

## Department of Computer Science & Engineering

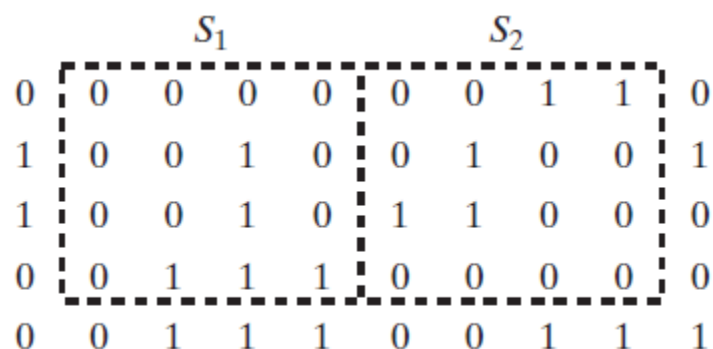
### Assignment – I

B.Tech CSE I & II

Subject : Fundamental of Digital Image Processing (Elective VIII)

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1. What do you mean by an image? Explain the concept of image processing and its applications
2. What are the fundamental steps in Digital Image Processing? Explain.
3. Explain the various components of image processing system.
4. Explain the structure of human eye.
5. How image is formed in eye? Consider an observer looking at a tree which is at distance 50m. If the height of the tree is 10m, find the size of the image formed in the retina.
6. Explain the important elements of image digitization.
7. How images are represented in digital form? Explain in detail
8. What is aliasing and Moire pattern? Explain
9. Write a note on spatial resolution and grey level resolution
10. What do you mean by zooming and shrinking of digital images? Explain the various techniques for zooming and shrinking
11. Explain the basic relationship between pixels:
  - a. Neighbours of a pixel
  - b. Connectivity
  - c. Adjacency
  - d. Path
  - e. Distance measure
12. Consider the two image subsets,  $S_1$  and  $S_2$ , shown in the following figure. For  $V=\{1\}$ , determine whether these two subsets are (a) 4-adjacent, (b) 8-adjacent, or (c) m-adjacent.



13. Consider the image segment shown below. Let  $V=\{0, 1\}$  and compute the lengths of the shortest 4-, 8-, and m-path between p and q. If a particular path does not exist between these two points, explain why.

	3	1	2	1 (q)
	2	2	0	2
	1	2	1	1
(p)	1	0	1	2

14. Consider the image segment of Q.no.13. Let  $V=\{1, 2\}$  and compute the lengths of the shortest 4-, 8-, and m-path between p and q. If a particular path does not exist between these two points, explain why.

15. Given below is image a 5x5 image, compute D4 and D8 distance between p and q

	3	2	4	3	1(q)
	0	4	4	3	2
	2	2	2	0	2
	2	2	1	1	1
(p)	1	0	1	0	3

16. Write a note on:

- (a) Image negatives
- (b) Thresholding
- (c) Log transformation
- (d) Power law (Gamma) transformation
- (e) Contrast stretching
- (f) Grey level slicing
- (g) Bit plane slicing

17. For the following binary image find the Dm distance between p and q

	0	1(q)
	0	1
(p)	1	

18. Obtain the digital negative of the following 8 BPP image:

121	205	217	156	151
139	127	157	117	125
252	117	236	138	142
227	182	178	197	242
201	106	119	251	240

19. Perform intensity level (grey level) slicing on 3 BPP image. Let  $r_1=3$  and  $r_5=5$ . Draw the modified image using background and without using background.

2	1	2	2	1
2	3	4	5	2
6	2	7	6	0
2	6	6	5	1
0	3	2	2	1

20. Using transformation function:

$$S=T(r)=0.75r \quad 0 < r < 5$$

$$= 1.1r \quad 5 \leq r < 10$$

$$= 0.9r \quad 10 \leq r \leq 75$$

15	14	13	11	10
10	11	12	13	14
2	3	2	3	0
0	0	5	6	7
7	8	9	10	15

Obtain the contrast stretched image from given image

21. What is histogram? Explain in detail.

22. Write a note on :

- |                            |                               |
|----------------------------|-------------------------------|
| a) Histogram stretching    | b) Histogram equalization     |
| c) Histogram specification | d) Local histogram processing |

23. Consider the following image of size  $5 \times 5$ . Construct the histogram and calculate average value of the intensities.

