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头文件

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

#include <sstream>

#include <fstream>

#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>

#include <bitset>

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 DEBUG

#ifdef DEBUG

#define debug(...) fprintf(stderr, \_\_VA\_ARGS\_\_)

#define deputs(str) fprintf(stderr, "%s\n",str)

#else

#define debug(...)

#define deputs(str)

#endif // DEBUG

typedef unsigned long long ULL;

typedef unsigned long long ull;

typedef unsigned int ui;

typedef long long LL;

typedef long long ll;

typedef pair<int,int> pii;

typedef pair<ll,ll> pll;

const int INF=0x3f3f3f3f;

const LL INFF=0x3f3f3f3f3f3f3f3fll;

const LL M=1e9+7;

const LL maxn=1e6+7;

const double pi=acos(-1.0);

const double eps=0.0000000001;

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

template<typename T>inline void pr2(T x,int k=64) {ll i; REP(i,k) debug("%d",(x>>i)&1); putchar(' ');}

template<typename T>inline void add\_(T &A,int B,ll MOD=M) {A+=B; (A>=MOD) &&(A-=MOD);}

template<typename T>inline void mul\_(T &A,ll B,ll MOD=M) {A=(A\*B)%MOD;}

template<typename T>inline void mod\_(T &A,ll MOD=M) {A%=MOD; A+=MOD; A%=MOD;}

template<typename T>inline void max\_(T &A,T B) {(A<B) &&(A=B);}

template<typename T>inline void min\_(T &A,T B) {(A>B) &&(A=B);}

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;

}

int n,m,q;

char str[maxn];

int startTime;

void startTimer() {startTime=clock();}

void printTimer() {debug("/--- Time: %ld milliseconds ---/\n",clock()-startTime);}

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);**

**}**

****并查集(维护块)****

struct Edge {

int u,v,val;

} edge[maxn];

int head[maxn];

bool cmp(Edge &A,Edge &B){

return A.val<B.val;

};

int fa[maxn];

ULL sum[maxn],cnt[maxn];

inline int getfa(int x){

if (fa[x]==x) return x;

int y=getfa(fa[x]);

if (fa[x]!=y) sum[x]+=sum[fa[x]];

fa[x]=y;

return y;

}

int solve(){

int n,m;

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

int i;

REP(i,m)

scanf("%d%d%d",&edge[i].u,&edge[i].v,&edge[i].val);

sort(edge,edge+m,cmp);

FOR(i,1,n) fa[i]=i,sum[i]=0,cnt[i]=1;

REP(i,m){

int x=getfa(edge[i].u),y=getfa(edge[i].v);

if (x==y) continue;

if (cnt[x]>cnt[y]) swap(x,y);

sum[y]+=cnt[x]\*edge[i].val;

sum[x]+=cnt[y]\*edge[i].val;

sum[x]-=sum[y];fa[x]=y;

cnt[y]+=cnt[x];

}ULL ans=0;

FOR(i,1,n){

int x=getfa(i);

ULL val=sum[i];

if (x!=i) val+=sum[x];

// printf("%d:%I64d ",i,val);

ans^=(ULL)i\*val;

}static int x=0;;

printf("Case #%d: %llu\n",++x,ans);

return 0;

}

读入挂

**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);

**//namespace输入挂**

namespace fastIO {//感觉没问题, 测试几次

#define BUF\_SIZE 100000

namespace Istream {

bool IOerror = 0;

inline char ic() {

static char buf[BUF\_SIZE],\*p1=buf+BUF\_SIZE,\*pend=buf+BUF\_SIZE;

if (p1==pend) {

p1=buf;

pend=buf+fread(buf,1,BUF\_SIZE,stdin);

if (pend == p1) {IOerror = 1; return -1;}

} return \*p1++;

}

inline bool blank(char ch) {

return ch == ' ' || ch == '\n' || ch == '\r' || ch == '\t';

}

template<typename T>

inline void readPositive(T &x) {//no

char ch;

while (blank(ch=ic()));

if (IOerror) return;

for (x=0; '0'<=ch&&ch<='9'; ch=ic()) x=x\*10+ch-'0';

}

template<typename T>

inline void read(T &x) {

char ch; T op=1;

while (blank(ch=ic()));

if (IOerror) return;

if (ch=='-') op=-1,ch=ic();

for (x=0; '0'<=ch&&ch<='9'; ch=ic()) x=x\*10+ch-'0';

x\*=op;

}

inline void read(char &c) {

c=ic();

}

inline void read(char \*s) { //len

char ch;

while (blank(ch=ic()));

if (IOerror) return;

for (; !blank(ch)&&!IOerror; ch=ic()) \*s++=ch;

\*s='\0';

}

}

namespace Ostream {

char buf[BUF\_SIZE], \*p1 = buf, \*pend = buf + BUF\_SIZE;

inline void flush() {

fwrite(buf,1,p1-buf,stdout);

p1=buf;

}

inline void oc(char ch) {

if (p1 == pend) flush();

\*p1++=ch;

}

inline void println() {

oc('\n');

}

template<typename T>

inline void print(T x) {

static char s[27],\*s1=s;

if (!x) \*s1++='0';

if (x<0) oc('-'),x=-x;

while (x) \*s1++=x%10+'0',x/=10;

do {s1--; oc(\*s1);} while (s1!=s);

}

inline void print(char s) {

oc(s);

}

inline void print(char \*s) {

for (; \*s; oc(\*s++));

}

inline void print(const char \*s) {

for (; \*s; oc(\*s++));

}

inline void print(string s) {

for (unsigned i=0; i<s.length(); i++) oc(s[i]);

}

struct \_flush {

~\_flush() {flush();}

} fflush;

};

template<typename T>

inline void read(T &x) {Istream::readPositive(x);}

inline void read(char \*x) {Istream::read(x);}

template<typename T>

inline void print(T x) {Ostream::print(x);}

template<typename T>

inline void println(T x) {print(x); Ostream::oc('\n');}

}

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")

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));

}

树形依赖背包

**// 树形依赖背包**

**// 题意: 是否存在块的val=i**

**// 做法: 先树分治变成必须包含top**

**// 然后往下dp, 按照dfs序看, 有一段是不能用的**

**// 所以倒着来dp或, 从下往上算贡献**

**// 大概做法是考虑这个点必选, 所以整体往右移val[x]来dp**

int A[maxn];

vector<int> edge[maxn];

int sz[maxn];

bool mark[maxn];

int minweight,root;

void dfs1(int x,int fa,int n) {

int weight=0;

sz[x]=1;

for (int v:edge[x]) {

if (v==fa||mark[v]) continue;

dfs1(v,x,n); sz[x]+=sz[v];

weight=max(weight,sz[v]);

} weight=max(weight,n-sz[x]);

if (weight<minweight) root=x,minweight=weight;

}

bitset<100007> now[3007],ans;//depth

void dfs2(int x,int fa,int dep) {

now[dep]=now[dep-1]; sz[x]=1;

for (int v:edge[x]) {

if (v==fa||mark[v]) continue;

dfs2(v,x,dep+1); sz[x]+=sz[v];

} now[dep-1]|=now[dep]<<A[x];

}

void dfs3(int x) {

debug("dfs3:%d\n",x);

now[0].reset(); now[0].set(0);

dfs2(x,0,1); mark[x]=1;

ans|=now[0];

for (int v:edge[x]) {

if (mark[v]) continue;

minweight=sz[v];

dfs1(v,0,sz[v]);

dfs3(root);

}

}

int main() {

int n,m,T;

int i;

scanf("%d",&T);

while (T--) {

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

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) scanf("%d",&A[i]);

minweight=n;

dfs1(1,0,n); dfs3(root);

FOR(i,1,m) printf("%d",(int)ans[i]);

puts("");

ans.reset();

FOR(i,1,n) edge[i].clear(),mark[i]=0;

}

return 0;

}

DP套DP

**//题意:麻将胡牌的可能种数**

**//为了不数漏,方法是这样的:**

**//首先考虑每个可能情况选择的个数,只可能有3\*3\*2=18种**

**//然后我们把状态压一下,每种牌型可能的1<<18的状态!**

**//对这个1<<18的状态进行转移**

void print2(int x) {

int i;

rREP(i,18) putchar(((x>>i)&1)+'0');

} int encode(int n\_2,int n\_1,int have2) { //start from n-2 | n-1

int ret=0;

ret=ret\*3+n\_2;

ret=ret\*3+n\_1;

ret=ret\*2+have2;

return ret;

} void decode(int e,int &n\_2,int &n\_1,int &have2) {

have2=e%2; e/=2;

n\_1=e%3; e/=3;

n\_2=e%3; e/=3;

}

void printstatus(int e) {

int n\_2,n\_1,have2;

decode(e,n\_2,n\_1,have2);

printf(" %d %d %d ",n\_2,n\_1,have2);

}

int getnextstatus(int status,int k) {

int nxtstatus=0,n;

int n\_2,n\_1,have2;

int x\_2,x\_1,xave2;

REP(n,18) if ((status>>n)&1) {

decode(n,n\_2,n\_1,have2);

x\_2=n\_1; x\_1=k-n\_2-n\_1; xave2=have2;

if (x\_1>=0) {

int x=encode(x\_2,x\_1%3,xave2);

nxtstatus|=(1<<x);

// printstatus(n);printf("->");printstatus(x);printf("(+%d)",k);puts("");

} if (!have2&&x\_1-2>=0) {

int x=encode(x\_2,x\_1-2,1);

nxtstatus|=(1<<x);

// printstatus(n);printf("->");printstatus(x);printf("(+%d)",k);puts("");

}

}

// printf("get:%d->%d (k=%d)\n",status,nxtstatus,k);

return nxtstatus;

}

queue<int> Q;

int id[1<<18|7],val[1007];

int tot;

int nxt[1007][7];

void initDP() {

int i,j; tot=0;

int k;//this\_number

Q.push(1); id[0]=++tot;

while (Q.size()) {

int status=Q.front(); Q.pop();

FOR(k,0,4) { //只考虑这里产生2~

int nxtstatus=getnextstatus(status,k);

if (!id[nxtstatus]) id[nxtstatus]=++tot,val[tot]=nxtstatus,Q.push(nxtstatus);

nxt[id[status]][k]=id[nxtstatus];

}

}

// printf("%d\n",tot);

// REP(i,(1<<18)) if (id[i]){

// printf("(%-2d): ",id[i]);

// print2(i);puts("");

// REP(j,18) if ((i>>j)&1) printstatus(j);puts("");

// }

// FOR(i,1,tot){

// printf(" %-2d : ",i);

// print2(val[i]);puts("");

// REP(j,18) if ((val[i]>>j)&1) printstatus(j);puts("");

// }

}

int dp[207][207][78];

inline void update(int &x,int y) {

((x+=y)>M)&&(x-=M);

}

int solve(int n,int m) {

int i,j,k,t;

FOR(i,0,n+3) FOR(j,0,m) FOR(t,0,68) dp[i][j][t]=0;

dp[0][0][1<<id[encode(0,0,0)]]=1;

FOR(i,0,n+3) {

int MAX;

if (i<n) MAX=4; else MAX=0;

FOR(j,0,m) {

FOR(t,1,tot) if (dp[i][j][t]) {

FOR(k,0,MAX) {

int nxtpos=nxt[t][k];

// printf("%d->%d; k=%d\n",t,id[nxtstauts],k);

update(dp[i+1][j+k][nxtpos],dp[i][j][t]);

}

}

}

} int ret=0;

// FOR(t,1,tot) printf("%d: %d\n",t,dp[n+3][m][t]);

FOR(t,1,tot) {

if ((val[t]>>encode(0,0,1))&1) {

update(ret,dp[n+3][m][t]);

// printf("t=%d\n",t);

}

}

return ret;

}

int main() {

int T;

initDP();

scanf("%d",&T);

while (T--) {

int n,m;

static int x=0;

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

printf("Case #%d: %d\n",++x,solve(n,m));

}

return 0;

}

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]);

}

}

斯坦纳树, 子集卷积的计数DP

**斯坦纳树:**

**//题意: 有几个点必须连接**

**//每个边的长度是1, 问你斯坦纳树有几个**

**// 斯坦纳树, 求min\_length很简单.. min\_cnt会重复计算, 所以从小到大计算**

**// len=1, 求方案数**

struct info {

int min,cnt;

info(int \_min=INF,int \_cnt=0):min(\_min),cnt(\_cnt) {};

} f[1<<12|7][57],g[1<<12|7][57];

inline void add(info &A,info B) {

if (A.min>B.min) A=info(B.min,0);

if (A.min==B.min) add\_(A.cnt,B.cnt);

}

inline info merge(info A,info B) {

info ret(A.min+B.min,(ll)A.cnt\*B.cnt%M);

if (ret.min>n) ret.min=n,ret.cnt=0;

return ret;

}

vector<int> edge[maxn];

vector<int> have[maxn];

int now[maxn],dep[maxn],vis[maxn];

int TaskA() {

int i,j,\_,maxs; scanf(“%d%d”,&n,&m);

scanf("%d",&\_); maxs=1<<\_;

REP(i,n) edge[i].clear();

REP(i,m) {

int u,v;

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

u--; v--;

edge[u].push\_back(v);

edge[v].push\_back(u);

}

REP(i,maxs) REP(j,n) f[i][j]=g[i][j]=info(n,0);

REP(i,n) {

int cur=i<\_?1<<i:0; vis[i]=-1;

f[cur][i]=g[cur][i]=info(0,1);

}

int sta;

REP(sta,maxs) {

REP(i,n) {//f:last\_op:addedge; g:no\_limit

if (i<\_&&!((sta>>i)&1)) continue;

int remove=i<\_?1<<i:0; int remain=sta^remove;

int lowbit=remain&-remain; // 防止重复计算, 一定注意这里是remain!

if (remain)

for (int pre=remain&(remain-1); pre; pre=remain&(pre-1)) if (pre&lowbit)

add(g[sta][i],merge(f[pre|remove][i],g[(sta^pre)|remove][i]));

dep[i]=g[sta][i].min;

if (dep[i]<n) have[dep[i]].push\_back(i);

} //?被卡常了?

vector<int> Q;

REP(i,n) {

for (auto x:have[i]) {

if (vis[x]==sta) continue;

Q.push\_back(x); vis[x]=sta;

} for (auto x:Q) {

info now=info(g[sta][x].min+1,g[sta][x].cnt);

for (auto v:edge[x]) {

if (!(v<\_&&!((sta>>v)&1))) {

if (dep[v]>dep[x]+1) {

dep[v]=dep[x]+1;

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

}

} int nxtsta=v<\_?sta|(1<<v):sta;

add(g[nxtsta][v],now); add(f[nxtsta][v],now);

}

} Q.clear(); have[i].clear();

}

} // printf("%d %d\n",g[maxs-1][1].min,g[maxs-1][1].cnt);

printf("%d\n",g[maxs-1][1].cnt);

return 0;

}

**另一个题:**

**//题意:**

**//给一堆边, 每个生成树上的边贡献w[i]\*max(dep[u],dep[v])**

**//问你生成树总贡献**

**//做法: 枚举生成树, 然后直接dp 两边cnt和len得到答案**

//f:\sum{dep} g:\sum{cnt}

int e[17][17]; int ew[17][17];

int f[17][1<<12|7],g[17][1<<12|7];

int F[17][1<<12|7],G[17][1<<12|7];//F,G:link

int bit[1<<12|7];

int main() {

int i,j;

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

REP(i,m) {

int u,v,w;

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

u--; v--; e[u][v]++; e[v][u]++;

ew[u][v]+=w; ew[v][u]+=w;

} int sta;

REP(i,n) g[i][1<<i]=1;

REP(sta,(1<<n)) bit[sta]=bit[sta>>1]+(sta&1);

