

2D arrays class 3

Q1 Set matrix zeroes

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix} \rightarrow \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

For any element which is "0" make corr. row & column 0.

Approach 1:

Algo: 1) Make a pass over original array & look for 0 elements

2) if entry at $arr[i][j] = 0$, then record i in row hashset & j in column hashset

3) Iterate over the original matrix
if $arr[r][c]$

if r is in rowset or c is in columnset
set $arr[r][c] = 0$

$$\begin{matrix} & 0 & 1 & 2 \\ \begin{matrix} 0 \\ 1 \\ 2 \end{matrix} & \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix} \end{matrix}$$

$[1, 0]$

$$\checkmark \quad O(M) \quad \begin{bmatrix} 1 \\ 0 \end{bmatrix} \quad \text{row}$$

$$\checkmark \quad \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad O(N) \quad \text{column}$$

$$\begin{bmatrix} 00 & 01 & 02 \\ 10 & 11 & 12 \\ 20 & 21 & 22 \end{bmatrix} \rightarrow \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

TC: $O(M \times N)$

SC: $O(M+N)$

$$2 \times (M+N) = O(M+N)$$

Approach 2:

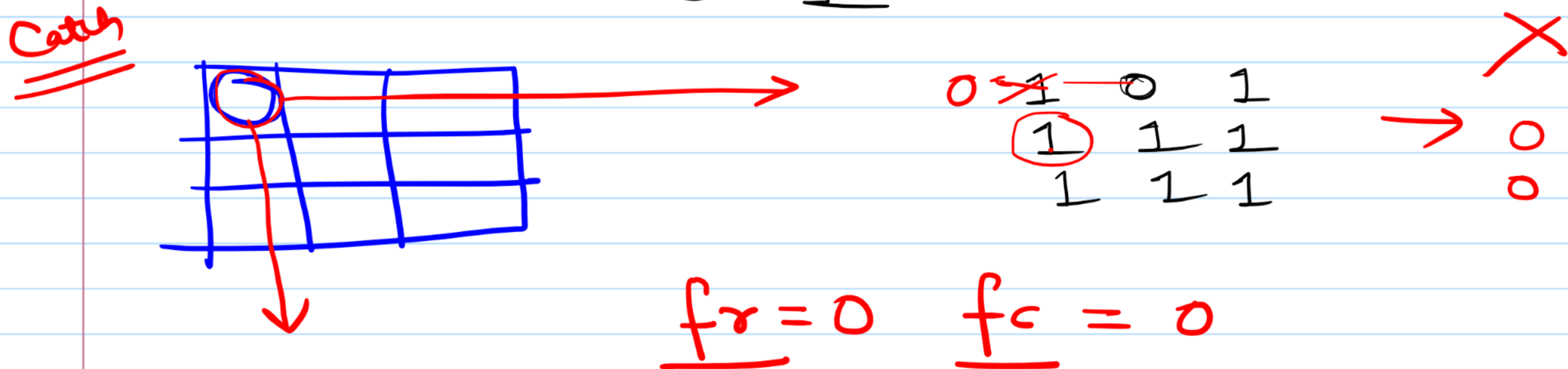
Hint: use first element of every row & column as a FLAG.

10

1	1 0	1	0 2
0 1	0	1	12
1	1	1	

1	0	1
0	0	0
1	0	1

1	0	1
0	0	0
1	0	1



Algorithm:

- 1) We iterate over the matrix & mark first cell of row i & first cell of column j , if $\text{cell}[i][j] = 0$
- Catch 2) for the first cell of row & column $\text{cell}[0][0]$, we'll use 2 variables fr and fc to know if first row / first column has to be set 0 or not -
- 3) Now we iterate over matrix again, $\text{matrix}[r][c]$
if $\text{matrix}[0][0] == 0$ or $\text{matrix}[0][c] == 0$
we set $\text{matrix}[r][c] = 0$
- 4) Based on value of fr & fc , we'll set first row / first column as 0.

