13204 - The Only Way Back Home

Description

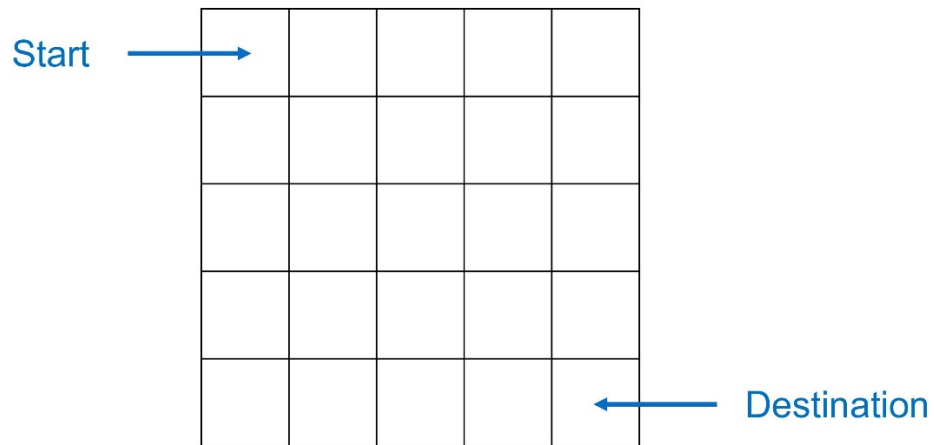# The Only Way Back Home

Data Structures Quiz 3
Tree

2021.5.10

NTHU EECS

Background

- Please help Sia find the way back home.

Overview

- Input
  - A pair of row & column of the matrix
  - A matrix of digits
- Task
  - Convert nonzero digits in matrix into a tree
  - The input matrix guarantees no cycle
- Output
  - If there is no way back home, return 0.
  - If there is a way back home, return the distance of the way back home. It is guaranteed that there is only one solution (no cycle).

Tree Specification

- Each cell in the matrix contains a digit (0, 1)
  - 0 represents no road
  - 1 represent road
  - Each cell can only be visited at most once
- The starting position represents the root
  - (0, 0)
  - Root must be 1, i.e. (0, 0) = 1
- Each node in the tree can have up to 4 children: Left, Down, Right, Up

Example 1 (Input)

- 3 3 # Row & Column of the Matrix
- 1 1 1 # a 2D Matrix
- 1 0 1
- 1 0 1

Example 1 (Conti.)

Path 1

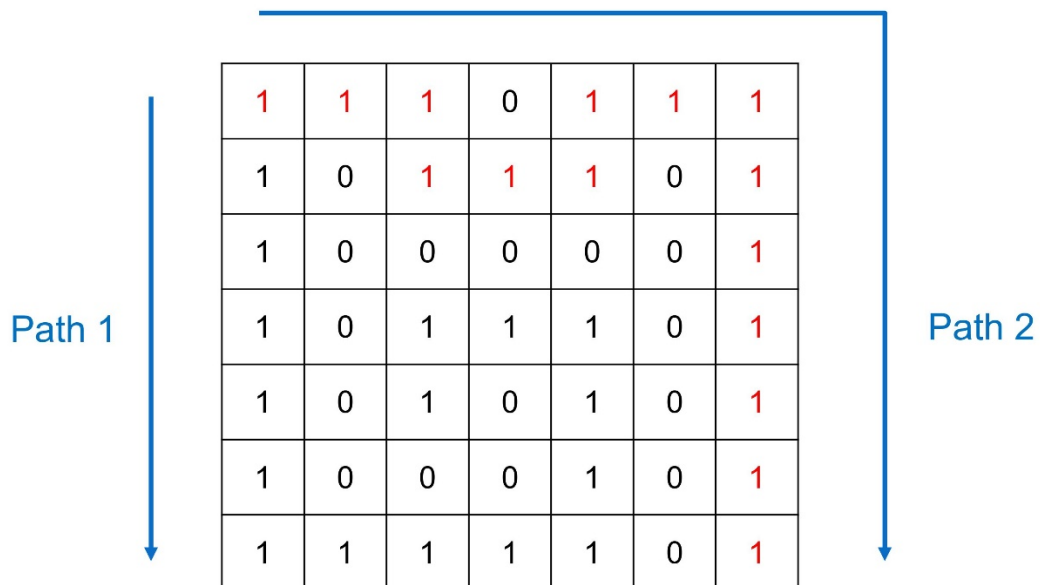| 1	1	1
1	0	1
1	0	1
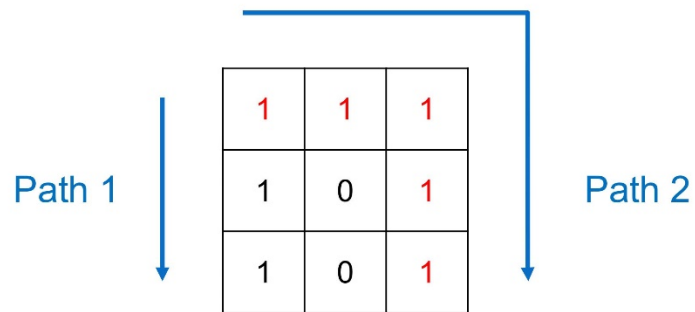
Path 2

Example 1 (Output)

- Path 1 : 1 1 1 -> distance = 3
- Path 2 : 1 1 1 1 1 -> distance = 5

- Since Path 1 doesn't reach the destination, the output will be the distance of Path 2 = 5.

