Question 3.

$$X = \begin{bmatrix} 7 & 5 & 0 & 0 & 3 & 2 \\ 6 & 4 & 5 & 1 & 4 & 8 \\ 9 & 0 & 2 & 2 & 5 & 4 \\ 6 & 3 & 4 & 7 & 9 & 8 \\ 5 & 7 & 5 & 6 & 9 & 0 \\ 7 & 9 & 0 & 8 & 2 & 3 \end{bmatrix}$$ = Input

$$F = \begin{bmatrix} 1 & 0 & -1 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{bmatrix}$$ = Filter

3-1

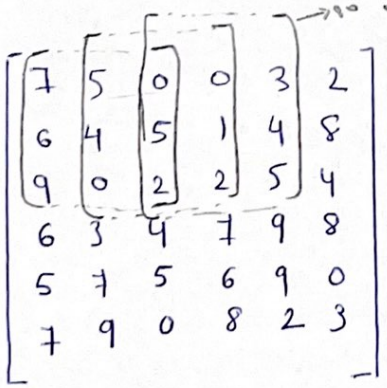
Dimension of input matrix = 6 x 6

Dimension of kernel / filter = 3 x 3

Total parameters in filter = 9

3.2 Output of activation map is calculated as follows :-

Consider 3 x 3 filter with stride 1 on X.



operated on filter

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

Each element of X is multiplied with corresponding element of F. The

values are then totaled.

$$\text{Output} = \begin{bmatrix} 7+12+9-10-2 & 5+8-2-7 & 10+2-3-8-5 & 2+2-2-16-4 \\ 6+18+6-5-4-4 & 4+3-1-4-7 & 5+4+4-4-10-9 & 1+4+7-8-8-8 \\ 9+12+5-2-8-5 & 6+7-2-14-6 & 2+8+5-5-18-9 & 2+14+6-4-16 \\ 6+10+7-4-10 & 3+14+9-7-12-8 & 4+10-9-18-2 & 7+12+8-8-3 \end{bmatrix}$$

$$\text{Output} = \begin{bmatrix} 16 & 9 & -4 & -18 \\ 17 & -5 & -10 & -12 \\ 11 & -9 & -17 & 2 \\ 9 & -1 & -15 & 16 \end{bmatrix}$$

3-3 : Applying max pooling to output from previous operation.

Lets consider a 2 x 2 max pooling with stride of 2.

$$\text{Output}_{2\times2} = \begin{bmatrix} \max\begin{bmatrix} 16 & 9 \\ 17 & -5 \end{bmatrix} & \max\begin{bmatrix} -4 & -18 \\ -10 & -12 \end{bmatrix} \\ \max\begin{bmatrix} 11 & -9 \\ 9 & 1 \end{bmatrix} & \max\begin{bmatrix} -17 & 2 \\ -15 & 16 \end{bmatrix} \end{bmatrix}$$

$$\text{Output after max pooling} = \begin{bmatrix} 17 & -4 \\ 11 & 16 \end{bmatrix}$$