IT 8-1 (RC) 2007-08

B.E. (IT) (Semester – VIII) (RC 2007-08) Examination, Nov./Dec. 2018
IMAGE PROCESSING AND PATTERN RECOGNITION

Duration : 3 Hours

Total Marks : 100

Instructions : 1) *Attempt **any five** questions, selecting at least **one** question from **each** Module.*
2) *Make appropriate assumptions **wherever** necessary.*
3) *Draw figures and sketches **wherever** necessary.*

MODULE – I

1. a) Consider a 3×3 image given below : **6**

$$\begin{pmatrix} 240 & 60 & 240 \\ 25 & 60 & 25 \\ 135 & 60 & 135 \end{pmatrix}$$

i) Perform negative transformation on the given image
ii) Write the 4th bit plane of the given image
iii) Perform log transformation on the image for c = 1.

b) Discuss the smoothing linear filters and the response they generate on filtering. **6**

c) Explain the process of digitizing an image. What are the factors that affect the process of digitization ? **8**

2. a) Consider the 4×4 image given below : **8**

$$\begin{pmatrix} 0 & 6 & 5 & 1 \\ 2 & 3 & 5 & 1 \\ 2 & 1 & 4 & 6 \\ 5 & 4 & 4 & 7 \end{pmatrix}$$

Write the processed image when the following techniques are applied to the image :
i) Median Filtering
ii) Contrast stretching between (3, 1) and (5, 7)
iii) Average filtering.

b) Explain the types of adjacency of pixels. Mention the benefits of using one over the other. **6**

c) Explain the use of second order derivatives for image enhancement. **6**

P.T.O.

MODULE – II

3. a) Explain the basic steps of filtering an image in the frequency domain.

   b) Explain the translation, periodicity and conjugate symmetry property of two dimensional Fourier Transform.

   c) Describe the following noise models :

      i) Gaussian noise model

      ii) Impulse noise model.

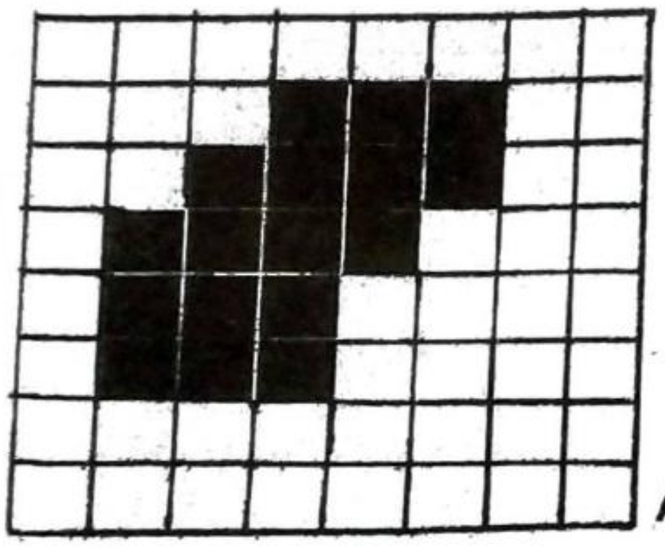
4. a) Explain various order statistics spatial filters used for restoration of images in the presence of noise only. 6

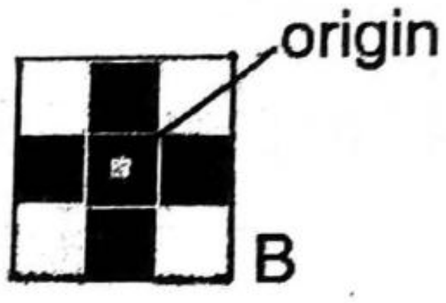
   b) Discuss the inverse filtering approach in image restoration. 7

   c) Define convolution between two 2-dimensional discrete functions. Explain in brief the application of this operation in image processing. 7

MODULE – III

5. a) Perform dilation and erosion of the image A with structuring element B given below : 6





   b) Explain the RGB colour model land state its applications. 7

   c) Explain Hough transform for line detection. 7

6. a) What is thresholding ? Consider the image given below and obtain the threshold value and perform thresholding operation. 7

$$\begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 2 & 2 & 1 & 1 \\ 2 & 3 & 4 & 4 & 3 & 2 \\ 2 & 3 & 4 & 4 & 3 & 2 \\ 1 & 1 & 2 & 2 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}$$

b) Explain the following morphological algorithms :
   i) Boundary extraction
   ii) Region filling. 7

