Sheet 1

1.

a.
$$\begin{bmatrix} 5 & 10 & 10 & 10 & 5 \\ 5 & 5 & 0 & 0 & 5 \\ 5 & 5 & 0 & 0 & 5 \\ 5 & 5 & 0 & 0 & 5 \\ 5 & 10 & 10 & 10 & 5 \end{bmatrix}$$
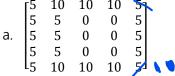
here we convolve and put the result in upper right pixel

This filter detects **horizontal** lines and smoothes the image.

b.
$$\begin{bmatrix} 5 & 5 & 5 & 5 & 5 \\ 10 & 5 & 5 & 5 & 10 \\ 10 & 0 & 0 & 0 & 10 \\ 10 & 0 & 0 & 0 & 10 \\ 5 & 5 & 5 & 5 & 5 \end{bmatrix}$$

This filter detects **vertical** lines and smoothes the image.

c.
$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 10 & 10 & 10 & 0 \\ 0 & 10 & 10 & 10 & 0 \\ 0 & 10 & 10 & 10 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

This is a **low-pass** filter that **blurs** the image.

d.
$$\begin{bmatrix} 0 & 0 & 10 & -25 & -15 & -25 \\ 0 & 0 & 15 & -15 & 0 & -15 \\ 10 & 15 & 20 & -20 & -15 & -25 \\ -25 & -15 & -20 & 20 & 15 & 10 \\ -15 & 0 & -15 & 15 & 0 & 0 \\ -25 & -15 & -25 & 10 & 0 & 0 \end{bmatrix}$$

This is a **high-pass** filter that **sharpens** the image.

e.
$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 10 \\ 0 & 0 & 0 & 0 & 15 & 10 \\ 0 & 0 & 0 & 15 & 15 & 10 \\ 0 & 0 & 15 & 15 & 15 & 10 \\ 0 & 15 & 15 & 15 & 15 & 10 \\ 10 & 10 & 10 & 10 & 10 & 5 \end{bmatrix}$$

This filter detects **diagonals** within the image having an **angle of 45°**.

f.
$$\begin{bmatrix} 0 & 0 & 0 & 5 & 5 & 5 \\ 0 & 0 & 5 & 5 & 10 & 5 \\ 0 & 0 & 5 & 10 & 10 & 10 \\ 5 & 5 & 10 & 10 & 15 & 10 \\ 5 & 10 & 10 & 15 & 15 & 10 \\ 5 & 5 & 10 & 10 & 10 & 10 \end{bmatrix}$$

This filter detects **diagonals** within the image having an **angle of -45°**.