REP(sta,(1<<n)) {

REP(i,n) if ((sta>>i)&1) { //this\_root

int remain=sta^(1<<i);

if (remain){

int low=remain&-remain;//low写错了 =\_=

for (int now=remain; now ; now=(now-1)&remain) if (now&low){

int sta1=now,sta2=sta^sta1;

add\_(f[i][sta],(ll)F[i][sta1]\*g[i][sta2]%M);

add\_(f[i][sta],(ll)G[i][sta1]\*f[i][sta2]%M);

add\_(g[i][sta],(ll)G[i][sta1]\*g[i][sta2]%M);

}

} else g[i][sta]=1;

REP(j,n) if (!((sta>>j)&1)&&e[i][j]){

add\_(F[j][sta],e[i][j]\*(f[i][sta]+(ll)g[i][sta]\*bit[sta]%M)%M);

add\_(G[j][sta],(ll)e[i][j]\*g[i][sta]%M);

}

}

} sta=(1<<n)-1; int ans=0;

REP(i,n) REP(j,n) if (ew[i][j]&&i!=j){

int s=sta^(1<<j);

for (int now=s; now; now=(now-1)&s) if ((now>>i)&1){

int sta1=now,sta2=sta^sta1;

int cnt=(f[i][sta1]+(ll)bit[sta1]\*g[i][sta1]%M)%M\*g[j][sta2]%M;

add\_(ans,(ll)ew[i][j]\*cnt%M);

}

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

}

# 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

**//x xor v->max;**

**//没注释的是v<limit**

**//注释的是xor后小于limit**

**//计数问题有个套路:**

**//先算出全部,然后for一边容斥**

int nxt[maxn\*20\*10][2],tot;

int cnt[maxn\*20\*10];

LL xornum,limit;

void Ins(int &now,int k,int val) {

if (!now) now=++tot;

cnt[now]+=val;

if (k==-1) return;

int c=(xornum>>k)&1;

Ins(nxt[now][c],k-1,val);

}

LL Que(int now,int k,bool mark) { //mark:have limit

if (!now||!cnt[now]) return -INFF;

if (k==-1) return 0;

int c=(xornum>>k)&1,lim=(limit>>k)&1;

LL ret=-INFF;

if (!lim&&mark) {

return (c<<k)+Que(nxt[now][0],k-1,mark);

// return Que(nxt[now][c],k-1,mark);

} else {

ret=(1ll<<k)+Que(nxt[now][c^1],k-1,mark&&!(c&1));

if (ret<0) ret=Que(nxt[now][c],k-1,mark&&(c&1));

// ret=(1ll<<k)+Que(nxt[now][c^1],k-1,mark);

// if (ret<0) ret=Que(nxt[now][c],k-1,0);

} return ret;

}

AC自动机

**//HDU2896,匹配多串,查询id**

namespace ACM {

const int maxn=505\*140;

int next[maxn][98],fail[maxn],len[maxn],tot;

vector<int> have[maxn];

void init() {

tot=0; len[0]=0; fail[0]=0;

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

}

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

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

REP(i,n) {

int c=s[i]-33;

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

next[p][c]=++tot; len[tot]=len[p]+1;

have[tot].clear(); fail[tot]=0;

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

} p=next[p][c];

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

}

int Q[maxn],ST,ED;

void buildAC() {

ST=0; ED=-1; Q[++ED]=0;

while (ST<=ED) {

int p=Q[ST++],c;

REP(c,98) {

if (next[p][c]) {

fail[next[p][c]]=p?next[fail[p]][c]:0;

Q[++ED]=next[p][c];

} else next[p][c]=p?next[fail[p]][c]:0;//否则可能fail=self

}

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

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

}

}

void query(char a[],vector<int> &ans) {

int p=0;

int n=strlen(a),i;

REP(i,n) {

int c=a[i]-33; p=next[p][c];

for (int v:have[p]) ans.push\_back(v);

}

}

}

后缀数组

**// HDU6138, 题意: 给n个串, 问你第x和y的串公共子串是这n个串中前缀的最大长度**

**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**

**// 这里可以看出, fail的含义就是说**

**// 某个位置往前len差长度的所有子串**

**// 然后对后缀树来建树然后对len倍增**

**// 就能求出对应的最短对应点来**

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);**

**}**

**}**

**//** **HackerRank - circular-palindromes**

**// 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

**// wannafly挑战赛11D**

**// 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**

**// 后缀自动机做法是直接链加链减**

**// 或者后缀顺序建平衡树然后树上query**

**// 后缀平衡树的顺序是倒着的, 倒着的后缀rank**

**// 以上是https://www.nowcoder.net/acm/contest/59/C**

**// 由于这个是倒着的rank, 反过来的情况非常常见(往前加)**

**// 这个直接用这个板子insert, query即可**

const double alpha=0.75;

namespace SAT {

const ull MAX=(1ull<<63)-1;

struct node {

int son[2]; int pre,size;

int sum,val; ull rank; char c;

void initval(char \_c) {

son[0]=son[1]=0; pre=0;

size=sum=val=1; rank=0; c=\_c;

}

} T[maxn];

int cnt,root,last;

inline bool cmp(int x,int y) {//x<y

assert(x!=y);

if (T[x].c!=T[y].c) return T[x].c<T[y].c;

return T[T[x].pre].rank<T[T[y].pre].rank;//same:

}

void pushup(int x){

T[x].size=1; T[x].sum=T[x].val;

if (T[x].son[0]) {

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

T[x].sum+=T[T[x].son[0]].sum;

} if (T[x].son[1]) {

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

T[x].sum+=T[T[x].son[1]].sum;

}

}

int id[maxn],tot;

bool rebuildRoot;//手动rebuild\_{root}

void getrank(int x) {

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

if (!rebuildRoot||T[x].val) id[++tot]=x;

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=id[m]; T[x].rank=mid;

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

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

pushup(x);

}

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; if (l<=r) T[x].rank=mid; return;}

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);

pushup(x); //changes

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

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

}

void insert(char c) {

T[++cnt].initval(c);

T[cnt].pre=last; last=cnt;

ins(root,1,MAX);

if (!T[cnt].rank) {

rebuildRoot=true;

rebuild(root,1,MAX);

rebuildRoot=false;

}

}

void insert(char s[]) {

int len=strlen(s),i;

REP(i,len) insert(s[i]);

}

bool cmp(int k,char s[],int len) {//smaller //okay!

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

if (!k) return 1;

if (s[i]!=T[k].c) return T[k].c<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+=T[now].val+T[T[now].son[0]].sum,

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) {

for (; k&&last; last=T[last].pre,k--) {

int now;

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

T[now].sum--;

int p=T[last].rank>=T[now].rank;

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

} assert(last==now);

T[last].val=0; T[last].sum--;

} if (!last) root=0;

}

void init(){

cnt=root=last=0;

}

}

**//2017icpc青岛J**

**//题意: 每个串找个后缀拼起来**

**//query 后缀最小序是多少**

**//倒着加, 然后找个最小rank把剩下的都去掉即可**

char pool[maxn],\*st=pool;

char \*A[maxn]; int len[maxn];

char ans[maxn];int L;

int main() {

int T;

scanf("%d",&T);

while (T--){

int i,j;

SAT::init(); L=0; st=pool;

scanf("%d",&n);

REP(i,n) {

A[i]=st,scanf("%s",A[i]);

st+=(len[i]=strlen(A[i]));

}

rREP(i,n) {

// printf("i=%d;\n",i);

rREP(j,len[i]) SAT::insert(A[i][j]);

int k=SAT::last; ull MIN=SAT::T[k].rank;int l=0;

REP(j,len[i]) {//del\_cnt

if (MIN>SAT::T[k].rank) MIN=SAT::T[k].rank,l=j;

k=SAT::T[k].pre;

} SAT::del(l);

rrep(j,l,len[i]) ans[L++]=A[i][j]; ans[L]=0;

} reverse(ans,ans+L);

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

}

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)**

**// 直接更改边在两边对答案的影响**

**// 然后递归的往下做**

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];

struct splay\_tree{

struct node{

int val,min,max,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);

++tot;if (tot==maxn) tot=1;

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;

}

int query(int l,int r,int k){//小于k的值个数,会被卡 应该套主席树(但是太长，两个log)

int u=select(l-1),v=select(r+1);

splay(u,0);splay(v,u);

return dfs(T[v].son[0],k);

}

int delbuf[maxn],bufs;

int build(int l,int r){//add\_list

if (l>r) return 0;

++tot;if (tot==maxn) tot=1;

int ret=delbuf[tot];

int mid=(l+r)/2;

T[ret].init(A[mid]);

if (l==r) return ret;

int ls=build(l,mid-1);

int rs=build(mid+1,r);

if (ls) fa[ls]=ret,T[ret].son[0]=ls;

if (rs) fa[rs]=ret,T[ret].son[1]=rs;

pushup(ret);

return ret;

}

void del(int x){

if (x==0) return;

bufs++;if (bufs==maxn) bufs=1;

delbuf[bufs]=x;

del(T[x].son[0]);

del(T[x].son[1]);

}

void Del(int l,int r){

int u=select(l-1),v=select(r+1);

splay(u,0);splay(v,u);

del(T[v].son[0]);

T[v].son[0]=0;

pushup(v);pushup(u);

}

void init(int n){

int i; tot=0;

REP(i,maxn) delbuf[i]=i;

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

A[1]=A[n+2]=-INF;

root=build(1,n+2);

fa[root]=0; T[0].init(-INF);

fa[0]=0;T[0].son[1]=root;T[0].size=0;

}

}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**

**//** **(把query的东西放到外面限制)**

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]);

}

李超树

//李超树最主要的作用在于维护线段,而不是直线!

//维护l<=x<=r时下放线段,时间复杂度两个log!

//这里是最大值

double cross(double k1,double b1,double k2,double b2) {

if (abs(k1-k2)<eps) return INF;

return (b2-b1)/(k1-k2);

}

int flag[maxn\*4];

double tagk[maxn\*4],tagb[maxn\*4];

void ins(int x,double k,double b,int l,int r,int id,int L,int R) {

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

if (!flag[x]) tagk[x]=k,tagb[x]=b,flag[x]=id;

else {

int mid=(L+R)/2;

double ini\_l=tagk[x]\*L+tagb[x],now\_l=k\*L+b;

double ini\_r=tagk[x]\*R+tagb[x],now\_r=k\*R+b;

if (ini\_l>=now\_l&&ini\_r>=now\_r) return;

if (ini\_l<=now\_l&&ini\_r<=now\_r) tagk[x]=k,tagb[x]=b,flag[x]=id;

else {

double pos=cross(k,b,tagk[x],tagb[x]);//交点x坐标

if ((pos<=mid&&ini\_l>=now\_l)||(pos>mid&&ini\_r>=now\_r)) { //坐标低的下放,平的直接留下就行

swap(tagk[x],k);

swap(tagb[x],b);

swap(flag[x],id);

} if (pos<=mid) ins(x<<1,k,b,l,r,id,L,mid);

else ins(x<<1|1,k,b,l,r,id,mid+1,R);

}

}

} else {

int mid=(L+R)/2;

if (l<=mid) ins(x<<1,k,b,l,r,id,L,mid);

if (mid<r) ins(x<<1|1,k,b,l,r,id,mid+1,R);

}

}

double ans; int id;

void que(int x,int pos,int L,int R) {

if (flag[x]) {

double now=tagk[x]\*pos+tagb[x];

if (now-ans>eps||(now-ans>-eps&&id>flag[x])) {

ans=now,id=flag[x];

}

}

if (L==R) return;

int mid=(L+R)/2;

if (pos<=mid) que(x<<1,pos,L,mid);

else que(x<<1|1,pos,mid+1,R);

}

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;

手写BITSET

struct BITSET {

vector<ULL> V;

void set(int x,int k) {

assert((int)V.size()>x/64);

if (k) V[x/64]|=1ull<<(x&63);

else V[x/64]&=~(1ull<<(x&63));

}

void resize(int x) {

V.resize((x-1)/64+1,0);

}

int get(int x) {

return (V[x/64]>>(x&63))&1;

}

bool operator < (const BITSET &B) const {

int i;

REP(i,(int)V.size()) if (V[i]!=B.V[i]) return V[i]<B.V[i];

return 0;

}

BITSET const doit(int size,int F[65536]) const {//相邻两位合并

BITSET ret; int i;

ret.resize(size/2);

REP(i,(int)V.size()) {

if (i&1) {

ret.V[i/2]|=((ULL)F[V[i]&65535]<<32)

|((ULL)F[(V[i]>>16)&65535]<<40)

|((ULL)F[(V[i]>>32)&65535]<<48)

|((ULL)F[(V[i]>>48)]<<56);

} else {

ret.V[i/2]|=((ULL)F[V[i]&65535])

|((ULL)F[(V[i]>>16)&65535]<<8)

|((ULL)F[(V[i]>>32)&65535]<<16)

|((ULL)F[(V[i]>>48)]<<24);

}

} return ret;

}

void print() {

int i;

REP(i,(int)V.size()) pr2(V[i],64);

}

};

# 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");

}

}

Hall定理

**// 题意: N个人,M个椅子,每个人只能坐[1,Li]|[Ri,M],求最多能坐多少人**

**// hall定理: 二分图; A->B (A<B)完美匹配当且仅当A中每k个在B中连着有至少k个点**

**// 引理(不常用): 如果A中每个连着最少t条边, B中每个连着最多t条边, 那么存在完美匹配; t任意**

**// 对于这个题来说: 最终选择的座位比人少; 任意座位集合A; B: [1,Lx][Rx,M]**

**// 座位当作A, 用定理, 所有区间满足: 对人的集合B, A->B ,|A|>=$加完边$的B 求下|A|-|B|>=0**

**// 枚举A的端点, 求: B的size最大值即可!**

int MIN[maxn],lazy[maxn];

inline void add(int x,int val) {

lazy[x]+=val; MIN[x]+=val;

} void update(int x,int l,int r,int val,int L,int R) {

if (l<=L&&R<=r) {add(x,val); return;}

if (lazy[x]) {

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

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

lazy[x]=0;

} int mid=(L+R)/2;

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

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

MIN[x]=min(MIN[x<<1],MIN[x<<1|1]);

} int n,m;

vector<int> have[maxn];

int i,j,k;

int l,r;

int ans;

int main() {

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

FOR(i,1,n) {

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

have[l].push\_back(r);

}

FOR(i,1,m) update(1,i,i,m-i+1,1,m+1);

ans=min(0,m-n);//为啥会有这个问题呢

FOR(i,0,m) {

if (i!=0) update(1,i+1,m+1,1,1,m+1);

for (int r:have[i])

update(1,i+1,r,-1,1,m+1);

ans=min(ans,MIN[1]);

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

}

KM 二分图最大权匹配

ll g[maxn][maxn];

ll lx[maxn],ly[maxn],slack[maxn];

int linky[maxn],par[maxn];

bool visy[maxn];

void augment(int root){

std::fill(visy+1,visy+n+1,false);

std::fill(slack+1,slack+n+1,INFF);

int py; linky[py=0]=root;

do{

visy[py]=true;

int x=linky[py],\_y=0,y; ll d=INFF;

FOR(y,1,n) if (!visy[y]){

int tmp=lx[x]+ly[y]-g[x][y];

if (tmp<slack[y]){

slack[y]=tmp; par[y]=py;

} if (slack[y]<d) {

d=slack[y]; \_y=y;

}

} FOR(y,0,n){

if (visy[y]){

lx[linky[y]]-=d;

ly[y]+=d;

} else slack[y]-=d;

} py=\_y;

} while (linky[py]!=-1);

do {

int pre=par[py];

linky[py]=linky[pre];

py=pre;

} while (py);

}

ll KM() {

int i,y;

FOR(i,1,n) {

lx[i]=0; ly[i]=0; linky[i]=-1;

FOR(y,1,n) max\_(lx[i],g[i][y]);

} ll ret=0;

FOR(i,1,n) augment(i);

FOR(i,1,n) ret+=g[linky[i]][i];

return ret;