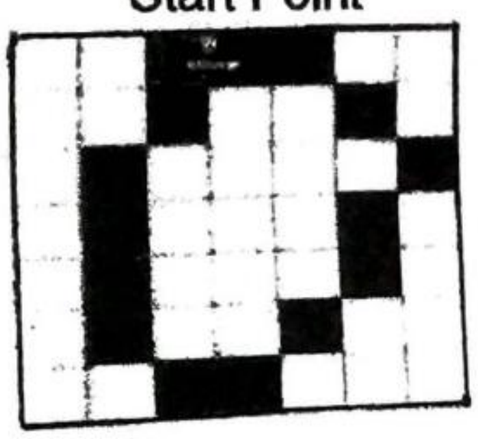
c) Explain the smoothing and sharpening of colour images. 6

MODULE – IV

7. a) Discuss any two techniques used for polygonal approximations. 6

   b) What do you mean by a pattern ? How can pattern be arranged ? Explain pattern recognition approach using minimum distance classifier. 8

   c) For the image boundary shown below, find the following : 6
      i) Chain code using 8 directions
      ii) First difference of chain code
      iii) Shape number.



8. a) Discuss the Medial Axis Transformation (MAT) for a region R. Draw the medial axis of the square, equilateral triangle and circle. 6

   b) Explain any one structural method used for pattern recognition. 6

   c) Explain the following descriptors with examples : 8
      i) Signatures
      ii) Topological descriptors
      iii) Fourier descriptors.

IT 8 – 1(RC)

B.E. (IT) (Semester – VIII) (RC) Examination, May/June 2016
IMAGE PROCESSING AND PATTERN RECOGNITION

Duration : 3 Hours

Max. Marks : 100

Instructions : *1) Attempt **any five** questions, selecting at least **one** question from **each** Module.*
*2) Make appropriate assumptions **wherever** necessary.*
*3) Draw figures and sketches **wherever** necessary.*

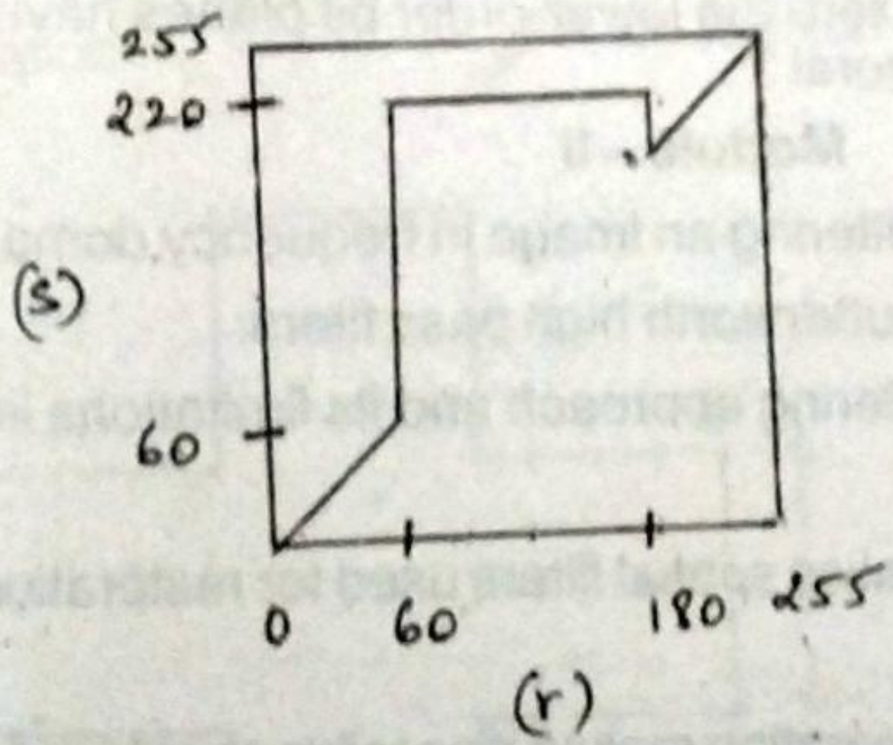
Module – I

1. a) Explain the process of image digitization. What are the effects that arise on an image due to inadequate digitization ? **8**

b) A 3 × 3 image is given below :

200	185	200
100	185	100
30	185	30

i) The above image is transformed using the point transformation shown below (r and s are variables denoting the gray level of input and processed image respectively). Write the pixel values of processed image. **2**



ii) Write the 7th bit plane of the given image. **2**

iii) Write the processed image after applying negative transform. **2**

c) Define histogram. Explain its features and importance in image processing. Draw the histogram of a chessboard. **6**

P.T.O.

