Binary Matrix Problem

**Problem**: An NxN binary Matrix is given. If a row contains a 0 all element in the row will be sent to 0 and if a column contains a 0 all element of the column will be set to 0. You have to do it in O(1) space.

Example:

Input array:

1 0 1 1 0

0 1 1 1 0

1 1 1 1 1

1 0 1 1 1

1 1 1 1 1

Result array:

0 0 0 0 0

0 0 0 0 0

0 0 1 1 0

0 0 0 0 0

0 0 1 1 0

**Solution**:

**Step 1:** Store matrix [0][0] value in a temporary variable (Space Complicity: O(1) ).

Temp = matrix [0][0]

**Step 2:** Apply **&** operation on first column and save it into Temp.

Temp = matrix [0][0] & matrix [0][1] & matrix [0][2] & matrix [0][3] & matrix [0][4]

**Step 3:** Apply **&** operation on first row and save it into matrix [0][0].

matrix [0][0] = matrix [0][0] & matrix [1][0] & matrix [2][0] & matrix [3][0] & matrix [4][0]

Now 2D Matrix Array becomes:

0 0 1 1 0

0 1 1 1 0

1 1 1 1 1

1 0 1 1 1

1 1 1 1 1

And value in Temp = 0

**Step 4:** Apply **&** operation on each row and save the result in the first cell of each row. Here i starts from 1 to n-1.

matrix [0][1] = matrix [0][1] & matrix [1][1] & matrix [2][1] & matrix [3][1] & matrix [4][1]

matrix [0][2] = matrix [0][2] & matrix [1][2] & matrix [2][2] & matrix [3][2] & matrix [4][2]

matrix [0][3] = matrix [0][3] & matrix [1][3] & matrix [2][3] & matrix [3][3] & matrix [4][3]

matrix [0][4] = matrix [0][4] & matrix [1][4] & matrix [2][4] & matrix [3][4] & matrix [4][4]

Now 2D Matrix Array becomes:

0 0 1 1 0

0 1 1 1 0

1 1 1 1 1

1 0 1 1 1

1 1 1 1 1

And value in Temp = 0

**Step 5:** Apply **&** operation on each column and save the result in the first cell of each column. Here j starts from 1 to n-1.

matrix [1][0] = matrix [1][0] & matrix [1][1] & matrix [1][2] & matrix [1][3] & matrix [1][4]

matrix [2][0] = matrix [2][0] & matrix [2][1] & matrix [2][2] & matrix [2][3] & matrix [2][4]

matrix [3][0] = matrix [3][0] & matrix [3][1] & matrix [3][2] & matrix [3][3] & matrix [3][4]

matrix [4][0] = matrix [4][0] & matrix [4][1] & matrix [4][2] & matrix [4][3] & matrix [4][4]

Now 2D Matrix Array becomes:

0 0 1 1 0

0 1 1 1 0

1 1 1 1 1

0 0 1 1 1

1 1 1 1 1

And value in Temp = 0

**Step 6:** Now to find the value at matrix[i][j], you have to do a[i][0] **&** a[0][j]. Here I and j start from 1 to n-1

matrix [1][1] = matrix [1][0] & matrix [0][1]

matrix [1][2] = matrix [1][0] & matrix [0][2]

matrix [1][3] = matrix [1][0] & matrix [0][3]

matrix [1][4] = matrix [1][0] & matrix [0][4]

Now 2D Matrix Array becomes:

0 0 1 1 0

0 0 0 0 0

1 1 1 1 1

0 0 1 1 1

1 1 1 1 1

And value in Temp = 0

matrix [2][1] = matrix [2][0] & matrix [0][1]

matrix [2][2] = matrix [2][0] & matrix [0][2]

matrix [2][3] = matrix [2][0] & matrix [0][3]

matrix [2][4] = matrix [2][0] & matrix [0][4]

Now 2D Matrix Array becomes:

0 0 1 1 0

0 0 0 0 0

1 0 1 1 0

0 0 1 1 1

1 1 1 1 1

And value in Temp = 0

matrix [3][1] = matrix [3][0] & matrix [0][1]

matrix [3][2] = matrix [3][0] & matrix [0][2]

matrix [3][3] = matrix [3][0] & matrix [0][3]

matrix [3][4] = matrix [3][0] & matrix [0][4]

Now 2D Matrix Array becomes:

0 0 1 1 0

0 0 0 0 0

1 0 1 1 0

0 0 0 0 0

1 1 1 1 1

And value in Temp = 0

matrix [4][1] = matrix [4][0] & matrix [0][1]

matrix [4][2] = matrix [4][0] & matrix [0][2]

matrix [4][3] = matrix [4][0] & matrix [0][3]

matrix [4][4] = matrix [4][0] & matrix [0][4]

Now 2D Matrix Array becomes:

0 0 1 1 0

0 0 0 0 0

1 0 1 1 0

0 0 0 0 0

1 0 1 1 0

And value in Temp = 0

**Step 7:** Now to find the value at matrix [0][i] and matrix[j][0]. If matrix [0][0] is **equal to 0** then make value 0 all the matrix[0][i] else remain unchanged. If Temp is **equal to 0** the make value 0 all the matrix [j][0] else remain unchanged.

**If (matrix [0][0] == 0)**

**Then**

matrix [0][1] = 0

matrix [0][2] = 0

matrix [0][3] = 0

matrix [0][4] = 0

**If (Temp == 0)**

**Then**

matrix [1][0] = 0

matrix [2][0] = 0

matrix [3][0] = 0

matrix [4][0] = 0

Now 2D Matrix Array becomes:

0 0 0 0 0

0 0 0 0 0

0 0 1 1 0

0 0 0 0 0

0 0 1 1 0

And value in Temp = 0

**Step 8:** Now to find the value at matrix [0][0], you need to do matrix [0][0] **&** Temp and save it into matrix [0][0].

matrix [0][0] = matrix [0][0] & Temp

Now 2D Matrix Array becomes:

0 0 0 0 0

0 0 0 0 0

0 0 1 1 0

0 0 0 0 0

0 0 1 1 0

And value in Temp = 0

**Step 9:** Print your matrix and exit.

**Result 2D Matrix array:**

0 0 0 0 0

0 0 0 0 0

0 0 1 1 0

0 0 0 0 0

0 0 1 1 0