}

int main() {

int T,\_T;

scanf("%d",&T);

FOR(\_T,1,T) {

scanf("%d",&n);

int i,j;

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

int x;

scanf("%d",&x);

g[i][j]=-x;

} ll ans=-KM();

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

printf("Case #%d: %I64d\n",\_T,ans);

}

}

最短路

**Dijkstra（n^2）：**

LL n,m,x,i,j,k;

LL a[N+2][N+2],b[N+2];

bool vis[N+2];

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;

LL d;

node() {}

node(int \_n,LL \_d):n(\_n),d(\_d) {};

const bool operator <(const node &A)const {

if (d!=A.d) return d>A.d;//注意!!! 否则为未优化的bellmanford

return n>A.n;

}

};

vector<node> edge[maxn];

priority\_queue<node> Q;

LL dis[maxn];

int n,m;

void dij(int s,int n) {

int i;

FOR(i,1,n) dis[i]=INFF;

dis[s]=0;

Q.push(node(s,0));

while (Q.size()) {

node x=Q.top();

Q.pop();

if (dis[x.n]!=x.d) continue;//!

for (node 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]));

}

}

}

}

**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(还有切比雪夫距离转曼哈顿距离和这种最小生成树)

**//最小曼哈顿距离生成树**

**//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**

**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);

}

}

笛卡尔树

**2017hdu多校1 给定区间:**

**int L[maxn],R[maxn];**

**pii S[maxn]; int top;**

**int fa[maxn],id[maxn];//id: topo**

**bool buildtree(int n){//return 1: wrong!**

**static int i,l[maxn],r[maxn],p[maxn],top;**

**FOR(i,1,n) id[i]=i; top=0;**

**sort(id+1,id+1+n,[](int i,int j){**

**if (L[i]!=L[j]) return L[i]<L[j];**

**return R[i]>R[j];**

**}); top=1;**

**l[1]=1; r[1]=n; p[1]=0;**

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

**// printf("%d %d %d %d\n",L[id[i]],l[top],r[top],R[id[i]]);**

**if (L[id[i]]!=l[top]||r[top]!=R[id[i]]) return 1;**

**fa[id[i]]=p[top]; top--;**

**if (id[i]<R[id[i]]) {**

**++top,p[top]=id[i];**

**l[top]=id[i]+1,r[top]=R[id[i]];**

**} if (L[id[i]]<id[i]) {**

**++top,p[top]=id[i];**

**l[top]=L[id[i]],r[top]=id[i]-1;**

**}**

**}**

**return 0;//okay**

**}**

**LL inv[1000002];//inverse**

**LL fac[1000002];//Factorial**

**LL C(int n,int m){**

**return fac[n]\*inv[m]%M\*inv[n-m]%M;**

**}**

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

**int main() {**

**int \_t=0; 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!)**

**while (1){**

**read(n);**

**if (Istream::IOerror) break;**

**int i;**

**FOR(i,1,n) read(L[i]);**

**FOR(i,1,n) read(R[i]);**

**int ans=1;**

**if (buildtree(n)) ans=0;**

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

**rFOR(i,1,n) sz[fa[id[i]]]+=sz[id[i]];**

**FOR(i,1,n) s[i]=sz[i]-1;**

**rFOR(i,2,n) {**

**mul\_(ans,C(s[fa[id[i]]],sz[id[i]])),s[fa[id[i]]]-=sz[id[i]];**

**}**

**printf("Case #%d: %d\n",++\_t,ans);**

**}**

**}**

**2018hdu多校1 给定数字:**

**// 按照A从大到小建笛卡尔树**

**int A[maxn],fa[maxn],id[maxn];//id: topo**

**void buildtree(int n){**

**static int S[maxn],top,tot,i;**

**tot=top=0;**

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

**int now=0;**

**while (top&&A[S[top]]<A[i]){**

**if (now) fa[now]=S[top],id[++tot]=now;//pop**

**now=S[top]; top--;**

**} S[++top]=i;**

**if (now) fa[now]=S[top],id[++tot]=now;//pop**

**} int now=0;**

**while (top){**

**if (now) fa[now]=S[top],id[++tot]=now;**

**now=S[top]; top--;**

**} fa[now]=0; id[++tot]=now;**

**reverse(id+1,id+1+n);// 变成正的**

**}**

**int inv[maxn];**

**int sz[maxn];//求树的size**

**int main() {**

**int T,\_t;**

**int i;**

**FOR(i,1,1000000) inv[i]=powMM((ll)i,M-2);**

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

**FOR(\_t,1,T){**

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

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

**buildtree(n);**

**int ans=(ll)n\*inv[2]%M;**

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

**rFOR(i,2,n) sz[fa[id[i]]]+=sz[id[i]];**

**FOR(i,1,n) mul\_(ans,inv[sz[i]]);**

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

**}**

**}**

强连通分量tarjan

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());

}

边双连通分量 仙人掌图

**// 2018hdu多校5A**

**// 题意: 每两个点之间只能有两条路径**

**// 也就是仙人掌**

**// 求\sum flow(i,j)^i^j, i<j**

**// 做法: 有环的话, 一定会切掉环上的一个边**

**// 所以把贡献加到其他里, 做个lca即可**

struct edges {

int u,v,len;

} e[maxn];

vector<edges> E;

namespace tarjan{// 边双连通分量, 这里是在做仙人掌

struct Edge {

int to,next,id;

Edge(int \_to=0,int \_next=-1,int \_id=0):to(\_to),next(\_next),id(\_id) {};

} edge[maxn\*2];

int head[maxn],etot;

inline void addedge(int u,int v,int id) {

edge[++etot]=Edge(v,head[u],id); head[u]=etot;

}

int dfn[maxn],low[maxn],tot;

bool vis[maxn],used[maxn];

int S[maxn],top;

void tarjan(int x,int fa) {

low[x]=dfn[x]=++tot; vis[x]=1;

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

int v=edge[i].to;

if (used[edge[i].id]) continue;

if (v==fa) continue;

S[++top]=edge[i].id;

used[edge[i].id]=1;

if (!dfn[v]) {

tarjan(v,x);

low[x]=min(low[x],low[v]);

if (dfn[x]<=low[v]){//割边和边双联通

vector<int> Eid;

while (1){

int id=S[top--];

Eid.push\_back(id);

if (id==edge[i].id) break;

} if (low[v]==dfn[x]){//双联通, 在这里dp

// printf(" one :");

// for (auto now:Eid) printf("%d ",now); puts("");

int id=Eid[0],l;

for (auto now:Eid) if (e[now].len<e[id].len) id=now; l=e[id].len;

for (auto now:Eid) e[now].len+=l;

for (auto now:Eid) if (now!=id) E.push\_back(e[now]);

} else for (auto now:Eid) E.push\_back(e[now]);//割边

}

} else if (vis[v])

low[x]=min(low[x],dfn[v]);

}

}

void init(int n,int m){

int i;

FOR(i,1,m) used[i]=0;

FOR(i,1,n) head[i]=-1,dfn[i]=0; etot=tot=0;

FOR(i,1,m) addedge(e[i].u,e[i].v,i),addedge(e[i].v,e[i].u,i);

FOR(i,1,n) if (!dfn[i]) tarjan(i,0);

}

}

**// 略去读入挂代码**

int fa[maxn];

int cnt[maxn][31][2];

inline int getfa(int x){

if (fa[x]==x) return x;

return fa[x]=getfa(fa[x]);

}

int main() {

int T;

read(T);

while (T--){

int i,k; E.clear();

read(n); read(m);

FOR(i,1,m) read(e[i].u),read(e[i].v),read(e[i].len);

tarjan::init(n,m);

sort(E.begin(), E.end(),[](edges &A,edges &B){

return A.len>B.len;

});

// for (auto now:E) printf("E : %d - %d %d\n",now.u,now.v,now.len);

// FOR(i,1,m) printf("e: %d-%d %d\n",e[i].u,e[i].v,e[i].len);

\_\_int128 ans=0;

FOR(i,1,n) {

fa[i]=i;

REP(k,31) cnt[i][k][(i>>k)&1]=1,cnt[i][k][!((i>>k)&1)]=0;

} for (auto now:E){

int x=getfa(now.u),y=getfa(now.v);

assert(x!=y); int o,\_o;

// printf("merge: %d %d\n",x,y);

fa[x]=y;

REP(k,31) REP(o,2) REP(\_o,2){

ans+=(\_\_int128)cnt[x][k][o]\*cnt[y][k][\_o]\*((o^\_o^((now.len>>k)&1))<<k);

// if (k<=6) printf("%d : %d %d : %d\n",k,o,\_o,cnt[x][k][o]\*cnt[y][k][\_o]);

}

REP(k,31) REP(o,2){

cnt[y][k][o]+=cnt[x][k][o];

}

// printf("%llu\n",ans);

} println(ans);

}

}

环套外向树

**// wannafly挑战赛16E**

**// 题意: 给个基环内向树, 每个点每时刻走1**

**// 问你最后某时刻 某个pos有几个点**

**// 做法是基环内向树dp一下, 分两部分贡献算一下**

struct node {

int l,r,val;

} T[maxn\*20]; int ntot;

void ins(int &x,int pos,int L,int R) {

if (!x) x=++ntot; T[x].val++;

if (L==R) return;

int mid=(L+R)/2;

if (pos<=mid) ins(T[x].l,pos,L,mid);

else ins(T[x].r,pos,mid+1,R);

}

int que(int x,int l,int r,int L,int R) {

if (!x) return 0;

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

int ret=0,mid=(L+R)/2;

if (l<=mid) ret+=que(T[x].l,l,r,L,mid);

if (mid<r) ret+=que(T[x].r,l,r,mid+1,R);

return ret;

}

int A[maxn];

vector<int> cir,edge[maxn];

map<int,int> cirnum[maxn];

int vis[maxn],cfa[maxn],circnt[maxn],dep[maxn];

int in[maxn],out[maxn],dtot,ctot;

void dfs(int x,int depth,int cir\_id) {

vis[x]=1; in[x]=++dtot; cfa[x]=cir\_id; dep[x]=depth;

for (int v:edge[x]) dfs(v,depth+1,cir\_id);

out[x]=dtot;

}

void solve(int x) {

cir.clear(); ctot++;

while (A[x]&&!vis[A[x]]) x=A[x],vis[x]=1;

while (A[x]&&vis[A[x]]==1) {

vis[A[x]]=2; cir.push\_back(x);

cfa[x]=ctot; x=A[x];

} int i; circnt[ctot]=cir.size();

rREP(i,cir.size()-1) dep[cir[i]]=dep[A[cir[i]]]+1;

for (int v:cir) for (int y:edge[v]) if (vis[y]!=2) dfs(y,1,v);

}

int n,m;

int root[maxn];

vector<pair<int,int> > t\_t[maxn];

void update(int i,int k) {

if (vis[k]==1) {

ins(root[i+dep[k]],in[k],1,n);

i+=dep[k]; k=cfa[k];

t\_t[i].push\_back(make\_pair(cfa[k],(i+dep[k])%circnt[cfa[k]]));

} else cirnum[cfa[k]][(i+dep[k])%circnt[cfa[k]]]++;

}

int getans(int i,int k) {

if (vis[k]==1) return que(root[i+dep[k]],in[k],out[k],1,n);

else return cirnum[cfa[k]][(i+dep[k])%circnt[cfa[k]]];

}

int lastans;

int main() {

int i,k;

scanf("%d",&n);

FOR(i,1,n) {

scanf("%d",&A[i]);

edge[A[i]].push\_back(i);

}

FOR(i,1,n) if (!vis[i]) solve(i);

scanf("%d",&m);

FOR(i,1,m) {

scanf("%d",&k);

k^=lastans;

update(i,k);

for (auto now:t\_t[i]) cirnum[now.first][now.second]++;

lastans=getans(i,k);

debug(" ans = ");

printf("%d\n",lastans);

}

return 0;

}

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**

**最小割的点可以放到边上，然后考虑边！**

**做法：奇偶染色，拆点然后最小割**

**最小割填INF边的意义：使得一个矩形不可行！**

**最小路径覆盖:**

**将原图拆点成两半, 然后连成二分图(边就分开来)**

**然后求个最大匹配(当然跑网络流也行)**

**要求的路径就是, 最大匹配走的路径**

**答案是边数减去匹配的边数**

**这里输出方案有个trick, 拓扑排序感觉写起来最舒服**

**//DINIC+当前弧优化**

namespace maxflow {

typedef int type;

const type INF=0x3f3f3f3f;

struct node {

int to; type cap; int next;

node(int t=0,type c=0,int n=0):to(t),cap(c),next(n) {};

} edge[maxn\*50];

int head[maxn],tot;

void addedge(int from,int to,type cap,type rcap=0) {

edge[tot]=node(to,cap,head[from]); head[from]=tot++;

edge[tot]=node(from,rcap,head[to]); head[to]=tot++;

}

int dep[maxn],cur[maxn];//当前弧优化

bool bfs(int s,int t,int n) {

static int Q[maxn],ST,ED;

memset(dep+1,0,n\*sizeof(int));

ST=0; ED=-1;

Q[++ED]=s; dep[s]=1;

while (ST<=ED) {

int u=Q[ST++];

for (int i=head[u]; i!=-1; i=edge[i].next) {

int v=edge[i].to;

if (!dep[v]&&edge[i].cap) {

Q[++ED]=v; dep[v]=dep[u]+1;

}

}

} return (dep[t]!=0);

}

type dfs(int x,const int &t,type flow=INF) {

if (x==t||flow==0) return flow;

type ret=0;

for (int i=cur[x]; i!=-1; i=edge[i].next) {

if (dep[x]+1==dep[edge[i].to]&&edge[i].cap){

type f=dfs(edge[i].to,t,min(flow,edge[i].cap));

edge[i].cap-=f; edge[i^1].cap+=f;

ret+=f; flow-=f; cur[x]=i;

if (flow==0) break;

}

} if (!ret) dep[x]=0;

return ret;

}

type maxflow(int s,int t,int n) {

type ret=0;

while (bfs(s,t,n)) {

type f;

memcpy(cur+1,head+1,n\*sizeof(int));

while ((f=dfs(s,t))>0) ret+=f;

} return ret;

}

void init(int n) {

memset(head+1,0xff,n\*sizeof(int)); tot=0;

}

}

**//ISAP**

namespace maxflow {

typedef LL type;

const type INF=0x3f3f3f3f3f3f3f3f;

struct node {

int to; type cap; int next;

node(int t=0,type c=0,int n=0):to(t),cap(c),next(n) {};

} edge[maxn\*50];

int head[maxn],tot;

void addedge(int from,int to,type cap,type rcap=0) {

edge[tot]=node(to,cap,head[from]); head[from]=tot++;

edge[tot]=node(from,rcap,head[to]); head[to]=tot++;

}

int gap[maxn],dep[maxn],cur[maxn];

void bfs(int s,int t,int n) {//t好像没啥用啊=\_=

static int Q[maxn],ST,ED;

memset(dep+1,0xff,n\*sizeof(int));

memset(gap+1,0,n\*sizeof(int));

gap[0]=1; dep[t]=0;

ST=0; ED=-1; Q[++ED]=t;

while (ST<=ED) {

int u=Q[ST++];

for (int i=head[u]; ~i; i=edge[i].next) {

int v=edge[i].to;

if (dep[v]!=-1) continue;

Q[++ED]=v; dep[v]=dep[u]+1;

gap[dep[v]]++;

}

}

}

int S[maxn];

type sap(int s,int t,int n) {

bfs(s,t,n);

memcpy(cur+1,head+1,n\*sizeof(int));

int top=0,u=s; type ret=0;

while (dep[s]<n) {

if (u==t) {

type MIN=INF,inser=0,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; 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; 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 (ret>INF) return ret;//not okay

if (!gap[dep[u]]) return ret;

dep[u]=MIN+1; gap[dep[u]]++;

if (u!=s) u=edge[S[--top]^1].to;

