DAA ASSIGNMENT
ON
DYNAMIC PROGRAMMING

GROUP -8

IIT2019207-BALLA SUBHASH
IIT2019208-DHANUSH VASA

PROBLEM STATEMENT

Given a matrix of random numbers, find maximum length Snake sequence and print it.
If multiple snake sequences exist with the maximum length, print any one of them.

A snake sequence is made up of adjacent numbers in the grid such that for each number, the number on the right or the number below it is +1 or -1 its value.

ALGORITHM DESIGN

dp[i][j] stores maximum snake sequence length starting at (i,j).

From the question,it is clear that a snake starting at a a position (say (i,j)) can only move right or down.
We will traverse dp array in such a a way that while we are at position (i,j),we would have already calculated
dp(i,j+1) and dp(i+1,j).It’s because that dp(i,j) requires dp(i+1,j) and dp(i,j+1).
One possibility is to traverse from bottom-right to top-left.

we can move from

$$(i, j) -> (i, j+1) <=> a[i][j] - a[i][j+1] = (+|-)1$$

$$(i, j) -> (i+1, j) <=> a[i][j] - a[i+1][j] = (+|-)1$$

POSSIBILITIES –

1) (!right possible AND !down possible), dp[i][j]= 1 (snake starts and ends at (i,j))

2) (right possible AND down possible), dp[i][j]=1+max(dp[i][j+1],dp[i+1][j])

3) (right possible AND !down possible), dp[i][j]=1+dp[i][j+1]

4) (!right possible AND down possible), dp[i][j]=1+dp[i+1][j]

BASE CASES -

dp[n][m]=1 (no more cells right or down of (n,m)).

right most column - snake can only go down.

bottom most row - snake can only go right.

Final Answer –

$$\max\{dp[i][j]\} \ \forall \ 1 <= i <= n \ , \ 1 <= j <= m$$

Trace path –

To trace the path of maximum snake sequence,we maintain a matrix path[][] where path[i][j] points to either RIGHT or DOWN cell(which ever of dp(i+1,j),dp(i,j+1) yields maximum)
or NONE ,if it has to end there it self.

TIME COMPLEXITY ANALYSIS

Number of sub problems=n*m.

Time per subproblem=O(1) (only finding maximum of 2 values).

Hence T(n,m)=(n*m)*O(1).

=O(n*m)

AUXILLARY SPACE

We have created dp[][] and path[][] of n*m size.

Hence auxillary space=O(n*m)


Thank You