Seat No.: _____   *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 714104   **Date: 05-12-2014**

Subject Name: Digital Image Processing and Applications

Time: 10:30 am - 01:00 pm   **Total Marks: 70**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full mark.**

Q.1 **(a)** Answer the following Questions.   **07**
  1. Define D4-Distance between two pixels P and Q of coordinates (x,y) and (s,t) respectively.
  2. Compare median filtering and a low pass filtering on a noisy image. Which performs best (i.e. removal of most noise with least blurring)? How?
  3. Explain Rayleigh noise. Also mention its mean and variance with respect to the gray level of an image.
  4. What is the basic idea of bitplane slicing?
  5. Draw the sobel mask for the edge detection.
  6. How can we construct digital laplacian mask from analog laplacian filter?
  7. What do you mean by a histogram of an image?

(b) In the image shown in figure 1 compute D4, D8 and Dm distances between pixels p and q for V= {5, 6, 7}. Take pixel p as center of the image and find the distances for all other pixels considered as q pixels.   **07**

1	2	2	2	3
5	3	5	6	7
5	2	5	5	6
7	5	1	7	7
7	4	2	3	1

Figure 1

Q.2 **(a)** Explain Histogram Specification technique in detail with suitable mathematics.   **07**

(b) Suppose **"m"** be the gray-level of the input image, which has to be transformed to output image gray level **"l"** by histogram equalization technique. For an 8-level image of size 64 X 64, we have the following frequency table for the input gray levels.   **07**

m	0	1	2	3	4	5	6	7
Frequency of m	123	78	281	417	639	1054	816	688

Obtain the resultant gray level **"l"** using histogram equalization technique. Also plot the equalized histogram of the output image.

OR

(b) Compute the DFT basis matrix for N=4.   **07**

Q.3 **(a)** Apply median operator on image shown in figure 2. Conclude about the results.　**07**

1	1	7	7	7	8	8	8
6	6	6	5	5	5	1	8
6	6	6	5	5	1	8	8
8	7	7	5	1	8	8	8
8	8	8	5	5	8	8	8
8	8	8	5	1	7	1	8
8	8	8	5	5	7	1	8
8	8	8	5	5	7	1	8

Figure 2

(b) Explain inverse filtering method. Discuss the drawback and its solution of the inverse filtering method.　**07**

OR

Q.3 **(a)** Describe the Ideal Low Pass Filter (ILPF). What benefits we have if we use a Butterworth low pass filter in place of the ILPF.　**07**

(b) Discuss about Homomorphic filtering in detail with suitable mathematics.　**07**

Q.4 **(a)** Discuss various filters used for detecting lines and edges in image, and give the mathematical logic behind the filter.　**07**

(b) Discuss about Hough transform in X-Y coordinate system.　**07**

OR

Q.4 **(a)** Apply the morphological erosion operation on an input image for structuring element as shown in Figure 3.　**07**

1	1	1	1	0	0
0	1	1	1	1	0
0	1	1	1	1	0
0	1	1	1	0	0
0	1	0	1	0	0
1	1	0	0	1	1

0	1	0
1	①	1
0	1	0

Figure 3; 6 X 6 Image Segment , Structuring Element

(b) What are the three stages of the canny edge detector? Briefly explain each phase.　**07**

Q.5 **(a)** Segment the image shown in figure 4 below, using the split-and-merge procedure. Also show the quadtree corresponding to the segmentation.　**07**
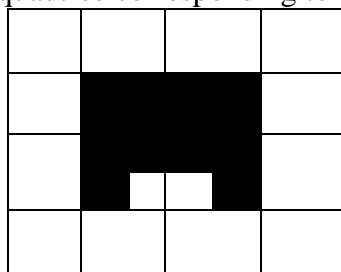

Figure 4: 4 X 4 binary image

(b) Give few applications of morphological operations in the field of image processing.　**07**

OR

Q.5 **(a)** Explain the region growing technique for region based image segmentation with suitable example.　**07**

(b) List out the various applications of digital image processing. Explain any one application in detail.　**07**

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