} return ret;

}

void init(int n) {

memset(head+1,0xff,n\*sizeof(int)); tot=0;

}

}

无向图全局最小割

**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**

**O(nmlogm)**

bool deleted[maxn],vis[maxn];

vector<pair<int,int> > edge[maxn];

priority\_queue<pair<int,int> > Q;

int weight[maxn];

int fa[maxn];

inline int getfa(int x) {

if (fa[x]==x) return x;

return fa[x]=getfa(fa[x]);

}

int getst(int &s,int &t,int n) {

int i; t=1;

while (Q.size()) Q.pop();

REP(i,n-1) {

vis[s=t]=1;

for (auto &e:edge[s]) {

int v=getfa(e.second);

e.second=v;

if (!vis[v])

Q.push(make\_pair(weight[v]+=e.first,v));

} t=0;

while (!t&&Q.size()) {

auto now=Q.top(); Q.pop();

int v=now.second;

if (!vis[v]) t=v;

} if (!weight[t]) return 0;

} return weight[t];

}

int mincut(int n) {

int ret=INF;

int s,t,i,j,k;

FOR(i,1,n) deleted[i]=0,fa[i]=i;

rFOR(i,2,n) {

FOR(j,1,n) weight[j]=0,vis[j]=0;

ret=min(ret,getst(s,t,i));

if (!ret) return 0;

for (auto v:edge[t]) edge[s].push\_back(v);

int x=getfa(s),y=getfa(t); fa[y]=x;

vector<pair<int,int> >().swap(edge[t]);

} return ret;

}

int n,m;

int main() {

int i,j;

int T;

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

FOR(i,1,n) edge[i].clear();

FOR(i,1,m) {

int u,v,val;

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

edge[u].push\_back(make\_pair(val,v));

edge[v].push\_back(make\_pair(val,u));

} printf("%d\n",mincut(n));

}

return 0;

}

**O(n^3)**

LL edge[507][507];

bool deleted[maxn],vis[maxn];

vector<int> id;

LL weight[maxn];

LL getst(int &s,int &t,int n) {

int i; t=1;

for (int v:id) weight[v]=0,vis[v]=0;

REP(i,n-1) {

vis[s=t]=1;

for (int v:id) if (!vis[v])

weight[v]+=edge[s][v],t=v;

for (int v:id) if (!vis[v])

if (weight[v]>=weight[t]) t=v;

if (!weight[t]) return 0;

} return weight[t];

}

LL mincut(int n) {

LL ret=INFF;

int s,t,i,j,k;

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

rFOR(i,2,n) {

j=0; id.clear();

FOR(k,1,n) if (!deleted[k]) id.push\_back(k);

ret=min(ret,getst(s,t,id.size()));

if (!ret) return 0;

for (int v:id) if (v!=s&&v!=t) {

edge[s][v]+=edge[t][v];

edge[v][s]+=edge[v][t];

} deleted[t]=1;

} return ret;

}

int n,m;

int main() {

int i,j;

int T;

while (~scanf("%d%d%\*d",&n,&m)&&(n||m)) {

FOR(i,1,n) FOR(j,1,n) edge[i][j]=0;

FOR(i,1,m) {

int u,v,val;

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

edge[u][v]+=val;

edge[v][u]+=val;

} printf("%lld\n",mincut(n));

}

return 0;

}

无向图最小割树 GH-tree

**GH-tree; 两点的LCA是最小割**

namespace gomoryhu\_tree {

typedef int type;

struct node { //只能是双向的

int u,v; type len;

node(int u=0,int v=0,type len=0):u(u),v(v),len(len) {};

} edge[maxn],e[maxn];

int tot,etot;

void addedge(int u,int v,int len) {

edge[++tot]=node(u,v,len);

} int n;

void solve(int l,int r,int id[]) {//id,id+n

// CNT++;

static int tmp[maxn];

if (l==r) return;

random\_shuffle(id+l,id+r+1);

maxflow::init(n); int i,L=l,R=r;

FOR(i,1,tot) maxflow::addedge(edge[i].u,edge[i].v,edge[i].len,edge[i].len);

e[++etot]=node(id[l],id[r],maxflow::maxflow(id[l],id[r],n));

FOR(i,l,r) if (maxflow::dep[id[i]])

tmp[L++]=id[i]; else tmp[R--]=id[i];

FOR(i,l,r) id[i]=tmp[i];

solve(l,R,id); solve(L,r,id);

}

void init(int \_n) {

n=\_n; tot=etot=0;

srand(time(0));

}

}

最小费用流

**// 这个好像就是zkw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!**

**// 连边是为了将"获取的"和"使用的"联系起来! 大概意思就是, 使用的流量确定...**

**// 注意观察特殊性质**

**// 费用流有个"短路"的性质, 如果流到这里可能会使得其他的流量减少, 这个好像有点用**

**namespace mincostflow {**

**typedef int type;**

**const type INF=0x3f3f3f3f;**

**struct node {**

**int to; type cap,cost; int next;**

**node(int t=0,type c=0,type \_c=0,int n=0):**

**to(t),cap(c),cost(\_c),next(n) {};**

**} edge[maxn\*2]; int tot;**

**int head[maxn];**

**void addedge(int from,int to,type cap,type cost,type rcap=0) {**

**edge[tot]=node(to,cap,cost,head[from]); head[from]=tot++;**

**edge[tot]=node(from,rcap,-cost,head[to]); head[to]=tot++;**

**}**

**type dis[maxn];**

**bool mark[maxn];**

**void spfa(int s,int t,int n) {**

**memset(dis+1,0x3f,n\*sizeof(type));**

**memset(mark+1,0,n\*sizeof(bool));**

**static int Q[maxn],ST,ED;**

**dis[s]=0; ST=ED=0; Q[ED++]=s;**

**while (ST!=ED) {**

**int v=Q[ST]; mark[v]=0;**

**if ((++ST)==maxn) ST=0;**

**for (int i=head[v]; ~i; i=edge[i].next) {**

**node &e=edge[i];**

**if (e.cap>0&&dis[e.to]>dis[v]+e.cost) {**

**dis[e.to]=dis[v]+e.cost;**

**if (!mark[e.to]) {**

**if (ST==ED||dis[Q[ST]]<=dis[e.to]) {**

**Q[ED]=e.to,mark[e.to]=1;**

**if ((++ED)==maxn) ED=0;**

**} else {**

**if ((--ST)<0) ST+=maxn;**

**Q[ST]=e.to,mark[e.to]=1;**

**}**

**}**

**}**

**}**

**}**

**} int cur[maxn];**

**type dfs(int x,int t,type flow) {**

**if (x==t||!flow) return flow;**

**type ret=0; mark[x]=1;**

**for (int i=cur[x]; ~i; i=edge[i].next) if (!mark[edge[i].to]) {**

**if (dis[x]+edge[i].cost==dis[edge[i].to]&&edge[i].cap) {**

**int f=dfs(edge[i].to,t,min(flow,edge[i].cap));**

**edge[i].cap-=f; edge[i^1].cap+=f;**

**ret+=f; flow-=f; cur[x]=i;**

**if (flow==0) break;**

**}**

**}**

**mark[x]=0;**

**return ret;**

**}**

**pair<type,type> mincostflow(int s,int t,int n,type flow=INF) {**

**type ret=0,ans=0;**

**while (flow) {**

**spfa(s,t,n); if (dis[t]==INF) break;**

**// 这样加当前弧优化会快, 我也不知道为啥**

**memcpy(cur+1,head+1,n\*sizeof(int));**

**type len=dis[t],f;**

**if ((f=dfs(s,t,flow))>0)//while也行**

**ret+=f,ans+=len\*f,flow-=f;**

**} return make\_pair(ret,ans);**

**}**

**void init(int n) {**

**memset(head+1,0xff,n\*sizeof(int));**

**tot=0;**

**}**

**}**

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, 流量就是ans**

**//最小流:ss->tt流, t->s连边, ss->tt流, s->t的就是最大流**

**//带权值的直接加权即可, in和out加的边val=0(只是为了限制流出可以等于流入而已)**

namespace pipeflow {

typedef int type;

int eid[maxn\*10],etot;

type in[maxn],out[maxn],flow[maxn\*10];

int s\_s,t\_t;//S,T

int addedge(int u,int v,int low,int high) {

eid[etot]=maxflow::addedge(u,v,high-low);

out[u]+=low; in[v]+=low; flow[etot++]=low;

return etot-1;

}

void init(int n) {

s\_s=n+1,t\_t=n+2; etot=0;

memset(in+1,0,n\*sizeof(type));

memset(out+1,0,n\*sizeof(type));

maxflow::init(n+2);

}

type solve(int n,int s,int t) {

int sum=0; int i;

FOR(i,1,n) {

sum+=max(0,in[i]-out[i]);

if (in[i]>out[i]) maxflow::addedge(s\_s,i,in[i]-out[i]);

if (in[i]<out[i]) maxflow::addedge(i,t\_t,out[i]-in[i]);

}

// // maxflow:

// maxflow::addedge(t,s,INF);

// if (maxflow::maxflow(s\_s,t\_t,n+2)!=sum) return -1;

// return maxflow::maxflow(s,t,n+2);//maxflow

// // minflow:

// type first=maxflow::maxflow(s\_s,t\_t,n+2);

// int retpos=maxflow::addedge(t,s,INF);

// if (first+maxflow::maxflow(s\_s,t\_t,n+2)!=sum) return -1;

// return maxflow::edge[retpos^1].cap;//minflow

// okay flow:

// if (maxflow::maxflow(s\_s,t\_t,n+2)!=sum) return 0;

REP(i,etot) flow[i]+=maxflow::edge[eid[i]^1].cap;//edges

//return 1;

}

}

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]);

}

}

动态点分治

**//题意: 动态查询到某点距离不超过x的权值和, 更改某点权值**

**//注意容斥的时候的length位置不是root~是上个root相连的位置**

**//也就是说dis得单独计算//dfs2一次比两次少一半多的常数=\_=**

**int BIT\_pool[maxn\*40],\*BIT[maxn],\*SUBBIT[maxn],\*st=BIT\_pool;**

**int size[maxn]; bool mark[maxn];**

**int minweight,root;**

**struct Node {**

**int to,next;**

**Node(int \_to=0,int \_next=0):to(\_to),next(\_next) {};**

**} edge[maxn\*2];**

**int head[maxn],tot;**

**void addedge(int u,int v) {**

**edge[++tot]=Node(v,head[u]); head[u]=tot;**

**}**

**void dfs1(int x,int fa,int n) {**

**int weight=0; size[x]=1;**

**for (int i=head[x]; ~i; i=edge[i].next) {**

**int v=edge[i].to;**

**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;}**

**}**

**int length[maxn];**

**struct node {**

**int top,sub,len,next;**

**node() {}**

**node(int \_top,int \_sub,int \_len,int \_next):top(\_top),sub(\_sub),len(\_len),next(\_next) {};**

**} nodes[maxn\*20];**

**int calhead[maxn],caltot;**

**int maxdep;**

**void addnode(int x,int top,int sub,int len) {**

**nodes[++caltot]=node(top,sub,len,calhead[x]); calhead[x]=caltot;**

**}**

**void dfs2(int x,int fa,int top,int sub,int dep) {**

**addnode(x,top,sub,dep);**

**for (int i=head[x]; ~i; i=edge[i].next) {**

**int v=edge[i].to;**

**if (v==fa||mark[v]) continue;**

**dfs2(v,x,top,sub,dep+1);**

**} maxdep=max(maxdep,dep);**

**}**

**int len[maxn],sublen[maxn];**

**void dfs3(int x) {**

**mark[x]=1; root=x;**

**maxdep=0; int xdep=0;**

**addnode(x,x,0,0);**

**for (int i=head[x]; ~i; i=edge[i].next) {**

**int v=edge[i].to;**

**if (mark[v]) continue;**

**minweight=size[v]; dfs1(v,0,size[v]);**

**maxdep=0; dfs2(v,0,x,root,1); //判重是x,init\_dep=1**

**sublen[root]=maxdep; xdep=max(xdep,maxdep);**

**SUBBIT[root]=st; st+=sublen[root]+1;**

**dfs3(root);**

**} len[x]=xdep;**

**BIT[x]=st; st+=len[x]+1;**

**}**

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

**void add(int \*T,int n,int x,int val) {**

**x++; T--; n++;**

**for (; x<=n; x+=lowbit(x)) T[x]+=val;**

**} int get(int \*T,int x) {**

**x++; T--; int ret=0;**

**for (; x; x-=lowbit(x)) ret+=T[x];**

**return ret;**

**}**

**void update(int x,int val) {**

**for (int i=calhead[x]; ~i; i=nodes[i].next) {**

**int v=nodes[i].top,length=nodes[i].len;**

**add(BIT[v],len[v],length,val);**

**v=nodes[i].sub;**

**if (v) add(SUBBIT[v],sublen[v],length,val);**

**}**

**} int query(int x,int dis) {**

**int ret=0;**

**for (int i=calhead[x]; ~i; i=nodes[i].next) {**

**int v=nodes[i].top,length=nodes[i].len;**

**if (dis>=length) {**

**ret+=get(BIT[v],min(dis-length,len[v]));**

**v=nodes[i].sub;**

**if (v) ret-=get(SUBBIT[v],min(dis-length,sublen[v]));;**

**}**

**} return ret;**

**}**

**int n,m,T;**

**int i,j,k;**

**char op[2];**

**int a[maxn];**

**int main() {**

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

**FOR(i,1,n) mark[i]=0,BIT[i]=SUBBIT[i]=nullptr;**

**memset(BIT\_pool,0,sizeof(int)\*(st-BIT\_pool)); st=BIT\_pool;**

**FOR(i,1,n) head[i]=calhead[i]=-1; tot=caltot=0;**

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

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

**int u,v;**

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

**addedge(u,v); addedge(v,u);**

**}**

**minweight=INF; dfs1(1,0,n);**

**dfs3(root);**

**FOR(i,1,n) update(i,a[i]);**

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

**int u,v;**

**scanf("%s%d%d",op,&u,&v);**

**if (op[0]=='!') update(u,v-a[u]),a[u]=v;**

**else printf("%d\n",query(u,v));**

**}**

**}**

**}**

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");**

**}**

**}**

2-sat 输出方案

**//对于一般点是对称的题目, 直接belong[i]<belong[i+n]输出即可**

**//否则需要拓扑排序, 破坏了本身良好的性质**

**// 题意: 给颗树, 每次给俩路径**

**// 问你m组询问, 从每个里选个路径, 是否可以不相交**

**// 做法: 可持久化建线段树然后 2-sat**

**// 输出方案需要把每个块都拓扑排序**

namespace T\_SAT {

const static int maxn=5e6+7;

vector<int> nodes[maxn];//choose !

struct enode {

int to,next;

enode(int \_to=0,int \_next=-1):to(\_to),next(\_next) {};

} edge[maxn\*6];

int head[maxn],etot;

void addedge(int u,int v) {

edge[++etot]=enode(v,head[u]); head[u]=etot;

}

int dfn[maxn],low[maxn],belong[maxn];

bool vis[maxn];

int tot,cnt;

int S[maxn],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;

nodes[cnt].push\_back(now);

if (now==x) break;

}

}

}

void init() {

memset(head,-1,sizeof(head)); etot=0;

}

int D[maxn],ID[maxn];

void solve(int n) {

int i; tot=cnt=0;

FOR(i,1,n) dfn[i]=vis[i]=0;

FOR(i,1,n) if (!dfn[i]) dfs(i);

FOR(i,1,n) {

for (int j=head[i]; ~j; j=edge[j].next) {

int v=edge[j].to;

if (belong[v]==belong[i]) continue;

D[belong[v]]++;

}

} queue<int> Q;

FOR(i,1,cnt) if (!D[i]) Q.push(i);

int recnt=0;

while (Q.size()) {

int x=Q.front(); Q.pop();

