UNSW ICPC Workshop T3W4 - Graph Theory
Easy Problem Set
Sources: Kattis, South Pacific Regionals, Atcoder

Discuss the problems in this document and try to solve them with your group. You can code them now if you want, but this is optional. Make sure everyone is comfortable with the solution before moving on. Ask us if you need help, or want to check your solution.

We recommend doing the problems in the given order (roughly difficulty order), but if you don't like a problem feel free to skip it.

All problems have links if you wish to code and submit to them.

If you finish these, move onto the hard problem set.

Submit here: https://open.kattis.com/problems/wheresmyinternet

Where's My Internet??

Problem ID: wheresmyinternet
CPU Time limit: 1 second
Memory limit: 1024 MB
Difficulty: 3.4

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Source: Icelandic High School Competition 2014

A new town is being built far out in the country, and currently there are N houses. People have already started moving in. However, some of the houses aren't connected to the internet yet, and naturally residents are outraged.

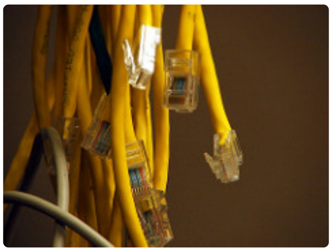


Photo by Jerry John from Flickr

The houses are numbered 1 to N. House number 1 has already been connected to the internet via a long network cable to a neighboring town. The plan is to provide internet to other houses by connecting pairs of houses with separate network cables. A house is connected to the internet if it has a network cable to another house that's already connected to the internet.

Given a list of which pairs of houses are already connected by a network cable, determine which houses are not yet connected to the internet.

Input

The first line of input contains two integers $1 \leq N, M \leq 200\,000$, where N is the number of houses and M is the number of network cables already deployed. Then follow M lines, each containing a pair of distinct house numbers $1 \leq a, b \leq N$ meaning that house number a and house number b are already connected by a network cable. Each house pair is listed at most once in the input.

Output

If all the houses are already connected to the internet, output one line containing the string `Connected`. Otherwise, output a list of house numbers in increasing order, one per line, representing the houses that are not yet connected to the internet.

Sample Input 1

```
6 4
1 2
2 3
3 4
5 6
```

Sample Output 1

```
5
6
```

Sample Input 2

```
2 1
2 1
```

Sample Output 2

```
Connected
```

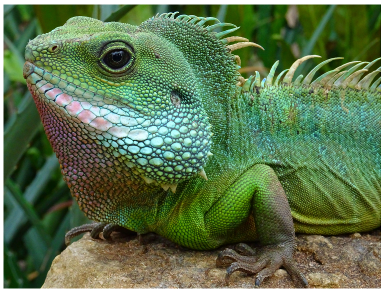
Sample Input 3

```
4 3
2 3
4 2
3 4
```

Sample Output 3

```
2
3
4
```

Problem I
Iguana Instructions
Time limit: 1 second



Iggy the Iguana has found himself trapped in a corn maze! The corn maze can be modelled as a square grid where some of the cells are blocked off with impassable corn plants and others are cleared out. Iggy can only travel in and through cells that are cleared out. Iggy can move to a cell in any of the four cardinal directions (north, south, east, and west).

Iggy is not good at mazes and needs your help. He has asked you to write down a list of instructions to show him how to reach the end of the maze. Each instruction has the form `<direction> <amount>` where `<direction>` is either North, South, East, or West and `<amount>` is how many cells Iggy should travel in that direction. Because Iggy has a bad memory, he wants this list of instructions to be as short as possible even if that means he has to walk further.

Iggy starts in the top-left cell of the maze and needs to get to the bottom-right cell. It is guaranteed that there exists a path Iggy can take to reach the end.

What is the minimum number of instructions you can give Iggy so that he can reach the end of the maze?

Input

The first line contains n ($2 \leq n \leq 100$), which is the length of one side of the square grid representing the maze.

Following this is an $n \times n$ grid of characters. If a cell is cleared out, its corresponding character is a dot (`.`). If a cell is blocked off with corn plants, its corresponding character is a hash (`#`).

Output

Display the minimum number of instructions you can give Iggy such that he can reach the end of the maze.

Sample Input 1	Sample Output 1
5 ..... ####. ..... .####	5

Sample Input 2	Sample Output 2
5 ..... .###. ..... .####	2

Sample Input 3

```
7
.......
#.##.#.
#....#.
..####.
#....##
...#...
##.....
```

Sample Output 3

```
5
```

Sample Input 4

```
31
...............................
...............................
...............................
...............................
.........##..##................
.....##..#.#.#.#...............
.....#.#..#.#.#.#...######.....
......#.#..##..#.#.#......##...
..##...##.#######.#...###...#..
..#.#.##.........#....#..#...#.
...#.#................#.#.....#
....#.................##......#
...#.......................##.#
.##....###....##...####......##
.#........#..#.....#..#......#.
.#.........#.#...#.#..#.....#..
#....#....#..#..#..###.....#...
#...#....#....#..#....#####....
#...#...#######...###...#......
#....##..#.....#..#.#...#......
#.....###......###.#.#.#.......
.##......##......#.#.#.........
...##......##.....#............
.....###.....##................
........####...#...............
............##..#..............
..............#..#.............
...............###.............
...............................
...............................
...............................
```

Sample Output 4

```
11
```

Reversible Cards

Submit here: https://atcoder.jp/contests/arc111/tasks/arc111_b

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 400 points

Problem Statement

We have N cards numbered 1 to N. Each side of each card has a color represented by a positive integer.

One side of Card i has a color a_i, and the other side has a color b_i.

For each card, you can choose which side shows up. Find the maximum possible number of different colors showing up.

Constraints

- $1 \leq N \leq 200000$
- $1 \leq a_i, b_i \leq 400000$
- All numbers in input are integers.

Input

Input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \\
a_1 \quad b_1 \\
a_2 \quad b_2 \\
\vdots \\
a_N \quad b_N
\end{array}
$$

Output

Print the answer.

Sample Input 1 Copy

Copy

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

Sample Output 1 Copy

Copy

```
4
```

We can choose the sides with $1, 3, 4, 2$ to have four colors.

Sample Input 2 Copy

Copy

```
2
111 111
111 111
```

Sample Output 2 Copy

Copy

```
1
```

They are painted with just one color.

Sample Input 3 Copy

Copy

```
12
5 2
5 6
1 2
9 7
2 7
5 5
4 2
6 7
2 2
7 8
9 7
1 8
```

Sample Output 3 Copy

Copy

```
8
```