Benha University   **Faculty of Computers & Informatics**

1ˢᵗ Term (January 2013) Final Exam   **Date**: 9/1/2013
Class: 4ᵗʰ Year Students   **Time:** 3 Hours
Subject: Image Processing   **Examiner:** Dr. Mazen Selim

Answer the following questions:

Question (1)   (15 Marks) (5+10)

(a) Write a MatLab function called "ImageAdjust" that accepts an input image and returns an enhancement image, using the following linear level adjustment formula:

Padjus(m,n)= Bottom + (P(m,n)-L)/(H-L)*(Top-Bottom) Where

P(m,n) original image pixel   **Padjus(m,n)** desired image pixel
H maximum pixel level in the original image   **L** minimum pixel level in the original image
Top maximum pixel level in the image desired   **Bottom** minimum pixel level in the desired image

Check the class of the input image in your code, to determine the correct values for Bottom and Top. The output image must be in uint8 class.

(b) Assume that an image of 32x32 with 32 gray levels distributed as follow

Gray level	12	14	15	16	18	19	20	21	22
no. of pixels	74	50	100	250	150	280	30	50	40

For the image represented in the previous table
  (i) Draw the image histogram
  (ii) Find the average(mean) intensity and the standard deviation
  (iii) Find the equalized histogram
  (iv) Find the specified histogram according the following values?

Zq	4	6	8	10	12	16	18	20	22
Specified $P_z(z_q)$	0.05	0.1	0.1	0.15	.2	0.15	0.1	0.1	0.05

Question (2)   (16 Marks) (4+12)

a) Explain the types of data redundancies, give an examples?
b) Consider the simple 4X7, 8-bit image:
   a. Compute the entropy of the image:
   b. Compress the image using Huffman coding
   c. Compute the compression achieved and the effectiveness of the Huffman coding
   d. Redistribute the image intensities according to 7 bits/gray
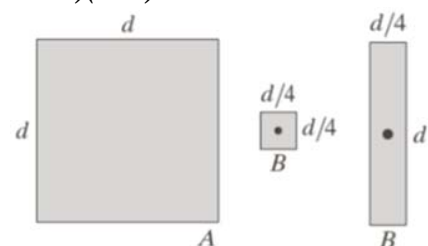
c)

22	22	22	96	96	245	245
22	22	22	96	96	245	245
22	22	50	50	50	255	255
25	25	25	25	99	99	99

Question (3)   (12 Marks)(4+8)

a) Explain with the aid of figure the most common types of image transformation functions?
b) Define the erosion and dilation processes in terms of set theory, give an equation. For the figures shown to the right, find the result of eroding and dialating of A by B

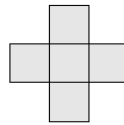## Question (4)   (22 Marks)(6+6+10)

a) A 4X4 Image is given by figure (i), Filter the image using a Median filter (after replicate-padding), where the filters mask is given as in figure (ii)

b) Describe an algorithm to locate all of the large boxes in the image below in figure (iii).

c) Explain how can the laplacian be used for image sharpening and then write an algorithm in MatLab code to represent the process
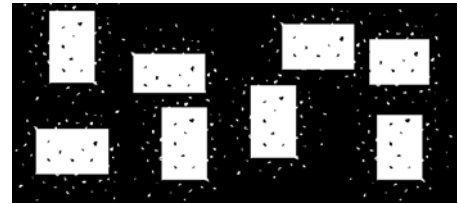
$$\nabla^2 f = \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$$

9	8	7	6
8	7	13	5
7	6	5	4
6	1	4	3

(i)   (ii)   (iii)

⚡ *GOOD LUCK* ⚡