2 Introduction

Two third-graders, a boy and a girl, are playing King/Queen of the Hill with coins in a grid formation. They have labeled the piles with coordinates (i, j) where $0 \leq i, j < N$. (These are honors third-graders.) Each pile has a height $h(i, j)$, a nonnegative integer that represents the number of coins in the pile. Aside from the coins in the piles, the children have an infinite number of spare coins that they can add to any pile.

The way the game is played is as follows: The girl arranges the piles in the shape of a grid with a nonnegative number of coins in each pile as described. The tallest of the piles is going to hold the Queen of the Hill; that pile will have at least as many coins as any other coin stack in the grid. It is now the boy's responsibility to add the minimum number of coins to the various piles in the grid so that the following restrictions are respected:

1. For any given row x, assume that the maximum height of a pile in that row occurs in column y. Then the heights of the piles must be decreasing

outward from column y in row x. Mathematically, $\forall i < j \leq y, h(x,i) \leq h(x,j)$ and $\forall i > j \geq y, h(x,i) \leq h(x,j)$.

2. For any given column x, assume that the maximum height of a pile in that column occurs in row y. Then the heights of the piles must be decreasing outward from row y in column x. Mathematically, $\forall i < j \leq y, h(i,x) \leq h(j,x)$ and $\forall i > j \geq y, h(i,x) \leq h(j,x)$.

3 Your code

You will write a class StudentSolver that determines the minimum number of coins the boy needs to satisfy the grid restrictions, given a grid of coin heights. You will also modify the input grid to show how tall the coin stacks should be *after* the boy is finished modifying them.

If you are writing the file in Java: StudentSolver.java should have a function with the header `public static int solve(int[][] grid)`

If you are writing the file in Python: studentsolver.py should have a function with the header `def solve(grid):`

If you are writing the file in C++: StudentSolver.h should have a line with the header `static int solve(int* grid[], const int n);`

4 Example

The following is an example of the results for a 5 by 5 grid. The total number of coins in this case should be 26.

1 2 5 3 3
2 4 1 5 1
2 1 1 5 2
1 1 5 1 3
4 3 1 5 1

1 2 5 3 3
2 4 5 5 3
2 4 5 5 3
2 4 5 5 3
4 4 4 5 1