2063
B.E. (Computer Science and Engineering)
Seventh Semester
CS-701: Digital Image Processing

Time allowed: 3 Hours

Max. Marks: 50

NOTE: *Attempt* **five** *questions in all, including Question No. I which is compulsory and selecting two questions from each Section.*

x-x-x

Q1. Attempt the following:-

    I.   What do you mean by Image and its gray level?
    II.   Compare Image Sampling and quantization?
    III.   Differentiate additive and subtractive color models?
    IV.   What is image negative?
    V.   Define Weber ratio?
    VI.   Give the formula for the transform function of a Butterworth low pass filter?
    VII.   What is run length coding?
    VIII.   What are the basic steps of JPEG Compression?
    IX.   Why is edge detection preferred for detecting discontinuities?
    X.   How to calculate euler number for a polygon and what is its significance?

(10x1)

Section - A

Q2. The so-called compass gradient operators of size 3 X 3 are designed to measure gradients of edges oriented in eight directions: E, NE, N, NW, W, SW, S and SE.

(a) Give the form of these eight operators using coefficients valued 0, 1, -1, -2 or 2.

(b) Specify the gradient vector direction of each mask, keeping in mind that the gradient direction is orthogonal to the edge direction. (10)

Q3. Prepare a 5X5 image with zero-pixel values. Add a square of size 3X3 pixels with the value 100 at the center of the image. Apply *i*) the subtracting Laplacian operator, and *ii*) the Laplacian operator to the image. Examine the pixel values inside and around the edges of the square in the resulting images. Give reasons for the effects you find.

b) Explain the HSI color model and compare it with RGB and CMY color models. Also Discuss the procedure for conversion from HSI to RGB color model. (7+3)

Q4. a) What are the prerequisites and importance of shape description? In what ways can you represent a boundary? Discuss how a digital boundary can be approximated using Minimum perimeter polygon.

b) Perform Histogram equalization of the 5X5 image with data as below.

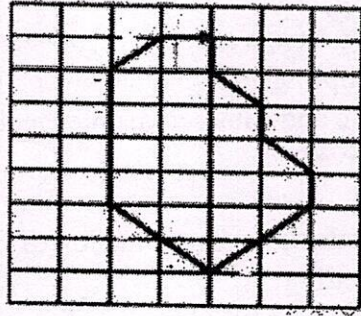| Gray levels	0	1	2	3	4	5	6	7
Number of pixels	0	0	0	6	14	5	0	0

(5+5)

Section - B

Q5. a) What is sampling and quantization? When and where will you use non-uniform quantization and sampling?

b)Find chain code and shape number using 8 code connectivity for the following image. Arrow shows the starting point for chain code.

(5+5)

Q6. a)Explain different types of noise models along with noises in detail.

b)What is histogram and its significance in image processing? What would be the effect on the histogram if we set to zero the four higher order bit planes? Also prove that the probability distribution function of the output image in Histogram Equalization is independent of the probability distribution function of the input image.

(5+5)

Q7. a)Generate a binary sequence of length L with $P(0) = 0.8$, and use the arithmetic coding algorithm to encode it. Plot the difference of the rate in bits/symbol and the entropy as a function of L. Comment on the effect of L on the rate.

b) What do you mean by the term image degradation and image restoration? Name various types of noises and Describe the restoration process with the help of the Degradation model.

(5+5)

x-x-x