1	1	2	3	4
4	2	3	3	7
6	5	4	4	2
1	1	1	3	5
0	0	0	3	4

24. Suppose that  $64 \times 64$ , 8 level image has the following gray level distribution:

$R_k$	0	1	2	3	4	5	6	7
$N_k$	600	750	940	425	350	250	210	571

Modify image with histogram equalization

25. For the given grey levels and number of pixels, perform histogram stretching so that new

image has dynamic range of [0,7]

$R_k$	0	1	2	3	4	5	6	7
$N_k$	0	0	50	60	50	20	10	0

26. For the given histogram, what happens when we equalize it twice:

<b>Grey levels</b>	0	1	2	3
<b><math>n_k</math></b>	70	20	7	3

27. Consider 64 x 64 image with 8 grey levels with grey level distribution given in table 1. The desired histogram is given in table 2. Using histogram specification method, obtain the histogram of resulting image

Table 1		Table 2	
$R_k$	$N_k$	$Z_k$	$N_k$
r0	779	z1	0.02
r1	999	z2	0.05
r2	855	z3	0.16
r3	669	z4	0.27
r4	330	z5	0.27
r5	237	z6	0.16
r6	135	z7	0.05
r7	92	z8	0.02

28. What is convolution and correlation? Explain with suitable example.

29. Let  $f(x)$  and  $h(x)$  are given below :

$$f(x) = 0 \ 0 \ 0 \ 1 \ 0 \ 0 \ 0 \ 0$$

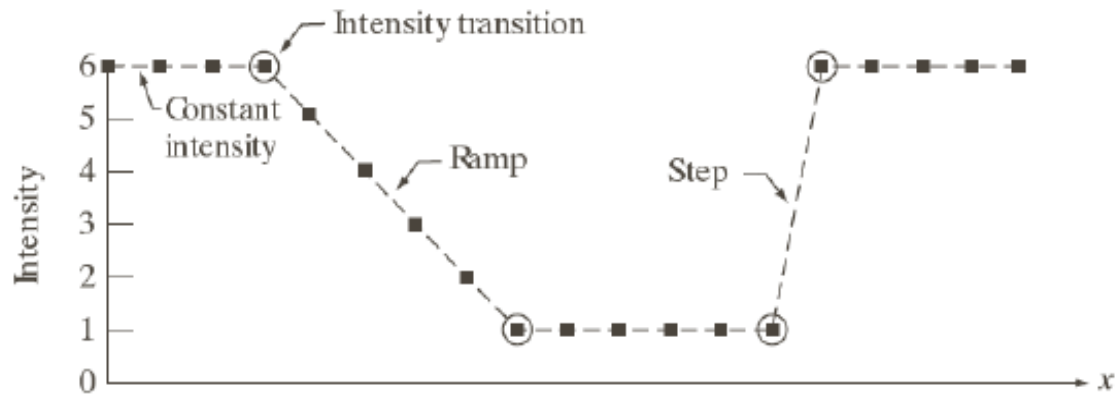
$$h(x) = 1 \ 2 \ 3 \ 2 \ 8$$

Obtain the result of convolution and correlation of  $f(x)$  with  $h(x)$ .

30. Define image smoothing? When it is required? Explain the various ways used for smoothing the images in spatial domain

31. Discuss the spatial filtering methods for image sharpening

32. Define first order derivative and Second order derivative. For the given diagram find the first order derivative and second order derivative and represent it in the form of horizontal intensity profile



33. Give the following masks of size 3 x 3 and state their usefulness in image processing:

- a) Sobel operator                      b) Laplacian operator                      c) Smoothing operator

34. What are the various ways used for smoothing and sharpening the images in frequency domain?

35. Write a short note on Discrete Fourier Transform

36. Find the DFT of :

a)  $x(n) = \{0, 1, 2, 1\}$

b)  $\begin{bmatrix} 0 & 1 & 2 & 1 \\ 1 & 2 & 3 & 2 \\ 2 & 3 & 4 & 3 \\ 1 & 2 & 3 & 2 \end{bmatrix}$

37. Explain the following properties of DFT:

- a) Separable property                      b) Translation                      c) Conjugate symmetry  
d) Rotation                      e) Periodicity                      f) Convolution                      g) Correlation  
h) Scaling                      i) Addition and multiplication

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Subject Incharge

B.tech. CSE I & II