return m==0?1:1ll\*C(n%M,m%M)\*lucas(n/M,m/M)%M;

}

int main(){

int i;

fac[0]=1;

FOR(i,1,1000000) fac[i]=i\*fac[i-1]%M;

inv[0]=inv[1]=1;

FOR(i,2,1000000) inv[i]=(M-M/i)\*inv[M%i]%M;

FOR(i,1,1000000) inv[i]=inv[i]\*inv[i-1]%M;// inv(n!)

printf("%I64d",C(10,3));

}

博弈：NIM,SG

**选择的最多次数,main中为异或!=0**

int sg[maxm+2];//打表~~~

**/\*这个是状态和剩余个数有关的**

map<int,int> Hash;

int SG(int mask){

if (Hash.count(mask)) return Hash[mask];

set<int> mex;

for (int i=0;i<maxm;++i){

if (!((mask>>i)&1)) continue;//continue

int tp=mask;

for (int j=i;j<maxm;j+=i+1)//change

if ((mask>>j)&1) tp^=1<<j;

mex.insert(SG(tp));//dfs

}

int ret=0;

for (;mex.count(ret);++ret);

return Hash[mask]=ret;

}\*/

**/\*这个是状态和剩余个数无关的**

map<LL,int> Hash[62];

int SG(int x,LL mask){

// printf("%d %d\n",x,mask);

if (Hash[x].count(mask)) return Hash[x][mask];

set<int> mex;

for (int i=1;i<=x;++i){

if ((mask>>(i-1))&1) continue;//continue

int tp=mask;

tp^=1<<(i-1);//change

mex.insert(SG(x-i,tp));//dfs

}

int ret=0;

for (;mex.count(ret);++ret);

return Hash[x][mask]=ret;

}\*/

int main(){

sg[0]=0;

}

FFT、NTT、FWT、FMT

**求逆:A\*B≡1(mod x^n)**

**C\*B≡1(mod x^(n/2))**

**(C\*B-1)\*(C\*B-1)≡0(mod x^(n/2))**

**C\*C\*B\*B-2\*B\*C+1≡0(mod x^n)**

**C\*C\*B-2\*C+A≡0(mod x^n)**

**A≡C\*(2-B\*C)(mod x^n)**

**求根:A\*A≡B(mod x^n)**

**C\*C≡B(mod x^n/2)**

**(C\*C-B)\*(C\*C-B)≡0(mod x^n)**

**C\*C\*C\*C-2\*A\*A\*C\*C+A\*A\*A\*A≡0(mod x^n)**

**(C\*C+A\*A)\*(C\*C+A\*A)≡4\*A\*A\*C\*C(mod x^n)**

**C\*C+B≡2\*A\*C(mod x^n)**

**A=(C\*C+B)/(2\*C)**

**FFT：**

struct complex{

double a,b;

complex(double \_a=.0,double \_b=.0):a(\_a),b(\_b){}

complex operator+(const complex x)const

{return complex(a+x.a,b+x.b);}

complex operator-(const complex x)const

{return complex(a-x.a,b-x.b);}

complex operator\*(const complex x)const

{return complex(a\*x.a-b\*x.b,a\*x.b+b\*x.a);}

};

void fft(complex \*A,int len,int inv){//抄的板子

int i,j,k;

for (i=1,j=len/2;i<len-1;i++){

if (i<j) swap(A[i],A[j]);

k=len/2;

while(j>=k){

j-=k;

k/=2;

}if (j<k) j+=k;

}

for(i=2;i<=len;i<<=1){

complex wn(cos(-inv\*2\*pi/i),sin(-inv\*2\*pi/i));

for (j=0;j<len;j+=i){

complex w(1.0,0.0);

for (k=j;k<(j+i/2);k++){

complex a=A[k],b=w\*A[k+i/2];

A[k]=a+b;

A[k+i/2]=a-b;

w=w\*wn;

}

}

}

if (inv==-1) REP(i,len) A[i].a/=len;

}

complex x1[maxn],x2[maxn];

char a[maxn],b[maxn];

int ans[maxn];

int main(){

int T;

int i,j,k;

scanf("%d",&T);

while (T--){

scanf("%s%s",a,b);

bool mark=0;;

int len1=strlen(a),len2=strlen(b),len=1;

if (a[0]=='-')

{REP(i,len1) a[i]=a[i+1];len1--;mark^=1;}

if (b[0]=='-')

{REP(i,len2) b[i]=b[i+1];len2--;mark^=1;}

while(len<=len1+len2+1) len<<=1;

REP(i,len1) x1[i]=complex(a[len1-i-1]-'0',0);

rep(i,len1,len) x1[i]=complex(0,0);

REP(i,len2) x2[i]=complex(b[len2-i-1]-'0',0);

rep(i,len2,len) x2[i]=complex(0,0);

fft(x1,len,1);fft(x2,len,1);

REP(i,len) x1[i]=x1[i]\*x2[i];

fft(x1,len,-1);

REP(i,len) ans[i]=x1[i].a+0.5;

REP(i,len) ans[i+1]+=ans[i]/10,ans[i]%=10;

while (ans[len-1]<=0&&len-1>0) len--;

if (mark) putchar('-');

rREP(i,len) putchar(ans[i]+'0');

puts("");

}

}

**NTT：**

const LL MOD=2281701377;

const LL g=3;

LL mul ( LL x , LL y ) {

return x\*y%MOD;

// return ( x \* y - ( long long ) ( x / ( long double ) MOD \* y + 1e-3 ) \* MOD + MOD ) % MOD ;

}

LL poww(LL a,LL b){

LL ret=1;

for (;b;b>>=1ll,a=mul(a,a))

if (b&1) ret=mul(ret,a);

return ret;

