TOPIC: TRANSFORMATION & FILTERING

1. Given an image with the size of 8×8 and gray levels,

$$f(x,y) = \begin{bmatrix} 4 & 4 & 4 & 4 & 4 & 4 & 4 & 0 \\ 4 & 5 & 5 & 5 & 5 & 5 & 4 & 0 \\ 4 & 5 & 6 & 6 & 6 & 5 & 4 & 0 \\ 4 & 5 & 6 & 7 & 6 & 5 & 4 & 0 \\ 4 & 5 & 6 & 6 & 6 & 5 & 4 & 0 \\ 4 & 5 & 5 & 5 & 5 & 5 & 4 & 0 \\ 4 & 4 & 4 & 4 & 4 & 4 & 4 & 0 \\ 4 & 4 & 4 & 4 & 4 & 4 & 4 & 0 \end{bmatrix}$$

   (a) Compute r_k , n_k , $p_r(r_k)$, s_k and the rounded off values in a table.
   (b) Derive the new image, $f'(x,y)$.
   (c) Plot the histogram distribution for (i) before and (ii) after histogram equalization of the given image.
2. Perform histogram specification/matching based on given information of gray levels for both original and specified images.

r_k	0	1	2	3	4	5	6	7
Original	790	1023	850	656	329	245	122	81
Specified	0	0	0	614	819	1230	819	614

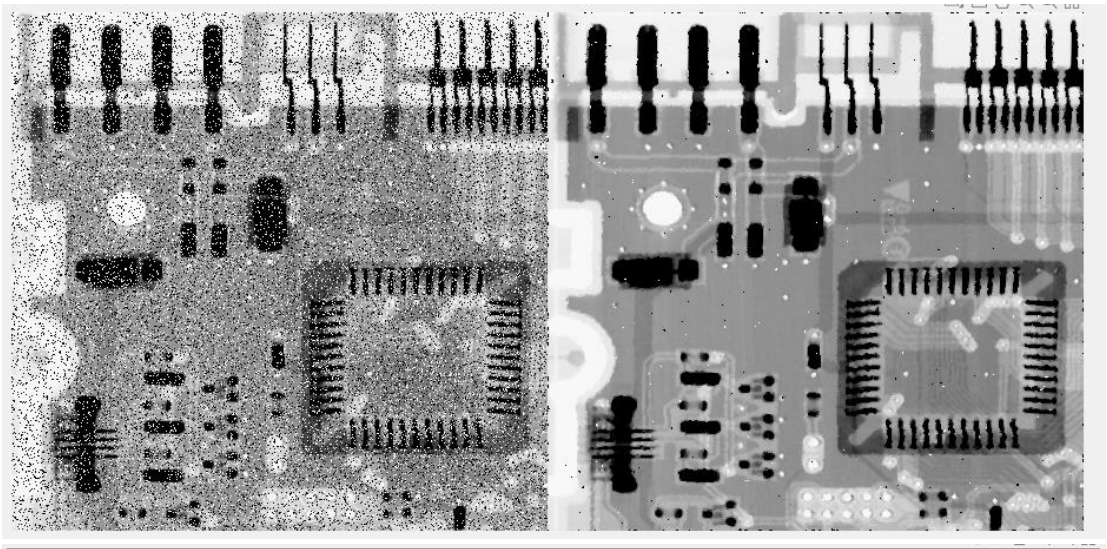
3. Explain the concept of Correlation and Convolution in a table based on a 3x3 filter.

4. You may use Matlab or any other tools you are comfortable to work with for this question. Based on images attached in the zip folder,
   (a) Demonstrate low-pass filter on (1).
   (b) Demonstrate high-pass filter on (2).

   Answers for (a) and (b) should be illustrated in a flow chart with explanation for each step, starting from input to output. You are required to include the mathematical equation/expression for the algorithm you choose and attach the screenshots of the codes. Sample outputs below can be used as references.

   Sample outputs:

(a)



(b)