1. Perform histogram equalization of the following 3-bit grayscale image whose gray level distribution is given as follows

Gray Level	0	1	2	3	4	5	6	7
No. of Pixels	8	4	12	3	5	10	2	2

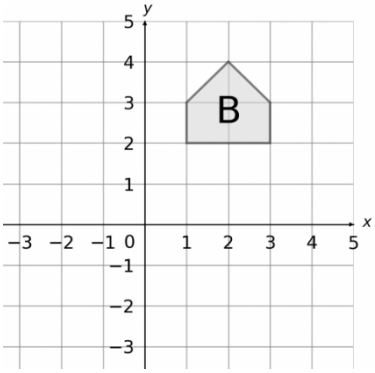
2. Perform histogram matching for above histogram using histogram of the following image

$$\begin{bmatrix} 4 & 4 & 4 & 4 & 4 \\ 3 & 4 & 5 & 4 & 3 \\ 3 & 5 & 5 & 5 & 3 \\ 3 & 4 & 5 & 4 & 3 \\ 4 & 4 & 4 & 4 & 4 \end{bmatrix}$$

3. Apply various filters such as mean, median, Sobel, Prewitt and LoG on the following image. Write the masks of all these filters.

$$\begin{bmatrix} 18 & 22 & 33 & 25 & 32 & 24 \\ 34 & 128 & 24 & 172 & 26 & 23 \\ 22 & 19 & 32 & 31 & 28 & 26 \end{bmatrix}$$

4. Translate following object by [-2, 3] and rotate it by 45° with respect to point (1,1). Compute the joint transformation matrix.



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

5. Apply i) region growing and ii) region splitting and merging algorithms on the given image (above matrix) for segmentation.
6. Given a 3x3 image matrix with pixel intensity values ranging from 0 to 255, apply the Sobel operator for edge detection in the horizontal direction and in the vertical direction. Provide the resulting gradient values at the location of [1,0].

12	2	0
30	100	40
2	2	111

(Input Image)

(b) Determine the direction of the gradient at [1,0] using the horizontal and vertical gradient values obtained.

(c) Given the gradient magnitude image and gradient directions obtained from the Sobel edge detection algorithm, apply non-maximum suppression at a specific location (1,0) in the image. Provide the resulting value after NMS at that location, considering the local neighborhood for suppression.

7. Explain all the steps in canny edge detection with suitable examples for all stage.

8. Derive the coefficients of various mask of 3x3 and 5x5 used in computer vision. Comment whether they are separable or not.

9. The following matrix represents binary image where 1s represent foreground (objects) and 0s represent background. You can apply a component labelling algorithm to this matrix to assign unique labels to connected components.

1	0	0	0	0	0	0	0	1	1	1	0
1	1	0	0	0	0	0	0	1	1	1	0
1	1	1	0	0	0	0	0	1	1	1	0
0	1	1	0	0	0	0	0	1	1	1	0
0	0	1	0	0	0	0	0	1	1	0	0
0	0	1	1	1	1	0	0	0	1	1	1
0	0	0	1	1	1	0	0	0	1	1	1
0	0	0	1	1	0	0	0	0	1	1	1

10. For the following image

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

i) Write the GCLM at 45°
ii) Find the Homogeneity from GLCM
iii) Find Correlation from GLCM