}

void ntt(LL \*A,int len,int inv){//抄的板子

int i,j,k;

for (i=1,j=len/2;i<len-1;i++){

if (i<j) swap(A[i],A[j]);

k=len/2;

while(j>=k){

j-=k;

k/=2;

}if (j<k) j+=k;

}

for(i=2;i<=len;i<<=1){

LL wn=poww(g,(MOD-1)/i);

if (inv==-1) wn=poww(wn,MOD-2);

for (j=0;j<len;j+=i){

LL w=1;

for (k=j;k<(j+i/2);k++){

LL a=A[k],b=mul(w,A[k+i/2]);

A[k]=(a+b)%MOD;

A[k+i/2]=(a-b+MOD)%MOD;

w=mul(w,wn);

}

}

}

if (inv==-1){

LL vn=poww(len,MOD-2);

REP(i,len) A[i]=mul(A[i],vn);

}

}

**FWT：**

void fwt(LL \*A,int len,int inv)//对拍对了

{

int i,j,k;

int div=powMM(2ll,M-2);

for(i=2;i<=len;i<<=1){

for(j=0;j<len;j+=i){

for(k=j;k<j+i/2;k++){

if (inv==1){

LL a=A[k],b=A[k+i/2];

A[k]=(a+b)%M;

A[k+i/2]=(a-b+M)%M;

//xor:a[k]=x+y,a[k+i/2]=(x-y+mod)%mod;

//and:a[k]=x+y;

//or:a[k+i/2]=x+y;

}else{

LL a=A[k],b=A[k+i/2];

A[k]=(a+b)\*div%M;

A[k+i/2]=(a-b+M)%M\*div%M;

//xor:a[k]=(x+y)/2,a[k+i/2]=(x-y)/2;

//and:a[k]=x-y;

//or:a[k+i/2]=y-x;

}

}

}

}

}

子集卷积(的分治套路)

**//http://acm.hdu.edu.cn/showproblem.php?pid=6057**

**//很容易卡T...3^18也许能过**

**//这个比2^nlog^2(n=19)的慢了快5倍**

**//这种思路这种题都能用**

int T;

int n;

ULL A[1<<19|7],B[1<<19|7];

ULL C[1<<22|7];

ULL ans,mul;

inline void solve(ULL \*A,ULL \*B,ULL \*C,int len){

int i;

if (len==2) {C[1]=A[0]\*B[1];C[0]=2\*A[1]\*B[1]+A[0]\*B[0];return;}//这样要快

// if (len==1) {C[0]=1ll\*A[0]\*B[0]%M;return;}

ULL \*D=C+len;

len>>=1;

solve(A,B,D,len);//这里A和B可能是要算的,这种情况下这就是正解

solve(A,B+len,D+len,len);

solve(A+len,B+len,D+len+len,len);

REP(i,len){

C[i+len]=D[i+len];

(C[i]=D[i+len+len]\*2+D[i])>INFF&&(C[i]%=M);

}

}

int main(){

int i;

scanf("%d",&n);

REP(i,(1<<n)) read(A[i]);

REP(i,(1<<n)) read(B[i]);

solve(A,B,C,1<<n);

mul=1;

REP(i,(1<<n)) {

// printf("%d ",C[i]);

C[i]%=M;

ans+=C[i]\*mul;

if(ans>INFF) ans%=M;

mul=1526\*mul%M;

}ans%=M;

printf("%llu\n",ans);

return 0;

}

**//真\*子集卷积by TLS**

const int maxn = 1 << 19 | 1, mod = 998244353, seed = 1526;

int n, all, bit[maxn], a[maxn], b[maxn], ans;

inline void mod\_inc(int &x, int y) {

(x += y) >= mod && (x -= mod);

}

int main() {

while(scanf("%d", &n) == 1) {

all = (1 << n) - 1;

for(int i = 0; i <= all; ++i)

scanf("%d", a + i);

for(int i = 0; i <= all; ++i)

scanf("%d", b + i);

bit[0] = 1;

for(int i = 1; i <= all; ++i) {

bit[i] = bit[i >> 1] << (i & 1);

a[i] = (LL)a[i] \* bit[i] % mod;

}

ans = 0;

for(int i = all; i >= 0; --i) {

int msk = all ^ i, tim = 0;

ULL cnt = 0;

for(int j = msk; j; j = (j - 1) & msk) {

cnt += (ULL)a[j] \* b[i | j];

(++tim) == 18 && (tim = 0, cnt %= mod);

}

cnt += (ULL)a[0] \* b[i];

cnt %= mod;

ans = ((LL)seed \* ans + cnt) % mod;

}

printf("%d\n", ans);

}

return 0;

}

高斯消元

**//求行列式的值**

**//%m,m为质数的积**

**//从0开始**

template<typename T>inline T poww(T a,T b,T M) {

T ret=1;

for (; b; b>>=1ll,a=1ll\*a\*a%M)

if (b&1) ret=1ll\*ret\*a%M;

return ret;

}

LL guass(LL A[107][107],int n,LL M) {

LL ret=1; int i,j,k;

REP(i,n) {

int id=i;

if (!A[i][i]) rep(j,i+1,n) if (A[j][i]) id=j;

if (!A[id][i]) continue;

if (id!=i) {rep(j,i,n) swap(A[i][j],A[id][j]); ret\*=-1;}

A[i][i]%=M; (A[i][i]<0) &&(A[i][i]+=M);

LL rev=poww(A[i][i],M-2,M);

rep(k,i+1,n)

rrep(j,i,n)(A[k][j]-=(LL)A[k][i]\*rev%M\*A[i][j])%=M;

