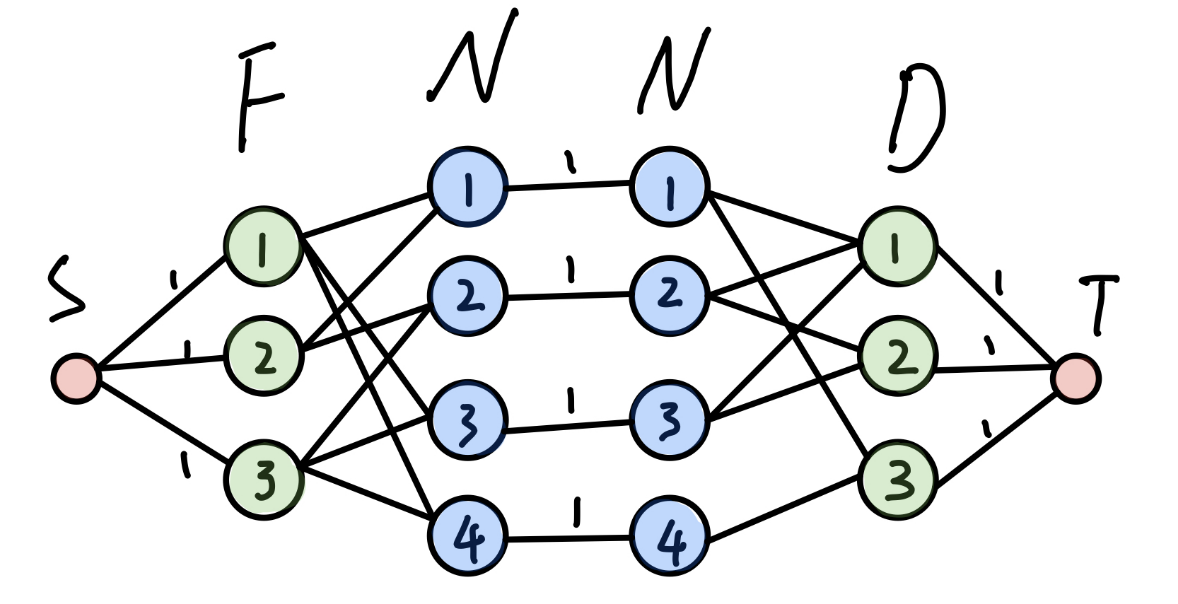
B - Dining(POJ-3281)

题意

每头牛都有各自喜欢的食物和饮料，而每种食物或饮料只能分配给一头牛。最多能有多少头牛可以同时得到喜欢的食物和饮料？

思路

最大流
将牛拆成点，限制牛的流量。保证增光路上对应得是牛喜欢的食物和水



```
#include <iostream>
#include <cstring>
#include <queue>
#include <cmath>
const int maxn = 4e2 + 5;
const int inf = 0x3f3f3f3f;
using namespace std;

struct ac{
    int v, c, nex;
}edge[maxn << 7];
int s, e;
int head[maxn], dis[maxn], curedge[maxn], cnt;
void init() {
    cnt = 0;
    memset(head, -1, sizeof(head));
}
void addedge(int u, int v, int c) {
    // 正向建边
    edge[cnt] = {v, c, head[u]};
    head[u] = cnt++;
    // 反向建边，流量为0
    edge[cnt] = {u, 0, head[v]};
    head[v] = cnt++;
}
```

```
bool bfs() {
    queue<int> que;
    que.push(s);
    memset(dis, 0, sizeof(dis)); // 对图进行分层
    dis[s] = 1;
    while (!que.empty()) {
        int u = que.front();
        que.pop();
        for (int i = head[u]; i != -1; i = edge[i].nex) {
            int v = edge[i].v;
            int c = edge[i].c;
            // 如果节点v已经分过层或者u->v流量为0, continue
            if (dis[v] || c == 0) continue;
            dis[v] = dis[u] + 1; // 对v进行标记并加入队列
            que.push(v);
        }
    }
    return dis[e] > 0;  // 判断是否存在增广路，s是否能到达e
}

int dfs(int u, int flow) { // 增广路走到u点的最小流量为flow
    if (u == e || flow == 0) return flow;
    // 遍历u的所有出边
    for (int &i = curedge[u]; i != -1; i = edge[i].nex) { // 当前弧优化
        int v = edge[i].v;
        int c = edge[i].c;
        // 判断能否u->v增广
        if (dis[v] != dis[u] + 1 || c == 0) continue;
        int d = dfs(v, min(flow, c));
        if (d > 0) { // 找到一条增广路，修改增广路上的正反向边
            edge[i].c -= d;
            edge[i^1].c += d;
            return d;
        }
    }
    dis[u] = -1; // // 炸点优化
    return 0;
}
int Dinic() {
    int sum = 0, d;
    while (bfs()) { // 判读是否存在增广路
        for (int i = 0; i <= e; ++i) curedge[i] = head[i]; // copy head数组，在
dfs中可以直接得到下一条没有被增广过的边
        while ((d = dfs(s, inf)) > 0) sum += d; // 多次dfs找增广路
    }
    return sum;
}

int main() {
    ios::sync_with_stdio(false);
    cin.tie(0), cout.tie(0);
    int N, F, D;
    cin >> N >> F >> D;
    s = 0, e = N + N + F + D + 1;
    init();
    for (int i = 1; i <= N; ++i) {
        int f, d, t;
        cin >> f >> d;
        for (int j = 0; j < f; ++j) {
            cin >> t;
            addedge(t, i+F, inf);
        }
        for (int j = 0; j < d; ++j) {
            cin >> t;
            addedge(i+F+N, t+F+N+N, inf);
        }
    }
    for (int i = 1; i <= N; ++i) {
        addedge(i+F, i+F+N, 1);
    }
    for (int i = 1; i <= F; ++i) {
        addedge(s, i, 1);
    }
    for (int i = 1; i <= D; ++i) {
        addedge(F+N+N+i, e, 1);
    }
    cout << Dinic() << endl;
    return 0;
}
```

