A1 - Maximum Bipartite Matching Size

Time Limit: 0.1 sec.

Problem Description

Implement the algorithm for the maximum matching problem in bipartite graphs.

Input Format

The first line consists of two integers n and m, the number of vertices in V and the number of edges in E. Each of the following m lines consists of two integers u, v, which indicates that there is an undirected edge between vertex u and vertex v. It is guaranteed that the input graph $G = (V, E)$ is a valid bipartite graph.

You may assume that

- The vertices are numbered from 0 to $n - 1$.
- $2 \leq n \leq 500$.
- $1 \leq m \leq \binom{n}{2}$.

Output Format

Print the size of the maximum matching of G in a line.

Sample Input

```
3 2
1 0
2 0
```

Sample Output

```
1
```

Note.

This is the basic version of problem A2, and it is okay if you directly submit the program for A2 to this problem.

A2 - The King's Matching-Cover Theorem

Time Limit: 0.1 sec.

Problem Description

Given a bipartite graph $G = (V, E)$, compute a maximum size matching and a minimum size vertex cover.

Input Format

The first line consists of two integers n and m, the number of vertices in V and the number of edges in E. Each of the following m lines consists of two integers u, v, which indicates that there is an undirected edge between vertex u and vertex v. It is guaranteed that the input graph $G = (V, E)$ is a valid bipartite graph.

You may assume that

- The vertices are numbered from 0 to $n - 1$.
- $2 \leq n \leq 500$.
- $1 \leq m \leq \binom{n}{2}$.

Output Format

In the first line, print the size of the maximum matching in G. In the following lines, print the endpoints of the matched edges in a maximum matching, separated by a space, one edge per line. In the second-last line, print the size of the minimum vertex cover for G. In the last line, print the indexes of the vertices in a minimum vertex cover.

If there are multiple answers, you can print any of them.

Sample Input

```
4 3
1 0
2 0
2 3
```

Sample Output

```
2
0 1
2 3
2
2 0
```

A3 - Maximum Matching in General Graphs

Time Limit: 0.1 sec.

Problem Description

Given a graph $G = (V, E)$, compute a maximum size matching for it.

Input Format

The first line consists of two integers n and m, the number of vertices in V and the number of edges in E. Each of the following m lines consists of two integers u, v, which indicates that there is an undirected edge between vertex u and vertex v.

You may assume that

- The vertices are numbered from 0 to $n - 1$.
- $2 \leq n \leq 500$.
- $1 \leq m \leq \binom{n}{2}$.

Output Format

In the first line, print the size of the maximum matching in G. In the following lines, print the endpoints of the matched edges in a maximum matching, separated by a space, one edge per line.

If there are multiple answers, you can print any of them.

Sample Input

```
4 3
1 0
2 0
2 3
```

Sample Output

```
2
0 1
2 3
```