} REP(i,n)(ret\*=A[i][i])%=M;

(ret<0) &&(ret+=M);

return ret;

}

LL A[107][107],B[107][107];

void exgcd(LL a,LL b,LL &d,LL &x,LL &y) {

if (!b) {d=a; x=1; y=0;}

else {exgcd(b,a%b,d,y,x); y-=a/b\*x;}

}

vector<LL> P;

vector<LL> Ans;

LL ans;

LL chinese\_remainder(vector<LL> &m,vector<LL> &r) {

int i; LL M=m[0],R=r[0];

rep(i,1,P.size()) {

LL x,y,d;

exgcd(M,m[i],d,x,y);

if ((r[i]-R)%d) return -1;

x=(r[i]-R)/d\*x%(m[i]/d);

R+=x\*M; M=M/d\*m[i];

R%=M; (R<0) &&(R+=M);

} return R;

}

int n,m;

int i,j,k;

int main() {

while (~scanf("%d%d",&n,&m)) {

P.clear(); Ans.clear();

REP(i,n)

REP(j,n) scanf("%lld",&A[i][j]);

for (i=2; i\*i<=m; i++) if (m%i==0) {

P.push\_back(i);

while (m%i==0) m/=i;

} if (m!=1) P.push\_back(m);

for (int v:P) {

REP(i,n) REP(j,n) B[i][j]=A[i][j];

Ans.push\_back((LL)guass(B,n,v));

}

ans=chinese\_remainder(P,Ans);

printf("%lld\n",ans);

}

}

**//emmmm kuangbin模板好像是错的**

**//这里是求正数的类似解,可能会不够精确**

bool gauss(long double A[107][107],long double X[107],int n,int m) {

int i,j,k;

REP(i,n) {

int id=i;

rep(j,i+1,m) if (abs(A[j][i])>abs(A[id][i])) id=j;

if (abs(A[id][i])<eps) continue;

if (id!=i)

{rep(j,i,n) swap(A[i][j],A[id][j]); swap(X[i],X[id]);}

REP(k,m) if (k!=i) {

X[k]-=A[k][i]/A[i][i]\*X[i];

rrep(j,i,n) A[k][j]-=A[k][i]/A[i][i]\*A[i][j];

}

}

REP(i,n) if (abs(A[i][i])<eps&&abs(X[i])>eps) return 0;

rep(i,n,m) if (abs(X[i])>eps) return 0;

REP(i,n) if (abs(A[i][i])<eps||abs(X[i])<eps) X[i]=0;

else X[i]/=A[i][i];

return 1;

}

矩阵树定理|拉格朗日插值

// 题意:求生成树中含k条给定树边的生成树个数

// 做法:为给定边加不同权值,然后矩阵树定理

// 矩阵树定理:生成树数量=|基尔霍夫矩阵C=D-A|;

// D为度数矩阵,A为边矩阵

// 然后拉格朗日插值求出系数即可

LL guass(LL A[107][107],int n,LL M) {

LL ret=1; int i,j,k;

REP(i,n) {

int id=i;

if (!A[i][i]) rep(j,i+1,n) if (A[j][i]) id=j;

if (!A[id][i]) continue;

if (id!=i) {rep(j,i,n) swap(A[i][j],A[id][j]); ret\*=-1;}

A[i][i]%=M; (A[i][i]<0) &&(A[i][i]+=M);

LL rev=poww(A[i][i],M-2,M);

rep(k,i+1,n) rrep(j,i,n)

(A[k][j]-=(LL)A[k][i]\*rev%M\*A[i][j])%=M;

} REP(i,n)(ret\*=A[i][i])%=M;

(ret<0) &&(ret+=M);

return ret;

}

int n,m;

int i,j,k;

int a[107][107]; LL A[107][107];

LL val[107],v\_v[107];

LL f[107],g[107],ans[107];

int main() {

scanf("%d",&n);

FOR(i,1,n-1) {

int u,v;

scanf("%d%d",&u,&v); u--; v--;

a[u][v]=a[v][u]=1;

} REP(i,n) v\_v[i]=i;

REP(k,n) {

REP(i,n) REP(j,n) A[i][j]=0;

REP(i,n) REP(j,n) if (i!=j) {

if (a[i][j]) A[i][j]=M-v\_v[k],A[i][i]+=v\_v[k];

else A[i][j]=M-1,A[i][i]++;

} val[k]=guass(A,n-1,M);

}

g[0]=1; REP(i,n) rFOR(j,0,i)(g[j+1]+=g[j])%=M,(g[j]\*=(M-v\_v[i]))%=M;

REP(k,n) {

LL rev=1;

rFOR(i,0,n) f[i]=(g[i+1]+f[i+1]\*v\_v[k]%M+M)%M;

REP(j,n) if (j!=k)(rev\*=(v\_v[k]-v\_v[j]))%=M;

(rev<0) &&(rev+=M); rev=powMM(rev,M-2);

rev=(rev\*val[k])%M;

FOR(i,0,n)(ans[i]+=(LL)f[i]\*rev%M)%=M;

} FOR(i,0,n-1) printf("%lld ",ans[i]);

}

Polya定理| Burnside引理

//HDU3923; 颜色m, 个数n, 翻转或者置换当成一种

//ans=1/|G|\*sigma{pow(k(color),m(not move point 不动点数))}

//注意特殊形式

//Burnside引理:等价类个数l=sum{ci(ai)},ci是置换下的不动点数

//这个pow是可以变化成其他形式的

//注意,polya定理相当于手动算了一下Burnside引理中不动点的个数!

