Team Reference Document

 

天津大学TianJin University

萌 萌 TJU\_cute\_cute

ACM-ICPC

目录

[AC自动机结构体版 0](#_Toc465964307)

[AC自动机基本查找 1](#_Toc465964308)

[Floyd 2](#_Toc465964309)

[Hash 3](#_Toc465964310)

[IASP 4](#_Toc465964311)

[Manachar 6](#_Toc465964312)

[RMQ（） 7](#_Toc465964313)

[Sap 7](#_Toc465964314)

[Spfa 9](#_Toc465964315)

[Spfa检测是否有正环 10](#_Toc465964316)

[Splay 11](#_Toc465964317)

[Treep 13](#_Toc465964318)

[Trie 14](#_Toc465964319)

[递归实现排列n各元素 15](#_Toc465964320)

[堆 16](#_Toc465964321)

[二层魔方 16](#_Toc465964322)

[二分图最大匹配 17](#_Toc465964323)

[割点割边 18](#_Toc465964324)

[归并排序求逆序数 19](#_Toc465964325)

[后缀数组 20](#_Toc465964326)

[快速幂 21](#_Toc465964327)

[利用kmp的next数组求循环节 21](#_Toc465964328)

[求素数个数 21](#_Toc465964329)

[三维树状数组 22](#_Toc465964330)

[树链剖分 23](#_Toc465964331)

[双联通分量 25](#_Toc465964332)

[线性求中位数 26](#_Toc465964333)

[线性筛法求素数 26](#_Toc465964334)

[最小费用最大流 27](#_Toc465964335)

# AC自动机结构体版

#include<cstdio>

#include<string.h>

#include<cstring>

#include<queue>

using namespace std;

struct node

{

int next[26];

int val, fail;

}AC\_node[1100];

int AC\_total;

char s[100];

int dp[30][100][2048];

int max(int a, int b)

{

return a>b? a: b;

}

void AC\_init()

{

AC\_total = 1;

AC\_node[0].val = 0;

for(int i =0; i < 26; i ++)

{

AC\_node[0].next[i] = 0;

}

}

int AC\_new()

{

for(int i = 0; i < 26; i ++)

{

AC\_node[AC\_total].next[i] = 0;

}

AC\_node[AC\_total].val = 0;

AC\_node[AC\_total].fail = 0;

return AC\_total ++;

}

void AC\_insert(char \*c, int num)

{

int len = strlen(c);

int pos = 0;

for(int i = 0; i < len; i ++)

{

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

if(AC\_node[pos].next[index] == 0)

{

AC\_node[pos].next[index] = AC\_new();

}

pos = AC\_node[pos].next[index];

}

AC\_node[pos].val |= 1<<num;

}

void AC\_build()

{

queue<int> q;

while(!q.empty())

q.pop();

for(int i = 0; i < 26; i ++)

{

int temp = AC\_node[0].next[i];

if(temp)

{

AC\_node[temp].fail = 0;

q.push(temp);

}

}

while(!q.empty())

{

int id = q.front();

q.pop();

AC\_node[id].val |= AC\_node[AC\_node[id].fail].val;

for(int i = 0; i < 26; i ++)

{

if(AC\_node[id].next[i])

{

AC\_node[AC\_node[id].next[i]].fail = AC\_node[AC\_node[id].fail].next[i];

q.push(AC\_node[id].next[i]);

}

else

AC\_node[id].next[i] = AC\_node[AC\_node[id].fail].next[i];

}

}

// for(int i = 0; i < AC\_total; i ++)

// {

// printf("%d %d\n", i, AC\_node[i].val);

// }

}

int solve(int n, int m, int k)

{

for(int i = 0; i <= n; i ++)

for(int j = 0;j <= AC\_total; j ++)

for(int l = 0; l < 1 << m; l ++)

dp[i][j][l] = 0;

//因为数组的范围并不精确，因此使用memset反而会比较慢

// memset(dp, 0, sizeof(dp));

dp[0][0][0] = 1;

for(int i = 0; i < n; i ++)

{

for(int j = 0; j < AC\_total; j ++)

{

for(int l = 0; l < 1<<(m); l ++)

{

if(dp[i][j][l])

{

for(int h = 0; h < 26; h ++)

{

dp[i+1][AC\_node[j].next[h]][AC\_node[AC\_node[j].next[h]].val|l] += dp[i][j][l];

dp[i+1][AC\_node[j].next[h]][AC\_node[AC\_node[j].next[h]].val|l] %= 20090717;

}

}

}

}

}

int ans = 0, total, temp;

for(int j = 0; j < 1<<(m); j ++)

{

total = 0;

temp = j;

while(temp)

{

total += temp&1;

temp>>= 1;

}

if(total < k)

continue;

for(int i = 0; i < AC\_total; i ++)

{

if(dp[n][i][j])

{

ans+= dp[n][i][j];

ans %= 20090717;

}

}

}

return ans % 20090717;

}

int main ()

{

int n, m, k;

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

{

AC\_init();

for(int i = 0; i < m; i ++)

{

scanf("%s", s);

AC\_insert(s, i);

}

AC\_build();

int ans = solve(n, m, k);

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

}

}

# AC自动机基本查找

#include <cstdio>

#include <string.h>

#include <queue>

using namespace std;

int ch[500005][26], fail[500005], val[500005], total[500005];

int AC\_total;

char s[1000006];

void AC\_init()

{

memset(ch, 0, sizeof(ch));

memset(fail, 0, sizeof(fail));

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

memset(total, 0, sizeof(total));

AC\_total = 1;

}

void AC\_insert()

{

int len = strlen(s), id;

int u = 0;

for(int i = 0; i < len; i ++)

{

id = s[i] - 'a';

if(ch[u][id] == 0)

ch[u][id] = AC\_total ++;

u = ch[u][id];

}

val[u] ++;

}

void AC\_build()

{

queue<int> q;

while(!q.empty())

q.pop();

for(int i = 0; i < 26; i ++)

if(ch[0][i])

q.push(ch[0][i]);

while(!q.empty())

{

int u = q.front();

q.pop();

for(int i = 0; i < 26; i ++)

{

int temp = ch[u][i];

if(temp != 0)

{

int v = fail[u];

while(v && !ch[v][i])

v = fail[v];

fail[temp] = ch[v][i];

q.push(temp);

}

}

}

}

int AC\_find()

{

int n = strlen(s);

int j = 0, ans = 0;

for(int i = 0; i < n; i ++)

{

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

while(j && !ch[j][c])

j = fail[j];

j = ch[j][c];

int temp = j;

while(temp && val[temp] != -1)

{

ans += val[temp];

val[temp] = -1;

temp = fail[temp];

}

}

return ans;

}

int main ()

{

int T, n;

scanf("%d", &T);

while(T --)

{

AC\_init();

scanf("%d", &n);

while(n --)

{

scanf("%s", s);

AC\_insert();

}

scanf("%s", s);

AC\_build();

int ans = AC\_find();

// int ans = 0;

// for(int i = 0; i < AC\_total; i ++)

// {

// if(total[i])

// ans += val[i];

// }

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

}

return 0;

}

# Floyd

#include<cstdio>

int min(int a, int b)

{

return a < b? a: b;

}

int w[1000][1000];

int main ()

{

int T;

scanf("%d", &T);

int N, M, W, a, b, c;

while(T --)

