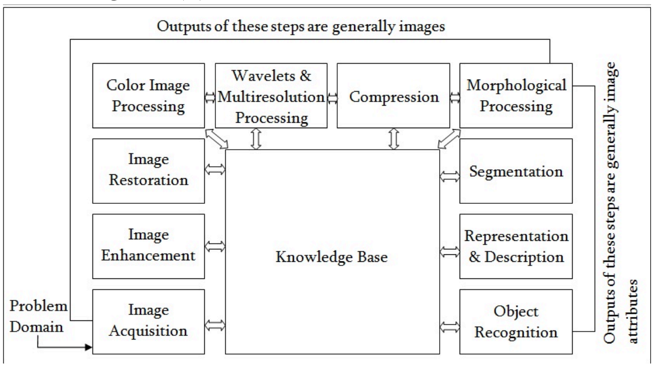
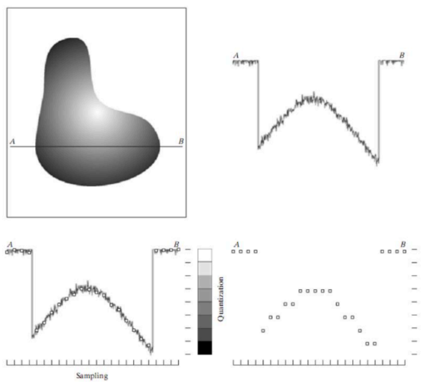
USN

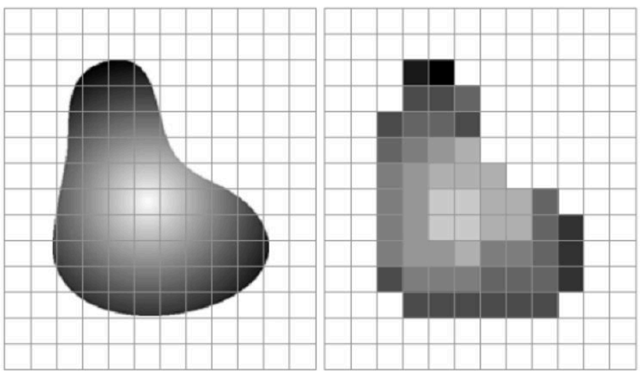
Internal Assessment Test 1 – Oct 2023
Solution and Scheme

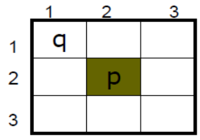
Sub:	Digital Image Processing			Sub Code:	18CS741	Branch:	CSE
Date:		Duration:	90 mins	Max Marks:	50	Sem / Sec:	7(A,B,C)	OBE

	Answer any FIVE FULL Questions	MARKS	CO	RBT
1	Explain the fundamental steps in digital image processing with a neat a block diagram sol: fundamental steps involved (4) block diagram (1)	5	1,2	L2
	Explain the concept of sampling and quantization sol: sampling explanation(2.5)- Digitizing the co-ordinate value is called sampling quantization explanation(2.5)- Digitizing the amplitude value is called quantization	5	1,2	L2







<table>
<tr>
<td>2</td>
<td>Briefly explain the following terms.
Sol:
a) Neighbors of a pixel(2)- 4-neighbours of p : N4(p), diagonal-neighbours of p : ND(p), 8-neighbours of p : N8(p)
b) Adjacency types and connectivity(2)- 4-adjacency, 8-adjacency, m-adjacency(mixed adjacency)
c) Distance function(1)
d) Euclidean distance(1)
e) City block distance(1)</td>
<td>7</td>
<td>1,2</td>
<td>L2</td>
</tr>
<tr>
<td></td>
<td>Compute the following distance between the two pixels using the three distances :
sol:
q :(1,1) p : (2,2)


a) Euclidean distance (1)
$D_e(p,q)=[(x-s)^2+(y-t)^2]^{1/2}$
b) City block distance(1)
$D(p,q)=|x-s|+|y-t|$
c) Chessboard distance(1)

