

## Introduction to Scientific Programming

### Project: Find the Shortest Path, 2D Matrix Traversal

Version 2016-1 as of 1 March 2016

Randomly build a 2 dimensional matrix,  $a$ , of size  $n \times n$  where some of the elements are filled with 1's and some are filled with 0's.

A '1' means the path is open, a '0' means that space is blocked and cannot be traversed.

From any given point in the matrix you can either traverse to the left, the right, or up, or down, unless that space is blocked by a '0'

Find the shortest path between the first element  $(0, 0)$  and the last element  $(n-1, n-1)$

For example if  $n=5$ , the matrix  $a$  may be:

1	1	1	1	1
1	1	0	1	1
1	1	1	0	1
0	1	1	1	1
1	1	0	0	1

and the shortest path would be:

$a[0,0]$  to  $a[0,1]$  to  $a[1,1]$  to  $a[2,1]$  to  $a[2,2]$  to  
 $a[3,2]$  to  $a[3,3]$  to  $a[3,4]$  to  $a[4,4]$

Write a program where the user will enter a value for  $n$ .

Your program will then generate a random  $n \times n$  matrix of 1 and 0's where 20% of the elements are 0's.

Print the matrix.

Your program will then traverse the matrix starting from element  $0, 0$  to element  $n-1, n-1$  and display all possible paths and then display the shortest path. If there are no paths, print "no possible paths"

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We welcome feedback; please address questions, suggestions, and requests for more information to [info@tacc.utexas.edu](mailto:info@tacc.utexas.edu).

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