{

scanf("%d%d%d", &N, &M, &W);

for(int i = 0; i <= N; i ++)

for(int j = 0; j <= N; j ++)

if(i == j)

w[i][j] = 0;

else

w[i][j] = 0x3fffffff;

for(int i = 0; i < M; i ++)

{

scanf("%d%d%d", &a, &b, &c);

if(w[a][b] > c)

w[a][b] = w[b][a] = c;

}

for(int i = 0; i < W; i ++)

{

scanf("%d%d%d", &a, &b, &c);

if(w[a][b] > -c)

w[a][b] = -c;

}

int flag = 0;

for(int k = 1; k <= N && !flag; k ++)

{

for(int i = 1; i <= N && !flag; i ++)

{

for(int j = 1; j <= N && !flag; j ++)

{

int t=w[i][k]+w[k][j];

if(w[i][j]>t)w[i][j]=t;

//用下面的方式就会t。。。。

// w[i][j] = min(w[i][j], w[i][k] + w[k][j]);

}

if(w[i][i] < 0)

flag = 1;

}

}

if(flag)

printf("YES\n");

else

printf("NO\n");

}

return 0;

}

# Hash

#include<cstdio>

struct Node

{

int num[6];

int next;

}node[100005];

int hashtable[1000007], cur;

void init\_hash();

int get\_hash(int num[]);

int search\_hash(int num[]);

void insert\_hash(int num[], int h);

int cmp(int num1[], int num2[]);

int main ()

{

int n, num0[6];

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

{

cur = 0;

init\_hash();

int temp, twins = 0;

for(int i = 0; i < n; i ++)

{

for(int j = 0; j < 6; j ++)

{

scanf("%d", &temp);

num0[j] = temp;

}

if(twins)

continue;

twins = search\_hash(num0);

}

if(twins)

printf("Twin snowflakes found.\n");

else

printf("No two snowflakes are alike.\n");

}

return 0;

}

void init\_hash()

{

for(int i = 0; i < 1000007; i ++)

hashtable[i] = -1;

for(int i = 0; i < 100005; i ++)

node[i].next = -1;

}

int get\_hash(int num[6])

{

int total = 0;

for(int i = 0; i < 6; i ++)

total = (total + num[i]) % 1000007;

return total;

}

int search\_hash(int num0[6])

{

int h = get\_hash(num0);

if(hashtable[h] != -1)

{

int t = hashtable[h];

while(t != -1)

{

if(cmp(node[t].num, num0))

return 1;

t = node[t].next;

}

}

insert\_hash(num0, h);

return 0;

}

void insert\_hash(int num0[6], int h)

{

node[cur].next = hashtable[h];

hashtable[h] = cur;

for(int i = 0; i < 6; i ++)

node[cur].num[i] = num0[i];

cur ++;

}

int cmp(int num1[6], int num2[6])

{

int ans = 1;

for(int i = 0; i < 6; i ++)

{

ans = 1;

for(int j = 0; j < 6; j ++)

if(num1[j] != num2[(j + i) % 6])

ans = 0;

if(ans)

return 1;

}

for(int i = 0; i < 6; i ++)

{

ans = 1;

for(int j = 0; j < 6; j ++)

if(num1[j] != num2[(6 - j + i) % 6])

ans = 0;

if(ans)

return 1;

}

return 0;

}

# IASP

#include <cstdio>

#include <string.h>

#include <queue>

using namespace std;

int min(int a, int b)

{

return a<b? a: b;

}

const int inf = 0x3fffffff;

const int ver = 500, edg = 30000;

struct Iasp

{

int top;

int head[ver], d[ver], gap[edg], pre[edg];

struct Edge

{

int v, next;

int c, f;

}edges[edg];

void init()

{

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

memset(gap, 0, sizeof(gap));

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

top = 0;

}

void add\_edge(int u, int v, int c)

{

edges[top].v = v;

edges[top].c = c;

edges[top].f = 0;

edges[top].next = head[u];

head[u] = top ++;

}

//每次加边的时候都要加原边和回边两条边。

void add(int u, int v, int c)

{

add\_edge(u, v, c);

add\_edge(v, u, 0);

}

//为d数组赋值，求出每个点所在的层次。

//汇点处于0层

void set\_d(int t)

{

queue<int> q;

d[t] = 0;

q.push(t);

while(!q.empty())

{

int v = q.front();

q.pop();

gap[d[v]] ++;

for(int i = head[v]; i != -1; i = edges[i].next)

{

int u = edges[i].v;

if(d[u] == -1)

{

d[u] = d[v] + 1;

q.push(u);

}

}

}

}

//求此图的最大流

int sap(int s, int t)

{

set\_d(t);

int ans = 0, u = s;

int flow = inf;

while(d[s] <= t)

{

int i;

for(i = head[u]; i != -1; i = edges[i].next)

{

int v = edges[i].v;

if(edges[i].c > edges[i].f && d[u] == d[v] + 1)

{

u = v;

pre[v] = i;

flow = min(flow, edges[i].c - edges[i].f);

if(u == t)

{

while(u != s)

{

int j = pre[u];

edges[j].f += flow;

edges[j^1].f -= flow;

u = edges[j ^ 1].v;

}

ans += flow;

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

flow = inf;

}

break;

}

}

if(i == -1)

{

if(--gap[d[u]] == 0)

break;

int dmin = t;

for(int j = head[u];j != -1; j = edges[j].next)

{

if(edges[j].c > edges[j].f)

dmin = min(dmin, d[edges[j].v]);

}

d[u] = dmin + 1;

gap[d[u]] ++;

if(u != s)

u = edges[pre[u] ^ 1].v;

}

}

return ans;

}

}Sap;

int main ()

{

int n, f, d;

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

{

int s = 0;

int t = n \* 2 + f + d + 1;

int num = t + 1;

Sap.init();

//先建立原点与食物的边，容量为1

for(int i = 1; i <= f; i ++)

{

Sap.add(s, i, 1);

}

int temp, food, drink;

for(int i = 1; i <= n; i ++)

{

scanf("%d %d", &food, &drink);

//建立食物与左牛的边，容量为1；

for(int j = 1; j <= food; j ++)

{

scanf("%d", &temp);

Sap.add(temp, f + i \* 2 - 1, 1);

}

//建立左牛与优牛的边，容量为1；

Sap.add(f + i \* 2 - 1, f + i \* 2, 1);

//建立右牛与饮料的边，容量为1；

for(int j = 1; j <= drink; j ++)

{

scanf("%d", &temp);

Sap.add(f+i\*2, temp + f+ n\*2, 1);

}

}

//建立饮料与汇点的边，容量为1；

for(int i = 1; i <= d; i ++)

{

Sap.add(2\*n+f+i, t, 1);

}

int ans = Sap.sap(s, t);

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

}

return 0;

}

# Manachar

#include<cstdio>

#include<string.h>

#include<algorithm>

using namespace std;

const int maxn = 110005;

char str[maxn], str1[maxn \* 2];

int dp[maxn \* 2], n, maxx = 0;

void Manacher()

{

memset(dp, 0, sizeof(dp));

int mx = 0, id;

for(int i = 1; i < n; i ++)

