MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

SEVENTH SEMESTER B.TECH. (INSTRUMENTATION AND CONTROL ENGG.)
END SEMESTER DEGREE EXAMINATIONS, JANUARY - 2021

SUBJECT: Digital Image Processing [ICE 4021]

TIME: 3 HOURS
27-01-2021
MAX. MARKS: 50

**Instructions to candidates :*Answer ALL questions and missing data may be suitably assumed.***

1A. With an example for each, explain any four components of general purpose image processing system.

1B. Define following terms: i) Connectivity ii) Spatial resolution

1C. Explain the significance of illumination and reflectance components in the process of object recognition.

(4+2+4)

2A. If the following kernel is separable, find w_1 and w_2 such that $w = w_1 \star w_2$.

$$w = \begin{bmatrix} 2 & 1 & 1 \\ 4 & 2 & 2 \end{bmatrix}$$

2B. How is image averaging used for noise reduction in images? Write an important application of image averaging.

2C. The two images shown in the following figure are quite different, but their histograms are the same. Suppose that each image is blurred using 3 X 3 box kernel (assume image size is 256 X 256).
a)   Would the histogram of the blurred images still be equal? Explain.
b)   If your answer is no, either sketch the two histograms or give two tables detailing the histogram component.
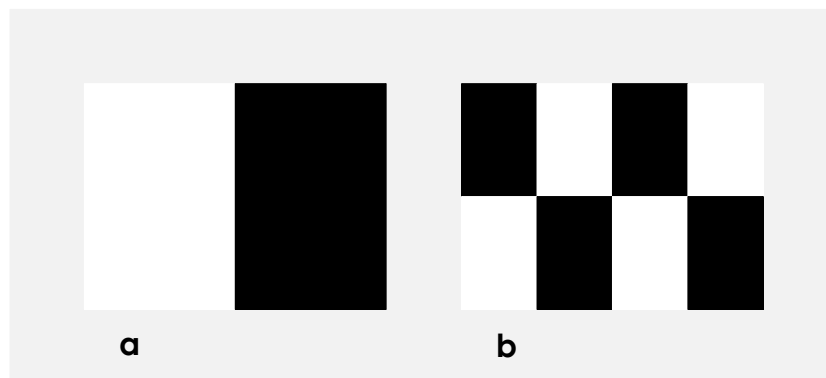
(2+3+5)

3A. What is median filter? How does it function? Why are median filters popular in image processing as compared to other order-statistics filters?

3B. Explain the following,

i) Bit-plane slicing ii) Local histogram processing

3C. With example, discuss the correspondence between filtering in the spatial and frequency domains.

(2+3+5)

4A. Compute the difference between the adjacent pixels to create new difference image of given 8-bit image. What is the entropy of new difference image?

21	21	21	95	169	243	243	243
21	21	21	95	169	243	243	243
21	21	21	95	169	243	243	243
21	21	21	95	169	243	243	243

4B. With an example, explain spatial and temporal redundancy.

4C. Use arithmetic coding to decode the message 0.068 with the help of following subintervals. Also explain how arithmetic coding address the finite precision arithmetic practically.

$$1.0 \quad 0.8 \qquad\qquad 0.4 \qquad 0.2 \quad 0.0$$
$$\alpha_4 \qquad \alpha_3 \qquad \alpha_2 \quad \alpha_1$$

(3+2+5)

5A. How to locate the region of interest using connected component analysis? Explain.

5B. Explain edge enhancement technique using the gradient.

5C. Discuss future healthcare systems to analyse medical images of different modalities.

(3+3+4)

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