University of Rajshahi
Department of Computer Science and Engineering
B.Sc. Engg. Part 4 Odd Semester Examination 2015 (Session: 2011-12)
Course No. : CSE4121 (Digital Image Processing)

Marks: 52.5 Time: 3 Hours

(Answer any three questions from each Part)

Part-A

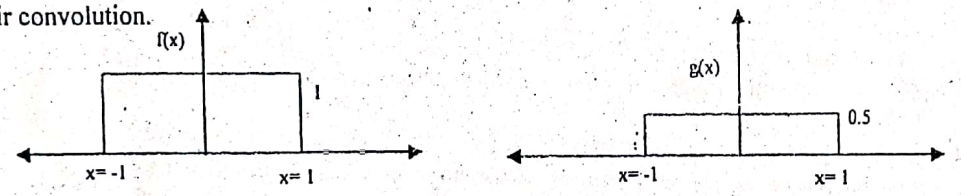
1. a) Define digital image. Explain the model for digital image representation. 3
   b) Define 4-adjacency, 8-adjacency and m-adjacency with example. 3
   c) Explain the image digitization process briefly. 2.75

2. a) Define image histogram. Explain its interpretation with example. 3
   b) How does the histogram of the following image look like: 2
   (i) Dark image, (ii) Bright image, (iii) Low contrast image, (iv) High contrast image
   c) Consider a 4x4 image segment having gray scale between [0, 9]. Find the histogram equalize image and draw the image histogram before and after equalization. 3.75

2	3	3	2
4	3	4	2
2	3	3	5
2	4	2	4

3. a) Explain general mode of image enhancement with point processing. 2
   b) With necessary graphs, explain Log transformation and power law transformation for spatial domain image enhancement. 4
   c) Suppose you have an image of landscape and you like to increase the intensity of specific gray levels. Which transformation is required? Explain. 2.75

4. a) Define spatial filtering method with general equation. Explain the effects of mask size. 3
   b) Define correlation and convolution. Consider the following functions f(x) and g(y) draw the outcome of their convolution. 2.75



   c) Explain the use of Laplacian operator in edge detection of an image. 3

Part-B

5. a) Define image sharpening filter and compare 1st and 2nd derivatives. 3
   b) Discus the process of frequency domain image filtering. 2.75
   c) Explain and compare ideal low pass filter and Butterworth filter for image smoothing. 3

6. a) Discuss the model of the image degradation and restoration process. 3.75
   b) Briefly discuss about any four noise probability density function with diagram. 4
   c) What is notch filter? 1

7. a) Why image segmentation is necessary? Explain the process of detecting -45^0 line in the image using the appropriate mask. 3
   b) How thresholding can be applied in image segmentation. Illustrate the basic global thresholding algorithm for image segmentation. 3
   c) Explain how histogram is used in image thresholding. 2.75

8. a) Write the basic formulation of region-based segmentation. 1.75
   b) Briefly discuss hit-or-miss transformation. 4
   c) Discuss boundary extraction algorithm using morphological processing. 3

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Department of Computer Science and Engineering

B.SC (Engg.) Part-4, Odd Semester, Examination 2016

Course: CSE-4181 (Digital Image Processing)

Time: 3 Hours | Full Marks: 52.5

Section-A

1. a) Define the terms: brightness, contrast, dynamic range. 3
   b) Discuss the model of the image degradation and restoration process. 4
   c) Illustrate the mathematical model for grayscale and binary image representation in terms of incident and reflected light intensity. 1.75

2. a) What is resolution? Explain spatial resolution and intensity level resolution. 2
   b) What type of information of image is represented by histogram? Can it be used image recognition? Explain. 2.75
   c) Obtain histogram equalization for the following image segment of size 5 X 5. Write the interference on the image segment before and after equalization. 4

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44444
34543
35553
34543
44444
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3. a) Explain gray level slicing and bit plan slicing. Mention their major application areas. 3
   b) Discuss in detail the Homomorphic and derivative filters. 3
   c) Suppose you have an x-ray image. How its intelligibility can be increased? Explain. 2.75

4. a) Illustrate the general model of spatial filtering for image enhancement. Is there any relationship between the spatial resolution and the size of the mask? Explain. 3
   b) Define cross correlation and autocorrelation with example. Mention the uses of autocorrelation. 2.75
   c) When edge detection is necessary? Explain how image enhancement is performed using histogram based thresholding. 3

