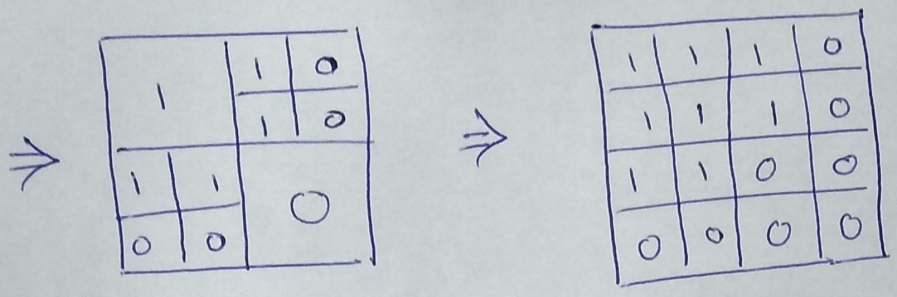
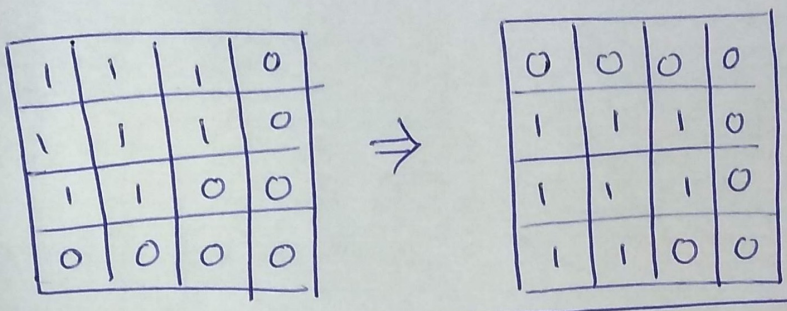
Q2> a) 1 (1001) 0 (1100)



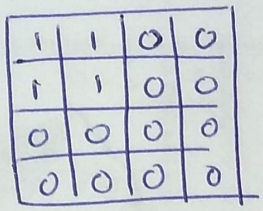
b) shift down;



quad tree ⇒ (0011)(0001)(1000) 1

c) No,

example:

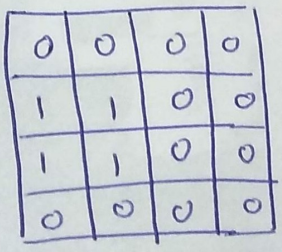


quadtree: 1 0 0 0

No. of 0s = 3

No. of 1s = 1

shift Down;



quadtree: (0011) 0 0 (1100)

No. of 0s = 6

No. of 1s = 4

2. **Question 2.**
Answer:

$$\begin{aligned}
\vec{x}_1^1 - \vec{x}_0^1 &= R\vec{x}_1^0 + \vec{T} - (R\vec{x}_0^0 + \vec{T}) \\
&= R(\vec{x}_1^0 - \vec{x}_0^0) \\
||\vec{x}_1^1 - \vec{x}_0^1||^2 &= (\vec{x}_1^1 - \vec{x}_0^1)(\vec{x}_1^1 - \vec{x}_0^1)^T \\
&= (R(\vec{x}_1^0 - \vec{x}_0^0))^T (R(\vec{x}_1^0 - \vec{x}_0^0)) \\
&= (\vec{x}_1^0 - x_0^0)^T R^T R(\vec{x}_1^0 - x_0^0) \\
&= (\vec{x}_1^0 - \vec{x}_0^0)^T (R^T R)(\vec{x}_1^0 - \vec{x}_0^0) \\
&= (\vec{x}_1^0 - \vec{x}_0^0)^T (\vec{x}_1^0 - \vec{x}_0^0) \\
&= ||\vec{x}_1^0 - \vec{x}_0^0||^2
\end{aligned}$$

Therefore, $||\vec{x}_1^1 - \vec{x}_0^1|| = ||\vec{x}_1^0 - \vec{x}_0^0||$.

4. There are several ways. the final region will be like the following.
Any reasonable answer is accepted.

0	0	1	2	0
0	0	1	2	3
0	0	0	2	3
0	0	4	3	3
0	0	4	4	3

Once you get the image, you can get vertices, the intersection point of more than 2 edges. So 6 vertices

5. $E = \sum_i \| \vec{x}_i' - (sR\vec{x}_i^{\circ} - \vec{T}) \|^2$