int n,m;

bool mark[maxn];

int phi[maxn];

int p[maxn],tot;

int main() {

int i,j;

phi[1]=1;

FOR(i,2,1000000) {

if (!mark[i]) p[tot++]=i,phi[i]=i-1;

REP(j,tot) {

if (i\*p[j]>1000000) break;

//感觉上不会爆,因为是从小往筛的

mark[i\*p[j]]=1;

if (i%p[j]==0) {phi[i\*p[j]]=phi[i]\*p[j]; break;}

else phi[i\*p[j]]=phi[i]\*(p[j]-1);

}

}

int t,T;

scanf("%d",&T);

FOR(t,1,T) {

scanf("%d%d",&m,&n);

LL all=0,cnt=0;

// FOR(i,1,n){

// (all+=powMM((LL)m,gcd(n,i)))%=M;

// (all<0)&&(all+=M);

// }cnt=n;

//置换

FOR(i,1,n) if (n%i==0) {

(all+=(LL)powMM(m,i)\*phi[n/i])%=M;

(all<0) &&(all+=M);

}

cnt=n;

//翻转

if (n&1) {

(all+=(LL)n\*powMM(m,(n+1)/2))%=M;

cnt+=n;

} else {

(all+=(LL)n/2\*powMM(m,n/2))%=M;

(all+=(LL)n/2\*powMM(m,n/2+1))%=M;

cnt+=n;

}

// printf("%lld %lld\n",cnt,all);

all=all\*powMM(cnt,M-2)%M;

printf("Case #%d: %lld\n",t,all);

}

}

Miller\_Rabin素性测试+pollard\_rho因数分解

**poj1181**

**/\*miller\_rabin\*/**

const int times=8;// random\_check; 8-12 is OK

LL mul(LL a,LL b,LL M) {

LL ret=0;

for (; b; b>>=1,(a+=a)>=M&&(a-=M))

if (b&1)(ret+=a)>=M&&(ret-=M);

return ret;

}

LL poww(LL a,LL b,LL M) {

LL ret=1;

for (; b; b>>=1,a=mul(a,a,M))

if (b&1) ret=mul(ret,a,M);

return ret;

}

bool check(LL a,LL n,LL x,LL t) {

LL ret=poww(a,x,n);

LL last=ret;

for (ret=mul(ret,ret,n); t--; last=ret,ret=mul(ret,ret,n))

if (ret==1&&last!=1&&last!=n-1) return true;

if (ret!=1) return true;

return false;

}

bool miller\_rabin(LL n) {

if (n<2) return false;

if (!(n&1)) return (n==2);

LL x=n-1,t=0;

while (!(x&1)) x>>=1,t++;

int i;

REP(i,times)

if (check(rand()%(n-1)+1,n,x,t)) return false;

return true;

}

**/\*pollard\_rho\*/**

LL pollard\_rho(LL x,LL c) {

LL x0=rand()%(x-1)+1;

LL y=x0; c%=x;

for (LL i=2,k=2;; i++) {

((x0=mul(x0,x0,x)+c)>=x)&&(x0-=x);

LL d=gcd(y-x0+x,x);

if (d!=1&&d!=x) return d;

if (y==x0) return x;

if (i==k) y=x0,k+=k;

}

}

LL factor[107]; int tot;

void findfac(LL n,int k) {

if (n==1) return;

if (miller\_rabin(n)) {factor[tot++]=n; return;}

LL p=n;

int c=k;

while (p>=n) p=pollard\_rho(p,c--);

findfac(p,k);

findfac(n/p,k);

}

int main() {

int T;

srand(time(0));

scanf("%d",&T);

while (T--) {

LL n; int i;

scanf("%I64d",&n);

if (miller\_rabin(n)) puts("Prime");

else {

tot=0;

findfac(n,107);

LL ans=factor[0];

REP(i,tot) ans=min(ans,factor[i]);

printf("%I64d\n",ans);

}

}

}

中国剩余定理(不一定互质)

void exgcd(LL a,LL b,LL &d,LL &x,LL &y){

if (!b) {d=a;x=1;y=0;}

else {exgcd(b,a%b,d,y,x);y-=a/b\*x;}

}

int n,m;

int i,j,k;

vector<LL> P,O;

int ans;

LL chinese\_remainder(vector<LL> &m,vector<LL> &r){

int i;LL M=m[0],R=r[0];

rep(i,1,P.size()){

LL x,y,d;

exgcd(M,m[i],d,x,y);

if ((r[i]-R)%d) return -1;

x=(r[i]-R)/d\*x%(m[i]/d);

R+=x\*M;M=M/d\*m[i];

R%=M;(R<0)&&(R+=M);

}return R;

}

int main(){

while (~scanf("%d",&n)){

P.clear();O.clear();

REP(i,n){

LL k;

scanf("%lld",&k);P.push\_back(k);

scanf("%lld",&k);O.push\_back(k);

}printf("%lld\n",chinese\_remainder(P,O));

}

}

Prime-counting function

**//这道题题意:小于n有多少个数字有4个因子**

**//(两个质数积,一个质数三次方)**

**//注意容斥减去多算的**

**//http://codeforces.com/blog/entry/44466?#comment-290036/**

**//考虑S(v,m):2...v,质因子全都>=m;那么考虑容斥:**

**//容斥掉的至少有一个p,而且没有小于p的因子**

**//很明显的,p=min(p,sqrt(v));**

**//S(v,p)=S(v,p-1)-(S(v/p,p-1)-S(p-1,p-1));(DP)**

**//那么反过来算即可;pi(n)=S(n,n);**

**//H[i]:pi(n/i);L[i]:pi(i)**

**//计算过程中,L[i]表示S(i,p),最终S(i,i)**

**//简单的这样DP,时间复杂度O(n^3/4),如果预处理n^2/3则最终n^2/3**

**//在后方,如果要容斥,FOR是很不方便的,感觉还是最好直接搞复杂度有保障**

LL H[maxn],L[maxn];

void calc(LL n) {

LL p,k,m;

for (m=1; m\*m<=n; ++m) H[m]=n/m-1;

