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**Seventh Semester B.E. Degree Examination, December 2011**  
**Image Processing**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting  
atleast TWO questions from each part.**

**PART – A**

- 1
  - a. Explain the fundamental steps in digital image processing. (10 Marks)
  - b. Explain the brightness adaptation, with the help of the related graph. (04 Marks)
  - c. Define spatial and gray level resolution. Briefly discuss the effects resulting from a reduction in number of pixels and gray levels. (06 Marks)
  
- 2
  - a. With a suitable diagram, explain how an image is acquired using a circular sensor strip. (06 Marks)
  - b. Explain the zooming. (04 Marks)
  - c. Define 4 – adjacency, 8 – adjacency and m – adjacency. (04 Marks)
  - d. Consider the image segment shown in Fig. Q2(d).
    - i) Let  $V = \{0, 1\}$ . Compute the lengths of shortest 4 – , 8 – and m – paths between p and q. (06 Marks)
    - ii) Repeat for  $V = \{1, 2\}$ .

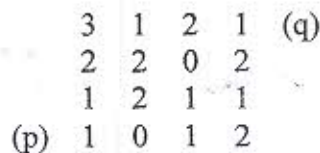


Fig. Q2(d)

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- 3
  - a. Define two – dimensional DFT. Explain the following properties of 2 – DFT.
    - i) Translation ii) Rotation iii) Distributivity and scaling iv) Separability (10 Marks)
  - b. What are basis vectors? (04 Marks)
  - c. For the given orthogonal matrix A and image u, obtain the transformed image and basis images. (06 Marks)
 
$$A = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}, u = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}.$$
  
- 4
  - a. Define discrete cosine transform and its inverse transformation. Discuss any three properties of discrete cosine transform. (10 Marks)
  - b. Develop Hadamard transform for  $n = 3$ . Discuss the properties of the Hadamard transform. (any two). (10 Marks)

**PART – B**

- 5
  - a. Explain the following image enhancement techniques, highlighting their area of application.
    - i) Intensity level slicing
    - ii) Power – law transformation
    - iii) Bit – plane slicing. (10 Marks)
  - b. What is histogram matching? Explain the development and implementation of the method. (10 Marks)

- 6 a. Explain the smoothing of images in frequency domain using :  
i) Ideal lowpass filter  
ii) Butterworth lowpass filter. (10 Marks)
- b. With a block diagram and equations, explain the homomorphic filtering. How dynamic range compression and contrast enhancement is simultaneously achieved? (10 Marks)
- 7 a. With a block diagram, briefly explain the image model of degradation – restoration process. (06 Marks)
- b. Explain the notch reject filters. How can we obtain the notch filter that pass rather than suppressing the frequency in the notch area? (08 Marks)
- c. Explain the Weiner – filtering method of restoring images. (06 Marks)
- 8 a. Explain the following order – statistics filters, indicating their uses.  
i) median filter  
ii) max filter  
iii) min filter. (06 Marks)
- b. Explain the RGB color model. (06 Marks)
- c. Write a note on the following pseudo image processing techniques :  
i) Intensity slicing  
ii) Graylevel to color transformations. (08 Marks)

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**Seventh Semester B.E. Degree Examination, June/July 2011-**  
**Image Processing**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions selecting  
at least TWO questions from each part.**

**PART – A**

- 1 a. Write in detail the fundamental steps in digital image processing. (10 Marks)  
b. How is image formed in the human eye? Explain with examples the perceived brightness is not a simple function of intensity. (10 Marks)
- 2 a. How many minutes would it take to transmit a  $1024 \times 1024$  image with 256 gray levels using 56 k baud modem? (Baud rate is the number of bits transmitted per second. Assume each byte is one packet with a start bit and a stop bit.) (04 Marks)  
b. Explain image sampling and quantization. (10 Marks)  
c. Consider the image segment given in Fig.Q2(c). Let  $V = \{0, 1\}$ , Compute the lengths of the shortest 4, 8 and m-path between 'p' and 'q'. If path does not exist, explain why. (06 Marks)
- |     |   |   |   |       |
|-----|---|---|---|-------|
|     | 3 | 1 | 2 | 1 (q) |
|     | 2 | 2 | 0 | 2     |
|     | 1 | 2 | 1 | 1     |
| (p) | 1 | 0 | 1 | 2     |

Fig.Q2(c)

- 3 a. Derive the expression for 2D circular convolution theorem. (10 Marks)  
b. Consider the  $2 \times 2$  transform A and the image U given below:

$$A = \frac{1}{2} \begin{bmatrix} \sqrt{3} & 1 \\ -1 & \sqrt{3} \end{bmatrix} \quad U = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$$

Calculate the transformed image V and the basis images. Check the transformed image V using the basis images and U. (10 Marks)

- 4 a. Derive the relation between DCT and DFT. (10 Marks)  
b. Write H matrix for the Harr transform for  $N = 8$  and explain how it is constructed. (05 Marks)  
c. Write four properties of Hadmard transform. (05 Marks)

**PART – B**

- 5 a. Explain histogram equalization technique. (10 Marks)  
b. Explain the following with applications:  
i) Contrast stretching      ii) Bit plane slicing      iii) Gray-level slicing  
iv) AND operation      v) OR operation. (10 Marks)
- 6 a. Discuss homomorphic filtering. (08 Marks)  
b. Explain sharpening filters in the frequency domain. (06 Marks)  
c. Explain smoothing filters in the frequency domain. (06 Marks)
- 7 a. Explain adaptive median filter and its advantages. (06 Marks)  
b. How do you reduce the periodic noise using frequency domain filters? (06 Marks)  
c. Derive the expression for observed image when the degradations are linear, position invariant. (08 Marks)
- 8 a. Explain RGB and HSI colour models with their conversions. (10 Marks)  
b. Explain pseudo colour image processing. (05 Marks)  
c. Explain inverse filtering. (05 Marks)

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