The Only Way Back Home

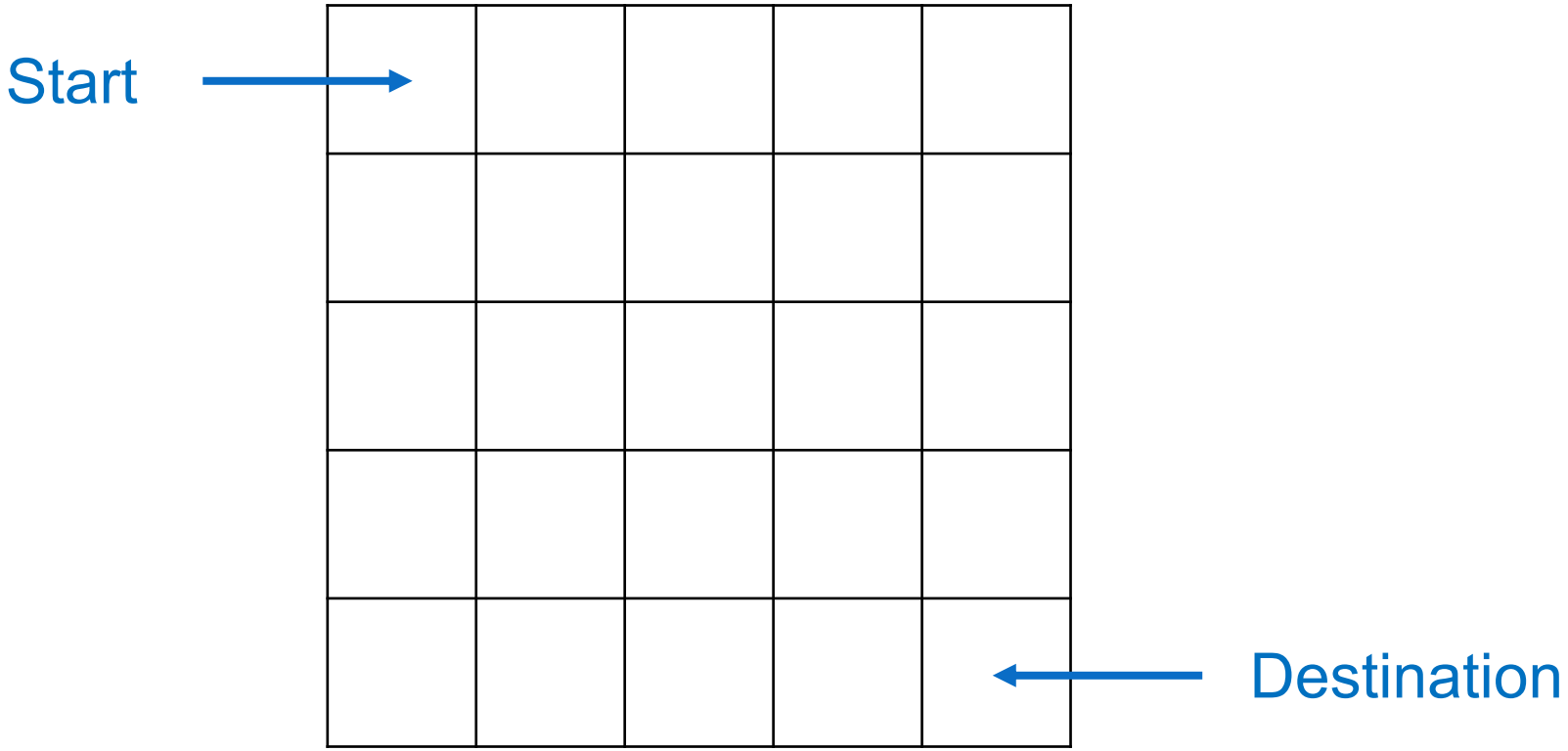
Data Structures Quiz 3
Tree

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).