FOR(p,1,m) L[p]=p-1;

FOR(p,2,m) {//在这里,如果前方限制了P的最大值,是min(P,m)

if (L[p]==L[p-1]) continue;//not\_prime

FOR(k,1,min(m-1,n/p/p)) {

if (p\*k<m) H[k]-=H[p\*k]-L[p-1];

else H[k]-=L[n/p/k]-L[p-1];

}

rFOR(k,p\*p,m) L[k]-=L[k/p]-L[p-1];

}

}

LL n,ans,i;

int main() {

scanf("%I64d",&n);

calc(n);

LL m=sqrt(n-1);

while (m\*m<=n) m++;

m--;

FOR(i,2,m) if (L[i]!=L[i-1]) ans+=H[i]-L[i];

m=cbrt(n-1);

while (m\*m\*m<=n) m++;

m--;

ans+=L[m];

printf("%I64d\n",ans);

}

N^2/3的方法:

**//pcf:get\_cnt；pcf::Lehmer(x)**

namespace pcf {

#define clr(ar) memset(ar, 0, sizeof(ar))

#define chkbit(ar, i) (((ar[(i) >> 6]) & (1 << (((i) >> 1) & 31))))

#define setbit(ar, i) (((ar[(i) >> 6]) |= (1 << (((i) >> 1) & 31))))

#define isprime(x) (( (x) && ((x)&1) && (!chkbit(ar, (x)))) || ((x) == 2))

const int MAXN=100;

const int MAXM=100010;

const int MAXP=666666;

const int MAX=10000010;

long long dp[MAXN][MAXM];

unsigned int ar[(MAX >> 6) + 5] = {0};

int len = 0, primes[MAXP], counter[MAX];

void Sieve() {//nloglogn...这里压64位减了点空间

setbit(ar, 0), setbit(ar, 1);

for (int i = 3; (i \* i) < MAX; i++, i++) {

if (!chkbit(ar, i)) {

int k = i << 1;

for (int j = (i \* i); j < MAX; j += k) setbit(ar, j);

}

}

for (int i = 1; i < MAX; i++) {

counter[i] = counter[i - 1];

if (isprime(i)) primes[len++] = i, counter[i]++;

}

}

void init() {

Sieve();

for (int n = 0; n < MAXN; n++) {

for (int m = 0; m < MAXM; m++) {

if (!n) dp[n][m] = m;

else dp[n][m] = dp[n - 1][m] - dp[n - 1][m / primes[n - 1]];

}

}

}

long long phi(long long m, int n) {

if (n == 0) return m;

if (primes[n - 1] >= m) return 1;

if (m < MAXM && n < MAXN) return dp[n][m];

return phi(m, n - 1) - phi(m / primes[n - 1], n - 1);

}

long long Lehmer(long long m) {//这里只是加速

if (m < MAX) return counter[m];

long long w, res = 0;

int i, a, s, c, x, y;

s = sqrt(0.9 + m), y = c = cbrt(0.9 + m);

a = counter[y], res = phi(m, a) + a - 1;

for (i = a; primes[i] <= s; i++) res = res - Lehmer(m / primes[i]) + Lehmer(primes[i]) - 1;

return res;

}

}

欧拉降幂公式

**//n^x(mod m)=m^(phi(m)+x%phi(m))%m (x>m)**

**//这个题让求pow(l,pow(l+1...pow(r)))**

inline int mod(LL a,int b){

if (a<b) return a;

return a%b+b;

}

inline int poww(int a,int b,int M){

int ret=1;

for (;b;b>>=1ll,a=mod(1ll\*a\*a,M))

if (b&1) ret=mod(1ll\*ret\*a,M);

return ret;

}

typedef pair<int,int> pii;

int P[maxn];

int phi(int x){

int k=x;

for (int i=2;i\*i<=k;i++) if (k%i==0){

x=x/i\*(i-1);

while (k%i==0) k/=i;

}if (k!=1) x=x/k\*(k-1);

return x;

}

int a[maxn];

int tot;

int solve(int l,int r,int pos){

if (l==r||pos==tot) return mod(a[l],P[pos]);

return poww(a[l],solve(l+1,r,pos+1),P[pos]);

}

int n,m,q;

int i,j,k;

int main(){

scanf("%d%d",&n,&m);

FOR(i,1,n) scanf("%d",&a[i]);

P[1]=m;

for (tot=1;P[tot]!=1;tot++) P[tot+1]=phi(P[tot]);

// FOR(i,1,tot) printf("%d ",P[i]);puts("");

scanf("%d",&q);

FOR(i,1,q){

int l,r;int ans=1;

scanf("%d%d",&l,&r);

printf("%d\n",solve(l,r,1)%m);

}

}

其他的东西

***BSGS：a^x = b (mod p)***

***做法：假设m=sqrt(p)+1; x=i\*m-j(0<i<j)***

***枚举i和j，我们得到了一个sqrt(p)的做法***

自适应 simpson积分

double simpson(double a,double b) {

double c = a + (b-a)/2;

return (F(a) + 4\*F(c) + F(b))\*(b-a)/6;

}

double asr(double a,double b,double eps,double A) {

double c = a + (b-a)/2;

double L = simpson(a,c), R = simpson(c,b);

if (fabs(L + R - A) <= 15\*eps)

return L + R + (L + R - A)/15.0;

return asr(a,c,eps/2,L) + asr(c,b,eps/2,R);

