

B.E. PRINTING ENGINEERING FOURTH YEAR FIRST SEMESTER – 2019

Subject: DIGITAL IMAGE PROCESSING

Time: 3Hr.

Full Marks: 100

1. Answer any one question

1 X 30 = 30

1a. i) Describe the digital derivatives based filter development in image processing and its applications. 15

ii) Describe the Dilation and Erosion operations in image morphological operations with suitable examples. 15

1b. i) Describe the image compression using variable length coding (VLC) method with suitable example. 15

ii) Describe different inter-pixel relationships normally practiced in image processing operations with suitable examples. 15

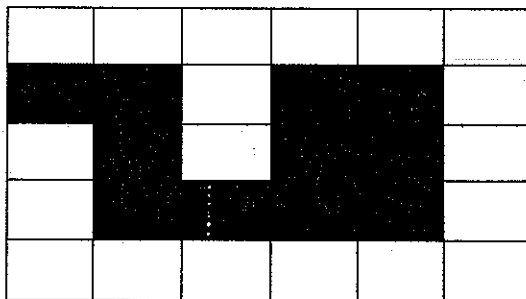
2. Answer any 1 question

1 X 30 = 30

2a. i) Apply 3x3 mean, median, min and max filter on the given image and draw your observations on the results. 15

| | | |
|----|----|-----|
| 20 | 80 | 100 |
| 20 | 90 | 100 |
| 15 | 5 | 200 |

ii) Apply opening and closing operations of image morphology to the following image *A* with structuring element *S*. Please show each steps of operations. 15



A



S

2b. i) Apply split and merge algorithm for segmentation of the given image. Please show the segmented image in binary form. You can choose the predicate but should be clearly stated in the answer.

15

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 171 | 194 | 107 | 149 | 84 | 110 | 154 | 194 |
| 185 | 195 | 187 | 161 | 47 | 101 | 161 | 94 |
| 60 | 65 | 167 | 159 | 55 | 163 | 84 | 134 |
| 187 | 196 | 194 | 103 | 172 | 168 | 149 | 76 |
| 141 | 194 | 145 | 145 | 151 | 70 | 145 | 160 |
| 55 | 118 | 45 | 67 | 91 | 118 | 66 | 81 |
| 84 | 168 | 176 | 153 | 192 | 111 | 120 | 121 |
| 128 | 62 | 190 | 45 | 45 | 144 | 120 | 121 |

ii) Apply the inter-pixel *path* relationship to find the possible 8-closed paths between p and q in the given image for $V = \{2,4,6\}$. Also state the smallest path length among those paths. Paths to be shown graphically as well as in terms of coordinates.

15

| | | | | | | | |
|-----|---|---|---|---|---|-----|---|
| | 6 | 6 | 2 | 4 | 3 | q | 6 |
| | 6 | 2 | 2 | 4 | 4 | | 1 |
| | 4 | 5 | 4 | 6 | 1 | | 4 |
| | 1 | 2 | 3 | 2 | 1 | | 3 |
| | 1 | 6 | 3 | 5 | 4 | | 1 |
| p | 2 | 3 | 5 | 5 | 5 | | 3 |

3. Answer any 1 question

1 X 20 = 20

3a. What can be the possible solution to enhance the following low contrast image? Show the result of applying the stated solution. 20

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 29 | 42 | 38 | 45 | 29 | 48 | 29 | 33 |
| 45 | 45 | 50 | 48 | 31 | 42 | 31 | 48 |
| 33 | 36 | 27 | 27 | 28 | 33 | 38 | 33 |
| 38 | 27 | 36 | 31 | 28 | 38 | 27 | 27 |
| 29 | 31 | 27 | 31 | 48 | 33 | 48 | 45 |
| 45 | 48 | 50 | 45 | 45 | 27 | 48 | 36 |
| 31 | 28 | 27 | 36 | 33 | 31 | 36 | 31 |
| 42 | 45 | 45 | 48 | 28 | 28 | 36 | 38 |

3b. What can be the possible way to find the presence of gradients in the following image? Show the result of applying the stated way. 20

| | | | | |
|----|-----|-----|-----|-----|
| 10 | 20 | 30 | 40 | 50 |
| 20 | 20 | 250 | 250 | 255 |
| 30 | 100 | 30 | 100 | 100 |
| 40 | 100 | 250 | 40 | 255 |
| 50 | 100 | 250 | 255 | 50 |

4. Answer any 1 question

1 X 20 = 20

4a. Consider the following results of applying two different enhancement filters. Compare the results using PSNR and SSIM. Also draw your observations. 20

| | | |
|-----|-----|-----|
| .09 | .95 | .23 |
| .13 | .57 | .35 |
| .94 | .05 | .83 |

Original image

| | | |
|-----|-----|-----|
| .16 | .95 | .38 |
| .26 | .62 | .49 |
| .84 | .05 | .73 |

Processed image A

| | | |
|-----|-----|-----|
| .35 | 1 | .58 |
| .47 | .82 | .70 |
| 1 | .25 | .93 |

Processed image B

4b. Consider the image and processed images shown in 4a. Evaluate the performance of the algorithms resulted A and B in terms of AMBE, Entropy and UQL. Also draw your observation.