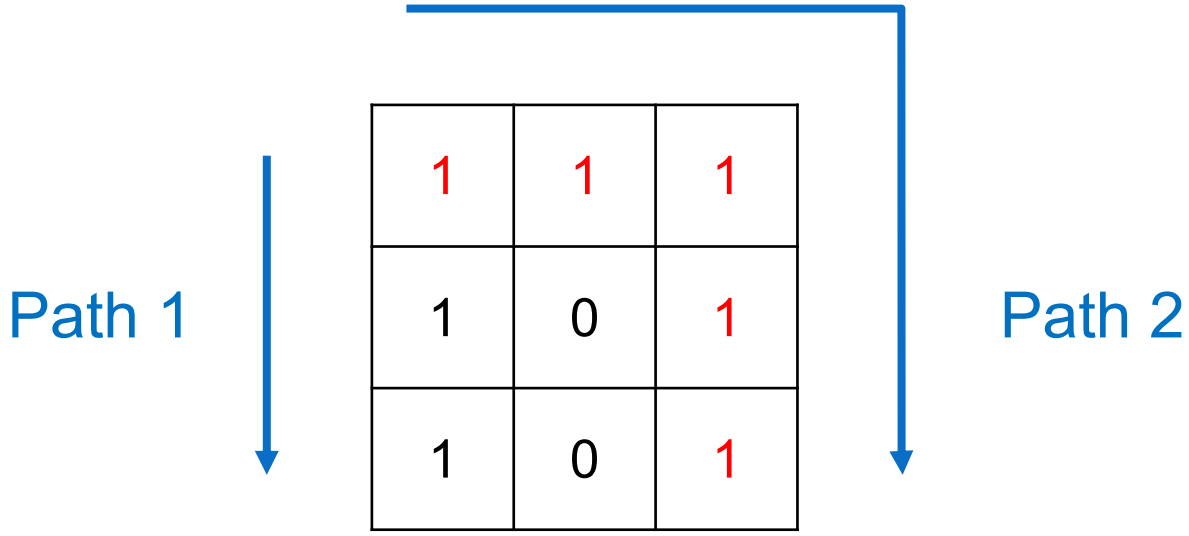
Tree Specification

- 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, 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.)



Example 1 (Output)

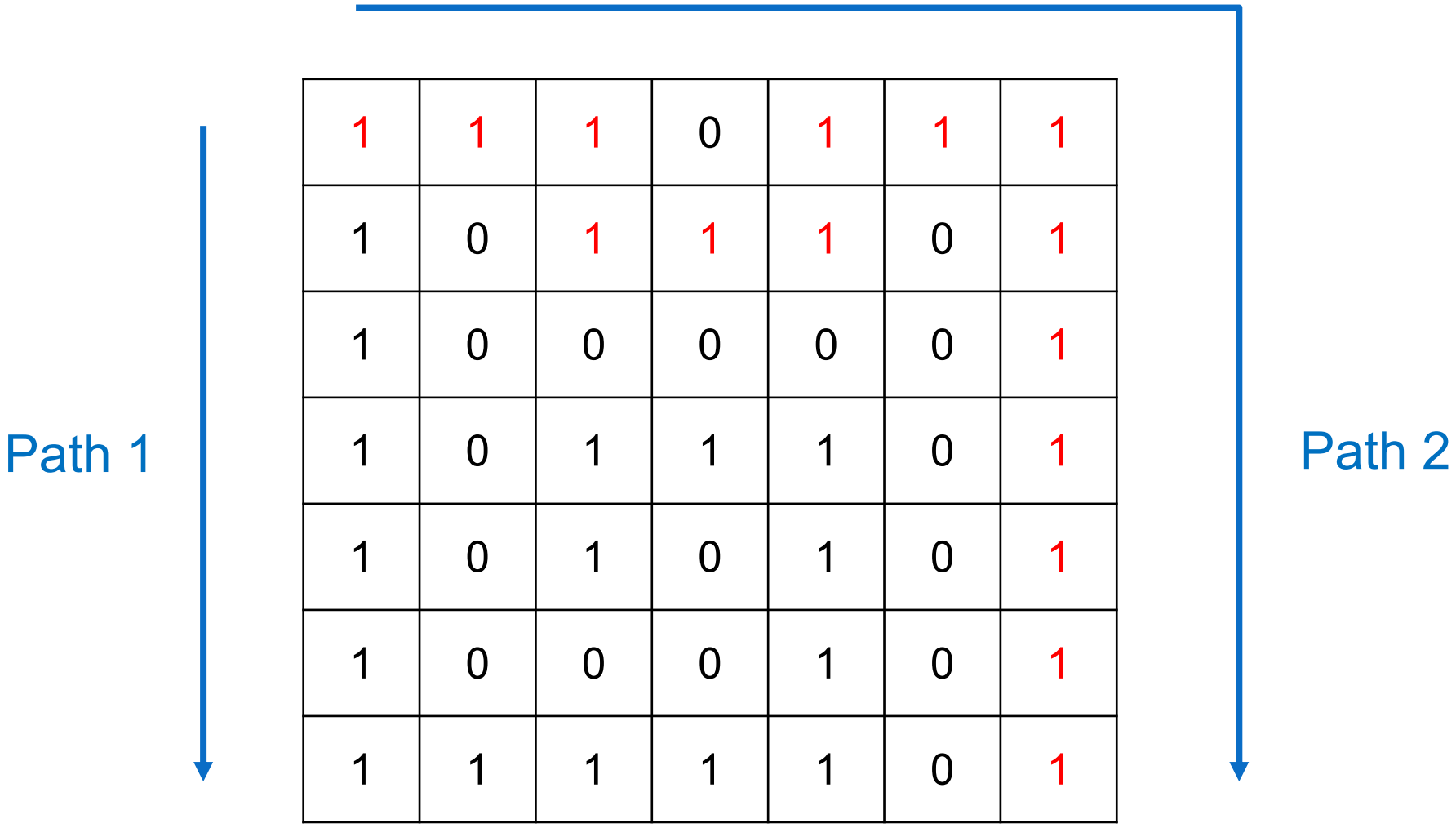
- Path 1 : 1 1 1 -> distance = 3
- Path 2 : 1 1 1 1 1 -> distance = 5

