(b) Describe the types of data redundancies present in an image. Explain the methods to remove these redundancies. (5)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1194 **C**

Unique Paper Code : 32347509

Name of the Paper : Digital Image Processing

Name of the Course : **B.Sc. (H) Computer Science (CBCS-LOCF): DSE II**

Semester : V [Year of Admission of 2019, 2020, 2021]

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Do any **four** questions from **Section B**.

Section – A

1. (a) If we want to resize a 1024 × 768 image to one that is 600 pixels wide with the same aspect ratio as the original, what should be the height of the resized image? (3)

(b) What does the weber ratio imply? Draw the plot of weber ratio as a function of intensity. (3)

(c) Explain Isopreference curve with its application and suitable example. (3)

(d) Give the three steps typically performed for edge detection. (3)

(e) What is the significance of sampling? How is the resolution of an image affected by sampling? (3)

(f) Justify the statement "Median filter is an effective tool to minimize Salt and Pepper noise" for the following image : (4)

24	22	33	25	22	24
34	255	24	0	26	23
23	21	32	31	28	26

(g) What are blurring and ringing effects? A sub-image, $f(m, n) = \begin{bmatrix} 4 & 2 \\ 5 & 8 \end{bmatrix}$ is passed through the

(ii) Geometric mean

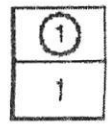
(iii) Harmonic mean

(iv) Min

7. (a) Perform the opening operation on the following 10×10 image : (5)

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

Use the structuring element as given below :



Use the two structuring elements as given below :

$B_1 =$ | 0 | 0 | 0 |
|---|---|---|
| 0 | (1) | 0 |
| 0 | 1 | 0 |

$B_2 =$ | 0 | 1 | 0 |
|---|---|---|
| 0 | (0) | 0 |
| 0 | 0 | 0 |

(6)

(b) Write a short note on line detection. (4)

6. (a) Calculate the Huffman code, coding efficiency, and code redundancy for the following data: (6)

F=[aaabbaaacccbddeeeccddffeddcdddd].

(b) Given below is a 3×3 image : (4)

1	7	5
6	2	3
1	4	2

What would be the value of the center pixel when this image is passed through the following filters :

(i) Arithmetic mean

linear filter, $h(m, n) = \frac{1}{2}\begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$. What is the resultant image? (Assume zero padding) (4)

(h) Explain the term brightness adaptation with example. If an observer is looking at a lamp-post which is at a distance of 50 meters and the height of the lamp-post is 10 meters then, find the size of the image formed in the retina. (4)

(i) Explain how noise and illumination effect the performance of the thresholding technique for image segmentation. (4)

(j) Compare point processing and mask processing operations for image enhancement. (4)

Section – B

2. (a) Explain how the low pass Gaussian filter kernel is used for image smoothening. Compare its performance with that of a box filter kernel. (5)

(b) Find the Discrete Fourier transform (DFT) of the following image : (5)

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

3. (a) What happens when we equalize the given histogram twice? (6)

Gray Level	0	1	2	3
Number of pixels	70	20	7	3

(b) Briefly explain the following terms : (4)

(i) Adjacency

(ii) Connectivity

(iii) D4

(iv) D8

4. (a) Explain and write the Probability Density Function (PDF) for the following noise models : (6)

(i) Gaussian Noise

(ii) Erlang Noise

(b) Explain how the Ideal filter is used for image smoothening and image sharpening. (4)

5. (a) Given the following 7×7 image, use the hit-or-miss transform to find the top edge of the 5×5 square formed with all pixel values equal to 1.

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