D - Going Home(POJ-2195)

题意

n个人要进到房子里面，每个人的花费是他移动的距离。求n个人进房子的最小花费

思路

费用流

```
#include <iostream>
#include <cstring>
#include <stdio.h>
#include <queue>
#include <cmath>
const int maxn = 2e2 + 5;
const int inf = 0x3f3f3f3f;
using namespace std;

int path[maxn], dis[maxn], head[maxn], vis[maxn], cnt;
void init() {
    cnt = 0;
    memset(head, -1, sizeof(head));
}
struct ac{
    int v, c, cost, nex;
}edge[maxn << 7];

void addedge(int u, int v, int c, int cost) {
    // 正向建边
    edge[cnt] = {v, c, cost, head[u]};
    head[u] = cnt++;
    // 反向建边
    edge[cnt] = {u, 0, -cost, head[v]};
    head[v] = cnt++;
```

```
}
int spfa(int s, int e) {
    memset(vis, 0, sizeof(vis));
    memset(dis, inf, sizeof(dis)); // 记录从s点出发到每个点的费用和最小值
    memset(path, -1, sizeof(path)); // 记录更新当前点的边在edge中的下标
    queue<int> que;
    que.push(s);
    dis[s] = 0;
    vis[s] = 1;
    while (!que.empty()) {
        int u = que.front();
        que.pop();
        vis[u] = 0;
        // 遍历u的所有出边
        for (int i = head[u]; i != -1; i = edge[i].nex) {
            int v = edge[i].v;
            int c = edge[i].c;
            int cost = edge[i].cost;
            // 判断是否更新v点
            if (dis[v] > dis[u] + cost && c > 0) {
                dis[v] = dis[u] + cost; // 更新最小费用
                path[v] = i;
                if (vis[v]) continue;
                vis[v] = 1;
                que.push(v);
            }
        }
    }
    return dis[e] != inf; // 判断s能否到达e
}
int MincostMaxflow(int s, int e, int &cost) {
    int maxflow = 0;
    while (spfa(s, e)) { // 搜先spfa看是否存在增广路，如果存在求一条费用和最小的一条
        int flow = inf;
        // 遍历增广路上的边，取最小的流量flow
        // path存的是那条边更新到这个点, i = 这个点在edge中的下标
        // edge[i^1].v 通过反向边得到前驱节点
        for (int i = path[e]; i != -1; i = path[edge[i^1].v]) {
            flow = min(flow, edge[i].c); // 取最小的流量
        }
        // 得到最小流量flow之后，更改正反向的流量
        for (int i = path[e]; i != -1; i = path[edge[i^1].v]) {
            edge[i].c -= flow;
            edge[i^1].c += flow;
            cost += flow * edge[i].cost;
        }
        maxflow += flow;
    }
    return maxflow; // 返回最大流
}

int main() {
    ios::sync_with_stdio(false);
    cin.tie(0), cout.tie(0);
    //freopen("in.txt", "r", stdin);
    int n, m;
    while (cin >> n >> m, n&&m) {
        init();
        vector< pair<int,int> > H, M;
        char c;
        for (int i = 0; i < n; ++i) {
            for (int j = 0; j < m; ++j) {
                cin >> c;
                if (c == 'H') H.push_back(make_pair(i, j));
                if (c == 'm') M.push_back(make_pair(i, j));
            }
        }
        int lenH = H.size();
        int lenM = M.size();
        int s = 0, e = lenH + lenM + 1;
        for (int i = 0; i < lenM; ++i) {
            for (int j = 0; j < lenH; ++j) {
                int cost = fabs(M[i].first - H[j].first) + fabs(M[i].second -
H[j].second);
                addedge(i+1, j+1+lenM, 1, cost);
            }
        }
        for (int i = 0; i < lenM; ++i) {
            addedge(s, i+1, 1, 0);
        }
        for (int i = 0; i < lenH; ++i) {
            addedge(lenM+i+1, e, 1, 0);
        }
        int cost = 0;
        MincostMaxflow(s, e, cost);
        cout << cost << endl;

    }

    return 0;
}
```