IT 8 - 1(RC)

2. a) Explain the basis for the coefficients of the 3 × 3 smoothing mask shown in figure 1 below.

Figure 1

Using the mask in figure 1 perform spatial averaging on the image shown below in figure 2

10	10	50	50
10	10	50	50
10	10	50	50
10	10	50	50

Figure 2

b) Define gradient of an image at location (x, y). Why are gradient operators used for edge detection ? Explain the approximations in gradient used in sobel operator. Explain the changes in an image when it is filtered with sobel operators.

c) What effect would setting to zero the lower-order bit planes have on the histogram of an image in general ?

Module – II

3. a) What do you understand by filtering an image in frequency domain ? Explain and compare the Ideal and Butterworth high pass fiters.

b) Explain in brief the inverse filtering approach and its limitations in image restoration.

c) Explain the various order statistics spatial filters used for restoration of images in the presence of noise only.

4. a) Explain how the property of separation makes it possible to calculate the two-dimensional Fourier transform from a one-dimensional Fourier transform.

b) Explain Ideal and Butterworth law pass filters. Explain why ringing is visible in images processed with the Ideal LPF but not evident in those processed with Butterworth LPF of lower order.

c) Define correlation between two 2-dimensional discrete functions. Explain in brief the application of this operation in image processing.

Module – III

5. a) Discuss the RGB color model. How many different shades of gray are there in a color RGB system in which each RGB component is 8-bit ? Justify your answer. 5

b) Write the split and merge segmentation Algorithm. Segment the image shown below using the split and merge technique. Here the condition for regions to be homogenous is that the value of pixels in a region have to be exactly equal.

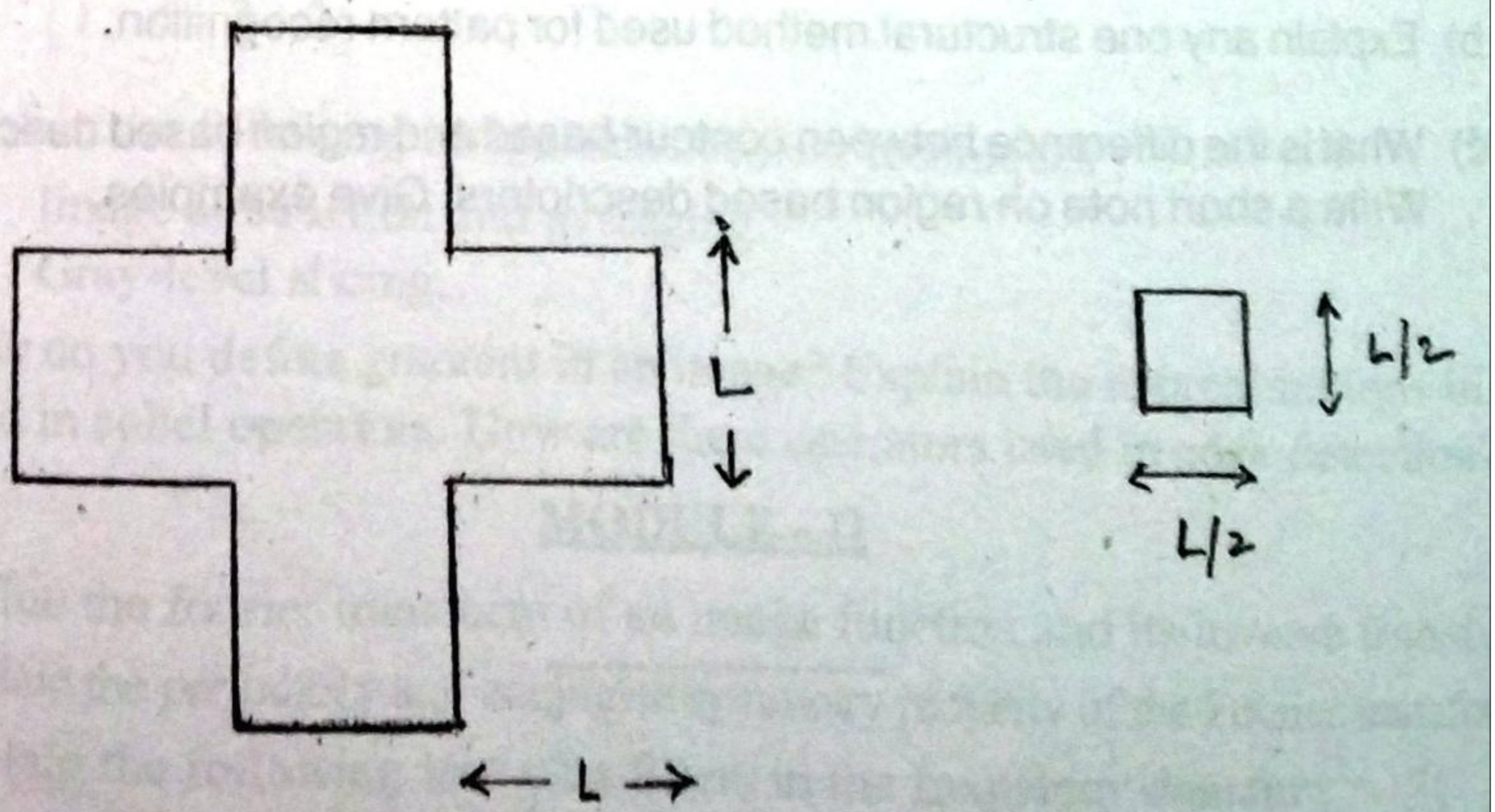
2	2	2	2	2	2	1	1
2	2	2	2	1	1	1	1
0	0	0	0	3	3	3	3
0	0	0	0	0	0	3	3
0	0	3	3	3	3	3	3
1	1	2	2	1	1	2	2
1	1	1	2	2	2	0	0
1	1	3	3	3	2	2	0

