No: _____ Date: __/__/____

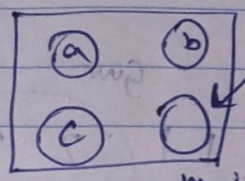
* Range Sum Query 2D - Immutable

range query ⇒ O(1)

$$\begin{bmatrix} 3 & 0 & 1 & 4 & 2 \\ 5 & 6 & 3 & 2 & 1 \\ 1 & 2 & 0 & 1 & 5 \\ 4 & 1 & 0 & 1 & 7 \\ 1 & 0 & 3 & 0 & 5 \end{bmatrix} \Rightarrow \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 3 & 0 & 1 & 4 & 2 \\ 0 & 5 & 6 & 3 & 2 & 1 \\ 0 & 1 & 2 & 0 & 1 & 5 \\ 0 & 4 & 1 & 0 & 1 & 7 \\ 0 & 1 & 0 & 3 & 0 & 5 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 3 & 3 & 4 & 8 & 10 \\ 0 & 8 & 14 & 18 & 24 & 27 \\ 0 & 9 & 17 & 21 & 28 & 36 \\ 0 & 13 & 22 & 26 & 34 & 44 \\ 0 & 14 & 23 & 30 & 38 & 58 \end{bmatrix}$$

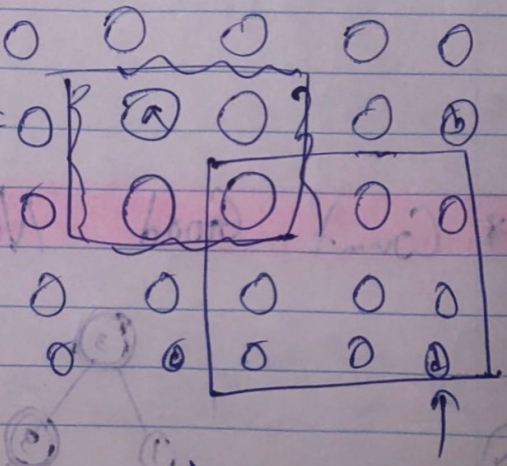
when we fill



$38 = 0 + 30 + 34 - 26$

$14 = 6 + 8 + 3 - 3$

Sum range → val = 0



$$val = d - c - b + a$$