

# CS325 - Project 3

Group #6

William Jernigan, Alexander Merrill, Sean Rettig

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## Correctness

### Equation 1

Given an array with an index starting at 0.

$$T[i, j] = \max \left\{ \begin{array}{l} A[i, j] \\ T[i - 1, j] + A[i, j] \\ T[i, j - 1] + A[i, j] \end{array} \right\}$$

Base Cases:

$T[i, j] = NaN$  if  $i < 0$  OR  $j < 0$

$$X[i, j, n_{row}, n_{col}] = \max \left\{ \begin{array}{l} T[i, j] \\ X[i - 1, j, n_{row}, n_{col}] \\ X[i, j - 1, n_{row}, n_{col}] \end{array} \right\}$$

Base Cases:

$X[i, j, n_{row}, n_{col}] = NaN$  if  $i < n_{row} - 1$  AND  $j < n_{col} - 1$ ;  $\forall n_{row}, n_{col}$

$$Z[n_{row}, n_{col}] = X[n_{row}, n_{col}, n_{row}, n_{col}]$$

$Z[n_{row}, n_{col}]$  returns the score of the optimal solution given an  $n_{col} \times n_{row}$  grid A.

## Pseudocode

```
load A[x,y] with values on board
initialize ybest, xbest, T[x,y] with 0
initialize P[x,y] with pointer to A[x,y]
for i = 0 ... y
    for j = 0 ... x
        T[i,j] <- A[i,j]
        if i > 0
            if T[i-1,j] + A[i,j] > T[i,j]
                T[i,j] <- T[i-1,j] + A[i,j]
                P[i,j] <- pointer to A[i-1,j]
        if j > 0
            if T[i,j-1] + A[i,j] > T[i,j]
                T[i,j] <- T[i,j-1] + A[i,j]
                P[i,j] <- pointer to A[i,j-1]
        if T[i,j] > T[ybest,xbest]
            ybest <- i
            xbest <- j
point.y <- ybest
point.x <- xbest
while point.y != -1 AND point.x != -1
    concat point with path
    point <- P[point.y,point.x]
```

## Running Time

$\Theta(n_{col} * n_{row})$

Populating the DP table just requires looping over the length and width of the grid, or  $n_{col} * n_{row}$ .