2193. Count Fertile Pyramids in a Land

Difficulty : Hard

https://leetcode.com/problems/count-fertile-pyramids-in-a-land

A farmer has a **rectangular grid** of land with `m` rows and `n` columns that can be divided into unit cells. Each cell is either **fertile** (represented by a `1`) or **barren** (represented by a `0`). All cells outside the grid are considered barren.

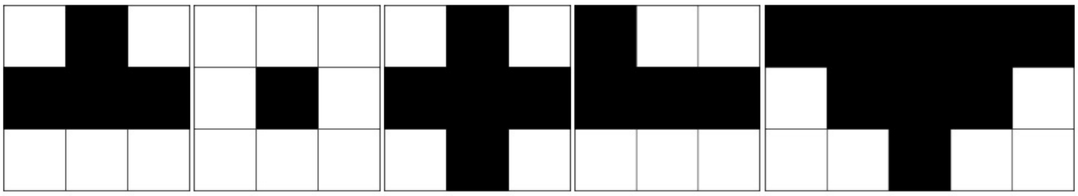
A **pyramidal plot** of land can be defined as a set of cells with the following criteria:

1. The number of cells in the set has to be **greater than** `1` and all cells must be **fertile**.
2. The **apex** of a pyramid is the **topmost** cell of the pyramid. The **height** of a pyramid is the number of rows it covers. Let `(r, c)` be the apex of the pyramid, and its height be `h`. Then, the plot comprises of cells `(i, j)` where `r <= i <= r + h - 1` **and** `c - (i - r) <= j <= c + (i - r)`.

An **inverse pyramidal plot** of land can be defined as a set of cells with similar criteria:

1. The number of cells in the set has to be **greater than** `1` and all cells must be **fertile**.
2. The **apex** of an inverse pyramid is the **bottommost** cell of the inverse pyramid. The **height** of an inverse pyramid is the number of rows it covers. Let `(r, c)` be the apex of the pyramid, and its height be `h`. Then, the plot comprises of cells `(i, j)` where `r - h + 1 <= i <= r` **and** `c - (r - i) <= j <= c + (r - i)`.

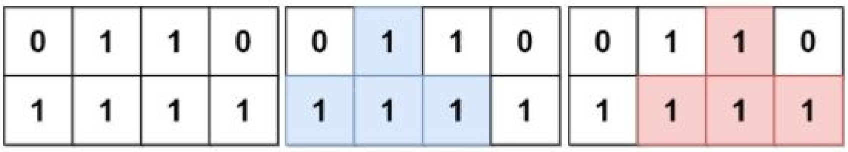
Some examples of valid and invalid pyramidal (and inverse pyramidal) plots are shown below. Black cells indicate fertile cells.



valid invalid invalid invalid valid

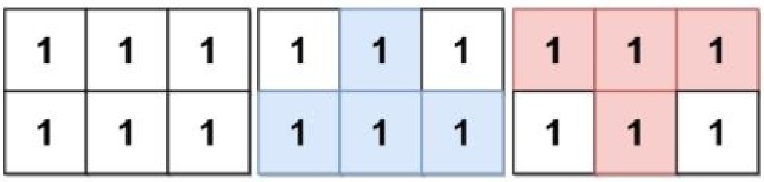
Given a **0-indexed** `m x n` binary matrix `grid` representing the farmland, return *the **total number** of pyramidal and inverse pyramidal plots that can be found in* `grid`.

Example 1:



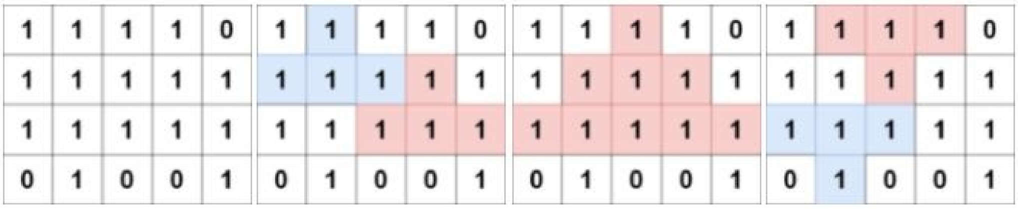

```
Input: grid = [[0,1,1,0],[1,1,1,1]]
Output: 2
Explanation: The 2 possible pyramidal plots are shown in blue and red respectively.
There are no inverse pyramidal plots in this grid.
Hence total number of pyramidal and inverse pyramidal plots is 2 + 0 = 2.
```

Example 2:




```
Input: grid = [[1,1,1],[1,1,1]]
Output: 2
Explanation: The pyramidal plot is shown in blue, and the inverse pyramidal plot is shown in red.
Hence the total number of plots is 1 + 1 = 2.
```

Example 3:



Input: grid = [[1,1,1,1,0],[1,1,1,1,1],[1,1,1,1,1],[0,1,0,0,1]]
Output: 13
Explanation: There are 7 pyramidal plots, 3 of which are shown in the 2nd and 3rd figures.
There are 6 inverse pyramidal plots, 2 of which are shown in the last figure.
The total number of plots is 7 + 6 = 13.

Constraints:

- m == grid.length
- n == grid[i].length
- 1 <= m, n <= 1000
- 1 <= m * n <= 10^5
- grid[i][j] is either 0 or 1.