Set Matrix Zeroes

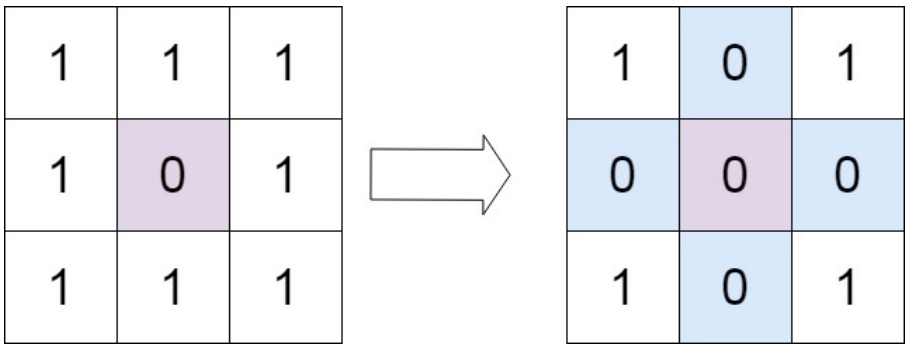
Difficulty	Medium
Category	Math& Geometry
Question	https://leetcode.com/problems/set-matrix-zeroes/
Solution	https://youtu.be/T41rL0L3Pnw
Status	Done

Question

> Given an `m x n` integer matrix `matrix`, if an element is `0`, set its entire row and column to `0`'s.
>
> You must do it in place.

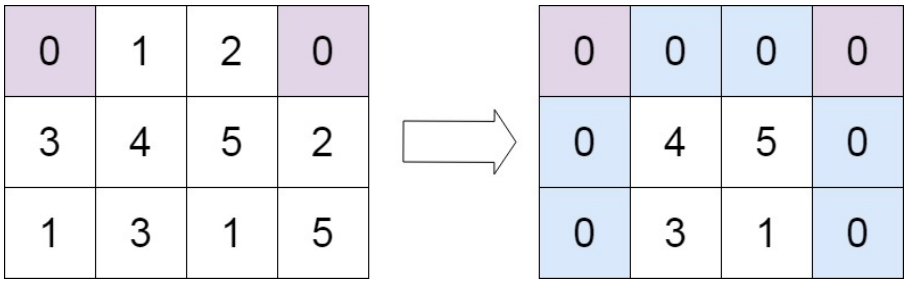
Example

Example 1:




```
Input: matrix = [[1,1,1],[1,0,1],[1,1,1]]
Output: [[1,0,1],[0,0,0],[1,0,1]]
```

Example 2:




```
Input: matrix = [[0,1,2,0],[3,4,5,2],[1,3,1,5]]
Output: [[0,0,0,0],[0,4,5,0],[0,3,1,0]]
```

Idea

This code modifies a matrix in-place by using the first row and first column to mark which rows and columns should be zeroed based on the presence of zeros in the matrix. It then iterates through the matrix again to apply these marks and handles special cases for the top-left corner and the first row.

Solution

```
class Solution:
    def setZeroes(self, matrix: List[List[int]]) -> None:
        """
        Do not return anything, modify matrix in-place instead.
        """
        # Get the number of rows and columns in the matrix
        ROWS, COLS = len(matrix), len(matrix[0])
        rowZero = False

        # Determine which row/column need to be zero

        # Loop through the matrix to mark rows and columns where 0 is found
        for r in range(ROWS):
            for c in range(COLS):
                if matrix[r][c] == 0:
                    matrix[0][c] = 0  # Mark the first row of the column with 0
```

```
                if r > 0:
                    matrix[r][0] = 0  # Mark the first column of the row with 0
                else:
                    rowZero = True  # If the first row has a 0, set the flag

        # Loop through the matrix to set elements to 0 based on the marks
        for r in range(1, ROWS):
            for c in range(1, COLS):
                if matrix[0][c] == 0 or matrix[r][0] == 0:
                    matrix[r][c] = 0

        # Check if the top-left corner (0, 0) should be zero
        if matrix[0][0] == 0:
            for r in range(ROWS):
                matrix[r][0] = 0

        # Check if the first row (rowZero) should be all zeros
        if rowZero:
            for c in range(COLS):
                matrix[0][c] = 0
```

Explanation

1. The code defines a class `Solution` with a method `setZeroes` that takes a 2D matrix as input and modifies it in place.
2. It starts by determining the number of rows and columns in the matrix and initializes a flag `rowZero`.
3. The first loop iterates through the entire matrix. If a zero is found at `matrix[r][c]`, it marks the first row and the first column related to that zero with a zero.
4. It checks whether `r > 0` to avoid marking the first row (index 0) as zero multiple times.
5. It sets the `rowZero` flag to `True` if the first row (index 0) contains a zero.

6. The second loop iterates through the matrix again, except the first row and the first column. It sets elements to zero based on the marks in the first row and the first column.
7. After the loops, it checks if the top-left corner (`matrix[0][0]`) should be zero based on the marks.
8. It also checks if the entire first row (if `rowZero` is `True`) should be set to zeros.