Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058, India
(Autonomous College Affiliated to University of Mumbai)

ESE Examination

Max. Marks: 100 | Dec 2023 | Duration: 3 Hrs.

Class: B.E. (VII) Computer + IT | Course Code:

Name of the Course: Digital Image Processing (DIP)

Instructions:

(1) All questions are compulsory
(2) Draw neat labelled diagrams
(3) Keep your answers clear and concise in order to maximize your points.
(4) Assume suitable data if necessary but justify the same
(5) State all of your assumptions carefully if any

<table>
<tr><th>Q.No.</th><th>Questions</th><th>Max Marks</th><th>CO-BL</th></tr>
<tr><td>Q.1 (a)</td><td>Apply histogram equalization on the image data given below.

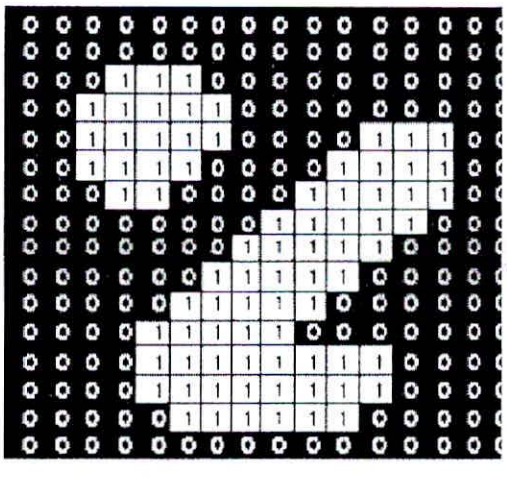
Construct the original and equalised histogram and analyse the same.

<table>
<tr><td>Gray Levels</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>No. of Pixels</td><td>100</td><td>50</td><td>200</td><td>80</td><td>70</td><td>200</td><td>140</td><td>160</td></tr>
</table>
</td><td>10</td><td>1,2-4</td></tr>
<tr><td>(b)</td><td>Apply sobel edge operators/kernels to the image given below.

<table>
<tr><td>10</td><td>50</td><td>10</td><td>50</td><td>10</td></tr>
<tr><td>10</td><td>55</td><td>10</td><td>55</td><td>10</td></tr>
<tr><td>10</td><td>65</td><td>10</td><td>65</td><td>10</td></tr>
<tr><td>10</td><td>50</td><td>10</td><td>50</td><td>10</td></tr>
<tr><td>10</td><td>55</td><td>10</td><td>55</td><td>10</td></tr>
</table>
</td><td>10</td><td>2-3</td></tr>
</table>

Q.2(a)	Apply the region splitting technique on the below given image. Draw the quadtree. Assume: Condition of threshold ≤ 3	10	2,5-3
(b)	Differentiate between Dilation and Erosion. Apply erosion and dilation on the image given below, use given 3*3 structuring element. Analyse the output images. OR Apply opening and closing operation on the image given below, use given 3*3 structuring element	4+10 7+7	2-4

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



(a)

<table>
<tr><td></td><td>1 1 1
1 1 1
1 1 1
(b)

Figure 1 (a) Input Image and (b) structuring element</td><td></td><td></td></tr>
<tr><td>Q.3(a)</td><td>Derive the 4*4 DCT matrix. Comment on symmetry</td><td>8</td><td>3-4</td></tr>
<tr><td>(b)</td><td>Derive Hadamard transform using the principle of Kronecker product and find sequency of each row of derived matrix.

OR

Derive Walsh transform.</td><td>8</td><td>3-4</td></tr>
<tr><td>Q.4(a)</td><td>For the given below input image

i. Construct huffman code
ii. Find the Average length
iii. Find the Entropy, H(s)
iv. Find the efficiency

<table><tr><td>1</td><td>2</td><td>5</td><td>7</td></tr><tr><td>2</td><td>3</td><td>5</td><td>7</td></tr><tr><td>7</td><td>2</td><td>1</td><td>3</td></tr><tr><td>6</td><td>4</td><td>7</td><td>1</td></tr></table></td><td>10+2+
2+2</td><td>4,5-4</td></tr>
<tr><td>(b)</td><td>i. How to achieve image compression ?
ii. What are different types of redundancies in digital image? Explain Psychovisual Redundancy.</td><td>2+1+5</td><td>4-4</td></tr>
<tr><td>Q.5(a)</td><td>Differentiate between Inter and Intra Frame Compression</td><td>8</td><td>1,4-4</td></tr>
<tr><td>(b)</td><td>Why do we need digital video format standards? List a few standards.</td><td>4+4</td><td>1,4-3</td></tr>
</table>