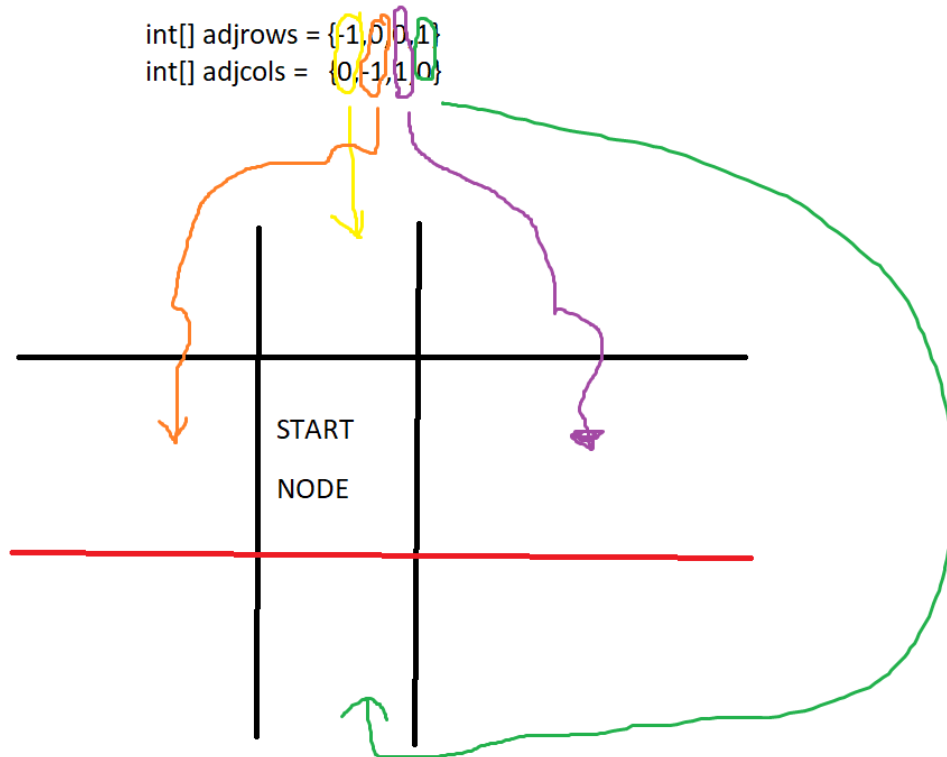


By Anando Zaman

Exercise 4.4.33 Shortest Path in a grid: Shortest path in a grid. Given an N -by- N matrix of positive integers, find the shortest path from the $(0,0)$ entry to the $(N-1, N-1)$ entry, where the length of the path is the sum of the integers in the path. Repeat the problem but assume you can only move right and down.

Solution: To find the shortest path, we can again use Dijkstra's Algorithm.

- Step 1: We must first create an edge weighted Digraph by creating the possible adjacent edges to a cell in the grid. There can be a MAX of 4 edges adjacently connected to a cell; This consists of *UP*, *DOWN*, *LEFT*, *RIGHT* nodes. However, there could still be less. For example, corners may only have 2 adjacent edges as the other 2 missing edges go outside the grid.
- We can do this by creating 2 arrays with 4 indices for representing each of the possible directions.



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- For each cell in the matrix, we can iterate through `adjrows` and `adjcols` to create the edges and then check if they are valid cells prior to inserting into *edgeweightedDigraph*. Do this until reaches $(n-1, n-1)$ coordinate.

- Step 2: Once the *edgeweighteddigraph* is complete, we can run Dijkstra's algorithm (code given on page 655 of textbook) where the length/weight of the edges will be the sum of the integers on the path of the grid.

For part b) of this problem, we can only move *right* and *down*. The solution will be the exact same as before except the *adjrows* and *adjcols* arrays will be changed to only incorporate the coordinates for finding these points.

The arrays change to the following below.

adjrows = 0,1

adjcols = 1,0