}

double asr(double a,double b,double eps) {

return asr(a,b,eps,simpson(a,b));

}

(我全都不会的)积性函数

1. **欧拉函数**

bool mark[maxn];

int phi[maxn];

int p[maxn],tot;

const int MAX=1e6;

void init(int x){

tot=0;int i,j;phi[1]=1;

FOR(i,2,MAX){

if (!mark[i]) p[tot++]=i,phi[i]=i-1;

REP(j,tot){

//感觉上不会爆,因为是从小往筛的

if (i\*p[j]>MAX) break;

mark[i\*p[j]]=1;

if (i%p[j]==0) {phi[i\*p[j]]=phi[i]\*p[j];break;}

else phi[i\*p[j]]=phi[i]\*(p[j]-1);

}

}

}

1. **莫比乌斯函数**

bool mark[maxn];

int mu[maxn];

int p[maxn],tot;

const int MAX=1e6;

void init(int x){

tot=0;int i,j;

FOR(i,2,MAX){

if (!mark[i]) p[tot++]=i,mu[i]=1;

REP(j,tot){

//感觉上不会爆,因为是从小往筛的

if (i\*p[j]>MAX) break;

mark[i\*p[j]]=1;

if (i%p[j]==0) break;

else mu[i\*p[j]]=-mu[i];

}

}

}

1. **用法和性质(不会qwq)**

**首先是简单性质：**

**n=sigma{phi(d)[d|n]} 将phi看作容斥系数**

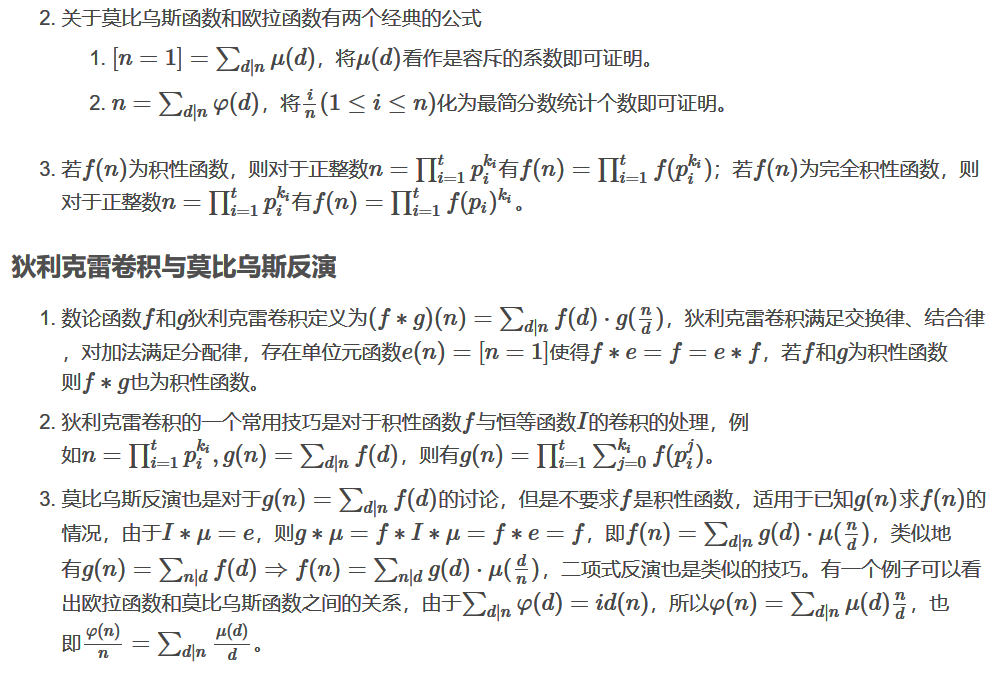
**[n=1]=sigma{mu(d)[d|n]} 将i/n化为最简分数**

**这里可以把gcd或者lcm的式子提出来!**

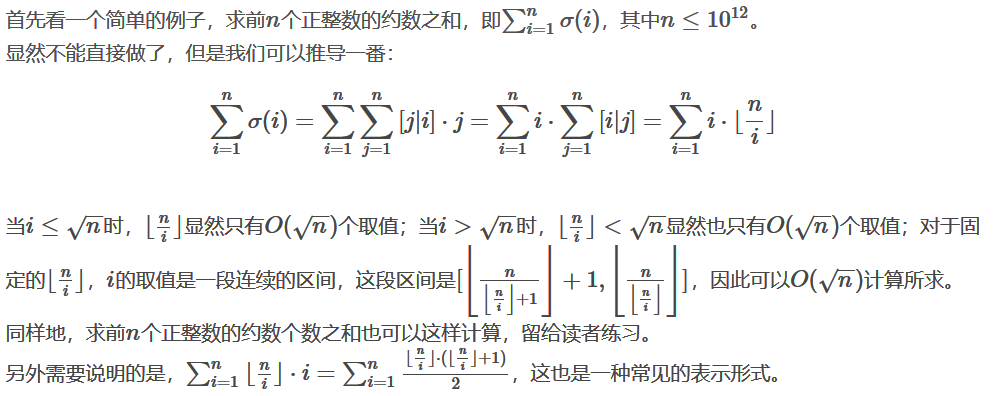
**1…n的与n互质数和n\*phi(n)/2**

**然后，经过推导可能将某些式子化成简单形式就能做了qwq完全不会，智商不够没办法……**

**懒得写了放个图**



**黑科技大概就是说把phi，mu或者其他的东西提到前面然后换元来做，根本不会qwq**

****

超麻烦的类欧几里得

一定注意前面是a,后面是b,线段树一定要注意顺序

f(a,b,c,n)=sigma{(ai+b)/c}; (0->n)

g(a,b,c,n)=sigma{(ai+b)/c\*i}; (0->n)

h(a,b,c,n)=sigma{((ai+b)/c)^2}; (0->n)

let m=(a\*n+b)/c;

