



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (IT)/SEM-7/IT-703B/2011-12
2011
IMAGE PROCESSING AND GIS

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) The image function $f(x, y)$ is characterized by two components : $f(x, y) = i(x, y) \cdot r(x, y)$ 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) $0 < i(x, y) < \infty$ & $0 < r(x, y) < 1$.
 - ii) Consider an image of size $M \times N$ with 256 grey 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.



- iii) Quantization is
 - a) digitizing the co-ordinate value (x, y)
 - b) digitizing the intensity value
 - c) digitizing the amplitude value
 - d) digitizing the pixel value.
- iv) Smoothing in frequency domain is achieved by
 - a) Homomorphic filter b) Low-pass filter
 - c) Wiener Filter d) High-pass filter.
- v) A spatial averaging filter in which all co-efficient are equal is called a
 - a) Weighted average filter
 - b) Box filter
 - c) Watershed segmentation
 - d) Histogram equalization.
- vi) Contrast stretching is an
 - a) image segmentation technique
 - b) image enhancement technique
 - c) image restoration technique
 - d) none of these.
- vii) In a gray scale image where pixel values are ranging from 0-255, how much space is necessary to store one pixel
 - a) 16 bit b) 32 bit
 - c) 24 bit d) 8 bit.



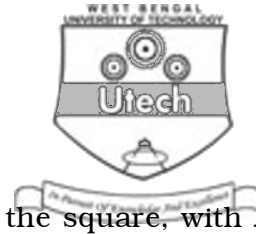
- viii) Line detection is a
- a) Feature extraction process
 - b) Image registration process
 - c) Global mapping model
 - d) None of these.
- ix) A 2000-foot road is represented on a map with a 1-inch line. What is the map scale ?
- a) 1 : 24,000
 - b) 1 : 2,400
 - c) 1 : 2, 000
 - d) None of these.
- x) Adaptive threshold is a
- a) point operator
 - b) a filtering technique
 - c) region growing technique
 - d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. a) What is the difference between global and local thresholding ?
- b) What do you mean by dynamic thresholding ? $3 + 2$
3. What is image smoothing and image sharpening ?



4. The following figure below shows

- i) a 3-bit image of size 5-by-5 image in the square, with x and y coordinates specified
- ii) a Laplacian filter and
- iii) a low-pass filter.

$y \backslash x$	0	1	2	3	4	Laplacian Filter	Low pass Filter
1	3	7	6	2	0	0 1 0	0.01 0.1 0.01
2	2	4	6	1	1	1 -4 1	0.10 0.56 0.10
3	4	7	2	5	4	0 1 0	0.01 0.1 0.01
4	3	0	6	2	1		
5	5	7	5	1	2		

Compute the following :

- a) The output of a 3×3 median Filter at (2, 2)
 - b) The output of the 3×3 Laplacian Filter shown above at (2, 2)
 - c) The output of the 3×3 low-pass Filter shown above at (2, 2). 1 + 2 + 2
5. a) What is vectorization and why is it required in GIS ?
- b) What is weber ratio ? 3 + 2
6. Explain Spatial and Gray Level resolution.

**GROUP – C****(Long Answer Type Questions)**Answer any *three* of the following. $3 \times 15 = 45$

7. a) Consider the two image subsets, S_1 and S_2 , show in the following figure. For $V = \{ 1 \}$, determine whether these two subsets are
- 4-adjacent,
 - 8-adjacent or
 - m -adjacent.

	S_1				S_2				
0	0	0	0	0	0	0	1	1	0
1	0	0	1	0	0	1	0	0	1
1	0	0	1	0	1	1	0	0	0
0	0	1	1	1	0	0	0	0	0
0	0	1	1	1	0	0	1	1	1

- What are gray image and binary image ?
- Consider the image segment shown :
 - Let $V = \{ 0, 1 \}$ and compute the lengths of the shortest 4-, 8- and m -path between p and q . If a particular path does not exist between these two points, explain why.



ii) Repeat $v = \{ 1, 2 \}$.

$$\begin{array}{cccc} 3 & 1 & 2 & 1 \\ 2 & 2 & 0 & 2 \\ 1 & 2 & 1 & 1 \\ (p) & 1 & 0 & 1 & 2 \end{array} \quad (q)$$

6 + 2 + 7

8. a) Compute Full Convolution and Correlation result for the following image segment f using given filter w .

Origin $f(x, y)$

0 0 0 0 0

0 0 0 0 0

0 0 1 0 0

0 0 0 0 0

0 0 0 0 0

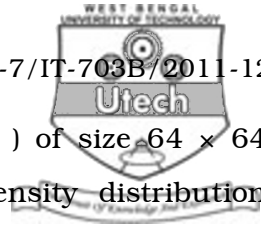
$w(x, y)$

1 2 3

4 5 6

7 8 9

- b) Discuss the contrast stretching method for image enhancement.



- c) Suppose that a 3-bit image ($L = 8$) of size 64×64 pixels ($MN = 4096$) has the intensity distribution shown below, where the intensity levels are integer in the range $[0, 7]$. Draw its original histogram, transformation function and equalized histogram.

r_k	n_k
$r_0 = 0$	790
$r_1 = 1$	1023
$r_2 = 2$	850
$r_3 = 3$	656
$r_4 = 4$	329
$r_5 = 5$	245
$r_6 = 6$	122
$r_7 = 7$	81

5 + 5 + 5

9. a) What is meant by GIS ?
- b) What are the functions of GIS ?
- c) What are the features of GIS ?
- d) Describe the perspective projection. 2 + 3 + 3 + 7



10. a) Describe the following operations :

- i) Median filtering
- ii) Lowpass spatial filtering.

b) Describe the process of Histogram equalization. What purpose does it serve ? (5 + 5) + 5

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

- a) Homomorphic filtering
 - b) Hough transform
 - c) Point processing
 - d) Discrete cosine transform
 - e) Pixel connectivity
 - f) Constrained least square filtering.
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