



VIT

Vellore Institute of Technology
(Recognized by the University under section 3 of UGC Act, 1956)
CHENNAI

Reg. Number: _____

Continuous Assessment Test (CAT) – I - JAN 2025

Programme	: B.Tech[CSE]	Semester	: Winter 24-25
Course Code & Course Title	: BCSE403L- Digital Image Processing	Class Number	: CH2024250502017
Faculty	: Dr.Sridhar Ranganathan	Slot	: A1+TA1
Duration	: 1½ Hours	Max. Mark	: 50

General Instructions:

Write only your registration number on the question paper in the box provided and do not write other information.

Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks
1	[a]	<p>VIT PCB TESTER Limited is a technology company that is beginning to examine use of Digital image processing techniques to detect the following types of faults in Electronic Printed Circuit Boards:</p> <p>[a] Short circuit between two points</p> <p>[b] Missing Components</p> <p>So far this activity has been done using Manual testers who manually examine PCB under microscope and declare it Faulty or Good. The company is entrusting you with the task of designing a Digital Image processing based Visual examination system that will be provided with a reference image of a correct PCB and the image of the next PCB that should be visually examined. Draw a diagram indicating the components of such a Digital image processing system and explain the functionality. The system should read the unique serial number on the PCB and after automated comparison with the Reference PCB write out the defects to a Text file with data [serial number, GOOD/DEFECTIVE, List of defects]. The examined PCB images also need to be stored in a Server. [10 marks]</p>	15
	[b]	<p>Explain the two arithmetic and one logical operations that could be used for Comparison of the images of reference PCB with the image of the PCB that is being examined. [5 marks]</p>	

2		<p>[a] Compute the Euclidean distance D_e, City block distance D_4, and Chessboard distance D_8 between p and q (2+2+1 Marks)</p> <div style="display: flex; align-items: center; margin: 10px 0;"><table style="border-collapse: collapse; text-align: center;"><tr><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><div style="margin-left: 10px;">(q)</div></div> <div style="display: flex; align-items: center; margin: 10px 0;"><table style="border-collapse: collapse; text-align: center;"><tr><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><div style="margin-left: 10px;">(p)</div></div>	0	1	2	3	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	2	3	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	10
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3		<p>The Gray level Image matrix for an image is given here.</p> <table border="1" style="margin: 10px auto; text-align: center; border-collapse: collapse;"><tr><td>5</td><td>1</td><td>34</td><td>44</td><td>78</td></tr><tr><td>14</td><td>0</td><td>35</td><td>65</td><td>81</td></tr><tr><td>21</td><td>0</td><td>32</td><td>89</td><td>91</td></tr><tr><td>2</td><td>3</td><td>46</td><td>100</td><td>94</td></tr><tr><td>3</td><td>5</td><td>49</td><td>99</td><td>82</td></tr></table> <p>[a] Detect Edge using Strength(Magnitude) and direction of the gradient in the point(4,4) of the above image matrix having intensity value 100 using</p> <p>i) Roberts Operator [2 Marks]</p> <p>ii) Sobel Operator [3 Marks]</p> <p>[b] Expand the above 5*5 image to a 9*9 image using Bilinear interpolation. If the calculated intensity value is fractional round it to the nearest integer value [5 marks]</p>	5	1	34	44	78	14	0	35	65	81	21	0	32	89	91	2	3	46	100	94	3	5	49	99	82	10															
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3	5	49	99	82																																							

[a]

Sanya, an image processing engineer, is tasked with improving an overexposed photograph captured on a sunny day. The image has a resolution of 64 x 64 pixels, and its brightness is excessively high, as indicated by the following pixel distribution using **Histogram Equalization** method.[5 marks]

Gray level	0	1	2	3	4	5	6	7
No of pixels	108	77	255	333	625	777	1023	898

Draw the histogram of the input as well as the histogram of the equalized image[5 marks]

4

Sanya has been requested to enhance the image to reduce its brightness using **Histogram Specification** technique, adhering to the specified desired distribution provided below:

15

[b]

Gray level	0	1	2	3	4	5	6	7
No of pixels	512	1024	2048	512	0	0	0	0

Draw the histogram of the final image that is achieved after the 'Histogram Specification' exercise.[7 marks]

[c]

What are the deficiencies in Histogram equalization process? Can we always assume that this will provide an image with very good contrast?

How can we modify histogram equalization process to improve contrast? [3 marks]