++recnt;

for (auto i:nodes[x]) {

for (int j=head[i]; ~j; j=edge[j].next) {

int v=edge[j].to;

if (belong[v]==belong[i]) continue;

D[belong[v]]--;

if (D[belong[v]]==0) Q.push(belong[v]);

} ID[i]=recnt;

}

}

}

}

int choose,remain;

int upid[maxn\*8],downid[maxn\*8],tot;

void build(int x,int L,int R) {

upid[x]=++tot; downid[x]=++tot;

if (downid[x>>1]) {

T\_SAT::addedge(downid[x>>1],downid[x]);

} if (L==R) return;

int mid=(L+R)/2;

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

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

}

bool update;

void query(int x,int l,int r,int L,int R) {

if (l>r) return;

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

if (!update) {

T\_SAT::addedge(choose,downid[x]);

} else {

T\_SAT::addedge(++tot,downid[x]); downid[x]=tot;

T\_SAT::addedge(upid[x],remain);

T\_SAT::addedge(downid[x],remain);

int fa=downid[x>>1],ls=downid[x<<1],rs=downid[x<<1|1];

if (fa) T\_SAT::addedge(fa,downid[x]);

if (ls) T\_SAT::addedge(downid[x],ls);

if (rs) T\_SAT::addedge(downid[x],rs);

}

return;

} else if (!update) T\_SAT::addedge(choose,upid[x]);

int mid=(L+R)/2;

if (l<=mid) query(x<<1,l,r,L,mid);

if (mid<r) query(x<<1|1,l,r,mid+1,R);

}

namespace PRE\_CAL {

vector<int> edge[maxn];

int fa[maxn],son[maxn],id[maxn],tot;

int sz[maxn],top[maxn],dep[maxn];

void dfs\_1(int u,int father,int depth) {

fa[u]=father; dep[u]=depth;

int mx=-1; sz[u]=1; son[u]=0;

for (int v:edge[u]) {

if (father==v) continue;

dfs\_1(v,u,depth+1);

sz[u]+=sz[v];

if (sz[v]>mx) mx=sz[v],son[u]=v;

}

}

void dfs\_2(int u,int x) {

id[u]=++tot; top[u]=x;

if (son[u]) dfs\_2(son[u],x);

for (int v:edge[u]) {

if (v==fa[u]||v==son[u]) continue;;

dfs\_2(v,v);

}

}

void solve(int x,int y) {

while (top[x]!=top[y]) {

if (dep[top[x]]<dep[top[y]]) swap(x,y);

query(1,id[top[x]],id[x],1,n); x=fa[top[x]];

} if (dep[x]>dep[y]) swap(x,y);

if (son[x]) query(1,id[son[x]],id[y],1,n);

}

}

int chosen[maxn];

int A[maxn],B[maxn],C[maxn],D[maxn];

int TaskA() {

int i,j,m; scanf(“%d”,&n);

FOR(i,1,n-1) {

int u,v;

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

PRE\_CAL::edge[u].push\_back(v);

PRE\_CAL::edge[v].push\_back(u);

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

T\_SAT::init();

PRE\_CAL::dfs\_1(1,0,0);

PRE\_CAL::dfs\_2(1,1);

FOR(i,1,m) chosen[i]=++tot,++tot;

build(1,1,n);

FOR(i,1,m) scanf("%d%d%d%d",&A[i],&B[i],&C[i],&D[i]);

FOR(i,1,m) {

choose=chosen[i]; remain=chosen[i]+1;

update=0;

PRE\_CAL::solve(A[i],B[i]);

swap(choose,remain);

PRE\_CAL::solve(C[i],D[i]);

update=1; swap(choose,remain);

PRE\_CAL::solve(A[i],B[i]);

swap(choose,remain);

PRE\_CAL::solve(C[i],D[i]);

} build(1,1,n);

rFOR(i,1,m) {

choose=chosen[i]; remain=chosen[i]+1;

update=0;

PRE\_CAL::solve(A[i],B[i]);

swap(choose,remain);

PRE\_CAL::solve(C[i],D[i]);

update=1; swap(choose,remain);

PRE\_CAL::solve(A[i],B[i]);

swap(choose,remain);

PRE\_CAL::solve(C[i],D[i]);

}

T\_SAT::solve(tot);

FOR(i,1,m) if (T\_SAT::belong[chosen[i]]==T\_SAT::belong[chosen[i]+1]) return 0\*puts("NO");

puts("YES");

FOR(i,1,m) printf("%d\n",(T\_SAT::ID[chosen[i]]<T\_SAT::ID[chosen[i]+1])+1);

return 0;

}

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("");

}

}

轻重儿子分开维护

**// 题意: 更改链上的边col**

**// 更改某个链相邻的边col**

**// 查询黑点数**

**// 做法: 轻重边分开维护**

struct segment\_tree {

int val[maxn<<2],len[maxn<<2],lazy[maxn<<2];

void build(int x,int L,int R) {

len[x]=R-L+1; val[x]=0; 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 Inverse(int x) {

lazy[x]^=1; val[x]=len[x]-val[x];

}

void pushdown(int x) {

if (lazy[x]) {

Inverse(x<<1);

Inverse(x<<1|1);

lazy[x]=0;

}

}

void pushup(int x) {

val[x]=val[x<<1]+val[x<<1|1];

}

void update(int x,int l,int r,int L,int R) {

debug("update: %d %d %d\n",x,l,r);

if (l<=L&&R<=r) {Inverse(x); return;}

int mid=(L+R)/2;

pushdown(x);

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

if (mid<r) update(x<<1|1,l,r,mid+1,R);

pushup(x);

}

int query(int x,int l,int r,int L,int R) {

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

int mid=(L+R)/2,ret=0;

pushdown(x);

if (l<=mid) ret+=query(x<<1,l,r,L,mid);

if (mid<r) ret+=query(x<<1|1,l,r,mid+1,R);

pushup(x);

return ret;

}

} heavy,light;

vector<int> edge[maxn];

int fa[maxn],dep[maxn],sz[maxn],tot;

int top[maxn],id[maxn],son[maxn];

void dfs1(int u,int father,int depth) {

int mx=-1; sz[u]=1;

fa[u]=father; son[u]=0; dep[u]=depth;

for (int v:edge[u]) {

if (v==father) continue;

dfs1(v,u,depth+1); sz[u]+=sz[v];

if (sz[v]>mx) mx=sz[v],son[u]=v;

}

}

void dfs2(int u,int x) {

top[u]=x; id[u]=++tot;

if (son[u]) dfs2(son[u],x);

for (int v:edge[u]) {

if (v==fa[u]||v==son[u]) continue;

dfs2(v,v);

}

}

inline void InverseEdge(int x,int y) {

while (top[x]!=top[y]) {

if (dep[top[x]]<dep[top[y]]) swap(x,y);

heavy.update(1,id[top[x]],id[x],1,n);

x=fa[top[x]];

}

if (dep[x]>dep[y]) swap(x,y);

if (son[x]) heavy.update(1,id[son[x]],id[y],1,tot);

}

inline void InverseNode(int x,int y) {

while (top[x]!=top[y]) {

debug("Inverse : %d %d\n",x,y);

if (dep[top[x]]<dep[top[y]]) swap(x,y);

light.update(1,id[top[x]],id[x],1,n);

heavy.update(1,id[top[x]],id[top[x]],1,n);

if (son[x]) heavy.update(1,id[son[x]],id[son[x]],1,n);

x=fa[top[x]];

}

debug("Inverse : %d %d\n",x,y);

if (dep[x]>dep[y]) swap(x,y);

light.update(1,id[x],id[y],1,tot);

heavy.update(1,id[x],id[x],1,n);

if (son[y]) heavy.update(1,id[son[y]],id[son[y]],1,n);

}

inline int Query(int x,int y) {

int ret=0;

while (top[x]!=top[y]) {

if (dep[top[x]]<dep[top[y]]) swap(x,y);

if (top[x]!=x) ret+=heavy.query(1,id[son[top[x]]],id[x],1,n);

ret+=heavy.query(1,id[top[x]],id[top[x]],1,n)^light.query(1,id[fa[top[x]]],id[fa[top[x]]],1,n);

x=fa[top[x]];

}

if (dep[x]>dep[y]) swap(x,y);

if (son[x]) ret+=heavy.query(1,id[son[x]],id[y],1,n);

return ret;

}

int TaskA() {

int i;

scanf("%d",&n); tot=0;

FOR(i,1,n) edge[i].clear();

FOR(i,1,n-1) {

int u,v;

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

edge[u].push\_back(v);

edge[v].push\_back(u);

} dfs1(1,0,0); dfs2(1,1);

FOR(i,1,n) debug("%d ",id[i]);

heavy.build(1,1,n);

light.build(1,1,n);

scanf("%d",&q);

REP(i,q) {

int op,u,v;

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

if (op==1) InverseEdge(u,v);

if (op==2) InverseNode(u,v);

if (op==3) printf("%d\n",Query(u,v));

}

return 0;

}

链分治, 动态维护树上dp

**//大概含义是维护树上dp**

**// f[x]:this\_ans=max(g[x]+f[heavy],0)**

**// g[x]:light\_ans=A[x]+sigma{f[light]}**

**// w[x]:dp[heavy\_son]**

**// 把轻链和重链分开维护, 在重链上一个序列上DP**

**// 题意是更改某点值, 查询联通块的最大权重和**

struct heap {

multiset<ll> S;

inline void ins(ll x) {

S.insert(x);

}

inline void del(ll x) {

multiset<ll>::iterator it=S.lower\_bound(x);

if (it!=S.end()) S.erase(it);

}

inline ll top() {

if (!S.size()) return 0;

return \*S.rbegin();

}

} SON[maxn]; // light

vector<int> edge[maxn];

int fa[maxn],dep[maxn],sz[maxn],tot;

int top[maxn],id[maxn],rid[maxn],son[maxn],leaf[maxn];

void dfs1(int u,int father,int depth) {

int mx=-1,i; sz[u]=1;

fa[u]=father; son[u]=0; dep[u]=depth;

REP(i,(int)edge[u].size()) {

int v=edge[u][i];

if (v==father) continue;

dfs1(v,u,depth+1); sz[u]+=sz[v];

if (sz[v]>mx) mx=sz[v],son[u]=v;

}

}

int A[maxn];

// f[x]:this\_ans=max(g[x]+f[heavy],0)

// g[x]:light\_ans=A[x]+sigma{f[light]}

// w[x]:dp[heavy\_son]

ll f[maxn],g[maxn],w[maxn];

void dfs2(int u,int x) {

top[u]=x; id[u]=++tot; rid[tot]=u;

g[u]=A[u]; f[u]=0; int i;

if (son[u]) dfs2(son[u],x);

REP(i,(int)edge[u].size()) {

int v=edge[u][i];

if (v==fa[u]||v==son[u]) continue;

dfs2(v,v); SON[u].ins(w[v]);

g[u]+=f[v]; max\_(w[u],w[v]);

} if (son[u]) {

leaf[u]=leaf[son[u]];

max\_(f[u],g[u]+f[son[u]]);

max\_(w[u],w[son[u]]);

} else leaf[u]=u;

max\_(f[u],g[u]); max\_(w[u],f[u]);

}

struct node {

ll ls,rs,sum,ans;

node(ll val=0) {sum=val; ls=rs=ans=max(0ll,val);}

} T[maxn<<2];

node merge(const node &A,const node &B) {

node ret;

ret.ls=max(A.ls,A.sum+B.ls);

ret.rs=max(B.rs,B.sum+A.rs);

ret.ans=max(A.ans,B.ans);

ret.ans=max(ret.ans,A.rs+B.ls);

ret.sum=A.sum+B.sum;

return ret;

}

// f[x]:this\_ans=max(g[x]+f[heavy],0)

// g[x]:light\_ans=A[x]+sigma{f[light]}

void build(int x,int L,int R) {

if (L==R) {

T[x]=node(g[rid[L]]);

max\_(T[x].ans,SON[rid[L]].top());

return;

} int mid=(L+R)/2;

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

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

T[x]=merge(T[x<<1],T[x<<1|1]);

}

void update(int x,int pos,int L,int R) {

if (L==R) {

T[x]=node(g[rid[L]]);

max\_(T[x].ans,SON[rid[L]].top());

return;

} int mid=(L+R)/2;

if (pos<=mid) update(x<<1,pos,L,mid);

if (mid<pos) update(x<<1|1,pos,mid+1,R);

T[x]=merge(T[x<<1],T[x<<1|1]);

}

node query(int x,int l,int r,int L,int R) {

if (l<=L&&R<=r) return T[x];

int mid=(L+R)/2;

if (r<=mid) return query(x<<1,l,r,L,mid);

if (mid<l) return query(x<<1|1,l,r,mid+1,R);

return merge(query(x<<1,l,r,L,mid),query(x<<1|1,l,r,mid+1,R));

}

inline void Update(int x,ll y) {

g[x]-=A[x]; A[x]=y; g[x]+=A[x];

while (x) {

update(1,id[x],1,n);

node nxtval=query(1,id[top[x]],id[leaf[x]],1,n);

ll initw=w[top[x]]; w[top[x]]=nxtval.ans;

ll initg=f[top[x]]; f[top[x]]=nxtval.ls;

x=fa[top[x]];

if (x) {

g[x]-=initg;

g[x]+=nxtval.ls;

SON[x].del(initw);

SON[x].ins(nxtval.ans);

}

}

}

inline ll Query(int x) {

return query(1,id[x],id[leaf[x]],1,n).ans;

}

int main() {

int i;

scanf("%d%d",&n,&q); tot=0;

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

FOR(i,1,n) edge[i].clear();

FOR(i,1,n-1) {

int u,v;

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

edge[u].push\_back(v);

edge[v].push\_back(u);

} dfs1(1,0,0); dfs2(1,1);

FOR(i,1,n) debug("%d ",id[i]); deputs("");

FOR(i,1,n) debug("%d ",rid[i]); deputs("");

build(1,1,n);

REP(i,q) {

char op[2];

scanf("%s",op);

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

int x; ll y;

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

Update(x,y);

} else {

int x;

scanf("%d",&x);

printf("%lld\n",Query(x));

}

}

return 0;

}

DSU on tree

**//大概意思就是轻儿子记录答案, 重儿子不清空, 最后把轻儿子的贡献放到重儿子上; 如果是基于深度可合并的, 长链剖分是O(n)的**

// CF741D 辣鸡题

// 问你重排能回文的最长串多长

// 直接上就可以了... 看下dfs顺序就行了

vector<int> edge[maxn];

int sz[maxn],son[maxn];

void dfs1(int x){

int mx=0;sz[x]=1;

for (int v:edge[x]){

dfs1(v); sz[x]+=sz[v];

if (sz[v]>mx) son[x]=v,mx=sz[v];

}

}

int A[maxn],dep[maxn];

int ans[maxn],MX[1<<22|7];

map<int,int> MP[maxn];

int Merge(map<int,int> &A,map<int,int> &B,int x){//B->A

int ret=0,i;

for (auto now:B){

int p=now.first,l=now.second;

if (MX[p]) ret=max(ret,MX[p]+l-2\*dep[x]);

REP(i,22) {

p=now.first^(1<<i);

// printf("now=%d; p=%d; %d %d %d\n",now.first,p,MX[p],l,dep[x]);

if (MX[p]) ret=max(ret,MX[p]+l-2\*dep[x]);

}

}//merge

for (auto now:B){

int p=now.first,l=now.second;

MX[p]=max(MX[p],l); A[p]=MX[p];

}map<int,int>().swap(B);

return ret;

}

void dfs2(int x){

for (int v:edge[x]) if (v!=son[x]){

dfs2(v); ans[x]=max(ans[x],ans[v]);

for (auto now:MP[v]) MX[now.first]=0;

}if (son[x]) {

dfs2(son[x]); ans[x]=max(ans[x],ans[son[x]]);

