



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (ECE-N)/SUPPLE/SEM-8/EC-803D/2010

2010

DIGITAL IMAGE PROCESSING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) Consider an image of size $M \times N$ with 256 gray levels. The total number of bits required to store this digitized image is

- a) $M \times N \times 256$ b) $M \times N \times 255$
c) $M \times N \times 8$ d) none of these.

ii) The image function $f(x,y)$ is characterized by two components : $f(x, y) = i(x, y).r(x, y)$ where

- a) $0 < i(x, y) < 1$ & $0 < r(x, y) < \infty$
b) $0 < i(x, y) < 1$ & $0 < r(x, y) < 1$
c) $0 < i(x, y) < \infty$ & $0 < r(x, y) < \infty$
d) $0 < i(x, y) < \infty$ & $0 < r(x, y) < 1$.



iii) The effect, caused by the use of an insufficient number of gray levels in smooth areas of a digital image is called

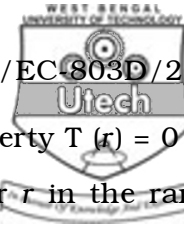
- a) false contouring b) gray level slicing
- c) bit plane d) none of these.

iv) A spatial averaging filter in which all co-efficient are equal is called a

- a) weighted average filter b) box filter
- c) median filter d) none of these.

v) The D8 distance (chessboard distance) between p and q with co-ordinates (x, y) , (s, t) is defined as

- a) $D8(p, q) = |x - s| + |y - t|$
- b) $D8(p, q) = \max(|x - s|, |y - t|)$
- c) $D8(p, q) = \left[(x-s)^2 + (y-t)^2 \right]^{\frac{1}{2}}$
- d) none of these.



- vi) A transformation function with the property $T(r) = 0$ for r in the range $[x, y]$ and $T(r) = 255$ for r in the range $[p, q]$ produces an image of the 7th bit plane is an 8-bit image where x, y, p, q are
- a) $x = 128, y = 255, p = 0, q = 128$
 - b) $x = 0, y = 127, p = 128, q = 255$
 - c) $x = 0, y = 63, p = 64, q = 127$
 - d) none of these.
- vii) is a common technique for enhancing the appearance of images.
- a) Splitting and Merging
 - b) Region growing
 - c) Watershed segmentation
 - d) Histogram equalization.
- viii) Image Degradation causes
- a) linearity of the optical sensor
 - b) relative motion between an object and camera
 - c) proper focus
 - d) all of these.



ix) The convolution of two functions $f(x, y)$ and $g(x, y)$

denoted by $f(x, y)*g(x, y)$, is defined as

a)
$$f(x, y)*g(x, y) = \int_0^{\infty} \int_0^{\infty} f(\alpha, \beta) g(x-\alpha, y-\beta) d\alpha d\beta$$

b)
$$f(x, y)*g(x, y) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f(\alpha, \beta) g(x-\alpha, y-\beta) d\alpha d\beta$$

c)
$$f(x, y)*g(x, y) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} g(\alpha, \beta) f(x-\alpha, y-\beta) d\alpha d\beta$$

d) none of these.

x) The inverse Fourier transform of $F(u, v)$ is

$F^{-1}\{F(u, v)\} = f(x, y)$ where $f(x, y)$ is defined as

a)
$$\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} F(u, v) \exp [J 2\pi (ux + vy)] du dv$$

b)
$$\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} F(u, v) \exp [J \pi (ux + vy)] du dv$$

c)
$$\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} F(u, v) \exp [J 4\pi (ux + vy)] du dv$$

d) none of these.



GROUP – B

(Short Answer Type Questions)

Write short notes on any *three* of the following.

3 × 5 = 15

2. a) What is Weber ratio ?
b) Define 4-adjacency, 8-adjacency and m- adjacency. 2 + 3
3. a) What is the basic equation for getting a negative image ?
b) Consider an 8-pixel line of intensity data { 255, 118, 127, 182, 18, 178, 82, 55 }. If it is uniformly quantized with 4 bit accuracy, compute the *rms* error and *rms* signal-to-noise ratios for the quantized data. 1 + 4
4. What is Wiener filtering ? Briefly describe the Wiener filtering. 1 + 4
5. a) Write an expression for 2-D discrete convolution.
b) What is sobel operator ?
c) Where do we apply Sobel operator ? 2 + 2 + 1
6. a) What is watermarking ?
b) How do we protect the watermarked images ? 2 + 3



GROUP – C

(Long Answer Type Questions)

Answer any *three* of the questions. $3 \times 15 = 45$

7. a) Consider the simple 4×8 , 8-bit image :
- | | | | | | | | |
|----|----|----|----|-----|-----|-----|-----|
| 21 | 21 | 95 | 95 | 169 | 169 | 243 | 243 |
| 21 | 21 | 95 | 95 | 169 | 169 | 243 | 243 |
| 21 | 21 | 95 | 95 | 169 | 169 | 243 | 243 |
| 21 | 21 | 95 | 95 | 169 | 169 | 243 | 243 |
- i) Compute the entropy of the image
- ii) Compress the image using Huffman coding.
- b) Describe coding redundancy, interpixel redundancy and psychovisual redundancy. $3 + 6 + 6$
8. a) What do you mean by image enhancement ? Explain.
- b) What are Mean and Median filters ? Compare the performance.
- c) Describe high pass filters and low pass filter. Explain when they are used. $4 + 6 + 5$
9. a) Describe the region growing technique for image segmentation and mention the problem associated with it.
- b) Discuss the hough transform method for edge-linking.
- c) State the problems associated with hough transform when slope-intercept form to equation of straight line is considered. Why is the problem reduced when normal form is considered ? $6 + 6 + 3$



10. Write short notes on any *three* of the following : 3 × 5

- a) Content-based image retrieval
- b) Polygonal approximation
- c) Properties of two-dimensional Fourier transform.
- d) Histogram equalization
- e) Discrete cosine transform.

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