{

if(mx > i)

dp[i] = min(dp[2 \* id - i], mx - i);

else

dp[i] = 1;

for(; str1[i - dp[i]] == str1[i + dp[i]]; dp[i] ++);

maxx = max(maxx, dp[i]);

if(i + dp[i] > mx)

{

mx = i + dp[i];

id = i;

}

}

}

void pre() //处理str1；

{

int i = 0, k = 1, t = 0;

str1[0] = '$';

while(str[i] != '\0')

{

str1[k ++] = t? str[i ++] : '#';

t ^= 1;

}

str1[k ++] = '#';

str1[k] = '\0';

n = k; //n是记录str1 的长度，但是要记住strlen的意思

//也可以每次用n的时候都赋值为 n = 2 \* strlen(str);

}

int main ()

{

while(~scanf("%s", str))

{

maxx = 0;

pre();

Manacher();

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

}

}

# RMQ（）

#include<cstdio>

#include<cmath>

int max(int x, int y)

{

return x>y? x: y;

}

int min(int x, int y)

{

return x<y? x: y;

}

int a[50005];

int st\_min[50005][20], st\_max[50006][20];

void initst(int n)

{

for(int i = 0; i < n; i ++)

{

st\_min[i][0] = st\_max[i][0] = a[i];

}

for(int j = 1; (1<<j) < n; j ++)

{

for(int i = 0; i + (1<<j) <= n; i ++)

{

st\_min[i][j] = min(st\_min[i][j - 1], st\_min[i + (1<<(j-1))][j-1]);

st\_max[i][j] = max(st\_max[i][j - 1], st\_max[i+(1<<(j-1))][j-1]);

}

}

}

int queryst\_max(int l, int r)

{

int k = (int)(log(r-l+1.0)/log(2.0));

return max(st\_max[l][k], st\_max[r-(1<<k)+1][k]);

}

int queryst\_min(int l, int r)

{

int k = (int)(log(r-l+1.0)/log(2.0));

return min(st\_min[l][k], st\_min[r-(1<<k)+1][k]);

}

int main ()

{

int n, m, l, r;

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

for(int i = 0; i < n; i ++)

{

scanf("%d", a+i);

}

initst(n);

while(m --)

{

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

l --;

r --;

int x=queryst\_max(l, r);

int y=queryst\_min(l, r);

printf("%d\n", x-y);

}

return 0;

}

# Sap

#include<cstdio>

#include<string.h>

#include<queue>

using namespace std;

int min(int a, int b)

{

return a<b? a: b;

}

const int inf = 0x3fffffff;

const int ver = 1000005, edg = 1000005;

int top;

int head[ver], d[ver], gap[edg], pre[edg];

struct Edge

{

int v, next;

int c, f;

}edges[edg];

struct Iasp

{

void init()

{

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

memset(gap, 0, sizeof(gap));

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

top = 0;

}

void add\_edge(int u, int v, int c)

{

edges[top].v = v;

edges[top].c = c;

edges[top].f = 0;

edges[top].next = head[u];

head[u] = top ++;

}

void add(int u, int v, int c)

{

add\_edge(u, v, c);

add\_edge(v, u, 0);

}

void set\_d(int t)

{

queue<int> q;

d[t] = 0;

q.push(t);

while(!q.empty())

{

int v = q.front();

q.pop();

gap[d[v]] ++;

for(int i = head[v]; i != -1; i = edges[i].next)

{

int u = edges[i].v;

if(d[u] == -1)

{

d[u] = d[v] + 1;

q.push(u);

}

}

}

}

int sap(int s, int t)

{

set\_d(t);

int ans = 0, u = s;

int flow = inf;

while(d[s] <= top)

{

int i;

for(i = head[u]; i != -1; i = edges[i].next)

{

int v = edges[i].v;

if(edges[i].c > edges[i].f && d[u] == d[v] + 1)

{

u = v;

pre[v] = i;

flow = min(flow, edges[i].c - edges[i].f);

if(u == t)

{

while(u != s)

{

int j = pre[u];

edges[j].f += flow;

edges[j ^ 1].f -= flow;

u = edges[j ^ 1].v;

}

ans += flow;

// printf("%d ", flow);

flow = inf;

}

break;

}

}

if(i == -1)

{

if(--gap[d[u]] == 0)

break;

int dmin = t;

for(int j = head[u]; j != -1; j = edges[j].next)

{

if(edges[j].c > edges[j].f)

dmin = min(dmin, d[edges[j].v]);

}

d[u] = dmin + 1;

gap[d[u]] ++;

if(u != s)

u = edges[pre[u] ^ 1].v;

}

}

return ans;

}

}Sap;

int main ()

{

int T, n, m, x, y, a, c, b, s, t;

scanf("%d", &T);

while(T --)

{

Sap.init();

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

int sx = 1000005, tx = -1000005;

for(int i = 0; i < n; i ++)

{

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

if(sx > x)

{

s = i + 1;

sx = x;

}

if(tx < x)

{

t = i + 1;

tx = x;

}

}

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

for(int i = 0; i < m; i ++)

{

scanf("%d %d %d", &a, &b, &c);

Sap.add(a, b, c);

Sap.add(b, a, c);

}

int ans = Sap.sap(s, t);

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

}

return 0;

}

# Spfa

int n; //表示n个点，从1到n标号

int s,t; //s为源点，t为终点

int d[N]; //d[i]表示源点s到点i的最短路

int p[N]; //记录路径（或者说记录前驱）

queue <int> q; //一个队列，用STL实现，当然可有手打队列，无所谓

bool vis[N]; //vis[i]=1表示点i在队列中 vis[i]=0表示不在队列中

//bfs求最短路

int spfa\_bfs(int s)

{

queue <int> q;

memset(d,0x3f,sizeof(d));

d[s]=0;

memset(c,0,sizeof(c));

memset(vis,0,sizeof(vis));

q.push(s); vis[s]=1; c[s]=1;

//顶点入队vis要做标记，另外要统计顶点的入队次数

int OK=1;

while(!q.empty())

{

int x;

x=q.front(); q.pop(); vis[x]=0;

//队头元素出队，并且消除标记

for(int k=f[x]; k!=0; k=nnext[k]) //遍历顶点x的邻接表

{

int y=v[k];

if( d[x]+w[k] < d[y])

{

d[y]=d[x]+w[k]; //松弛

if(!vis[y]) //顶点y不在队内

{

vis[y]=1; //标记

c[y]++; //统计次数

q.push(y); //入队

if(c[y]>NN) //超过入队次数上限，说明有负环

return OK=0;

}

}

}

}

return OK;

}

//dfs 判断负环

int spfa\_dfs(int u)

{

vis[u]=1;

for(int k=f[u]; k!=0; k=e[k].next)

{

int v=e[k].v,w=e[k].w;

if( d[u]+w < d[v] )

{

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

if(!vis[v])

{

if(spfa\_dfs(v))

return 1;

}

else

return 1;

}

}

vis[u]=0;

return 0;

}

# Spfa检测是否有正环

#include<cstdio>

#include<string.h>

#include<queue>

using namespace std;

int e;

int head[10500], vis[10005], cnt[10050];

double dis[10050];

//dis可能是小数

struct node

{

int v, next;

double r, c;

}edge[1500];

//采用邻接表的方式存储图

void add(int a, int b, double r, double c)

{

edge[e].v = b;

edge[e].r = r;

edge[e].c = c;

edge[e].next = head[a];

head[a] = e ++;

