111-2 Data Structure

Homework 8 – Graph

Question 1 (80%)

There are a total of numActions actions in a recipe, labeled from 0 to numActions - 1. You are given an array prerequisites where prerequisites[i] = [a_i, b_i] indicates that you must do action b_i first if you want to do action a_i.

- For Example, the pair [0, 1] indicates that to do action 0 you have to do action 1 first.

Please print “true” if you can finish all actions in the recipe. Otherwise, print “false”.

Input format

Please read the input from **STDIN**. The first line of a test case has two integers numActions and numPrerequisites, and each of the following numPrerequisites lines has two integers a_i and b_i.

Constraints

- 1 <= numActions <= 1000
- 0 <= numPrerequisites <= 3000
- 0 <= a_i, b_i < numActions
- a_i != b_i
- All the pairs [ai, bi] are **unique**.

Output format

Please print “true” or “false” to **STDOUT**.

DO NOT print anything else except for the answer.

Sample input 1

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

Sample output 1

```
true
```

Sample input 2

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

Sample output 2

```
false
```

Question 2 (20%)

Continuing from **Question 1**, please print the ordering of actions you should do to finish all actions. If there are many valid answers, print **any** of them. If it is impossible to finish all actions, print -1 instead.

Input format

Please read the input from **STDIN**. The first line of a test case has two integers numActions and numPrerequisites, and each of the following numPrerequisites lines has two integers a_i and b_i.

Constraints

- 1 <= numActions <= 1000
- 0 <= numPrerequisites <= 3000
- 0 <= a_i, b_i < numActions
- a_i != b_i
- All the pairs [ai, bi] are **unique**.

Output format

Please print your answer to **STDOUT**, your answer should be integers separated by a space.

DO NOT print anything else except for the answer.

Sample input 1

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

Sample output 1

```
0 1 2
```

Sample input 2

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

Sample output 2

```
-1
```

Grading

Each question has **5 test cases**, and you'll get **0.2*the total score of the question** if you pass 1 test case of the question.

Please do not plagiarize, or you'll get 0 point.

For Question 1, DO NOT print "true" or "false" without considering the inputs, or you might not get any points even if your answer is right.

Notes

- Please avoid commenting in **Chinese**, it might cause compiling problem.
- Please comment the code which could produce redundant outputs, e.g., input prompt, debug message, system call, etc.
- You can assume the test cases are designed according to the constraints, you don't have to handle the exceptions.
- Your code must terminate after printing the answer, do not use an infinite loop to get another test case input.

Submission

You can only use C/C++ to write the program.

Please name your files as Q{question_id}_{student_id}, for example:

- Q1_123456.c or Q1_123456.cpp
- Q2_123456.c or Q2_123456.cpp

and then upload your files to E3.

If you have any questions, please send an e-mail to the teacher and all the TAs **via E3**.