IMAGE PROCESSING
(CSEN 4133)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

    (i)   The range of values for a digital image represented by 8 bits is
            (a) $[0,\infty]$ (b) $[0,255]$ (c) $[0,1]$ (d) $[-255,255]$

    (ii)   How many shades of grey are there in a 9 bit image?
            (a) 511   (b) 256   (c) 512   (d) none of these.

    (iii)   Image negative can be done using _____operator.
            (a) AND   (b) NOT   (c) OR   (d) Non of these.

    (iv)   Which is not the operator for edge detection?
            (a) Roberts   (b) Prewitt   (c) Sobel   (d) Butterworth.

    (v)   Which is not a property of the 2-D Fourier Transform?
            (a) Distributivity   (b) Translational
            (c) Rotation   (d) Linearity.

    (vi)   Which of the following is a lossy-coding?
            (a) Huffman encoding   (b) Run-length encoding
            (c) JPEG   (d) None of the above.

    (vii)   Digitizing the intensity value of an image is called
            (a) quantization   (b) sampling
            (c) segmentation   (d) compression.

    (viii) Median filter belongs to which of the following categories?
            (a) Linear spatial filter   (b) Laplacian filter
            (c) Frequency domain filter   (d) Order statistic filter

    (ix)   Morphological Image Processing means
            (a) DFT of image   (b) finding regions of image
            (c) extracting meaningful image components   (d) Histogram of image.

(x)   To find edge in segmentation the following is used
(a) Sobel operators   (b) second order derivatives
(c) first order derivatives   (d) All the above.

Group – B

2. (a)   What is 4-adjecency and 8-adjecency ? Explain with suitable example.
            [(CO4)(Remember/LOCQ)]
    (b)   Explain the process of uniform sampling and quantization with the aid of
            figures. [(CO2)(Understand/LOCQ)]
    (c)   Contrast the quality of an image when its histogram is clustered at the low end
            to when its histogram is with a wide spread. [(CO1)(Analyze/IOCQ)]
                                                                    4 + 5 + 3 = 12

3. (a)   Write some properties of the two dimensional discrete Fourier transform.
            [(CO2)(Remember/LOCQ)]
    (b)   What is meant by arithmetic operations on an image? Explain.
            [(CO3)(Understand/LOCQ)]
    (c)   Compare the Geometric model basic transformations – translation, rotation and
            scaling. [(CO4)(Analyse/IOCQ)]
                                                                    5 + 5 + 2 = 12

Group – C

4. (a)   What is Laplacian edge detector? [(CO4)(Remember/LOCQ)]
    (b)   Compare mean filtering with median filtering. [(CO2) (Analyze/LOCQ)]
    (c)   What are the advantage and disadvantages of FFT and DFT?
            [(CO3)(Analyze/IOCQ)]
                                                                    6 + 3 + 3 = 12

5. (a)   Briefly explain which type of arithmetic operation will be most suitable for
            (i)   Shading correction
            (ii) Mask mode radiography like angiography. [(CO4) (Understand/LOCQ)]
    (b)   What is the relationship of transform function of bandpass filter and band reject
            filter? Explain how a band reject filter can be the filter used to restore an image
            that is corrupted by sinusoidal noise. [(CO1)(Analyze/IOCQ)]
                                                                    (4 × 2) + 4 = 12

Group – D

6. (a)   Explain algebraic restoration of image using unconstrained method.
            [(CO4)(Remember/LOCQ)]
    (b)   What are the various ways of estimating the degradation functions?
            [(CO2)(Remember/LOCQ)]
    (c)   Differentiate between lossless and lossy compression using examples.
            [(CO1)(Analyze/IOCQ)]
                                                                    3 + 6 + 3 = 12

7. (a) What is restoration by homomorphic filtering? [(CO1)(Remember/LOCQ)]
   (b) Calculate the Huffman code for the following symbols whose probability of occurrence is given below: [(CO3) (Understand/LOCQ)]

Symbol	Probability
A1	0.9
A2	0.06
A3	0.02
A4	0.02

   (c) Compare the two types of redundancy suffered by an image. [(CO1)(Analyze/IOCQ)]

   4 + 5 + 3 = 12

Group – E

8. (a) What is a hit-or-miss transformation? [(CO4)(Remember/LOCQ)]
   (b) Explain the morphological algorithm – Boundary extraction. [(CO3)(Understand/LOCQ)]
   (c) Compare morphological processing operations of erosion and dilation. [(CO4)(Analyse/IOCQ)]

   5 + 3 + 4 = 12

9. (a) What is region splitting and merging in segmentation? [(CO1)(Remember/LOCQ)]
   (b) How is thresholding used in segmentation? Explain along with diagrams. [(CO2)(Understand/LOCQ)]
   (c) Analyse the region growing technique for image segmentation and do you see any problem associated with it? [(CO2)(Analyse/IOCQ)]

   2 + 6 + 4 = 12

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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	33.3%	36.1%	30.2%

Course Outcome (CO):
After the completion of the course students will be able to

CO1. Understand the general terminology, basic concepts and applications of digital image processing.
CO2. Implement two dimensional filters in both spatial and frequency domain for image enhancement.
CO3. Analyze and develop various image restoration techniques.
CO4. Evaluate the methodologies for image segmentation, compression etc.
CO5. Implement various morphological algorithms.
CO6. Apply image processing algorithms in practical applications.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

Department & Section	Submission link:
CSE A+B+C	https://classroom.google.com/c/NDA2MTE5NDY3NTMy/a/NDYzODI5MTU3ODE1/details