COMP3121 Assignment 3 - Q2

Demiao Chen z5289988

July 26, 2021

Acknowledgement: the answer is inspired from tutorial 4 question 12 b) solution.

Answer

We solve all subproblems of the form: "What is the smallest total elevation we can get arriving at the cell at row i and column j from square $(1, R)$"? We use $opt(i, j)$ to denote such smallest total elevation and square(i, j) to denote the elevation number on row i and column j, so the base case is $opt(1, R) = square(1, R)$, and $opt(1, 1) = \infty$ for all i and j that are off the square. We use a recursion and a list called $path$ to record the $opt(i, j)$ we choose. The recursion is:

$$opt(i, j) = square(i, j) + min\{opt(i - 1, j), opt(i, j + 1)\}.$$

After solving all subproblems, we start recursion by $i = C$ and $j = 1$, and add tuple (i, j) to list $path$ for each time calling $opt(i, j)$ from $opt(C, 1)$, where i, j are chosen from $min\{opt(i-1, j), opt(i, j+1)\}$, then reverse $path$ when finishing the whole recursion. The tuple list $path$ is the path we are looking for.
As the dimension of the square is R x C, we need to solve $R * C$ subproblems, and each subproblem takes $O(1)$. Hence the time complexity is $O(RC)$