}//cal

MP[x][A[x]]=dep[x];

if (son[x]) {

ans[x]=max(ans[x],Merge(MP[son[x]],MP[x],x));

swap(MP[x],MP[son[x]]);

}else MX[A[x]]=dep[x];

for (int v:edge[x]) if (v!=son[x]){

ans[x]=max(ans[x],Merge(MP[x],MP[v],x));

}

}

int main() {

int n,i,j,k;

char c;

scanf("%d",&n);

FOR(i,2,n){

int fa;

scanf("%d %c",&fa,&c);

A[i]=A[fa]^(1<<(c-'a'));

dep[i]=dep[fa]+1;

edge[fa].push\_back(i);

}dfs1(1);dfs2(1);

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

return 0;

}

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

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];

虚树 ST表求lca

**// 题意:问最少去掉几个未标记点可以把所有的标记点全分开**

**// 做法:建虚树然后树上DP**

**// 虚树板子,注意:sort过程可以提到外边去**

**// 注意, 原先有的标记有的时候会到边上, 需要特判的, 千万不要if**

struct Edges {

int to; LL len; int next;

Edges(int \_to=0,LL \_len=0,int \_next=0):to(\_to),len(\_len),next(\_next) {}

} edge[maxn\*2]; int etot;

int head[maxn];

int fa[maxn];

LL uplen[maxn];

int id[maxn],dfn[maxn],idtot;

inline void addedge(int u,int v,LL len) {

edge[++etot]=Edges(v,len,head[u]); head[u]=etot;

}

namespace LCA {//内部和外部dfn不同...

int dep[maxn]; LL len[maxn];

int st\_dfn[maxn],tot;

int ST[maxn\*2][20];//only L

void dfs(int x,int f,int d,LL l) {

int i; dep[x]=d; len[x]=l;

st\_dfn[x]=++tot; ST[tot][0]=x;

::id[++idtot]=x; ::dfn[x]=idtot;

for (i=head[x]; ~i; i=edge[i].next) if (edge[i].to!=f) {

int v=edge[i].to;

::fa[v]=x; ::uplen[v]=edge[i].len;

dfs(v,x,d+1,l+edge[i].len);

ST[++tot][0]=x;

}

}

int t\_t[maxn\*2];

inline void initST(int n) {

int i,j;

FOR(i,1,n\*2) t\_t[i]=t\_t[i>>1]+1;

FOR(i,1,n\*2) {

rep(j,1,t\_t[i]) {

int u=ST[i][j-1],v=ST[i-(1<<(j-1))][j-1];

ST[i][j]=dep[u]<dep[v]?u:v;

}

}

}

inline int lca(int x,int y) {

x=st\_dfn[x]; y=st\_dfn[y];

if (x>y) swap(x,y);

int t=t\_t[y-x+1]-1;

x=ST[x+(1<<t)-1][t]; y=ST[y][t];

return dep[x]<dep[y]?x:y;

}

inline LL dis(int x,int y) {

return len[x]+len[y]-2\*len[lca(x,y)];

}

void init(int n){

memset(head+1,0xff,n\*sizeof(int));

etot=idtot=tot=0;

}

}

namespace vtree {

int S[maxn],top;

int pid[maxn],mark[maxn];

int vid[maxn],vfa[maxn];

LL vlen[maxn];

int cmp(int x,int y) {

return dfn[x]<dfn[y];

}

void addedge(int u,int v) {

vfa[v]=u; vlen[v]=LCA::dis(u,v);

}

int m;

void vbuild(int n) {

int i; m=0;

sort(pid+1,pid+1+n,cmp);

S[top=1]=pid[1];

mark[pid[1]]=1;

FOR(i,2,n) {

int f=LCA::lca(pid[i-1],pid[i]);

while (top&&LCA::dep[S[top]]>LCA::dep[f]) {

int v; vid[++m]=v=S[top--];

if (top&&LCA::dep[S[top]]>LCA::dep[f]) addedge(S[top],v);

else addedge(f,v);

} if (!top||S[top]!=f) S[++top]=f;

S[++top]=pid[i]; mark[pid[i]]=1;

} while (top-1) addedge(S[top-1],S[top]),vid[++m]=S[top--];

vid[++m]=S[1];

reverse(vid+1,vid+m+1);

}

void vclear() {

int i;

FOR(i,1,m) mark[vfa[vid[i]]]=0;

FOR(i,1,m) mark[vid[i]]=0;

}

}

int ans;

int cnt[maxn];

void solve() {

int i;

FOR(i,1,vtree::m) cnt[vtree::vid[i]]=0;

rFOR(i,1,vtree::m) {

int x=vtree::vid[i];

if (vtree::mark[x]) ans+=cnt[x],cnt[x]=1;

else if (cnt[x]>1) ans++,cnt[x]=0;

if (i>1) cnt[vtree::vfa[x]]+=cnt[x];

}

}

**Ladder长链剖分 k级祖先**

namespace ladder {

vector<int> edge[maxn];

int id[maxn]; int tot;

int fa[maxn][21],son[maxn],top[maxn],len[maxn],dep[maxn];

vector<int> ladder[maxn];

int upp[maxn];

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

fa[x][0]=father; id[++tot]=x;

for (int v:edge[x]) if (v!=father) dfs(v,x);

}

void buildfa() {

int i,j; dep[id[1]]=0;

FOR(i,1,tot) rep(j,1,21) fa[i][j]=fa[fa[i][j-1]][j-1],dep[i]=dep[fa[i][0]]+1;

rFOR(i,1,tot) {

int o=0,x=id[i]; top[x]=x;

ladder[x].clear();

for (int v:edge[x]) if (v!=fa[x][0]){

if (!o||len[o]<len[v]) o=v;

} if (o) len[x]=len[o]+1; else o=0;

son[x]=o; top[x]=x;

} FOR(i,1,tot) if (son[id[i]]) top[son[id[i]]]=top[id[i]];

rFOR(i,1,tot) ladder[top[id[i]]].push\_back(id[i]);

FOR(i,2,tot) {

int x=id[i];

if (top[x]==x) {

for (int y=fa[x][0],c=len[x]; y&&c; y=fa[y][0],c--)

ladder[x].push\_back(y);

}

} upp[0]=-1;

FOR(i,1,tot) upp[i]=upp[i-1]+(i==(i&-i));

}

int prev(int x,int k) {

if (!k) return x;

if (dep[x]<=k) return 0;

x=fa[x][upp[k]]; k-=1<<upp[k];

k-=dep[x]-dep[top[x]]; x=top[x];

return ladder[x][len[x]+k];

}

}

using namespace ladder;

int main() {

int i;

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

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); buildfa();

FOR(i,1,m){

int x,k;

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

printf("%d\n",prev(x,k));

}

}

**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, kummer等基础

**// 注意n>M时要用lucas!**

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));

}

Pell方程

**x^2-D\*y^2=n**

**打表求出第一项**

**然后下面的项可以线性递推**

**xk+sqrt(D)yk=(x1+sqrt(D)y1)^k**

**xn+1=x0xn+Dy0yn**

**yn+1=y0xn+x0yn**

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){

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;

}\*/

Exgcd

//ax+by%x=y

int n,m;

int i,j,k;

void exgcd(LL a,LL b,LL &d,LL &x,LL &y){//d==0时存在逆元 //(x+p)%p为逆元

if (!b) {d=a;x=1;y=0;}

else {exgcd(b,a%b,d,y,x);y-=a/b\*x;}

}

bool check(LL a,LL b,LL x){

LL A,B,d;exgcd(a,b,d,A,B);

A\*=x;B\*=x;

LL T=A/b+B/a;

A%=b;B%=a;

if (A<0) A+=b,T--;

if (B<0) B+=a,T--;

// printf("%lld %lld %lld %lld %lld %lld\n",a,b,x,A,B,T);

return T>=0;

}

int solve(){

int a,b,x,y;

scanf("%lld%lld%lld%lld",&a,&b,&x,&y);

int g=gcd(a,b);

if (x%g||y%g) return 0\*puts("NO");

x/=g;y/=g;a/=g;b/=g;

if (!(x%a)&&!(y%b)) return 0\*puts("YES");

if (!(y%a)&&!(x%b)) return 0\*puts("YES");

if (!(x%(a\*b))&&check(a,b,y)) return 0\*puts("YES");

if (!(y%(a\*b))&&check(a,b,x)) return 0\*puts("YES");

return 0\*puts("NO");

}

K次方和, 伯努利数

**//sum{pow(i,k)}(1->n)**

ll B[maxn],pw[maxn];

ll A[maxn];

ll INV[10007];

LL inv[10002];//inverse

LL fac[10002];//Factorial

LL C(int n,int m){

return fac[n]\*inv[m]%M\*inv[n-m]%M;

}ll SUM\_N\_K(int n,int k){

ll pw=1,now=0; int i;

FOR(i,1,k+1) {

pw=pw\*(n+1)%M;

now+=INV[k+1]\*C(k+1,i)%M\*B[k+1-i]%M\*pw%M;

}mod\_M(now);

return now;

}

int TaskA(){

int i,j,k;

return 0;

}

void initialize(){

int i,j;

fac[0]=1;

FOR(i,1,10000) fac[i]=i\*fac[i-1]%M;

inv[0]=inv[1]=1; INV[0]=INV[1]=1;

FOR(i,2,10000) INV[i]=inv[i]=(M-M/i)\*inv[M%i]%M;

FOR(i,1,10000) inv[i]=inv[i]\*inv[i-1]%M;// inv(n!)

B[0]=1;

FOR(i,1,2000) {

FOR(j,0,i-1) B[i]-=INV[i+1]\*C(i+1,j)%M\*B[j]%M; mod\_M(B[i]);

}

// FOR(i,0,2000) printf("%lld ",B[i]);

}

求原根 二次三次剩余(无板子)

**原根:存在:m=2,4,p^a,2\*p^a,p为奇质数,个数phi(phi(p-1))**

**查找:假设是g,从小枚举g**

**phi(m)=p1^a1\*p2^a2\*...\*pk^ak;**

**pow(g,phi(m)/pi)≡1恒成立(m质数则phi=m-1)**

**性质:pow(g,i)%p得到的答案两两不同**

**推论1 若d|(p-1),则x^d≡1(mod p)恰有d个解**

**推论2 若p为素数,d|(p-1),则阶为d (pow(x,d)≡1)**

**的最小剩余(mod p)的个数为phi(d)**

**二次剩余:x\*x≡n(mod p)**

**1.小的(a=0|p=2)直接判断**

**2.pow(n,(p-1)/2)≡1或-1(mod p)**

**pow(n,(p-1)/2)≡1则有解**

**3.由于1/2的数字有二次剩余**

**令w=a\*a-n;且pow(n,(p-1)/2)≡-1**

**struct A+B\*sqrt(w):**

**pow(a+sqrt(w),p)=pow(a,p)+pow(w,(p-1)/2)\*sqrt(w))**

**≡a-sqrt(w)**

**pow(a+sqrt(w),p+1)≡a\*a-w≡n**

**pow(a+sqrt(w),(p+1)/2)即为答案**

**三次剩余:x\*x\*x≡n(mod p)**

**1.小的(a=0|p=2,3)直接判断**

**2.p≡-1(mod 3):x≡pow(a,(2\*p-1)/3)**

**3.p≡1(mod 3):设e为三次单位根,e\*e\*e≡1(mod p)**

**pow(a,(p-1)/3)≡1(mod p)则有三次剩余**

ll poww(ll a,ll b,ll M){

ll ret=1;

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

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

return ret;

}

int p[maxn],tot;

bool mark[maxn];

bool isroot(int x,int p){

if (!(x%p)||(x%p==1&&p!=2)) return 0;

for (ll i=2;i\*i<=p-1;i++) if ((p-1)%i==0)

if (poww(x,(p-1)/i,p)==1||poww(x,i,p)==1) return 0;

return 1;

}

int TaskA() {

int i,x;

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

if (mark[n+1]) return 0\*puts("-1");

rFOR(i,2,x-1){

if (!isroot(i,n+1)) continue;

return 0\*printf("%d\n",i);

} return 0\*puts("-1");

}

void initialize() {

int i,j;

FOR(i,2,5000001) {

if (!mark[i]) p[tot++]=i;

REP(j,tot) {

if (i\*p[j]>5000001) break;

mark[i\*p[j]]=1;

if (i%p[j]==0) break;

}

}

}

FFT、NTT

**DFT式子: X\_k=\sum{x\_i\*wn[k\*i]};**

**任意模数FFT：**

namespace FFT {

const int maxn=1<<20|7;

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);}

};

complex wn[maxn];

void initwn(int l) {

static int len=0; int i;

if (len==l) return; else len=l;

REP(i,len) wn[i]=complex(cos(2\*pi\*i/l),sin(2\*pi\*i/l));

}

void fft(complex \*A,int len,int inv) {

int i,j,k; initwn(len);

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) {

for (j=0; j<len; j+=i) {

for (k=j; k<(j+i/2); k++) {

complex a,b; a=A[k];

b=A[k+i/2]\*wn[(ll)(k-j)\*len/i];

A[k]=a+b; A[k+i/2]=a-b;

}

}

} if (inv==-1) REP(i,len) A[i]=complex(A[i].a/len,A[i].b/len);

}

inline complex conj(complex &A) {return complex(A.a,-A.b);}

void mul(int \*A,int \*B,int \*ans,int len,int mod) { //ans=A\*B

static complex x1[maxn],x2[maxn];

static complex x3[maxn],x4[maxn];

static const int S=1<<15 ; int i;

REP(i,len) x1[i]=complex(A[i]/S,A[i]%S);

REP(i,len) x2[i]=complex(B[i]/S,B[i]%S);

fft(x1,len,1); fft(x2,len,1);

REP(i,len) {//这个k1, b1就是前面的, 这就减掉了一半常数

int j=(len-i)&(len-1);

complex k1=(conj(x1[i])+x1[j])\*complex(0.5,0);//dft k1

complex b1=(conj(x1[i])-x1[j])\*complex(0,0.5);//dft b1

complex k2=(conj(x2[i])+x2[j])\*complex(0.5,0);//dft k2

complex b2=(conj(x2[i])-x2[j])\*complex(0,0.5);//dft b2

x3[i]=k1\*k2+k1\*b2\*complex(0,1);

x4[i]=b1\*k2+b1\*b2\*complex(0,1);

} fft(x3,len,-1); fft(x4,len,-1);

REP(i,len) {

ll kk=x3[i].a+0.5,kb=x3[i].b+0.5;

ll bk=x4[i].a+0.5,bb=x4[i].b+0.5;

ans[i]=((kk%mod\*S%mod+kb+bk)%mod\*S%mod+bb)%mod;

}

}

void mul(int \*A,int \*B,int \*ans,int n,int m,int mod) {

int len=1,i;

while (len<n+m) len<<=1;

rep(i,n,len) A[i]=0;

rep(i,m,len) B[i]=0;

mul(A,B,ans,len,mod);

}

}

int A[maxn],B[maxn],ans[maxn];

int main() {

int mod,i;

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

REP(i,n) scanf("%d",&A[i]);

REP(i,m) scanf("%d",&B[i]);

FFT::mul(A,B,ans,n,m,mod);

REP(i,n+m-1) printf("%d ",ans[i]);

}

**预处理部分然后NTT：**

const int len=32768;

const ll MOD=1004535809;

const ll g=3;

int wn[maxn],invwn[maxn];

ll mul(ll x,ll y) {

return x\*y%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 initwn(int len) {

ll w=poww(g,(MOD-1)/len); int i;

ll invw=poww(w,MOD-2); wn[0]=invwn[0]=1;

rep(i,1,len) {

wn[i]=mul(wn[i-1],w);

invwn[i]=mul(invw,invwn[i-1]);

