

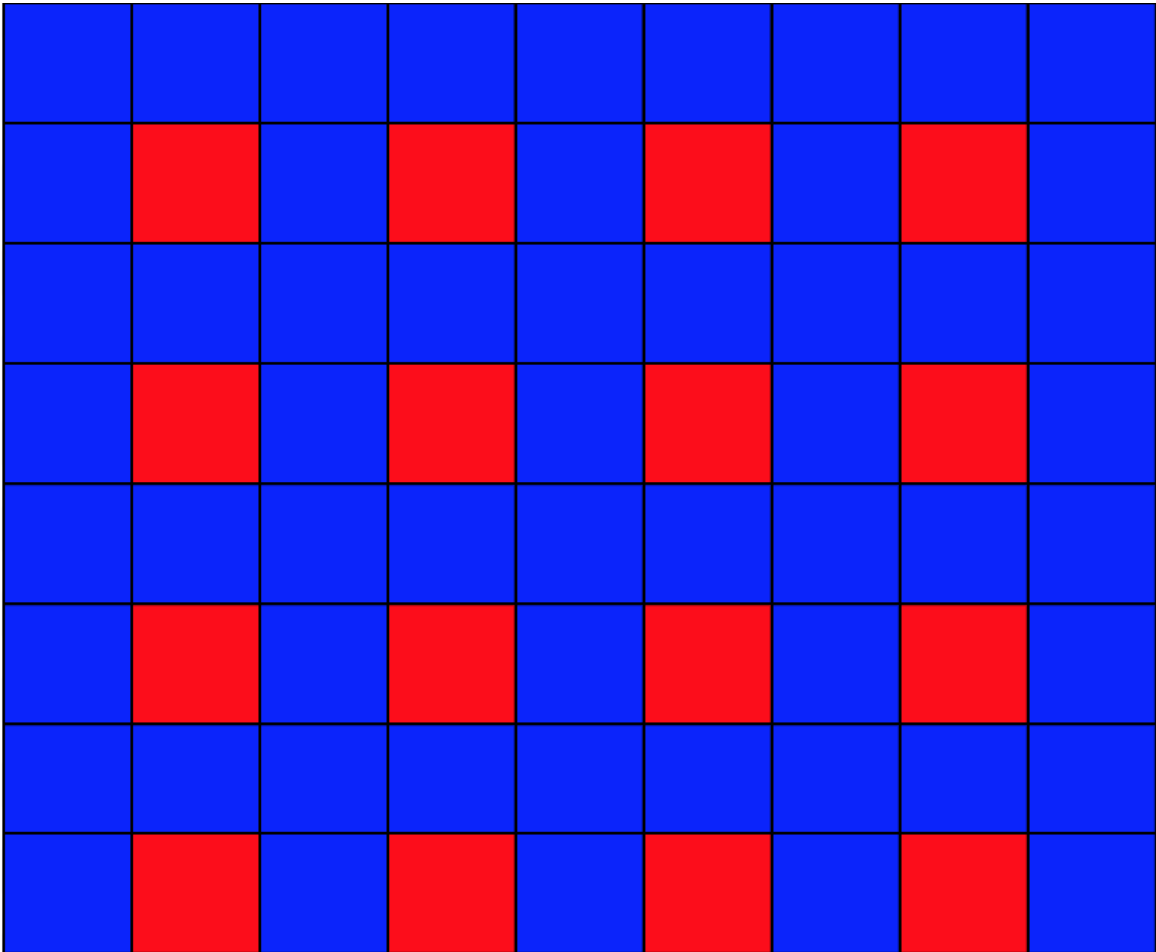
ASSIGNMENT 4

Neeraj Pandey

Discrete Mathematics

Q1. Can a 9 x 8 rectangle be covered by 1 x 6 rectangles? Justify your answer.

Solution: Let us make a 9 x 8 rectangle with blue color.



- We can represent the colors in the form of a vector:

$$\begin{bmatrix} \text{BLUE} \\ \text{RED} \end{bmatrix}$$

- From the image, we can see that the vector we have is:

$$\begin{bmatrix} 56 \\ 16 \end{bmatrix}$$

where 56 belongs to **Blue** color boxes and 16 belongs to **Red** color boxes.

- If we have to place 1 x 6 rectangles over the 9 x 8 rectangles, there are only two patterns:

$$\begin{bmatrix} 3 \\ 3 \end{bmatrix}$$

OR

$$\begin{bmatrix} 36 \\ 0 \end{bmatrix}$$

- Now, we can have two different patterns rectangles as **X** and **Y** respectively. if this is true, then it should cover all the 9 x 8 rectangle.

- So, the two matrix should be equal to the $\begin{bmatrix} 56 \\ 16 \end{bmatrix}$:

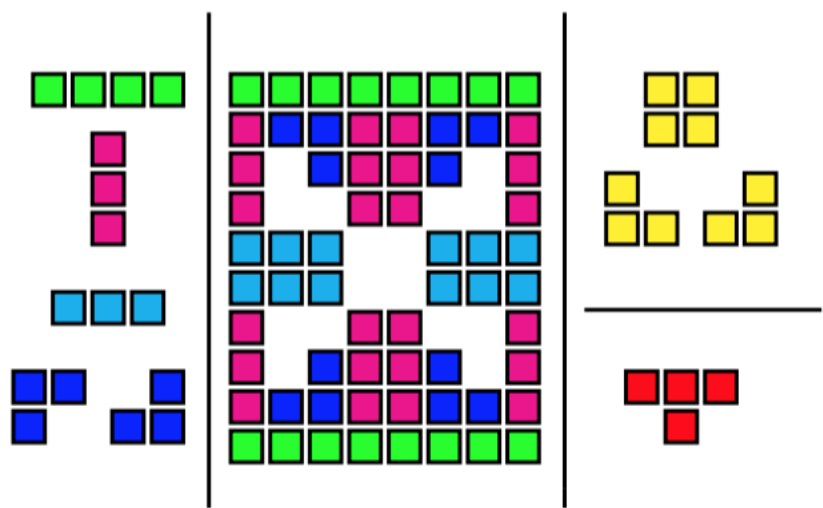
$$\mathbf{X} \begin{bmatrix} 3 \\ 3 \end{bmatrix} + \mathbf{Y} \begin{bmatrix} 36 \\ 0 \end{bmatrix} \Rightarrow \begin{bmatrix} 6\mathbf{X} + 3\mathbf{Y} \\ 3\mathbf{Y} \end{bmatrix} = \begin{bmatrix} 56 \\ 16 \end{bmatrix}$$

which means that, $3Y$ should be equal to 16

But, $3Y \neq 16$

This contradicts the above assumption and therefore, 1 x 6 rectangle cannot cover the 9 x 8 rectangle.

Q2. Consider the figure below:



A 10 x 8 rectangular floor (middle part in the figure) was made up of different type of tiles which is evident from the figure. After some years, some of these tiles got smashed (uncoloured region inside the floor). The original tiles which had covered uncoloured region of the floor are shown at the right side of the floor. But, these tiles are not available now. Instead, four T-tetromino tiles are available (shown in red colour) now. Can the floor be covered up by rearranging the remaining tiles along with four T-tetromino tiles?

Solution: Below is the image as the solution:

