The LNM Institute of Information Technology

ECE and CCE

ECE4141: Introduction to Image Processing

Mid Term

Time: 90 minutes **Date:** 04/10/2021 **Max. Marks: 30**

Instructions: *1) There are total of 6 questions and total marks is 30.*

Q1. [4]

Consider the image below. Show the results of 3×3 median filtering if the following masks are used. A "0" in a mask position means that the corresponding pixel is not used for median calculation.

$$\begin{matrix} 3 & 5 & 8 & 4 \\ 9 & 1 & 2 & 9 \\ 4 & 6 & 7 & 3 \\ 3 & 8 & 5 & 4 \end{matrix}$$

(a) $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ (c) $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

Perform the above question for all pixels in the 2nd row of the image.

Q2. [6]

Consider the histogram (2, 2, 4, 8, 16, 32, 64, 128), where the number of gray levels is 8. What is the output histogram of histogram equalization? Explain using the result how histogram equalization enhances the contrast of an image.

Q3. [4]

What happens to histogram if the least significant bit of every pixel is set to 0? Show with an example.

Q4. [5]

If you want to sharpen an image in frequency domain, what type of filters do you use? Explain an example of such a filter.

Q5. [5]

Explain how compression can be achieved using KL Transform (only steps).

Q6. [6]

Given following 4x4 image ,

8	4	4	5
6	8	2	2
8	6	5	4
1	6	5	3

Find output using Unsharp masking.