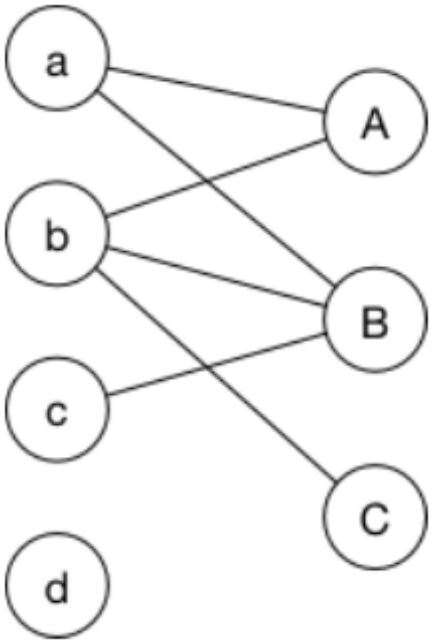
8271 Tracer Deployment

Distributed denial of service (DDoS) is a rapidly growing network security problem. DDoS attacks always paralyze the network nodes such as servers and occupy the network bandwidth. How to defense DDoS attacks is a challenging issue for network security problem. The key to defense DDoS attacks is to find the attack origins. The log of attack origins can be used as evidence for post-attack investigations. Furthermore, if the attack origins can be located during the attack, the anomaly attack packets can be blocked by cooperative filter nodes distributed over the Internet. Therefore the network bandwidth among the attackers and targets can be prevented from being occupied by the attack packets. The IP traceback technology can be applied to identify the attack origins. It usually relays on enhanced routers and provides assistance in tracing the path traversed by attack traffic and then identify the machines that directly generate attack packets. Here, we refer to the enhance routers which provide tracing service as *tracers*. Evidently, the location of traces will affect the performance of locating the attack origins.

Next, we consider the following tracer deployment problem: How many and where should the tracers be deployed in the network to be effective for locating the attack origins? Notice that the attacker can generate attack packets that appear to have originated from anywhere. It seems impossible to predict the location of attack origins. If the attack packets do not pass through any tracer in the network, the attack origins cannot be located using the IP traceback method.

For example, if tracers are deployed at node 'A' and node 'C', when an attack initiates at node 'a', passing through node 'B', and finally attacks node 'c', no tracer will detect the above attack. On the other hand, if three tracers are deployed at nodes 'A', 'B', and 'b', then any attack will always pass through at least one of the three tracer nodes, and the attack will be detected.



Please write a program to determine the minimum number of tracers need to be deployed to ensure any attck will pass through (and be detected) at least one tracer. Note that the given network is a bipartite network $G = (S, T, E)$ whose nodes can be partitioned into two subsets S and T so that each communication link (in E) has one end in S and one end in T.

Also note that the network may be disconnected or even have isolated nodes.

Input

There are at most 10 test cases.

The first line of each instance consists of an integer m ($1 \leq m \leq 20$), where m is the number of nodes (in set S of $G = (S, T, E)$) labeled with $\{0, 1, 2, \ldots, m-1\}$ in the network. The second line of each instance consists of an integer n ($1 \leq n \leq 20$), where n is the number of nodes (in set T of $G = (S, T, E)$) labeled with $\{0, 1, \ldots, n-1\}$ in the network. The third line of each instance consists of an integer e ($1 \leq e \leq 100$), where e is the number of communication links in the network. The next e lines, each contains two integers i, j, indicating a communication link exists between nodes i and node j.

The last test case will be followed by a line containing a single '0'.

Output

The output for each instance should contain an integer denoting the minimum number tracers needed for the given network.

Sample Input

```
4
3
6
0 0
0 1
1 0
1 1
1 2
2 1
4
4
7
0 0
0 2
1 1
1 3
2 0
2 2
3 3
0
```

Sample Output

```
3
4
```