}

void SPFA\_init()

{

e = 0;

memset(vis, 0, sizeof(vis));

memset(dis, 0, sizeof(dis));

memset(cnt, 0, sizeof(cnt));

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

}

int SPFA(int source, double much, int N)

{

queue<int> q;

q.push(source);

vis[source] = 1;

dis[source] = much;

cnt[source] ++;

while(!q.empty())

{

int first = q.front();

q.pop();

vis[first] = 0;

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

{

int v = edge[i].v;

double tempdis = (dis[first] - edge[i].c) \* edge[i].r;

if(dis[v] < tempdis)

{

dis[v] = tempdis;

if(!vis[v])

{

q.push(v);

vis[v] = 1;

}

cnt[v] ++;

if(cnt[v] > N + 1)

return -1;

}

}

}

return 1;

}

int main ()

{

int N, M, a, b, source;

double much, rab, rba, cba, cab;

scanf("%d%d%d%lf", &N, &M, &source, &much);

SPFA\_init();

for(int i = 0; i < M; i ++)

{

scanf("%d%d%lf%lf%lf%lf", &a, &b, &rab, &cab, &rba, &cba);

add(a, b, rab, cab);

add(b, a, rba, cba);

}

int ans = SPFA(source, much, N);

if(ans == -1)

printf("YES\n");

else

printf("NO\n");

return 0;

}

# Splay

#define N 500000

#define lc (tr[id].c[0])

#define rc (tr[id].c[1])

#define KEY (tr[tr[root].c[1]].c[0])//根的右孩子的左孩子

struct Tr {

int fa, sum, val, c[2], lz;

}tr[N];

int newtr(int k, int f) {//新建立一个节点

tr[tot].sum = 1, tr[tot].val = k;

tr[tot].c[0] = tr[tot].c[1] = -1;

tr[tot].lz = 0;

tr[tot].fa = f;

return tot++;

}

void Push(int id) {

int lsum, rsum;

lsum = (lc == -1)?0:tr[lc].sum;

rsum = (rc == -1)?0:tr[rc].sum;

tr[id].sum = lsum+rsum+1;

}

void lazy(int id) {//flip专属懒操作

if (tr[id].lz) {

swap(lc, rc);

tr[lc].lz ^= 1, tr[rc].lz ^= 1;

tr[id].lz = 0;

}

}

int build(int l, int r, int f) {//建树

if (r < l) return-1;

int mid = l+r>>1;

int ro = newtr(data[mid], f);

tr[ro].c[0] = build(l, mid-1, ro);

tr[ro].c[1] = build(mid+1, r, ro);

Push(ro);

return ro;

}

void Rotate(int x, int k) {//k=1右旋,k=0左旋

if (tr[x].fa == -1) return;

int fa = tr[x].fa, w;

lazy(fa), lazy(x);

tr[fa].c[!k] = tr[x].c[k];

if (tr[x].c[k] != -1) tr[tr[x].c[k]].fa = fa;

tr[x].fa = tr[fa].fa, tr[x].c[k] = fa;

if (tr[fa].fa != -1) {

w = tr[tr[fa].fa].c[1]==fa;

tr[tr[fa].fa].c[w] = x;

}

tr[fa].fa = x;

Push(fa);

Push(x);

}

void Splay(int x, int goal) {//将x节点转到goal的儿子上

if (x == -1) return;

lazy(x);

while (tr[x].fa != goal) {

int y = tr[x].fa;

lazy(tr[y].fa), lazy(y), lazy(x);

bool w = x==tr[y].c[1];

if (tr[y].fa != goal && w == (y==tr[tr[y].fa].c[1]))

Rotate(y, !w);

Rotate(x, !w);

}

if (goal == -1) root = x;

Push(x);

}

int find(int k) {//找到第k个节点的ID

int id = root;

while (id != -1) {

lazy(id);

int lsum = (lc==-1)?0:tr[lc].sum;

if (lsum >= k) {

id = lc;

}

else if (lsum+1 == k) break;

else {

k = k-lsum-1;

id = rc;

}

}

return id;

}

int Index(int l, int r) {//将区间(l+1, r-1)化成一颗子树

Splay(find(l), -1);

Splay(find(r),root);

}

int Getnext(int id) {//寻找后继节点

lazy(id);

int p = tr[id].c[1];

if (p == -1) return id;

lazy(p);

while (tr[p].c[0] != -1) {

p = tr[p].c[0];

lazy(p);

}

return p;

}

int del(int l, int r) {//将【l,r】切掉,返回切掉子树的根节点

Index(l-1, r+1);

int ro = KEY;

tr[KEY].fa = -1;

KEY = -1;

Push(tr[root].c[1]);

Push(root);

return ro;

}

void cut(int k, int ro) {//将子树ro接到第k个树之后

Index(k, k+1);

KEY = ro;

tr[ro].fa = tr[root].c[1];

Push(tr[root].c[1]);

Push(root);

}

void filp(int l, int r) {//对区间【l,r】反转

Index(l-1, r+1);

lazy(root), lazy(tr[root].c[1]);

tr[KEY].lz ^= 1;

}

void Add(int l, int r, int d) {//区间【l,r】的数加上d

Index(l-1, r+1);

tr[KEY].add += d;

tr[KEY].mi += d;

tr[KEY].val += d;

Push(tr[root].c[1]);

Push(root);

}

void Delete(int x) {//删除第x个数

Index(x-1, x+1);

tr[KEY].fa = -1;

tr[tr[root].c[1]].c[0] = -1;

Push(tr[root].c[1]);

Push(root);

}

void Insert(int l, int x) {//在l之后插入x

Index(l, l+1);

int ro;

ro = newtr(x, tr[root].c[1]);

KEY = ro;

Push(tr[root].c[1]);

Push(root);

}

void Revolve(int l, int r, int d) {//【l, r】整体右移d位

int ro = del(r+1-d, r);

cut(l-1, ro);

}

# Treep

#include<cstdio>

#include<cstdlib>

struct treap

{

treap \*left, \*right;

int val, pri;

int size;

treap (int vv)

{

left = right = NULL;

pri = rand();

val = vv;

}

}\*root;

void print(treap \*p)

{

if(!p)

return;

print(p->left);

printf("%d ", p->val);

print(p->right);

}

int lsize(treap \*p)

{

return p->left ? p->left->size : 0;

}

int rsize(treap \*p)

{

return p->right ? p->right->size : 0;

}

//传参数的时候一定记得&

//左旋。

void l\_rotate(treap \*&p)

{

treap \*temp = p->right;

p->right = temp->left;

temp->left = p;

temp->size = p->size;

p->size = lsize(p) + rsize(p) + 1;

p = temp;

}

void r\_rotate(treap \*&p)

{

treap \*temp = p->left;

p->left = temp->right;

temp->right = p;

temp->size = p->size;

p->size = lsize(p) + rsize(p) + 1;

p = temp;

}

void insert(treap \*&p, int val)

{

if(!p)

{

p = new treap(val);

p->size = 1;

}

else if(val <= p->val)

{

p->size ++;

insert(p->left, val);

if(p->left->pri < p->pri)

r\_rotate(p);

}

else

{

p->size ++;

insert(p->right, val);

if(p->right->pri < p->pri)

l\_rotate(p);