Example 2 (Input)

- 7 7 # Row & Column of the Matrix
- 1 1 1 0 1 1 1 # a 2D Matrix
- 1 0 1 1 1 0 1
- 1 0 0 0 0 0 1
- 1 0 1 1 1 0 1
- 1 0 1 0 1 0 1
- 1 0 0 0 1 0 1
- 1 1 1 1 1 0 1

Example 2 (Conti.)

|						
1	1	1	0	1	1	1
1	0	1	1	1	0	1
1	0	0	0	0	0	1
1	0	1	1	1	0	1
1	0	1	0	1	0	1
1	0	0	0	1	0	1
1	1	1	1	1	0	1

Path 1

Path 2

Example 2 (Output)

- Path 1 : 1 1 … 1 -> distance = 17
- Path 2 : 1 1 … 1 -> distance = 15

- Since Path 1 doesn't reach the destination,
  the output will be the distance of Path 2 = 15.

Example 3 (Input)

- 7 7 # Row & Column of the Matrix
- 1 1 1 0 1 1 1 # a 2D Matrix
- 1 0 1 1 1 0 1
- 1 0 0 0 0 0 1
- 1 0 1 0 1 0 1
- 1 0 1 0 1 0 1
- 1 0 1 0 1 1 1
- 1 1 1 0 0 0 0

Example 3 (Conti.)

Path 1

1	1	1	0	1	1	1
1	0	1	1	1	0	1
1	0	0	0	0	0	1
1	0	1	0	1	0	1
1	0	1	0	1	0	1
1	0	1	0	1	1	1
1	1	1	0	0	0	0
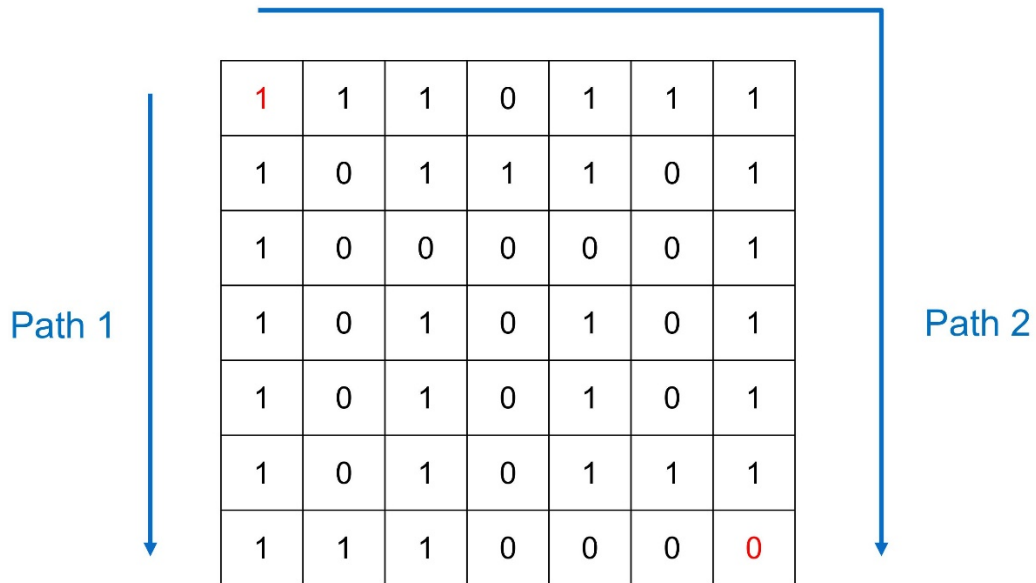
Path 2

Example 3 (Output)

- Path 1 : 1 1 … 1 -> distance = 12
- Path 2 : 1 1 … 1 -> distance = 18

- Since both Path 1 and Path 2 don't reach the destination, the output will be 0.

Input

First line, you will get the row and column of the matrix.

$1 <= R <= 10^5$, $1 <= C <= 10^5$

Second line, you will get a 2D matrix, for each element N in the matrix:

$0 <= N <= 1$

Output

If there is no path to the destination, return 0.

If there is a path to the destination, return the distance of the path from root to destination. It is guaranteed that there is only one solution for each testcase.

(Remember to print out "\n" after the answer)