**推导f:**

**a=0:**

return b/c\*(n+1)

**a>=c||b>=c:有一部分是规律的;**

return (a/c)\*n(n+1)/2+(b/c)\*(n+1)+f(a%c,b%c,c,n)

**else:直接算,这个东西是个梯形中的点数,反过来算就可以了**

f(a,b,c,n)=∑i=0->n ∑j=0->m-1 [(ai+b)/c>=j+1]

f(a,b,c,n)=∑i=0->n ∑j=0->m-1 [ai>=cj+c−b]

f(a,b,c,n)=∑i=0->n ∑j=0->m-1 [ai>cj+c−b−1]

f(a,b,c,n)=∑i=0->n ∑j=0->m-1 [i>(cj+c−b−1)/a]

f(a,b,c,n)=∑j=0->m (n−(cj+c−b−1)/a)

f(a,b,c,n)=n\*m-f(c,c-b-1,a,m-1);

**推导g:**

**a=0:**

return b/c\*n(n+1)/2 (sigma的是i)

**a>=c||b>=c:有一部分是规律的;**

g(a,b,c,n)=(a/c)\*n(n+1)(2n+1)/6+(b/c)\*n(n+1)/2+g(a%c,b%c,c,n)

**else:**

g(a,b,c,n)=∑i=0->n i\*∑j=0->m [(ai+b)/c>=j]

g(a,b,c,n)=∑i=0->n i\*∑j=0->m-1 [i>(cj+c−b−1)/a]

然后把这个i放进去求和

g(a,b,c,n)=1/2\*∑j=0->m-1 (n+1+(cj+c−b−1)/a)\*(n−(cj+c−b−1)/a)

g(a,b,c,n)=1/2\*∑j=0->m-1 n(n+1)−(cj+c−b−1)/a−[(cj+c−b−1)/a]^2

g(a,b,c,n)=1/2\*[n(n+1)\*m−f(c,c−b−1,a,m−1)−h(c,c−b−1,a,m−1)]

**推导h:**

**a=0:**

return (b/c)^2\*(n+1) (sigma的是i)

**a>=c||b>=c:有一部分是规律的;**

h(a,b,c,n)=(a/c)^2\*n(n+1)(2n+1)/6+(b/c)^2\*(n+1)+(a/c)\*(b/c)\*n(n+1)

+h(a%c,b%c,c,n)+2\*(a/c)\*g(a%c,b%c,c,n)+2\*(b/c)\*f(a%c,b%c,c,n)

**else:**

n^2=2\*n(n+1)/2−n=2(∑i=0->n i)−n

有了思路我们来推h

h(a,b,c,n)=∑i=0->n (2(∑j=1->(ai+b)/c j)−(ai+b)/c)

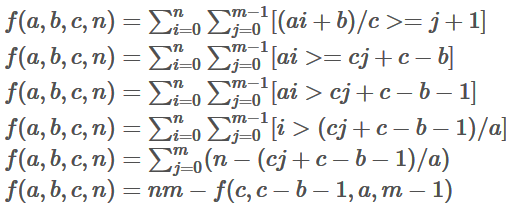
可以想到交换主体。

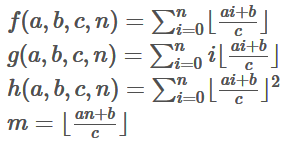
h(a,b,c,n)=∑j=0->m-1 (j+1)\*∑i=0->n [(ai+b)/c>=j+1]−f(a,b,c,n)

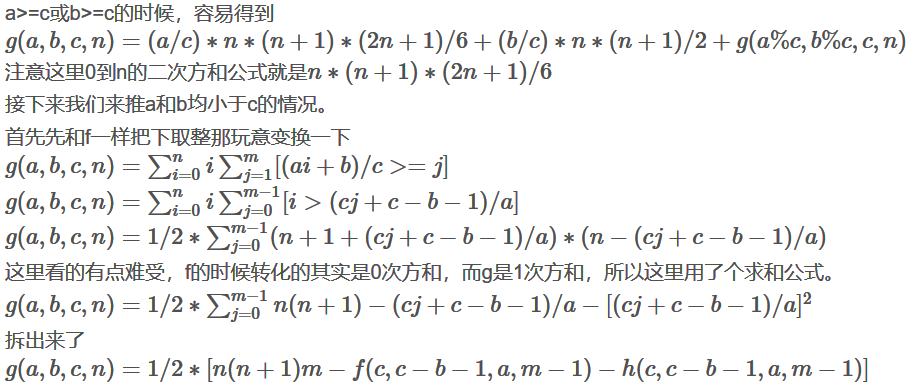
h(a,b,c,n)=∑j=0->m-1 (j+1)\*∑i=0->n [i>(cj+c−b−1)/a]−f(a,b,c,n)