}

}

void ntt(ll \*A,int len,int inv) {

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) {

for (j=0; j<len; j+=i) {

for (k=j; k<(j+i/2); k++) {

ll a,b; a=A[k];

if (inv==-1) b=mul(A[k+i/2],invwn[(k-j)\*len/i]);

else b=mul(A[k+i/2],wn[(k-j)\*len/i]);

A[k]=(a+b); (A[k]>=MOD) &&(A[k]-=MOD);

A[k+i/2]=(a-b+MOD); (A[k+i/2]>=MOD) &&(A[k+i/2]-=MOD);

}

}

} if (inv==-1) {

ll vn=poww(len,MOD-2);

REP(i,len) A[i]=mul(A[i],vn);

}

}

**// http://120.78.128.11/Problem.jsp?pid=3400**

**// Xk=\sum{xi\*wn[k\*i]};**

**// 某个区间ntt下**

int A[1007];

int V[1007][len];

ll ini[len],nxt[len];

int TaskA() {

int i,k,x;

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

initwn(len);

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

FOR(i,1,n) REP(k,len) V[i][k]=(V[i-1][k]+wn[(k\*A[i])%len])%MOD;

REP(k,len) ini[k]=1;

FOR(i,1,m) {

int l,r; scanf("%d%d",&l,&r);

REP(k,len) nxt[k]=(V[r][k]-V[l-1][k]+1+MOD)%MOD;

REP(k,len) ini[k]=mul(ini[k],nxt[k]);

if (i%22==0) {

ntt(ini,len,-1);

rep(k,10001,len) ini[k]=0;

ntt(ini,len,1);

}

} ntt(ini,len,-1);

printf("%lld\n",ini[x]);

return 0;

}

多项式开根求逆,除法取模

**// http://codeforces.com/contest/438/problem/E**

**// 题意: 问你有多少个二叉树点权从c中取, 而且权值和是k**

**// 做法: 考虑多一个点, 所以f[x]=sigma{f[k]\*f[x-k-s],(s in c)}**

**// 所以 满足 F=F^2\*C+1, 左边是生成函数**

**// 所以 F=[1-sqrt(1-4C)]/2C**

**// 当且仅当常数项有逆元, 可以多项式求逆**

**// 求逆:C\*A≡1(mod x^n)**

**// B\*A≡1(mod x^(n/2))**

**// (B\*A-1)\*(B\*A-1)≡0(mod x^(n/2))**

**// B\*B\*A\*A-2\*A\*B+1≡0(mod x^n)**

**// B\*B\*A-2\*B+C≡0(mod x^n)**

**// C≡B\*(2-A\*B)(mod x^n)**

**// 求根:C\*C≡A(mod x^n)**

**// B\*B≡A(mod x^n/2)**

**// (B\*B-A)\*(B\*B-A)≡0(mod x^n)**

**// B\*B\*B\*B-2\*C\*C\*B\*B+C\*C\*C\*C≡0(mod x^n)**

**// (B\*B+C\*C)\*(B\*B+C\*C)≡4\*C\*C\*B\*B(mod x^n)**

**// B\*B+A≡2\*C\*B(mod x^n)**

**// C=(B\*B+A)/(2\*B)**

namespace NTT {

const int maxn=1<<20|7;

const ll MOD=998244353;

const ll g=3;

int wn[maxn],invwn[maxn];

ll mul(ll x,ll y) {

return x\*y%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 initwn(int l) {

static int len=0;

if (len==l) return; len=l;

ll w=poww(g,(MOD-1)/len); int i;

ll invw=poww(w,MOD-2); wn[0]=invwn[0]=1;

rep(i,1,len) {

wn[i]=mul(wn[i-1],w);

invwn[i]=mul(invw,invwn[i-1]);

}

}

void ntt(ll \*A,int len,int inv) {

int i,j,k; initwn(len);

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) {

for (j=0; j<len; j+=i) {

for (k=j; k<(j+i/2); k++) {

ll a,b; a=A[k];

if (inv==-1) b=mul(A[k+i/2],invwn[(ll)(k-j)\*len/i]);

else b=mul(A[k+i/2],wn[(ll)(k-j)\*len/i]);

A[k]=(a+b); (A[k]>=MOD) &&(A[k]-=MOD);

A[k+i/2]=(a-b+MOD); (A[k+i/2]>=MOD) &&(A[k+i/2]-=MOD);

}

}

} if (inv==-1) {

ll vn=poww(len,MOD-2);

REP(i,len) A[i]=mul(A[i],vn);

}

}

void mul(ll \*A,ll \*B,ll \*C,int len) { //C=A\*B

int i;

ntt(A,len,1); ntt(B,len,1);

REP(i,len) C[i]=mul(A[i],B[i]);

ntt(C,len,-1);

}

void inv(ll \*A,ll \*B,int l) { //B=inv(A)

static ll C[maxn];

B[0]=poww(A[0],MOD-2); B[1]=0;

for (int len=2; len<=l; len<<=1) {

int i; fill(B+len,B+len+len,0);

copy(A,A+len,C); fill(C+len,C+len+len,0);

ntt(C,len\*2,1); ntt(B,len\*2,1);

REP(i,len\*2) B[i]=mul(B[i],(MOD+2-mul(C[i],B[i])));

ntt(B,len\*2,-1); fill(B+len,B+len+len,0);

}

}

void sqrt(ll \*A,ll \*B,int l) { //B=sqrt(A)

static ll C[maxn],\_B[maxn];

B[0]=1; B[1]=0;// 这里应该是个二次剩余

for (int len=2; len<=l; len<<=1) {

int i; ll inv2=poww(2,MOD-2);

inv(B,\_B,len); fill(B+len,B+len+len,0);

copy(A,A+len,C); fill(C+len,C+len+len,0);

ntt(C,len\*2,1); ntt(\_B,len\*2,1); ntt(B,len\*2,1);

REP(i,len\*2) B[i]=mul(inv2,B[i]+mul(C[i],\_B[i]));

ntt(B,len\*2,-1); fill(B+len,B+len+len,0);

}

}

static ll A[maxn],B[maxn];

void multiply(ll \*a,ll \*b,ll \*ans,int n,int m) {//C=A\*B(actual)

int len=1,i;

while (len<n+m-2) len<<=1;

REP(i,n) A[i]=a[i]; rep(i,n,len) A[i]=0;

REP(i,m) B[i]=b[i]; rep(i,m,len) B[i]=0;

mul(A,B,ans,len);

}

void divide(ll \*a,ll \*b,ll \*ans,int n,int m,int &l) {

if (n<m) {l=1; ans[0]=0; return;}

int len=1,i; l=n-m+1;

while (len<n-m+1) len<<=1;

REP(i,n) A[i]=a[i]; reverse(A,A+n); min\_(n,l);

REP(i,m) B[i]=b[i]; reverse(B,B+m); min\_(m,l);

rep(i,m,len) B[i]=0;

inv(B,ans,len);

multiply(A,ans,ans,len,n);

reverse(ans,ans+l);

}

//ans1:答案; ans2:余数

void delivery(ll \*a,ll \*b,ll \*ans1,ll \*ans2,int n,int m,int &l1,int &l2) {

divide(a,b,ans1,n,m,l1); l2=m-1;

multiply(b,ans1,ans2,m,l1);

int i; REP(i,l2) ans2[i]=(a[i]-ans2[i]+M)%M;

}

}

**// F=[1-sqrt(1-4C)]/2C**

ll C[maxn],A[maxn],ans[maxn],tmp[maxn];

int main() {

int i,k;

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

FOR(i,1,n) scanf("%d",&k),C[k]++;

int len=1;

while (len<=m) len<<=1;

REP(i,len) A[i]=-4\*C[i]; A[0]++;

REP(i,len) mod\_(A[i]);

NTT::sqrt(A,tmp,len);

add\_(tmp[0],1);

NTT::inv(tmp,ans,len);

REP(i,len) mul\_(ans[i],2);

FOR(i,1,m) printf("%lld\n",ans[i]);

}

fwt, fmt, 子集卷积

**//or/and的理解:这里的变换是利用dp时分治来压位(写成非递归形式)实现的，时间nlogn**

**//进行组合可以将二元运算的东西都组合出来**

**//实际上or都没用**

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

**//第一种做法: 按位考虑**

**//大概做法是按照每一位来分类，然后往下递归获得答案**

**就是，按照这一位是1和0分成几类往下递归**

**//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**

**//最好像tls那样推一推然后写成非递归, 常数会减少到和2^n\*n^2差不多**

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;

}

**//第二种做法: 数学方法**

**前一次的分治可以认为是枚举元素!**

**快速莫比乌斯变换：**

**h\_S = \sum\_{L \subseteq all} \sum\_{R \subseteq all} [L \cup R = S] f\_L \* g\_R**

**h\_S = \sum\_{L \subseteq S} \sum\_{R \subseteq S} [L \cup R = S] f\_L \* g\_R**

**! 重要:**

**let \hat{h\_S} = \sum\_{T \subseteq S} h\_T**

**那么后面的等于变成 \subseteq (属于)**

**\hat(h\_S) = \hat(f\_S) \* \hat(g\_S)**

**可以for (i->1<<n) for (j,n) if ((i>>j)&1) f[i]+=f[i^(1<<j)];**

**子集卷积:**

**h\_S = \sum\_{T \subseteq S} f\_T \* g\_{S-T}**

**h\_S = \sum\_{L \subseteq all} \sum\_{R \subseteq all} [L \cup R = S] [L \cap R = \varnothing] f\_L \* g\_R**

**h\_S = \sum\_{L \subseteq all} \sum\_{R \subseteq all} [L \cup R = S] [|L| + |R| = |S|] f\_L \* g\_R**

**所以，按照|L|和|R|个数来分类，然后直接容斥(dp)减去多算的那些即可**

**减就直接手动枚举|S|和|L|,ans[|S|][i]+=\sum\_{|L|} f[|L|][i]\*g[|S|-|L|][i]**

**! 注意这里这个枚举bit要加个新的tmp数组...**

**快速沃尔什变换：**

**h\_S = \sum\_{L \subseteq all} \sum\_{R \subseteq all} [L \oplus(xor) R = S] f\_L \* g\_R**

**由于**

**[S != \varnothing (空集)] = \frac{1}{2^n} \* \sum\_{T \subseteq all} -1^{|S \cap T|}**

**这个东西的证明: 由于S有值时, S \cap T 奇偶性五五开, 所以这个东西会变成 0 !**

**h\_S = \sum\_{L \subseteq all} \sum\_{R \subseteq all} [L \oplus R \oplus S = \varnothing] f\_L \* g\_R**

**= \frac{1}{2^n} \* \sum\_{T \subseteq all} \sum\_{L \subseteq all} \sum\_{R \subseteq all} -1^{|S \cap L \cap R|} f\_L \* g\_R**

**把后面那俩东西分开, 所以**

**let \hat{h\_S} = \sum\_{T \subseteq all} -1^{S \cap T} h\_T**

**\hat(h\_S) = \hat(f\_S) \* \hat(g\_S) \* \frac{1}{2^n}**

**然后可以枚举每个数字，对这位进行交换更新, 最后再乘 \frac{1}{2^n}**

**子集卷积**

**// C[k]=\sum\_{i&j=k} A[i^j] B[i|j]**

**// let i'=i^j, j'=i|j, 这样的i,j对有2^bit(i')个**

**// C[k]=\sum [j'-i'=k] [i' \subseteq j'] 2^i' \* A[i'] \* B[j']**

**// C[k]=\sum [i^j=k] [i&j=i] \* 2^i \* A[i] \* B[j] //这里的意思就是i|k=j, i+k=j**

**// C[k]=\sum [i^j=k] [bit(j)-bit(i)=bit(k)] 2^i \* A[i] \* B[j]**

**// ! 注意这里这个枚举bit要加个新的tmp数组...**

int A[20][maxn],B[20][maxn],C[20][maxn];

int bit[maxn],pw1526[maxn],ans[maxn];

int main() {

int k,i;

scanf("%d",&m); n=1<<m;

REP(i,n) bit[i]=bit[i>>1]+(i&1);

REP(i,n) scanf("%d",&A[bit[i]][i]);

REP(i,n) scanf("%d",&B[bit[i]][i]);

pw1526[0]=1;

rep(i,1,n) pw1526[i]=1526ll\*pw1526[i-1]%M;

REP(i,n) mul\_(A[bit[i]][i],powMM(2,bit[i]));

REP(i,m+1) fwt(A[i],n,1),fwt(B[i],n,1);

REP(k,m+1) REP(i,m-k+1) {

int t=0,j=i+k;

REP(t,n) add\_(C[k][t],(ll)A[i][t]\*B[j][t]%M);

} REP(i,m+1) fwt(C[i],n,-1);

REP(i,n) ans[i]=C[bit[i]][i];

int Ans=0;

REP(i,n) add\_(Ans,(ll)ans[i]\*pw1526[i]%M);

printf("%d\n",Ans);

}

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;

}

**//辗转相除法**

ans=1;

REP(i,n){

rep(j,i+1,n){

int x=i,y=j;

while (a[y][i]){

LL t=a[x][i]/a[y][i];

rep(k,i,n) a[x][k]=(a[x][k]-a[y][k]\*t)%m;

swap(x,y);

}

if (x!=i){

rep(k,i,n) swap(a[i][k],a[x][k]);

ans=(-ans+m)%m;

}

}

ans=ans\*a[i][i]%m;

ans=(ans+m)%m;

}

***使用这个定理必须是平面图;***

**indström–Gessel–Viennot lemma**

**这个是个求不相交路径对数的方案数的定理**

**答案是：下列矩阵行列式，其中A[i,j]表示i到j方案数**

**|A[1,1],A[1,2]|**

**|A[2,1],A[2,2]|**

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));

}

}

广义容斥

**错排公式: D[n]=(n-1)(D[n-2]+D[n-1])=(-1)^n+n\*D[n-1]**

**卡特兰数: (括号序列匹配数, 或者一条不经过中线的路径条数)**

**C(2\*n,n)-C(2\*n,n-1)**

**考虑一个人(或者一种方案), 用来计算容斥系数**

**对于这种方案会被算到的方案数:**

**对于组合数形式:**

**1.\sum{C(n,i)\*f[i]}=1**

**2.\sum{C(n,i)\*f[i]}=a[i]**

**然后, 你的答案的方案数就一定是C(......)了**

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);

}

**// 质数次方和**

namespace pcf {

typedef unsigned int ll;

ll H[maxn],L[maxn];

ll getsum(ll n,ll k) {

if (k==0) return n;

if (k==1) {

ll a=n,b=n+1;

if (a%2==0) a/=2; else b/=2;

return a\*b;

} if (k==2) {

ll a=n,b=n+1,c=2\*n+1;

if (a%2==0) a/=2; else b/=2;

if (a%3==0) a/=3; else if (b%3==0) b/=3; else c/=3;

return a\*b\*c;

} if (k==3) {

ll a=n,b=n+1;

if (a%2==0) a/=2; else b/=2;

return a\*b\*a\*b;

} return 0\*debug("getsum:wrong!");

}

ll power(ll n,ll k) {

ll ret=1;

while(k--) ret\*=n;

return ret;

}

ll cal(ll n,ll K) {//小于n的质数K次方和

ll p,k,m;

for (m=1; m\*m<=n; ++m) H[m]=getsum(n/m,K)-1;

FOR(p,1,m) L[p]=getsum(p,K)-1;

FOR(p,2,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]-=power(p,K)\*(H[p\*k]-L[p-1]);

else H[k]-=power(p,K)\*(L[n/p/k]-L[p-1]);

} rFOR(k,p\*p,m) L[k]-=power(p,K)\*(L[k/p]-L[p-1]);

}

// return H[1];

ll ret=0; ui l;

FOR(l,1,n){//val+=n/i

ll r=n/(n/l);

if (r<=m) ret+=n/l\*(L[r]-L[l-1]);

else ret+=n/l\*(H[n/l]-H[n/l+1]);

l=r;

} return ret;

}

}

N^2/3的方法: (**Miller-Lehmer**)