}

}

int find(int k, treap \*p)

{

int temp = lsize(p);

if(k == temp + 1)

return p->val;

else if(k <= temp)

return find(k, p->left);

else return find(k - temp - 1, p->right);

}

int main ()

{

int m, n, num[30005];

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

for(int i = 1; i <= m; i ++)

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

int temp = 1, len, ans;

root = NULL;

for(int i = 1; i <= n; i ++)

{

scanf("%d", &len);

for(; temp <= len; temp ++)

{

insert(root, num[temp]);

}

ans = find(i, root);

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

}

return 0;

}

# Trie

#include<cstdio>

#include<string.h>

struct node{

node \* next[3];

int val;

void clean()

{

val = 0;

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

}

}\*root;

void release(node \*p)

{

for(int i = 0; i < 3; i ++)

{

if(p->next[i] != NULL)

release(p->next[i]);

}

delete p;

}

void insert(char \*s)

{

node \*p = root;

int len = strlen(s);

for(int i =0 ;i < len ; i ++)

{

int t = s[i] - 'a';

if(p->next[t] == 0)

{

p->next[t] = new node;

p->next[t]->clean();

}

p = p->next[t];

}

p->val = 1;

}

//flag = 0: no change

bool search(char \*s, int flag, node \*p)

{

if(strlen(s) == 0)

return flag;

int t= s[0] - 'a';

if(flag)

{

if(p->next[t] == NULL)

return 0;

return search(s + 1, 1, p->next[t]);

}

else

{

if(p->next[t] != NULL)

if(search(s + 1, 0, p->next[t]))

return 1;

t = (t + 1) % 3;

if(p->next[t] != NULL)

if(search(s + 1, 1, p->next[t]))

return 1;

t = (t + 1) %3;

if(p->next[t] != NULL)

if(search(s + 1, 1, p->next[t]))

return 1;

return 0;

}

}

char c[1000000];

int main ()

{

int n ,m;

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

{

root = new node;

root ->clean();

for(int i = 0; i < n; i ++)

{

scanf("%s", c);

insert(c);

}

for(int i = 0; i < m; i ++)

{

scanf("%s", c);

if(search(c, 0, root))

printf("YES\n");

else

printf("NO\n");

}

release(root);

}

}

/\*

#include<cstdio>

#include<string>

#include<iostream>

#include<map>

using namespace std;

map<string, int> ma;

int main ()

{

int n, m;

string s;

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

{

for(int i = 0; i < n; i ++)

{

cin>> s;

ma[s] = 1;

}

char temp;

for(int i = 0; i < m; i ++)

{

cin>> s;

int flag = 0;

for(int j = 0; j < s.length();j ++)

{

temp = s[j];

if(temp != 'a')

{

s[j] = 'a';

if(ma[s] == 1)

{

flag = 1;

break;

}

}

if(temp != 'b')

{

s[j] = 'b';

if(ma[s] == 1)

{

flag = 1;

break;

}

}

if(temp != 'c')

{

s[j] = 'c';

if(ma[s] == 1)

{

flag = 1;

break;

}

}

s[j] = temp;

}

if(flag)

printf("YES\n");

else

printf("NO\n");

}

}

}

\*/

# 递归实现排列n各元素

#include<cstdio>

using namespace std;

void combine\_increase(const int \*numbers, int \*result, const int arrysize,const int elements,

int current = 0, int start = 0)

{

for(int i = start; i <= arrysize - elements + current; i ++)

{

result[current] = i;

if(elements - current - 1)

{

combine\_increase(numbers, result, arrysize, elements, current + 1, i + 1);

}

else

{

for(int j = current; j >= 0; j --)

{

printf("%d\t", numbers[result[current - j]]);

}

printf("\n");

}

}

}

int main()

{

int numbers[] = {0, 1, 2, 3, 4, 5};

int elements = 3;

int \*result = new int[3];

combine\_increase(numbers, result, 6, elements);

return 0;

}

# 堆

#include<cstdio>

#include<algorithm>

using namespace std;

int a[10000], b[2000], c[2000];

int main ()

{

int T, n, m;

scanf("%d", &T);

while(T --)

{

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

int temp = m;

for(int i = 0; i < m; i ++)

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

for(int i = 1; i < n; i ++)

{

sort(c, c + m);

for(int i = 0; i < m; i ++)

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

for(int i = 0; i < m; i ++)

a[i] = b[0] + c[i];

make\_heap(a, a + m);

for(int i = 1; i < m; i ++)

{

for(int j = 0; j < m; j ++)

{

if(b[i] + c[j] > a[0])

break;

pop\_heap(a, a + m);

a[m - 1] = b[i] + c[j];

push\_heap(a, a + m);

}

}

for(int i = 0; i < m; i ++)

c[i] = a[i];

}

sort(c, c + m);

for(int i = 0; i < m; i ++)

{

if(i)

printf(" %d", c[i]);

else

printf("%d", c[i]);

}

printf("\n");

}

return 0;

}

# 二层魔方

#include<cstdio>

int B[6][24]={ {6,1,12,3,5,11,16,7,8,9,4,10,18,13,14,15,20,17,22,19,0,21,2,23}, //ok

{20,1,22,3,10,4,0,7,8,9,11,5,2,13,14,15,6,17,12,19,16,21,18,23}, //ok

{1,3,0,2,23,22,4,5,6,7,10,11,12,13,14,15,16,17,18,19,20,21,9,8}, //ok

{2,0,3,1,6,7,8,9,23,22,10,11,12,13,14,15,16,17,18,19,20,21,5,4}, //ok

{0,1,8,14,4,3,7,13,17,9,10,2,6,12,16,15,5,11,18,19,20,21,22,23}, //ok

{0,1,11,5,4,16,12,6,2,9,10,17,13,7,3,15,14,8,18,19,20,21,22,23} //ok

};

int ans;

int one(int \*x, int a, int b, int c, int d)

{

if(x[a] == x[b] && x[b] == x[c] && x[c] == x[d]) return 1;

return 0;

}

int now(int \*x)

{

int ret = 0;

if(one(x, 0,1,2,3)) ret ++;

if(one(x, 4,5,10,11)) ret ++;

if(one(x, 6,7,12,13)) ret ++;

if(one(x, 8,9,14,15)) ret ++;

if(one(x, 16,17,18,19)) ret ++;

if(one(x, 20,21,22,23)) ret ++;

return ret;

}

int max(int x, int y)

{

return x> y? x:y;

}

void dfs(int \*x, int n)

{

ans = max(ans, now(x));

if(n == 0)

return ;

int temp[24];

for(int i = 0; i < 6; i ++)

{

for(int j = 0; j < 24; j ++)

{

temp[j] = x[B[i][j]];

}

dfs(temp, n - 1);

}

}

int main ()

{

int n;

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

{

int a[30];

for(int i = 0; i < 24; i ++)

{

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

}

ans = 0;

dfs(a, n);

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

}

return 0;

}

# 二分图最大匹配

#include<cstdio>

#include<string.h>

int g[107][107], msp[1007][1007], msw[1007][1007], mpw[1005][1005], used[1005], linker[1004];

int uN, vN;

bool dfs(int u)

{

for(int v=0; v<vN; v++){

if(g[u][v]&&!used[v]){

used[v]=true;

if(linker[v]==-1||dfs(linker[v])){

linker[v]=u;

return true;

