

# Pipe Rotation

## Problem ID: piperotation

The four ninja turtles: Leonardo, Donatello, Michelangelo, and Raphael are seeking a new home in Manhattan, New York City. The turtles don't like sudden deadends in their home. Fortunately the government recently installed a new sewage system where pipes can be rotated! The turtles need your help finding a suitable home so they're willing to provide you a grid describing the current layout of the sewage system.

The grid consists of  $R$  and  $C$  columns. The cell  $G_{r,c}$  will be one of 4 pipes encoded as a between "A" and "D". These pipes can be rotated by any multiple of 90 degrees:



- (A) Nothing
- (B) Straight pipe (pipes leaving through 2 opposite edges)
- (C) Elbow-shaped pipe (pipes leaving through 2 adjacent edges)
- (D) Four-way pipe (pipes leaving through all 4 edges)

Determine whether or not it's possible to rotate the cells such that the pipes all line up with one another. In particular, for each edge shared by a pair of adjacent cells, there must either be a pipe on both sides of that edge, or on neither side. And for each each of the  $2 \cdot (R + C)$  outer edges of the grid, there must be no pipe leaving through that edge. Below are examples:

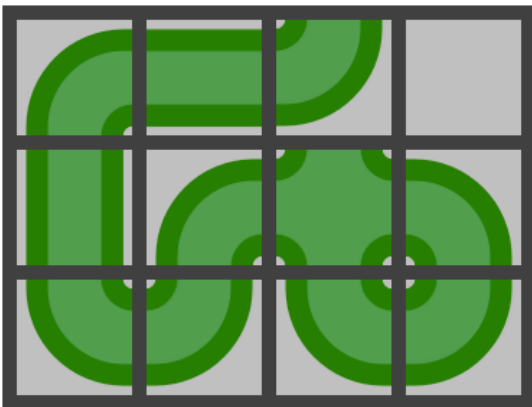


Figure 1: invalid example, two sudden deadends

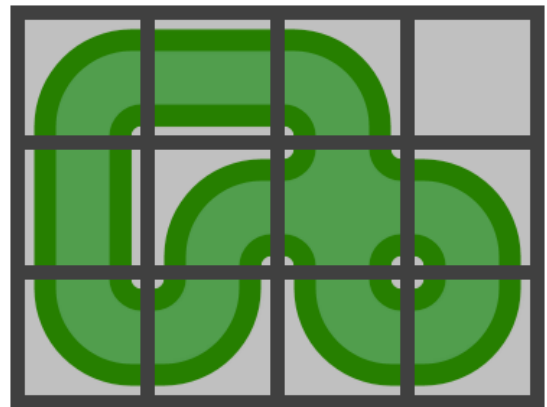


Figure 2: valid example, no sudden deadends

### Input

Line 1: 2 integers,  $R$  and  $C$

Next  $R$  lines:  $C$  characters,  $G_{i,1..C}$ , for  $i=1..R$

### Output

A string, either "Possible" if it's possible to produce a valid grid, or "Impossible" otherwise

**Sample Input 1**

2 2  
CC  
CC

**Sample Output 1**

Possible

**Sample Input 2**

2 2  
CC  
CB

**Sample Output 2**

Impossible

**Sample Input 3**

3 3  
CCC  
CCC  
CCC

**Sample Output 3**

Impossible

**Sample Input 4**

3 4  
CBCA  
BCDC  
CCCC

**Sample Output 4**

Possible

**Sample Input 5**

5 2  
CC  
CC  
AA  
CC  
CC

**Sample Output 5**

Possible