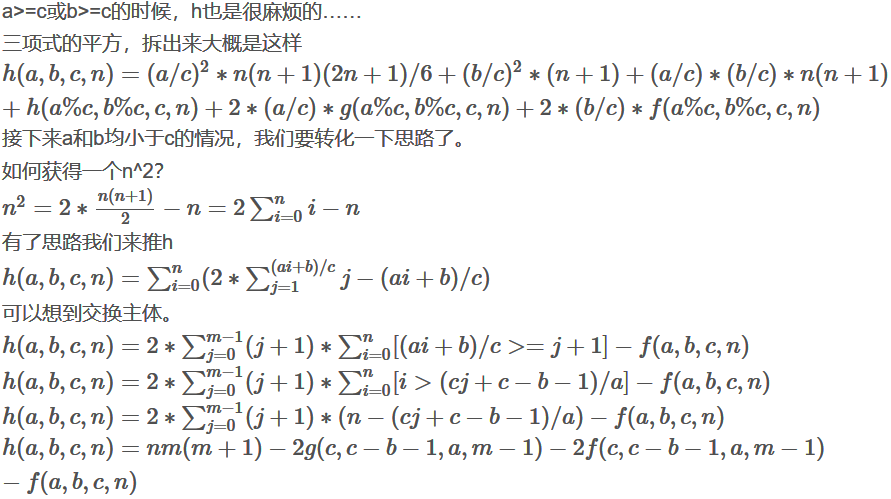
h(a,b,c,n)=∑j=0->m-1 (j+1)\*(n−(cj+c−b−1)/a)−f(a,b,c,n)

h(a,b,c,n)=n\*m(m+1)−2g(c,c−b−1,a,m−1)−2f(c,c−b−1,a,m−1)−f(a,b,c,n)









# 不会的计算几何

**切比雪夫距离转曼哈顿距离：**

**切比雪夫距离：max(|x1-x2|,|y1-y2|);**

**曼哈顿距离：|x1-x2|+|y1-y2|**

**转化方式：旋转45度然后/2**

**(x,y)->((x+y)/2,(x-y)/2)**

**曼哈顿距离最小生成树：**

**按照45度4个方向排序，最近的两个点连边即可**

**swap方向代码：**

int a[MAXN],b[MAXN];

tot = 0;

for (int dir = 0; dir < 4; dir++) {

//4种坐标变换

if (dir == 1 || dir == 3) {

for (int i = 0; i < n; i++) swap(p[i].x,p[i].y);

} else if (dir == 2) {

for (int i = 0; i < n; i++) p[i].x = -p[i].x;

}

sort(p,p+n,cmp);

for (int i = 0; i < n; i++)

a[i] = b[i] = p[i].y - p[i].x;

sort(b,b+n);

int m = unique(b,b+n) - b;

for (int i = 1; i <= m; i++) bit[i].init();

for (int i = n-1 ; i >= 0; i--) {

int pos = lower\_bound(b,b+m,a[i]) - b + 1;

int ans = ask(pos,m);

if (ans != -1)

addedge(p[i].id,p[ans].id,dist(p[i],p[ans]));

update(pos,p[i].x+p[i].y,i);

}

}

求凸包(旋转卡壳,最近最远点对)

inline int sgn(double x) {

if (abs(x)<eps) return 0;

if (x<0) return -1;

return 1;

}

struct point {

LL x,y;

bool operator <(const point &a) const {

if (y<a.y) return 1;

if (y>a.y) return 0;

return x<a.x;

}

} p[maxn],P[maxn],p1[maxn];

inline LL X(point A,point B,point C) {

return (B.x-A.x)\*(C.y-A.y)-(B.y-A.y)\*(C.x-A.x);

}

inline LL len(point A,point B) {

return (A.x-B.x)\*(A.x-B.x)+(A.y-B.y)\*(A.y-B.y);

}

bool cmp(point A,point B) {

LL cp=X(p[0],A,B);

if (cp>0) return 1;

if (cp<0) return 0;

return len(p[0],A)<len(p[0],B);

// return sgn(len(p[0],A)-len(p[0],B))<=0;

}

int n;

LL getMAX() { //求完凸包旋转卡壳

int tot,i,j,m;

LL ans=0;

if (n==1) {

tot=0;

P[0]=p[0];

} else if (n==2) {

tot=1;

P[0]=p[0];

P[1]=p[1];

} else {

REP(i,n) if (p[i]<p[0]) swap(p[0],p[i]);

sort(p+1,p+n,cmp);

P[0]=p[0];

P[1]=p[1];

tot=1;

rep(i,2,n) {

while (tot&&X(P[tot-1],P[tot],p[i])<=0) tot--;

P[++tot]=p[i];

}

} m=tot;

FOR(i,0,tot) P[++m]=P[i];

j=0; ans=0;

FOR(i,0,m) {

while (j<m&&len(P[i],P[j])<len(P[i],P[j+1])) j++;

ans=max(ans,len(P[i],P[j]));

} return ans;

}

inline int cmpx(point a,point b) {return a.x<b.x;}

inline int cmpy(point a,point b) {return a.y<b.y;}

LL getMIN(int l,int r) { //分治求最近点对,nsqrtn

LL ans=0;

int i,j;

if (l>=r) return INFF;

if (l+1==r) return len(p[l],p[r]);

int mid=(l+r)>>1;

ans=min(getMIN(l,mid),getMIN(mid+1,r));

int cn=0;

FOR(i,l,r) if (p[i].x-p[mid].x<ans) p1[cn++]=p[i];

sort(p1,p1+cn,cmpy);

REP(i,cn) {

rep(j,i+1,cn) {

if (p1[j].y-p1[i].y>=ans) break;

ans=min(ans,len(p1[i],p1[j]));

}

} return ans;

}

int i,j,k;

LL ans;

int main() { //0->tot是凸包上的点

while (~scanf("%d",&n)) {

REP(i,n) scanf("%lld%lld",&p[i].x,&p[i].y);

sort(p,p+n,cmpx);

printf("%lld %lld\n",getMIN(0,n-1),getMAX());

}

}