}

}

}

return false;

}

int hungary()

{

int res=0, u;

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

for(u=0; u<uN; u++){

memset(used, 0, sizeof(used));

if(dfs(u))res++;

}

return res;

}

int main ()

{

int T, ns, np, nw;

scanf("%d", &T);

while(T --)

{

int to;

scanf("%d %d %d", &ns, &np, &nw);

memset(msp, 0, sizeof(msp));

memset(msw, 0, sizeof(msw));

memset(mpw, 0, sizeof(mpw));

for(int i = 1; i <= ns; i ++)

{

int temp;

scanf("%d", &temp);

while(temp --)

{

scanf("%d", &to);

msp[i][to] = 1;

}

}

for(int i = 1; i <= ns; i ++)

{

int temp;

scanf("%d", &temp);

while(temp --)

{

scanf("%d", &to);

msw[i][to] = 1;

}

}

for(int i = 1; i <= np; i ++)

{

int temp;

scanf("%d", &temp);

while(temp --)

{

scanf("%d", &to);

mpw[i][to] = 1;

}

}

memset(g, 0, sizeof(g));

for(int i = 1; i <= np; i ++)

{

for(int j = 1; j <= ns; j ++)

{

if(msp[j][i])

{

for(int k = 1; k <= nw; k ++)

{

if(msw[j][k] && mpw[i][k])

{

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

}

}

}

}

}

uN = np, vN = ns;

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

}

return 0;

}

# 割点割边

#include<cstdio>

#include<string.h>

int dfn[106], vis[105], low[105], head[106], flag[105];

int time, total, ans;

struct node

{

int to, next;

}edge[10000006];

int min(int a, int b)

{

return a>b? b: a;

}

void add(int a, int b)

{

edge[total].to = b;

edge[total].next = head[a];

head[a] = total ++;

}

void dfs(int id)

{

time ++;

low[id] = dfn[id] = time;

vis[id] = 1;

int cnum = 0;

for(int i = head[id]; i; i = edge[i].next)

{

int temp = edge[i].to;

if(vis[temp])

{

low[id] = min(low[id], dfn[temp]);

}

else

{

cnum++;

dfs(temp);

low[id] = min(low[id], low[temp]);

if(id == 1 && cnum > 1)

flag[id] = 1;

if(id != 1 && low[temp] >= dfn[id])

flag[id] = 1;

}

}

}

int main ()

{

int N, a, b;

while(~scanf("%d", &N) && N)

{

ans = time = 0;

total = 1;

memset(vis, 0, sizeof(vis));

memset(head, 0, sizeof(head));

//head=0表示没有该边。因此edge的下标必须从1开始

memset(flag, 0, sizeof(flag));

while(~scanf("%d", &a) && a)

{

while(~scanf("%d", &b))

{

add(a, b);

add(b, a);

if(getchar()=='\n')

break;

}

}

dfs(1);

for(int i = 1; i <= N; i ++)

ans += flag[i];

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

}

}

# 归并排序求逆序数

#include<cstdio>

int b[500005], a[500005];

long long ans;

void merge(int l, int r, int mid)

{

// int mid = (l + r) >> 1;

int last = mid + 1, temp = l;

while(l <= mid && last <= r)

{

if(a[l] <= a[last])

b[temp ++] = a[l ++];

else

{

ans += mid - l + 1;

b[temp ++] = a[last ++];

}

}

while(l <= mid)

b[temp ++] = a[l ++];

while(last <= r)

b[temp ++] = a[last ++];

}

void mergesort(int l, int r)

{

if(l >= r)

return ;

int mid = (l + r) >> 1;

mergesort(l, mid);

mergesort(mid + 1, r);

merge(l, r, mid);

for(int i = l; i <= r; i ++)

a[i] = b[i];

}

int main ()

{

int n;

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

{

ans = 0;

for(int i = 0; i < n; i ++)

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

mergesort(0,n - 1);

// for(int i = 0; i < n; i ++)

// printf("%d ", a[i]);

// printf("\n");

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

}

return 0;

}

# 后缀数组

#include<cstdio>

#include<cstring>

#include<string.h>

const int maxn = 100005;

int wa[maxn], wb[maxn], wsf[maxn], wv[maxn], sa[maxn];

int rank[maxn], height[maxn], s[maxn];

char str[maxn], str1[maxn];

int cmp(int \*r, int a, int b, int k)

{

return r[a] == r[b] && r[a + k] == r[b + k];

}

void get\_sa(int \*r, int \*sa, int n, int m)

{

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

for(i = 0; i < m; i ++) wsf[i] = 0;

for(i = 0; i < n; i ++) wsf[x[i] = r[i]] ++;

for(i = 1; i < m; i ++) wsf[i] += wsf[i - 1];

for(i = n - 1; i >= 0; i --) sa[-- wsf[x[i]]] = i;

p = 1, j = 1;

for(; p < n; j \*= 2, m = p)

{

for(p = 0, i = n - j; i < n; i ++) y[p ++] = sa[i] - j;

for(i = 0; i < n; i ++) if(sa[i] >= j) y[p ++] = sa[i] - j;

for(i = 0; i < n; i ++) wv[i] = x[y[i]];

for(i = 0; i < m; i ++) wsf[i] = 0;

for(i = 0; i < n; i ++) wsf[wv[i]] ++;

for(i = 1; i < m; i ++) wsf[i] += wsf[i - 1];

for(i = n - 1; i >= 0; i --) sa[--wsf[wv[i]]] = y[i];

t = x;

x = y;

y = t;

x[sa[0]] = 0;

for(p = 1, i = 1; i < n; i ++)

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

}

}

void getheight(int \*r, int n)

{

int i, j, k = 0;

for(i = 1; i <= n; i++)

rank[sa[i]] = i;

for(i = 0; i < n; i ++)

{

if(k)

k --;

j = sa[rank[i] - 1];

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

k ++;

height[rank[i]] = k;

}

}

int main()

{

int T, n;

scanf("%d", &T);

while(T --)

{

scanf("%d", &n);

scanf("%s", str);

strcpy(str1, str);

strcat(str1, str1);

for(int i = 0; i < n; i ++)

str[i] = str1[n - 1 - i];

strcat(str, str);

n \*= 2;

for(int i = 0; i < n; i ++)

{

s[i] = str[i] - 'a';

}

s[n ++] = 28;

// for(int i = 0; i < strlen(str1); i ++)

// printf("%c", str1[i]);

// printf("\n");

// for(int i = 0; i < strlen(str); i ++)

// printf("%c", str[i]);

// printf("\n");

get\_sa(s, sa, n + 1, 30);

getheight(s, n);

for(int i = 0; i < n; i ++)

{

if(height[i] == n / 2)

{

ans = i;

break;

}

}

}

return 0;

}

# 快速幂

#include<cstdio>

long long multi(long long a, long long b, long long mod)

{

long long ret;

ret = 1;

while(b > 0)

{

if(b & 1)

ret = ret \* a % mod;

a = (a \* a) % mod;

b = b >> 1;

}

return ret;

}

int main ()

{

long long a, b;

while(~scanf("%lld%lld", &a, &b))

{

if(b == 1)

{

printf("1\n");

continue;