c) Define and explain opeining and closing morphological operations with suitable examples. What is the effect of these operations on an image ?

6. a) Write the basic formulation of region based segmentation. Describe region growing approach. What are the problems associated with this method ?

b) Sketch the results of the following morphological operations on the image given in figure (1) with the structuring element in figure (2) (the black dot denotes the origin)

i) Dilation ii) Erosion



c) Explain the detection of straight lines using Hough transform.

7. a) Explain with examples the use of vector, string and tree data structures for pattern recognition.

b) A classifier that uses Euclidian distance computer distance from pattern x to class j as

$$D_j(x) = \| x-m_j \|$$

Where mj is the mean , vector of the patterns of that class and $\| a \| (a^T a)^{1/2}$ is the Euclidian norm show that classification with this rule is equivalent to using the discriminant function.

$$dj(x) = x^T mj - \frac{1}{2} m_j^T mj$$

c) Explain the following boundary descriptors.

i) Eccentricity

ii) Curvature

iii) Shape Number.

8. a) Discuss the medical Axis Transformation (MAT) for a region R. Draw the medial axis of

i) a square

ii) a rectangle.

b) Explain any one structural method used for pattern recognition.

c) What is the difference between contour-based and region based descriptors ? Write a short note on region based descriptors. Give examples.

IT 8 – 1 (RC)

B.E. (IT) (Semester – VIII) (RC) Examination, May/June 2017
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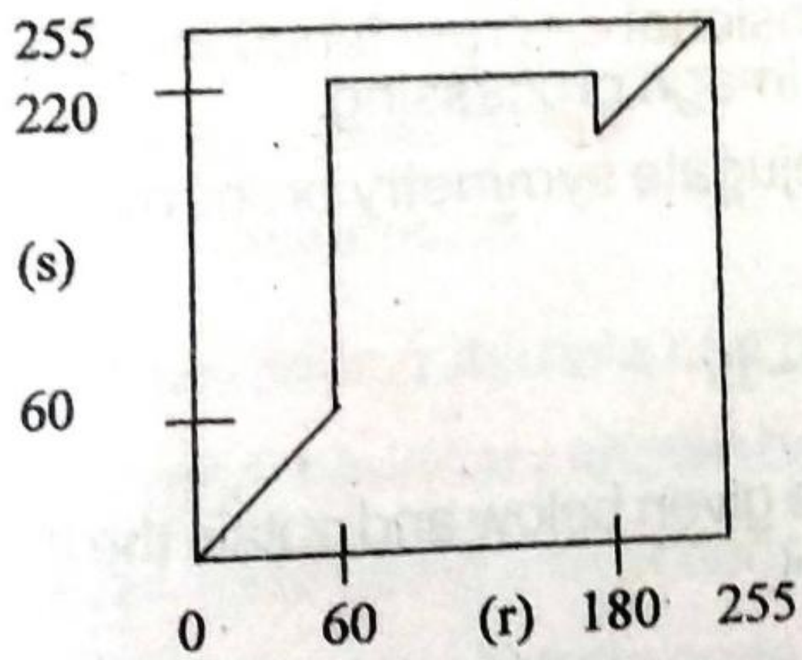
Instructions : *1) Attempt **any five** questions, selecting at least **one** question from **each** Module.*
*2) Make appropriate assumptions **wherever** necessary.*
*3) Draw figures and sketches **wherever** necessary.*