$D(p,q)= \max(|x-s|,|y-t|)$</td>
<td>3</td>
<td></td>
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<tr>
<td>3</td>
<td>Consider the image segment shown,
3 1 2 1(q)
2 2 0 2
1 2 1 1
(p)1 0 1 2
Let V={1,2}. Compute the length of the shortest 4,8 and m-path between p and q.
Sol:
Finding shortest path(10)
4PATH= (x+1,y),(x-1,y),(x,y+1),(x,y-1)
8PATH=(x+1,y+1),(x+1,y-1),(x-1,y+1),(x-1,y-1)
m-path=
if q is in $N_4(p)$
Or q is in $N_D(p)$ and N4(p) intersection N4(q) has no pixels</td>
<td>10</td>
<td>1,2</td>
<td>L3</td>
</tr>
<tr>
<td>4</td>
<td>Explain piecewise-linear transformation function
Sol:
• Explanation(1)
• contrast stretching(3)
• threshold (3)
• bit plane slicing(3)</td>
<td>10</td>
<td>1,2</td>
<td>L2</td>
</tr>
<tr>
<td>5</td>
<td>Define normalized histogram
Sol :
definition (2)</td>
<td>2</td>
<td>1,2</td>
<td>L2</td>
</tr>
<tr>
<td></td>
<td>Consider a 3 bit image (L=8) of size 64x64 pixels (MN=4096) with the intensity distribution given in the table. Perform histogram equalization.
<table>
<tr><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>790</td><td>1023</td><td>850</td><td>656</td><td>329</td><td>254</td><td>122</td><td>81</td></tr>
</table>

Sol:
equalization (8)</td>
<td>8</td>
<td>1,2</td>
<td>L3</td>
</tr>
</table>

Suppose that a 3-bit image (L=8) of size 64 × 64 pixels (MN = 4096) has the intensity distribution shown in following table.
Get the histogram equalization transformation function and give the $p_s(s_k)$ for each s_k.

r_k	n_k	$p_r(r_k) = n_k/MN$
$r_0 = 0$	790	0.19
$r_1 = 1$	1023	0.25
$r_2 = 2$	850	0.21
$r_3 = 3$	656	0.16
$r_4 = 4$	329	0.08
$r_5 = 5$	245	0.06
$r_6 = 6$	122	0.03
$r_7 = 7$	81	0.02

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$r_4 = 4$	329	0.08
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$r_6 = 6$	122	0.03
$r_7 = 7$	81	0.02

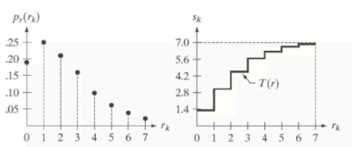
$$s_0 = T(r_0) = 7\sum_{j=0}^{0} p_r(r_j) = 7 \times 0.19 = 1.33 \quad \rightarrow 1$$

$$s_1 = T(r_1) = 7\sum_{j=0}^{1} p_r(r_j) = 7 \times (0.19 + 0.25) = 3.08 \quad \rightarrow 3$$

$s_2 = 4.55 \rightarrow 5$ $\qquad$ $s_3 = 5.67 \rightarrow 6$

$s_4 = 6.23 \rightarrow 6$ $\qquad$ $s_5 = 6.65 \rightarrow 7$

$s_6 = 6.86 \rightarrow 7$ $\qquad$ $s_7 = 7.00 \rightarrow 7$



a b c
FIGURE 3.19 Illustration of histogram equalization of a 3-bit (8 intensity levels) image. (a) Original histogram. (b) Transformation function. (c) Equalized histogram.

6	Explain smoothing spatial filters in detail. Sol: Filters Explanation(10) **Use:** for blurring and noise reduction. **Type of smoothing filters:** 1.Standard average 2. Weighted average. 3. Median filter	10	1,2	L2