}

long long ans = multi(2, b, 1000000007);

ans --;

ans = multi(ans , a, 1000000007);

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

}

return 0;

}

# 利用kmp的next数组求循环节

#include<cstdio>

char in[1000005];

int next[1000005];

int N;

void get(void)

{

for(int i = 2; i <= N; i ++)

{

int j = next[i - 1];

while(j && in[j] != in[i - 1])

j = next[j];

next[i] = in[i - 1] == in[j] ? j + 1: 0;

}

}

void work(void)

{

for(int i = 1; i <= N; i ++)

if(i % (i - next[i]) == 0 && i / (i - next[i]) > 1)

printf("%d %d\n", i, i / (i - next[i]));

}

int main ()

{

int a = 1;

while(scanf("%d", &N), N != 0)

{

scanf("%s", in);

printf("Test case #%d\n", a ++);

get();

work();

printf("\n");

}

return 0;

}

# 求素数个数

#include <cstdio>

long long f[340000], g[340000], n;

long long min(long long a, long long b)

{

return a< b? a: b;

}

void init()

{

long long i, j, m;

for(m = 1; m \* m <= n; m ++)

f[m] = n / m - 1;

for(i = 1; i <= m; i ++)

g[i] = i - 1;

for(i = 2; i <= m; i ++)

{

if(g[i] == g[i - 1])

continue;

for(j = 1; j <= min(m - 1, n / i / i); j ++)

{

if(i \* j < m)

f[j] -= f[i \* j] - g[i - 1];

else

f[j] -= g[n / i / j] - g[i - 1];

}

for(j = m; j >= i \* i; -- j)

g[j] -= g[j / i] - g[i - 1];

}

}

int main()

{

while(~scanf("%lld", &n))

{

init();

printf("%lld\n", f[1]);

}

return 0;

}

# 三维树状数组

#include<cstdio>

#include<cstring>

using namespace std;

int N;

int cube[102][102][102];

int lowbit(int x)

{

return x & (-x);

}

int sum(int x, int y, int z)

{

int ans = 0;

for(int i = x; i > 0; i -= lowbit(i))

for(int j = y; j > 0; j -= lowbit(j))

for(int k = z; k > 0; k -= lowbit(k))

ans += cube[i][j][k];

return ans & 1;

}

void update(int x, int y, int z)

{

for(int i = x; i <= N; i += lowbit(i))

for(int j = y; j <= N; j += lowbit(j))

for(int k = z; k <= N; k += lowbit(k))

cube[i][j][k] ++;

}

int main ()

{

int M;

while(~scanf("%d%d", &N, &M))

{

memset(cube, 0, sizeof(cube));

for(int i = 0; i < M; i ++)

{

int temp;

scanf("%d", &temp);

if(temp == 1) //update

{

int x1, x2, y1, y2, z1, z2;

scanf("%d %d %d %d %d %d", &x1, &y1, &z1, &x2, &y2, &z2);

update(x1, y1, z1);

update(x1, y1, z2+1);

update(x1, y2+1, z1);

update(x1, y2+1, z2+1);

update(x2+1, y1, z1);

update(x2+1, y1, z2+1);

update(x2+1, y2+1, z1);

update(x2+1, y2+1, z2+1);

}

else if(temp == 0) //sum

{

int x, y, z;

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

int ans = sum(x, y, z);

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

}

}

}

return 0;

}

# 树链剖分

#include<cstdio>

#include<algorithm>

#include<string.h>

using namespace std;

const int N = 50015;

//树上节点的权值，以该节点为根的子树节点个数，节点所在重链的头，节点重链上的子节点

int num[N], siz[N], top[N], son[N];

//节点的深度，节点对应线段树上的位置下标，线段树上位置对应的节点下标，节点的父节点

int dep[N], tid[N], \_rank[N], fa[N];

//建图所用

int head[N], to[N \* 2], \_next[N \* 2], edge;

//线段树上每个节点所需维护的值，线段树上节点是否有更改操作

int sum[N \* 4], col[N \* 4];

//当前深度，树的总结点树（线段树的最右端点）

int tim, n;

void init()

{

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

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

tim = 1;

edge = 0;

}

void add\_edge(int u, int v)

{

to[edge] = v;

\_next[edge] = head[u];

head[u] = edge ++;

to[edge] = u;

\_next[edge] = head[v];

head[v] = edge ++;

}

//当前结点，父节点，深度

void dfs1(int u, int f, int d)

{

dep[u] = d;

fa[u] = f;

siz[u] = 1;

for(int i = head[u]; i != -1; i = \_next[i])

{

int v = to[i];

if(v != f)

{

dfs1(v, u, d + 1);

siz[u] += siz[v];

if(son[u] == -1 || siz[v] > siz[son[u]])

son[u] = v;

}

}

}

//当前节点，所在重链

void dfs2(int u, int tp)

{

top[u] = tp;

tid[u] = tim;

\_rank[tim ++] = u;

if(son[u] == -1)

return ;

dfs2(son[u], tp);

for(int i = head[u]; i != -1; i = \_next[i])

{

int v = to[i];

if(v != son[u] && v != fa[u])

dfs2(v, v);

}

}

//由ｒｔ节点的两个儿子节点更新ｒｔ

void push\_up(int rt)

{

sum[rt] = max(sum[rt << 1], sum[rt << 1 | 1]);

}

//rt 点的lazy 操作

void push\_down(int rt, int m)

{

if(col[rt])

{

col[rt << 1] += col[rt];

col[rt << 1 | 1] += col[rt];

sum[rt << 1] += (m - (m >> 1)) \* col[rt];

sum[rt << 1 | 1] += (m >> 1) \* col[rt];

col[rt] = 0;

}

}

//线段树建树

void build(int l, int r, int rt)

{

col[rt] = 0;

if(l == r)

{

sum[rt] = num[\_rank[l]];

return ;

}

int mid = (l + r) >> 1;

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

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

push\_up(rt);

}

//线段树更新

void update(int l, int r, int v, int ll, int rr, int rt)

{

if(l <= ll && r >= rr)

{

col[rt] += v;

sum[rt] += v \* (rr - ll + 1);

return ;

}

push\_down(rt, rr - ll + 1);

int mid = (ll + rr ) >> 1;

if(l <= mid)

update(l, r, v, ll, mid, rt << 1);

if(r > mid)

update(l, r, v, mid + 1, rr, rt << 1 | 1);

push\_up(rt);

}

//线段树查询

int query(int l, int r, int rt, int val)

{

if(l == r)

return sum[rt];

push\_down(rt, r - l + 1);

int mid = (l + r) >> 1;

int ret = 0;

if(val <= mid)

ret = query(l, mid, rt << 1, val);

if(val > mid)

ret = query(mid + 1, r, rt << 1 | 1, val);

push\_up(rt);

return ret;

}

//树链更新

void change(int x, int y, int val)

{

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

{

if(dep[top[x]] < dep[top[y]])

swap(x, y);

update(tid[top[x]], tid[x], val, 1, n, 1);

x = fa[top[x]];

}

if(dep[x] > dep[y])

swap(x, y);

update(tid[x], tid[y], val, 1, n, 1);

}

int main ()

{

int a, b, c, m, q;

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

{

init();

memset(num, 0, sizeof(num));

for(int i = 1; i<= n; i ++)

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

for(int i = 1; i <= m; i ++)