Section-B

5. a) Explain point processing and neighborhood operations for image enhancement. How are they related? 3
   b) Consider the following image and draw the signal representing the gray level values along the scanning line AB. Then illustrate the Fourier transform of the signal. 2.75

   c) How frequency domain image filtering is implemented? Explain ideal filter for image sharpening. 3

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6. a) Define Sobel operator. Write Sobel horizontal and vertical edge detection masks. 3.75
   b) Explain line detection technique. 3
   c) Define compression ratio. How are shift codes generated? 2

7. (a) Explain the terms Hue and Saturation for a color image. 2
   (b) Describe the procedures to convert colors from RGB to HSI and HSI to RGB. 5
   (c) Explain the color complements of a color image with figure. 1.75

8. a) Define Image segmentation and mention its necessity. Explain basic global thresholding method. 4
   b) Differentiate between single and multi-value thresholding with examples. 1.75
   c) Write morphological algorithm for (i) Convex Hull, (ii) Thinning and (iii) Thickening. 3

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Department of Computer Science and Engineering
B.Sc. (Engg.) Part-IV, Odd Semester, Examination 2017
CSE4181 (Digital Image Processing)

Marks: **52.5** Time: **3 Hours**

Answer any **three** questions from **each part.**

Part-A

1.(a) Illustrate the mathematical model to represent gray-scale and color image. 2

(b) Define non-uniform sampling. Explain the effects of sampling and quantization on the quality of digital image. 4

(c) Differentiate between gray-scale and B/W image. Suppose you have a color in which the maximum intensity levels of Red, Green and Blue colors are 25, 26 and 27 respectively. How much memory is required to store the image of size 200×200. 2.75

2.(a) Define histogram and illustrate its applications in image understanding. 3

(b) Explain the process of histogram equalization in image enhancement. Differentiate between histogram equalization and histogram specification methods for image enhancement. 3

(c) Perform histogram equalization of 5x5 image having the following data: 2.75

Gray level	0	1	2	3	4	5	6	7
No. of pixels	0	0	0	8	~~12~~ 11	6	0	0

3.(a) Is it possible to reduce the noise contents by adding a set of noisy images? Justify your answer. 3.75

(b) Assume that the fingerprint shown in the following Figure-3(a) is corrupted by noise. Write down the steps to eliminate the noise and its effects on the fingerprint while distorting it as little as possible so that we can get an image as shown in the following Figure-3(b). 5

(a) (b)

Figure-3

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4.(a) Mention the effects of power law transformation. Explain the outcomes of power law transformation with $\gamma = 3$ and $\gamma = 0.3$ in general equation, $s = c * r^{\gamma}$. 3

(b) Differentiate between point processing and neighbourhood operation for image enhancement in spatial domain. Illustrate the general model of spatial filtering. 2.75

(c) Explain weighted smoothing filter operation with example. 3

Part-B

5.(a) Derive the Laplacian mask using 2nd derivative in spatial domain. 3

(b) Consider the following image with 4-bit gray level and construct the vector x consisting the intensity along the scanning line AB. Then derive the 1st and 2nd derivatives of x. 3

(c) Differentiate between 1st and 2nd derivatives for image sharpening. 2.75

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6.(a) Assume a 4-bit 6×6 image, $f(x, y)$, has the following matrix of intensity, 5.75

15	5	15	15	5	6
6	15	2	2	14	4
5	15	2	2	12	2
4	15	4	4	10	1
3	15	3	4	15	0
2	2	15	15	0	0

What are the 1st, 2nd, 3rd and 4th bit planes of $f(x, y)$? What kind of information do the higher-order and lower-order bit planes contain?

(b) What will be the output image (intensity matrix), $g(x, y)$, after applying transformation function $T(r)$ as shown in Figure-6(a) and Figure-6(b) on $f(x, y)$ [intensity matrix shown in question 6(a)]. 3

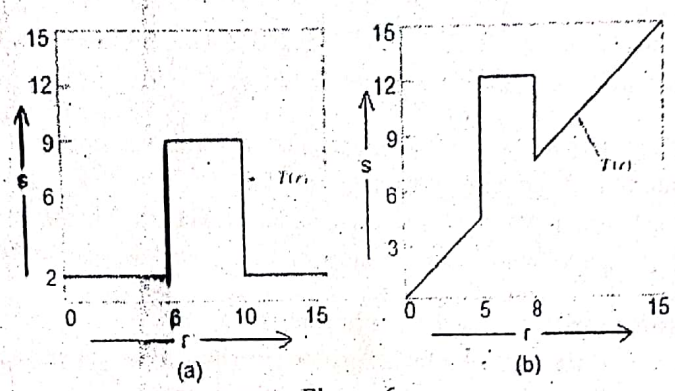

Figure-6

Here r and s denote gray levels of $f(x, y)$ and $g(x, y)$, respectively.

