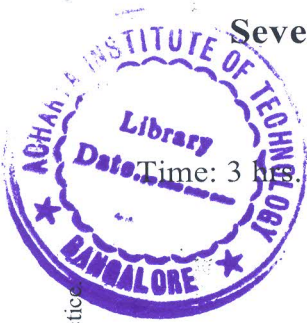USN ☐☐☐☐☐☐☐☐☐☐

10EC763

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020

Image Processing

Time: 3 hrs.

Max. Marks:100

**Note: *Answer any FIVE full questions, selecting
at least TWO questions from each part.***

PART – A

1 a. Define a digital image. With neat diagram, explain the components of image processing system. **(10 Marks)**

   b. Briefly explain:
   i)   Brightness adaptation and discrimination
   ii) Weber ratio
   iii) Mach bands **(10 Marks)**

2 a. Explain in detail the image acquisition using the three principal sensor arrangements. **(10 Marks)**

   b. Consider the two image subsets, S_1 and S_2, shown in the Fig.Q2(b). For $V = \{1\}$, determine and explain whether these are (i) 4-adjacent (ii) 8-adjascent (iii) m-adjacent.
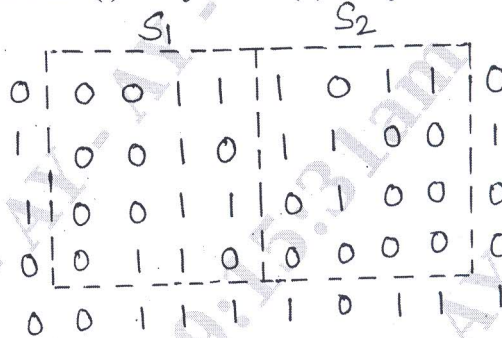

$$
\begin{array}{cccc|cccc}
 & S_1 & & & & S_2 & & \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
\end{array}
$$

Fig.Q2(b)   **(06 Marks)**

   c. Consider the image shown in Fig.Q2(c). Let $V = \{1, 2\}$
   (i) compute length of shortest m-path
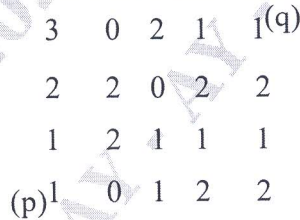   (ii) compute D_4 distance between the points p and q.

$$
\begin{array}{ccccc}
3 & 0 & 2 & 1 & 1^{(q)} \\
2 & 2 & 0 & 2 & 2 \\
1 & 2 & 1 & 1 & 1 \\
^{(p)}1 & 0 & 1 & 2 & 2 \\
\end{array}
$$

Fig.Q2(c)   **(04 Marks)**

3 a. Define unitary transforms. Explain the properties of unitary transforms. **(06 Marks)**

   b. Calculate the transformed image V and the basis images for the orthogonal matrix A and image U.

$$A = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix} \qquad U = \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$$ **(06 Marks)**

   c. Explain in brief the following properties of 2D – Discrete Fourier Transforms:
   (i) Separability   (ii) Translation **(08 Marks)**

4 a. Define 2-D forward and inverse discrete cosine transform, and mention its properties.

(08 Marks)

b. Generate 8 × 8 Hadamard transform matrix. The core matrix $H_1 = \dfrac{1}{\sqrt{2}}\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$ indicate its sequency.

(04 Marks)

c. Explain Haar transformation with its properties. Compute Haar transformation of image $F = \begin{bmatrix} 3 & -1 \\ 6 & 2 \end{bmatrix}$.

(08 Marks)

PART – B

5 a. With necessary graphs, explain the spatial enhancement operations:
i) Power law transformation
ii) Gray level slicing
iii) Contrast stretching
iv) Bit plane slicing

(12 Marks)

b. Derive the equation for histogram equalization.

(08 Marks)

6 a. Explain with a block diagram, the basic steps for image filtering in frequency domain.

(08 Marks)

b. Explain highpass butterworth filter.

(06 Marks)

c. List the steps involved in homomorphic filtering.

(06 Marks)

7 a. Explain the basic model for image degradation/restoration process.

(06 Marks)

b. Explain inverse filtering with necessary equations.

(06 Marks)

c. Explain any four noise models with necessary equations and graphs.

(08 Marks)

8 a. Explain different color models.

(10 Marks)

b. Explain pseudo coloring.

(06 Marks)

c. How many minutes it will take to transmit a 1024 × 1024 colour image with 256 shades of RGB. Assume 56 Kbps modem is used for transmission?

(04 Marks)

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