{

scanf("%d %d", &a, &b);

add\_edge(a, b);

}

dfs1(1, 0, 0);

dfs2(1, 1);

build(1, n, 1);

char op[20];

while(q --)

{

scanf("%s", op);

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

{

scanf("%d", &a);

printf("%d\n", query(1, n, 1, tid[a]));

}

else

{

scanf("%d %d %d", &a, &b, &c);

if(op[0] == 'D')

c = -c;

change(a, b, c);

}

}

}

}

# 双联通分量

#include<cstdio>

#include<string.h>

//此题利用tarjan求加多少条边可以得到双连通分量

struct node

{

int to, next;

}edge[3000];

int dfn[1005], vis[1005], low[1004], head[1005], in[1005];

int time, n, edge\_total;

void addEdge(int a, int b)

{

edge[edge\_total].to = a;

edge[edge\_total].next = head[b];

head[b] = edge\_total ++;

edge[edge\_total].to = b;

edge[edge\_total].next = head[a];

head[a] = edge\_total ++;

}

void tarjan\_init()

{

memset(vis, 0, sizeof(vis));

memset(dfn, 0, sizeof(dfn));

memset(in, 0, sizeof(in));

time = 1;

}

int min(int a, int b)

{

return a<b? a: b;

}

void dfs(int id, int fa)

{

// printf("%d %d\n", id, fa);

dfn[id] = low[id] = time ++;

vis[id] = 1;

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

{

int t = edge[i].to;

if(t == fa)

continue;

//因为建边的时候建的是双向边，因此必须检测这条边是否指向他的父亲

if(!vis[t])

{

dfs(t, id);

low[id] = min(low[id], low[t]);

}

else

{

low[id] = min(low[id], dfn[t]);

}

}

}

int tarjan()

{

for(int i = 1; i <= n; i ++)

{

if(!vis[i])

dfs(i, i);

}

for(int i = 1; i <= n; i ++)

{

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

{

if(low[i] != low[edge[j].to])

in[low[i]] ++;

}

}

int ans = 0;

for(int i = 1; i <= n; i ++)

{

if(in[i] == 1)

ans ++;

}

return (ans + 1) / 2;

}

int main ()

{

int r, a, b;

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

{

edge\_total = 0;

memset(head, -1, sizeof(head[0]) \* (n+1));

for(int i = 0; i < r; i ++)

{

scanf("%d %d", &a, &b);

addEdge(a, b);

}

tarjan\_init();

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

}

return 0;

}

# 线性求中位数

#include<cstdio>

int find\_mid(int arr[], int left, int right, int x)

{

if(left >= right){

return arr[left + x];

}

int mid = arr[left];

int i = left;

int j = right;

while(i < j){

while(i < j && arr[j] >= mid) j--;

arr[i] = arr[j];

while(i < j && arr[i] <= mid) i++;

arr[j] = arr[i];

}

arr[j] = mid;

if(i - left == x)

return arr[i];

if(i - left < x)

return find\_mid(arr, i + 1, right, x - (i - left + 1));

else

return find\_mid(arr, left, i - 1, x);

}

int arr[10005];

int main(){

int n;

while(scanf("%d", &n) != EOF){

for(int i = 0;i < n;i ++){

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

}

printf("%d\n", find\_mid(arr, 0, n-1, n / 2));

}

return 0;

}

# 线性筛法求素数

#include<cstdio>

#include<string.h>

const int N = 25600000;

bool a[N];

int prime[N], num;

//a[i] = 0表示i为素数

//prime[i]存储第i个素数

//num存储一共多少个素数

void Prime(int n) //n表示最大界,但是不包括n

{

memset(a, 0, n \* sizeof(a[0]));

num = 0;

a[0] = a[1] = 1;

//不要冒昧的吧<改成<=

//不然会错。亲测

for(int i = 2; i < n; ++i)

{

if(!(a[i])) prime[num ++] = i;

for(int j = 0; j < num && i \* prime[j] < n; ++j)

{

a[i \* prime[j]] = 1;

if(!(i % prime[j])) break;

}

}

}

int main ()

{

Prime(200005);

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

for(int i =0; i < num; i ++)

{

printf("%d ", prime[i]);

}

printf("\n");

for(int i = 0; i < 100; i ++)

if(!a[i])

printf("%d ", i);

return 0;

}

# 最小费用最大流

#include<cstdio>

#include<string.h>

#include<queue>

#include<cmath>

using namespace std;

const int maxNode = 210;

const int INF = 0x3fffffff;

bool inq[maxNode];

char org[105][105];

int pre[maxNode], res[maxNode][maxNode], cost[maxNode][maxNode], d[maxNode];

struct node

{

int x, y;

}h[maxNode], m[maxNode];

bool SPFA(int s, int t)

{

queue<int> q;

memset(inq, 0, sizeof(inq));

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

inq[s] = 1;

q.push(s);

for(int i = s; i <= t; i ++)

d[i] = INF;

d[s] = 0;

while(!q.empty())

{

int u = q.front();

q.pop();

inq[u] = 0;

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

for(int i = s; i <= t; i ++)

{

if(res[u][i] && d[u] + cost[u][i] < d[i])

{

d[i] = d[u] + cost[u][i];

pre[i] = u;

if(!inq[i])

{

inq[i] = 1;

q.push(i);

}

}

}

}

if(pre[t] == -1)

return false;

return true;

}

int MCMF(int s, int t)

{

int mincost = 0;

while(SPFA(s, t))

{

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

int v = t;

while(v != -1)

{

// printf("%d ", v);

res[pre[v]][v] -= 1;

res[v][pre[v]] += 1;

v = pre[v];

}

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

mincost += d[t];

}

return mincost;

}

int main ()

{

int r, c;

while(~scanf("%d %d", &r, &c) && r && c)

{

for(int i = 1; i <= r; i ++)

{

scanf("%s", org[i]+1);

}

int house = 0, man = 0;

for(int i = 1; i <= r; i ++)

{

for(int j = 1; j <= c; j ++)

{

if(org[i][j] == 'H')

{

h[house].x = i;

h[house].y = j;

house ++;

}

if(org[i][j] == 'm')

{

m[man].x = i;

m[man].y = j;

man ++;

}

}

}

// printf("house man: %d %d\n", house, man);

memset(res, 0, sizeof(res));

memset(cost, 0, sizeof(cost));

int s = 0, t = house + man + 1;

for(int i = 1; i <= house; i ++)

res[s][i] = 1;

for(int i = 0; i < house; i ++)

{

for(int j = 0; j < man; j ++)

{

int dis = abs(h[i].x - m[j].x) + abs(h[i].y - m[j].y);

res[i + 1][j + house + 1] = 1;

cost[i + 1][j + house + 1] = dis;

cost[j + house + 1][i + 1] = -dis;

}

}

for(int i = house + 1; i < t; i ++)

res[i][t] = 1;

// for(int i = s; i <= t; i ++)

// {

// for(int j = s; j <= t; j ++)

// {

// printf("%d ", res[i][j]);

// }

// printf("\n");

// }

//

// for(int i = s; i <= t; i ++)

// {

// for(int j = s; j <= t; j ++)

// {

// printf("%d ", cost[i][j]);

// }

// printf("\n");

// }

printf("%d\n", MCMF(s, t));

}

return 0;

}