7.(a) Associate each histogram shown in Figure-7[d-f] with an Image shown in Figure-7[a-c]. 1.5

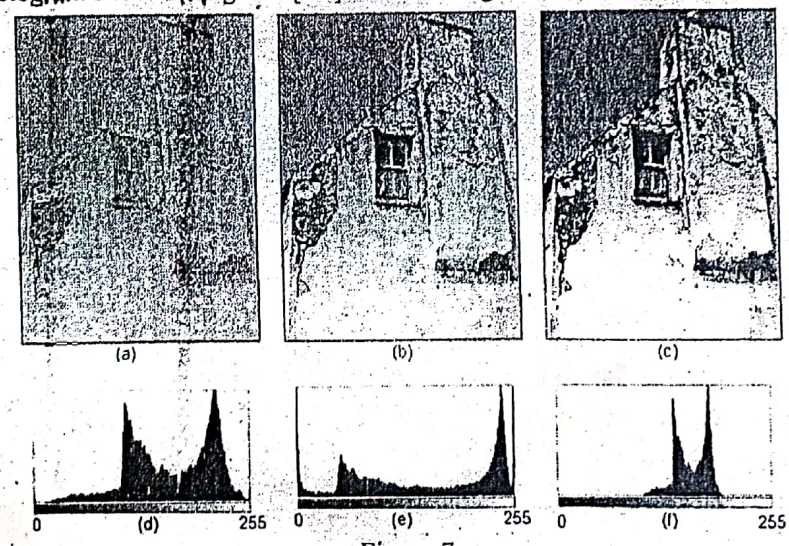

Figure-7

(b) Write down the steps to get the image in Figure-7(c) from the image in Figure-7(a). 5

(c) Can we reconstruct any image from its histogram? Justify your answer. 2.25

8.(a) Illustrate the applications of morphological operations in image processing with examples. 3

(b) Explain opening operation with examples. 3

(c) Define hit, fit and structuring element. Explain the effects of structuring element in erosion. 2.75

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University of Rajshahi

Department of Computer Science and Engineering

B.Sc. (Engg.) Part-4, Odd Semester, Examination-2018

Course: CSE4181 (Digital Image Processing)

Marks: 52.5 **Time: 3:00 Hours**

[N.B. Answer any **Six** questions taking **Three** from each section]

Section-A

1. (a) Illustrate the image processing system with block diagram. Explain its two most crucial steps. 4
   (b) Why sampling is required? Explain the effects of quantization on the quality of digital image. 3
   (c) State the model of grayscale and color image representation. 1.75

2. (a) Define image histogram. Is it possible to use histogram as feature for image classification? Explain. 3
   (b) How does the histogram of the following image look like: 2
   (i) Dark image, (ii) Bright image, (iii) Low contrast image, (iv) High contrast image
   (c) Explain histogram equalization process for image enhancement with example 3.75

3. (a) How point processing works for image enhancement? Discuss. 2.75
   (b) Why Log transform is used in image enhancement? Explain with proper example. 3
   (c) How negative image is obtained? Explain gray level slicing method. 3

4. (a) What are the different causes of image degradation? 2
   (b) Discuss the model of the image degradation and restoration process. 5
   (c) Mention the drawbacks of inverse filtering. 1.75

Section-B

5. (a) Why image sharpening filter is required for image enhancement? Explain. 3
   (b) Write down the steps of frequency domain image filtering. Compare it with spatial filtering. 3
   (c) Explain the problem of using ideal low pass filter. Explain the equation $H_{hp}(u, v) = 1 - H_{lp}(u, v)$. 2.75

6. (a) Mention the sources of noise. Explain the model of noisy image. 3
   (b) Discuss the method of suppressing periodic noise from the image. 3
   (c) Explain Geometric mean and midpoint filter to remove noise. 2.75

7. (a) Define image segmentation with example. Illustrate the process of detecting horizontal and vertical lines in an image with appropriate mask. 3.75
   (b) Explain the method of thresholding for image segmentation. 2
   (c) Explain how histogram is used in image thresholding. 3

8. (a) Define compression ratio. How are the shift codes generated? 3
   (b) State the principle of Huffman coding. 4
   (c) Mention the limitation of Huffman coding. 1.75

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