MODULE – I

1. a) Consider a 3×3 image given below : **6**

$$\begin{pmatrix} 180 & 65 & 180 \\ 100 & 65 & 100 \\ 210 & 65 & 210 \end{pmatrix}$$

i) The above image is transformed using the point transformation shown in figure below (r and s are variables denoting the gray level of input and output image respectively). Write pixel values of the processed image.



ii) Perform negative transformation on the given image.

iii) Write the 5th bit plane of the given image. **6**

b) Explain how an image is acquired using sensor strips. **8**

c) Explain the use of second order derivatives for image enhancement.

2. a) Consider the 4×4 image given below :

$$\begin{pmatrix} 0 & 3 & 5 & 1 \\ 2 & 3 & 5 & 1 \\ 2 & 4 & 4 & 6 \\ 2 & 4 & 4 & 7 \end{pmatrix}$$

P.T.O.

Write the processed image when the following techniques are applied to the image :

i) Median Filtering

ii) Contrast stretching between (2, 1) and (4, 7)

iii) 3×3 low pass filtering. 8

b) Explain the use of first order derivatives for image enhancement. 8

c) Briefly explain neighbors of a pixel. 4

MODULE – II

3. a) Explain various order statistics spatial filters used for restoration of images in the presence of noise only. 6

b) Briefly explain the inverse filtering approach and its limitations in image restoration. 8

c) Explain the Ideal and Butter worth high pass filters. 6

4. a) Explain various mean spatial filters used for restoration of images in the presence of noise only. 6

b) Define correlation between two 2-dimensional discrete functions. Explain in brief the application of this operation in image processing. 6

c) Explain the rotation, periodicity and conjugate symmetry property of two dimensional Fourier Transform. 8

MODULE – III

5. a) What is thresholding ? Consider the image given below and obtain the threshold value and perform thresholding operation. 8

$$\begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 2 & 2 & 1 & 1 \\ 2 & 3 & 4 & 4 & 3 & 2 \\ 2 & 3 & 4 & 4 & 3 & 2 \\ 1 & 1 & 2 & 2 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}$$

b) Define the opening and closing morphological operations. State their effects on a binary image. 6

c) Explain the RGB model for color images. 6

a) Explain region splitting and merging technique with the help of an example. 8

b) Explain hit – or-miss transform with a suitable example. State its applications. 6

c) Explain how color image smoothing and sharpening is carried out. 6

MODULE – IV

7. a) Discuss the Medial Axis Transformation (MAT) for a region R. Draw the medial axis of the following 2 regions : 6

Region 1

Region 2

b) Explain any one structural method used for pattern recognition. 6

c) Explain the following descriptors with examples : .

i) Signatures

ii) Topological descriptors

iii) Fourier descriptors. 8

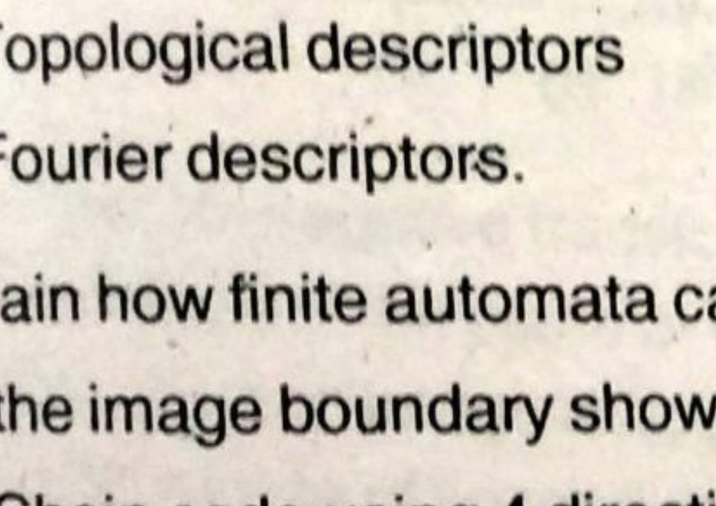
8. a) Explain how finite automata can be used as string recognizers. 6

b) For the image boundary shown below, find the following : 6

i) Chain code using 4 directions

ii) First difference of chain code

iii) Shape number.



c) Discuss techniques used for polygonal approximations. 8