- 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

Example 2 (Output)

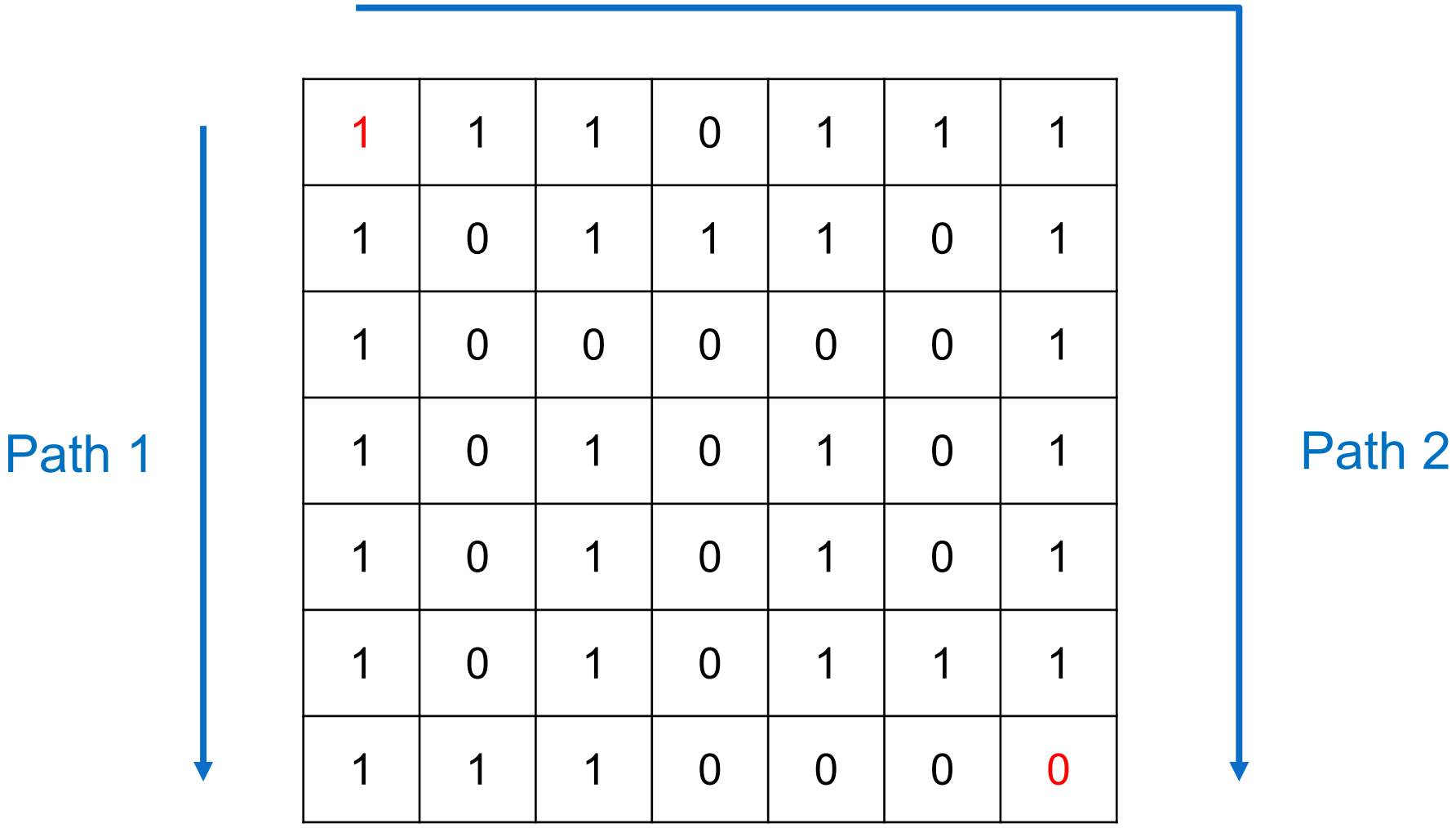
- Path 1 : 1 1 … 1 -> distance = 17
- Path 2 : 1 1 … 1 -> distance = 15

- 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.)



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.