TC: $O(m \times n)$

SC: $O(1)$

Q2: Reshape the matrix

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \quad r, c \\ 1, 4$$

$$m \times n = r \times c$$

$$2 \times 2 = 1 \times 4$$

1st Approach: Queue ✓

Queue 1 2 3 4

$$\underline{\underline{TC: O(M \times N)}}$$

$$\underline{\underline{SC: O(M \times N)}}$$

$$\begin{bmatrix} 1 & 2 & 3 & 4 \end{bmatrix} \quad \checkmark$$

$$\begin{bmatrix} 1 & 2 & 4 & 3 \end{bmatrix} \quad \times$$

First In First out

$$r \times c \quad \begin{bmatrix} 1 & 2 & 3 & 4 \end{bmatrix}$$

Stack

LIFO

(Last In First out)

2nd approach:

$$\begin{array}{ccc} 1 & 2 & 3 \\ 4 & 5 & 6 \end{array}$$

$$r=0 \quad c=0$$

3x2 matrix

r=0 c=0	1	2
r=1 c=1	3	4
r=2 c=2	5	6

Algorithm:

Start pushing elements in the resultant matrix directly. We start from a particular row & keep on incrementing the column number till we reach end of required columns. At that moment, we increment row & reset column no. to 0.

$$\underline{\underline{TC: O(m \times n)}}$$

$$\underline{\underline{SC: O(1)}}$$

3x4 matrix

C = total no. of columns

Approach:

00	01	02	03
10	11	12	13
20	21	22	23

1x4+2

$$\frac{\text{count}}{c} = \text{row}$$

$$\text{count} \% c = \text{column}$$

$$i * c + j$$

$$\checkmark \quad \frac{6}{4} = 1 \quad 6 \% 4 = 2 \quad [12]$$

$$\frac{11}{4} = 2 \quad 11 \% 4 = 3 \quad [23]$$

$$i, j \quad i * c + j$$

Q3: Flipping an image

$$\begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} \xrightarrow{\text{Flip}} \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} \xrightarrow{\begin{smallmatrix} (1 \leftrightarrow 0) \\ (0 \leftrightarrow 1) \\ \text{Reverse} \end{smallmatrix}} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & 0 \end{bmatrix} \rightarrow 100$$

$$\underline{i^{\text{th}} \text{ bit}} = \underline{n-i-1 \text{ bit}} \neq$$

(flip it).

(No operation)

$$\begin{array}{ccc} 0 & 1 & 2 \\ \boxed{1 & 0 & 1} \end{array} \rightarrow 101 \rightarrow \underline{0} \underline{1} \underline{0}$$

$$\begin{array}{ccc} \text{1st} & & \text{3rd} \\ \text{0} & & \text{0} \end{array}$$

i^{th}

$n-i-1$

$$\rightarrow 1101 \rightarrow 1011 \rightarrow 0100$$

$n=4$

$$\begin{array}{cccc} & \swarrow & & \searrow \\ 1 & 1 & 0 & 1 \\ \swarrow & & \searrow & \\ 0 & 1 & 2 & 3 \end{array} \rightarrow \underline{0} \underline{1} \underline{0} \underline{0}$$

$$i, n-i-1$$

$$(0, 3)$$

0 to $n/2$

$$\begin{array}{cc} 2 & 4-2-1 \\ & [2 \ 1] \\ 1 & 2 \\ & [2 \ 1] \\ \checkmark & [1 \ 2] \end{array}$$

(1, 2)

TC: $O(M \times N)$

SC: $O(1)$

$$\begin{array}{ccc|cc|c} 1 & 1 & 0 & 0 & 1 & 1 & 100 \end{array}$$

$$\begin{array}{ccc} 1 & 1 & 0 \\ \downarrow & & \downarrow \\ 1 & 0 & 0 \end{array} \rightarrow \begin{array}{ccc} 1 & 0 & 0 \end{array}$$

$$\begin{array}{c} 1 \\ \downarrow \\ 0 \end{array}$$

$$x \wedge 1 = \bar{x}$$

$$0 \wedge 1 = 1$$

$$1 \wedge 1 = 0$$

\oplus XOR operation

$$\begin{array}{ccc} 0 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{array}$$