304. Range Sum Query 2D - Immutable

Description

Given a 2D matrix `matrix`, handle multiple queries of the following type:

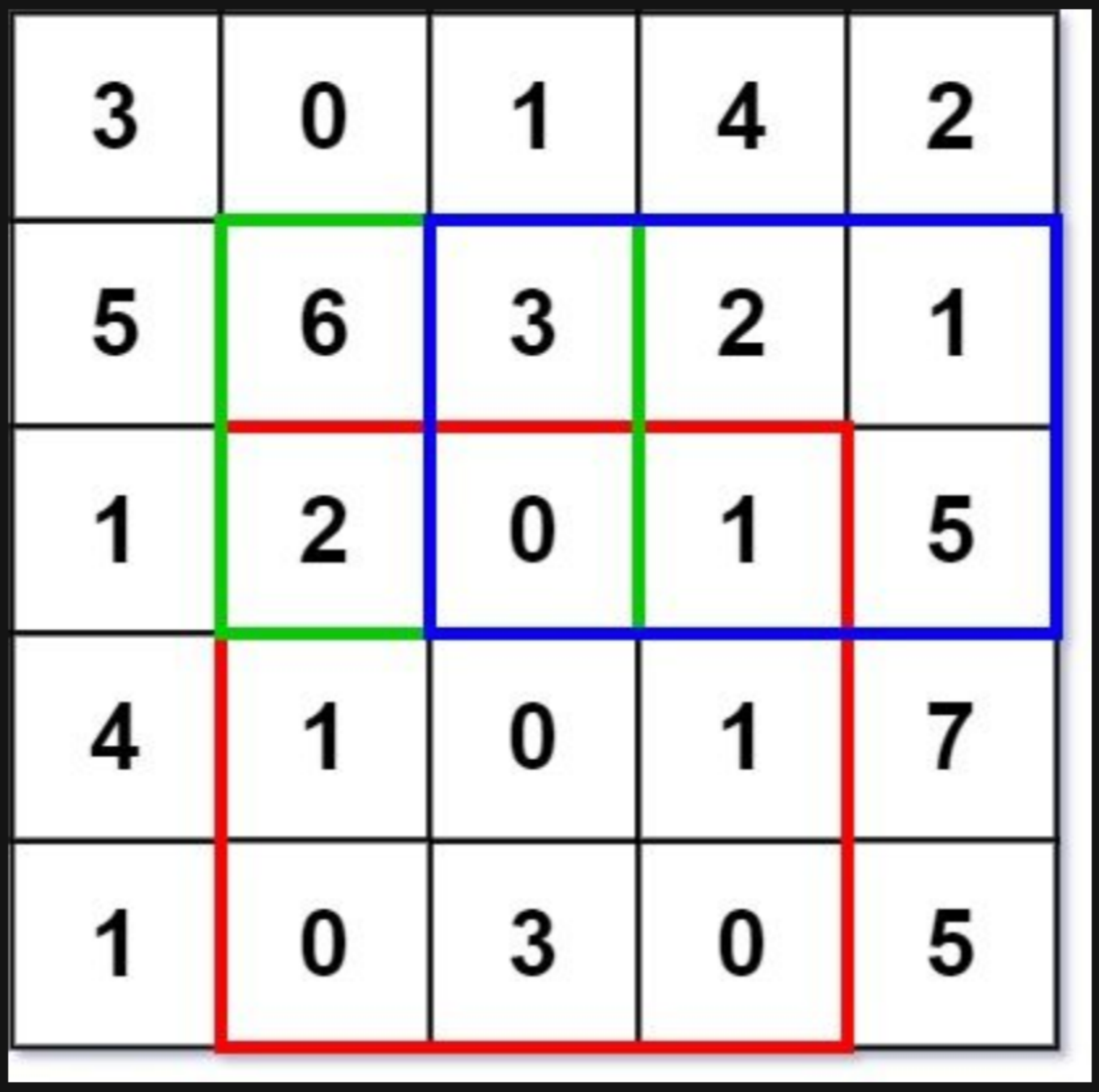
- Calculate the **sum** of the elements of `matrix` inside the rectangle defined by its **upper left corner** `(row1, col1)` and **lower right corner** `(row2, col2)`.

Implement the `NumMatrix` class:

- `NumMatrix(int[][] matrix)` Initializes the object with the integer matrix `matrix`.
- `int sumRegion(int row1, int col1, int row2, int col2)` Returns the **sum** of the elements of `matrix` inside the rectangle defined by its **upper left corner** `(row1, col1)` and **lower right corner** `(row2, col2)`.

You must design an algorithm where `sumRegion` works on `O(1)` time complexity.

Example 1:



```
Input
["NumMatrix", "sumRegion", "sumRegion", "sumRegion"]
[[[[3, 0, 1, 4, 2], [5, 6, 3, 2, 1], [1, 2, 0, 1, 5], [4, 1, 0, 1, 7], [1, 0, 3, 0, 5]]], [2, 1, 4, 3], [1, 1, 2, 2], [1, 2, 2, 4]]
Output
[null, 8, 11, 12]

Explanation
NumMatrix numMatrix = new NumMatrix([[3, 0, 1, 4, 2], [5, 6, 3, 2, 1], [1, 2, 0, 1, 5], [4, 1, 0, 1, 7], [1, 0, 3, 0, 5]]);
numMatrix.sumRegion(2, 1, 4, 3); // return 8 (i.e sum of the red rectangle)
numMatrix.sumRegion(1, 1, 2, 2); // return 11 (i.e sum of the green rectangle)
numMatrix.sumRegion(1, 2, 2, 4); // return 12 (i.e sum of the blue rectangle)
```

Constraints:

- `m == matrix.length`
- `n == matrix[i].length`
- `1 <= m, n <= 200`
- $-10^4 \le matrix[i][j] \le 10^4$
- `0 <= row1 <= row2 < m`
- `0 <= col1 <= col2 < n`
- At most 10^4 calls will be made to `sumRegion`.