**//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;

}

}

Min\_25筛

**SPOJ DIVCNTK(sum\_ \sigma(i^k))**

**直接上即可**

namespace seives { // 抄的define

#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 MAXP=66666;

const int MAX=100010;//euler\_seive

const int maxn=100010;//min\_25, =sqrt(n)

int p[MAXP],tot;

ui ar[(MAX>>6)+7]= {0};

void init() {//seives

setbit(ar,0); setbit(ar,1);

int i,j; tot=0;

rep(i,2,MAX) {

if (isprime(i)) p[tot++]=i;

REP(j,tot) {

if (i\*p[j]>=MAX) break;

if ((i\*p[j])&1) setbit(ar,i\*p[j]);

if (i%p[j]==0) break;

}

}

}

**// 普通pcf公式: g(i,j)=g(i-1,j)-p^k\*g(i-1,j/p)**

**// 只有小于等于sqrt的p有用, 所以枚举这个, 考虑对其他答案的贡献**

**// 对于某个积性函数: (算贡献)**

**// g(i,j)=g(i-1,j)+\sum\_p^k F(p^k)\*g(i-1,j/[p^k]),还要加p^k的贡献**

**// 对于小于等于sqrt的p, 直接筛**

**// 对于大于的, 贡献只会是F(p)! 也就是...直接洲阁筛把答案的贡献加进去**

**// 这个加贡献=\_= 竟然真的是直接暴力算啊...**

**// 竟然是直接pcf求个前缀和啥的就完事了啊=\_=**

**// typedef ull ll;**

**// 注意如果想要去掉某个质数的贡献, 这个p[k]至少要筛到sqrtn...**

**// 注意F1的贡献, 是要乘的...**

**// 我这个F和G和一般的定义是反的...要先算G**

ll n,m;//blocksize

ll H[maxn],L[maxn];

void pcf() {

ll p,k;

FOR(p,1,m) L[p]=p-1,H[p]=n/p-1;

FOR(p,2,m) {

if (L[p]==L[p-1]) continue;//not\_prime

FOR(k,1,min(m,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 F[maxn],G[maxn];//F[n/k]:H[n/k], G[i]:L[i]

ll K;

ll getans(ll x,int i) {

if (x<=1||p[i]>x) return 0;

if (p[i]>m) return F[n/x]-G[m];

ll ans=((x<=m)?G[x]:F[n/x])-G[p[i]-1];

for (; (ll)p[i]\*p[i]<=x; i++) {

for (ll \_x=x/p[i],c=1; \_x>=p[i]; \_x/=p[i],c++)

ans+=getans(\_x,i+1)\*(c\*K+1)+((c+1)\*K+1);

} return ans;

}

ll solve() {

int p;

for (m=1; m\*m<=n; ++m); m--; pcf();

FOR(p,1,m) F[p]=H[p]\*(K+1),G[p]=L[p]\*(K+1);

return getans(n,0)+1;//1:1

}

}

积性函数 前缀和 杜教筛

**n=\sum\_{d|n}{phi(d)} 将phi看作容斥系数**

**[n=1]=\sum\_{d|n}{mu(d)} 将i/n化为最简分数**

**phi(n)=\sum\_{d|n}{d\*mu(n/d)}**

**这里可以把gcd或者lcm的式子提出来!**

**(重要!) 1…n的与n互质数和(n\*phi(n)+[n=1])/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……**

**\sum{[gcd(i,j)=1]}=\sum{\mu(d) \* (n/d)^2}**

**\sum{gcd(i,n)}=\sum{d|n}{d\*phi(n/d)}**

**\sum{约数个数sigma{n}}=\sum{n/d}**

**sigma{n\*m}=\sum\_{i|n} \sum\_{j|m} [gcd(i,j)=1] (原因是枚举约数i\*(m/j),gcd(i,j)=1不会算重)**

**\sum\_i \sum\_j{sigma{i\*j}}=\sum\_d mu(d) \* \sum\_i n/(d\*i) \* \sum\_j n/(d\*j)**

**\sum{约数和sigma\_1{i}}=\sum{(n/d)\*d} = \sum{n/d\*(n/d+1)/2}**

**\mu(n)^2=0(无平方因子)时, 存在 \varphi(n\*k) = \sum\_{d|gcd(n,k)} \varphi(d) \varphi(k)**

**\sum\_i^n \mu(i)^2 = \sum\_i \mu(i) \* \frac{n}{i\*i} (可以认为是无平方因子数个数 )**

**注意最好还是化成能书写的形式，脑补还是很可能出问题!**

**关于莫比乌斯反演：**

**f(n)=\sum\_{d|n} g(d) 等价于 g(n)=\sum\_{d|n} mu(d)f(n/d)**

**本质是个容斥**

**关于积性函数:**

**单位函数e(x)=[x==1]**

**常函数I(x)=1**

**幂函数id^k(x)=x^k**

**欧拉函数phi(x)=x\*multi{1-1/p}**

**莫比乌斯函数mu(x)={(-1)^k,x=p1\*p2..pk}**

**约数个数函数sigma{d}=\prod\_{p|d} (k+1)**

**约数和函数sigma\_1{d}=\prod\_{p|d} (p\*k+1)**

**狄利克雷卷积: (f\*g(n)=\sum{f(d)\*g(n/d)})**

**积性函数的狄利克雷卷积也是积性函数**

**可以将一个ans化成多个狄利克雷卷积相加的形式**

**(重要!) 狄利克雷卷积满足交换律、结合律，对加法满足分配律**

**积性函数前缀和（杜教筛）:**

**如果能通过狄利克雷卷积构造一个更好计算前缀和的函数，且用于卷积的另一个函数也易计算，则可以简化计算过程。**

**你需要先构造一个可以很快计算前缀和的东西, 然后利用交换 i 和 d|i 来化简式子来加速运算**

**这个 x 可能非常大, 乘起来就可能会爆掉, 需要特别注意!**

**可以不用map来记录比较大的数的答案, 可以开个数组直接记录g(i)代表n/i的答案**

**pcf, 洲阁筛, min\_25筛**

**普通pcf公式: g(i,j)=g(i-1,j)-p^k\*g(i-1,j/p)**

**只有小于等于sqrt的p有用, 所以枚举这个, 考虑对其他答案的贡献**

**对于某个积性函数: (算贡献)**

**g(i,j)=g(i-1,j)+\sum\_p^k F(p^k)\*g(i-1,j/[p^k]),还要加p^k的贡献**

**对于小于等于sqrt的p, 直接筛**

**对于大于的, 贡献只会是F(p)! 也就是...直接洲阁筛把答案的贡献加进去**

**这个加贡献=\_= 竟然真的是直接暴力算啊...**

**竟然是直接pcf求个前缀和啥的就完事了啊=\_=**

**其他奇怪的东西：**

**rng\_58-clj等式**

**\sum\_i^a \sum\_j^b \sum\_k^c d(i\*j\*k) = \sum\_gcd(i,j)=gcd(j,k)=gcd(k,i)=1 \frac{i}{a} \frac{j}{b} \frac{k}{c}**

**这个可以扩展到任意维度**

**Zoj3881**

**$ \sum\_i^n \sum\_{d|i} rad(d) \* \varphi(\frac{d}{rad(d)}) $ rad表示最大无平方因子数**

**tls: 后面的这个东西很明显是个积性函数! 所以就不用努力了=\_=**

**假设 $p^k | i$**

**$ = \sum\_i^n \prod\_{p|i, p是质数} (1 + \sum\_t^k p \* \varphi(p^{t-1}))$ 后面这个东西按t=1分类**

**$ = \sum\_i^n \prod\_{p|i, p是质数} (1 + p^k)$**

**tls: 所以后面这个东西要么全选要么全不选**

**$ = \sum\_i^n \sum\_{k|i} [gcd(k,\frac{i}{k}) = 1] \* k$**

**let j=i/k**

**$ = \sum\_j^\frac{n}{k} \sum\_k^n [gcd(k,j) = 1] \* k$**

**$ = \sum\_j^\frac{n}{k} \sum\_k^n \sum\_{d|gcd(k,j)} \mu(d) \* k$**

**$ = \sum\_d \mu(d) \* d \* \sum\_j^\frac{n}{k \* d^2} \sum\_k^\frac{n}{d} \* k$**

**$ = \sum\_d \mu(d) \* d \* \sum\_k^\frac{n}{d^2} \* k \* \frac{n}{k\*d^2}$**

**感谢 tls 教我不要这么写了。。这个界限还是写个乘积的形式为妙**

**后半段是 $\sum\_i^\frac{n}{d^2} \sigma\_1$ 而且直接就可以求，就做完了**

vector<int> P[maxn];

namespace seives { // 抄的define

#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 MAXP=666666;

const int MAX=2000010;

int mu[MAX],sigma1[MAX],c1[MAX],f[MAX];

int p[MAXP],tot;

ui ar[(MAX>>6)+7]= {0};

void init() {

setbit(ar,0); setbit(ar,1);

int i,j; tot=0; mu[1]=1; sigma1[1]=1;

rep(i,2,MAX) {

if (isprime(i)) p[tot++]=i,mu[i]=-1,sigma1[i]=i+1,c1[i]=i+1;

REP(j,tot) {

if (i\*p[j]>=MAX) break;

if ((i\*p[j])&1) setbit(ar,i\*p[j]);

if (i%p[j]==0) {

c1[i\*p[j]]=p[j]\*c1[i]+1;

sigma1[i\*p[j]]=sigma1[i]/c1[i]\*c1[i\*p[j]];

break;

} else {

c1[i\*p[j]]=p[j]+1;

sigma1[i\*p[j]]=sigma1[i]\*(p[j]+1);

mu[i\*p[j]]=-mu[i];

}

}

} rep(i,1,MAX) f[i]=sigma1[i],add\_(f[i],f[i-1]);

}

map<int,int> HASH;

int get2(ll x){

x%=M; return x\*(x+1)%M\*500000005%M;

}

int get\_f(ll x){//直接sqrt也行

if (x<MAX) return f[x];

if (HASH.count(x)) return HASH[x];

ll ret=0; ll l;

FOR(l,1,x) {

ll t=x/l,r=x/t;

add\_(ret,(get2(r)-get2(l-1)+M)%M\*(t%M)%M);

l=r;

} return HASH[x]=ret;

}

}

int main() {

// startTimer();

seives::init(); ll n;

// printTimer();

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

// startTimer();

int ans=0;

for (ll d=1;d\*d<=n;d++) add\_(ans,(M+seives::mu[d])\*d%M\*seives::get\_f(n/d/d)%M);

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

// printTimer();

}

}

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)**

**// 题意:n%1,n%2...异或, 做法是BSGS然后类欧几里得**

**// 每块是n-n/l\*l ^ ... ^ n-n/r\*r**

**// 也就是n-(n/l)\*k,(等价于n%r+(n/l)\*k) k是0->r-l**

**// 按位计算, 就变成了个类欧几里得**

**// 玄学卡常,n<=某值直接暴力, 这里tls说是一个log的**

LL f(LL a,LL b,LL c,LL n) {

if (a==0) return b/c\*(n+1);

if (a>=c||b>=c)

return (a/c)\*n\*(n+1)/2+(b/c)\*(n+1)+f(a%c,b%c,c,n);

LL m=(a\*n+b)/c;

return n\*m-f(c,c-b-1,a,m-1);

}

LL solve(LL l,LL c,LL n) {

LL ret=0,i;

if (n<=10000) REP(i,n+1) ret^=l,l+=c;

else REP(i,40) ret^=(f(c,l,(1ll<<i),n)&1)<<i;

return ret;

}

LL getans(LL n) {

LL ans=0;

for (LL l=1,r; l<=n;) {

r=n/(n/l);

ans^=solve(n%r,n/l,r-l);

l=r+1;

} return ans;

}

int main() {

int T;

int i,j,k;

scanf("%d",&T);

while (T--) {

LL n;

scanf("%lld",&n);

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

}

return 0;

}

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***

线性递推BM板子

int \_,n;

namespace linear\_seq {

const int N=10010;

ll res[N],base[N],\_c[N],\_md[N];

vector<int> Md;

void mul(ll \*a,ll \*b,int k) {

rep(i,0,k+k) \_c[i]=0;

rep(i,0,k) if (a[i]) rep(j,0,k) \_c[i+j]=(\_c[i+j]+a[i]\*b[j])%mod;

for (int i=k+k-1;i>=k;i--) if (\_c[i])

rep(j,0,SZ(Md)) \_c[i-k+Md[j]]=(\_c[i-k+Md[j]]-\_c[i]\*\_md[Md[j]])%mod;

rep(i,0,k) a[i]=\_c[i];

}

int solve(ll n,VI a,VI b) { // a 系数 b 初值 b[n+1]=a[0]\*b[n]+...

// printf("%d\n",SZ(b));

ll ans=0,pnt=0;

int k=SZ(a);

assert(SZ(a)==SZ(b));

rep(i,0,k) \_md[k-1-i]=-a[i];\_md[k]=1;

Md.clear();

rep(i,0,k) if (\_md[i]!=0) Md.push\_back(i);

rep(i,0,k) res[i]=base[i]=0;

res[0]=1;

while ((1ll<<pnt)<=n) pnt++;

for (int p=pnt;p>=0;p--) {

mul(res,res,k);

if ((n>>p)&1) {

for (int i=k-1;i>=0;i--) res[i+1]=res[i];res[0]=0;

rep(j,0,SZ(Md)) res[Md[j]]=(res[Md[j]]-res[k]\*\_md[Md[j]])%mod;

}

}

rep(i,0,k) ans=(ans+res[i]\*b[i])%mod;

if (ans<0) ans+=mod;

return ans;

}

VI BM(VI s) {

VI C(1,1),B(1,1);

int L=0,m=1,b=1;

rep(n,0,SZ(s)) {

ll d=0;

rep(i,0,L+1) d=(d+(ll)C[i]\*s[n-i])%mod;

if (d==0) ++m;

else if (2\*L<=n) {

VI T=C;

ll c=mod-d\*powmod(b,mod-2)%mod;

while (SZ(C)<SZ(B)+m) C.pb(0);

rep(i,0,SZ(B)) C[i+m]=(C[i+m]+c\*B[i])%mod;

L=n+1-L; B=T; b=d; m=1;

} else {

ll c=mod-d\*powmod(b,mod-2)%mod;

while (SZ(C)<SZ(B)+m) C.pb(0);

rep(i,0,SZ(B)) C[i+m]=(C[i+m]+c\*B[i])%mod;

++m;

}

}

return C;

}

int gao(VI a,ll n) {

VI c=BM(a);

c.erase(c.begin());

rep(i,0,SZ(c)) c[i]=(mod-c[i])%mod;

for (int v:c) printf("%d ",v);puts("");

return solve(n,c,VI(a.begin(),a.begin()+SZ(c)));

}

};

int main() {

int k=linear\_seq::gao(VI{7,16,25,50,84,159,277,511,906,1651,2952,5348,9601,17345,31199,56288,101341},10);

printf("%d\n",k);

for (scanf("%d",&\_);\_;\_--) {

scanf("%d",&n);

printf("%d\n",linear\_seq::gao(VI{0,1,1,2,3,5,8,13,21,34},n-1));

}

}

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));

}

牛顿迭代 开根

C = int(raw\_input())

for i in range(0, C):

n = int(raw\_input())

if n < 2 :

print n

continue

m = 2

tmpn, len = n, 0

while tmpn > 0:

tmpn /= 10

len += 1

base, digit, cur = 300, len / m, len % m

while (cur + m <= base) and (digit > 0):

cur += m

digit -= 1

div = 10 \*\* (digit \* m)

tmpn = n / div

x = int(float(tmpn) \*\* (1.0 / m))

x \*= (10 \*\* digit)

while True:

x0 = x

x = x + x \* (n - x \*\* m) / (n \* m)

if x == x0: break

while (x + 1) \*\* m <= n:

x = x + 1

print x % 2