Seventh Semester B.E. Degree Examination, June 2012
Image Processing

Time: 3 hrs. Max. Marks: 100

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

PART – A

1. a. With a neat block diagram, describe various components used in general purpose image processing system. (10 Marks)
   b. Describe briefly the principle of image formation in human eye. (05 Marks)
   c. “Perceived brightness is not a simple function of intensity”. Why? (05 Marks)

2. a. What is image sampling and quantization? What are the different parameters which will decide the number of storage bits of the image in discrete domain? (10 Marks)
   b. Find \( D_3 \) and \( D_{31} \) for the following 2-D section with \( V = \{0, 1\} \) and \( V = \{1, 2\} \) between \( p \) and \( q \).

\[
\begin{array}{ccccccc}
5 & 4 & 3 & 1 & 1 & (q) \\
5 & 4 & 0 & 2 & 0 \\
3 & 2 & 0 & 2 & 4 \\
2 & 1 & 1 & 3 & 5 \\
1 & 3 & 5 & 1 & 3 \\
\end{array}
\]

(05 Marks)

c. Explain the process of image acquisition using single sensor. (05 Marks)

3. a. Explain any four properties of two dimensional Fourier transform. (08 Marks)
   b. Prove that if an image \( f(m, n) \), \( 0 \leq m \leq M - 1 \) and \( 0 \leq n \leq N - 1 \), is multiplied by the checkerboard pattern \( (-1)^{m+n} \), then its DFT is centred at \( (M/2, N/2) \). (06 Marks)
   c. Write four properties of Hadamard transform. (06 Marks)

4. a. Compute discrete cosine transform matrix for \( N = 4 \). (10 Marks)
   b. Compute the basis of the KL transform for the input data \( x_1 = (1, 4, 5)^T \), \( x_2 = (3, 2, 5)^T \), \( x_3 = (5, 7, 6)^T \) and \( x_4 = (6, 7, 7)^T \). (10 Marks)

PART – B

5. a. Perform histogram equalization for the following image data, Fig.Q.5(a). Sketch the histogram of the original image and histogram of equalized image. (10 Marks)

<table>
<thead>
<tr>
<th>( n_k )</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n_k )</td>
<td>790</td>
<td>1023</td>
<td>850</td>
<td>656</td>
<td>329</td>
<td>245</td>
<td>122</td>
<td>81</td>
</tr>
</tbody>
</table>

Fig.Q.5(a)

b. What is the importance of image enhancement in image processing? Explain in brief any two point processing techniques implemented in image processing. (10 Marks)

6. a. What is homomorphic filtering? Explain the filtering approach with a block diagram. Indicate where this filter is used and the effect of using these filters images. (10 Marks)
   b. Write short notes on Weiner filtering and inverse filtering. (10 Marks)

7. a. Discuss various mean filters and order statistics filters in image restoration system. (10 Marks)
   b. Justify the statements “median filter is an effective tool to minimize salt and pepper noise” using the following image segment below:

\[
\begin{array}{cccccc}
24 & 22 & 33 & 25 & 32 & 24 \\
34 & 255 & 24 & 0 & 26 & 23 \\
23 & 21 & 32 & 31 & 28 & 26 \\
\end{array}
\]

(10 Marks)

8. a. Explain the pseudo color image processing with neat functional block diagram. (10 Marks)
   b. Discuss briefly the HSI color model and RGB color model used in color image processing. (10 Marks)

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