Benha University ***Faculty of Computers & Informatics***

1st Term (January 2015) Final Exam ***Date**: 10/1/2016*
***Class:** 4th Year Students* ***Time:** 3 Hours*
***Subject:** Image Processing* ***Examiner:** Dr. M. Taha*

Answer the following questions:

Question (1) ***please make a table of two columns, one for the question no. and the other for your selection (10 Marks)***

1) *The process of moving a filter mask over the image and computing the sum of products at each location is defined by_____*
   a) Convolution b) Rotation c) Linearity d) Correlation e) None of the above
2) *The sum of all components of a normalised histogram is equal to_____*
   a)Size of the image b) Size of rows of the image c) Size of columns of the image d) One e) MxN
3) *Image restoration usually uses a model that is based on ____*
   a) Additive noise b) Multiplicative noise c) Division noise d) Subtractive noise
   e) None of the above
4) *Convolution is usually used in the _____ domain.*
   a) Frequency b) Spatial c) Feature d) Featureless e) None of the above
5) *Fourier transform is a _____ transform*
   a) Linear b) Nonlinear c) Bilinear d) Bicubic e) None of the above
6) *Ideal filters can be _____*
   a) LPF b) HPF c) BPF d) All of the above e) None of the above
7) *The Rayleigh density can be used to approximate _____*
   a) Ideal histograms b) Non-Ideal histograms c) Butterworth histograms d) Gaussian histograms
   e) Skewed histograms
8) *Which of the following filters is effective in the presence of salt-and-pepper noise?*
   a) Average filter b) Median filter c) Sobel filter d) Robert filter e) All of the above
9) *_____ is the process of using known data to estimate values at unknown locations .*
   a) Decimation b) Interpolation c) Formulation d) All of the above e) None of the above
10) *An image element is usually called a _____*
   a) Pixel b)f(x,y) c) picture point d) All of the above e) None of the above

Question (2)

a) *For the image shown in Fig. 2(a), find a transformation function (i.e. a look-up-table) that will change its histogram to match the one shown in Table 1. Draw the transformed image in Fig. 2(b). Also determine the histogram of the transformed image. Assume that the processed images can only take integer values between 0 and 7 (including 0 and 7).*

b) *Briefly explain the operation of the Alpha-trimmed mean filter. What are its uses for image processing?*

Question (3)

a) *List the major steps needed for performing edge detection of an image by thresholding the gradient magnitude computed using **Sobel operator**. For simplicity, assuming the threshold value is given in advance, denoted by T.*

b) *Write a MATLAB function that will implement these steps in (a). Assuming the image size is W (width) x H (height). Also you can ignore the boundary problem by performing edge detection only on non-boundary pixels.*

Question (4)

a) *Explain the differences between regular and adaptive thresholding. Give examples of when each type should be used.*

b) *Find the opening of the binary image, F, in Fig. (a) by the structuring element H in Fig. (b).*

c) *Given an input image of size 7 x 7 shown below, was filtered using 3 x 3 adaptive median filter with maximum allowed size of 5 x 5. What are the values of the pixels x, y, and z in the output image?*

3	3	4	3	3	3	0
3	0	0	0	0	0	3
3	4	0	0	4	4	3
4	5	7	7	0	0	3
3	3	6	0	0	7	0
3	0	4	3	3	5	3
3	4	3	3	0	0	4

Fig.(a)

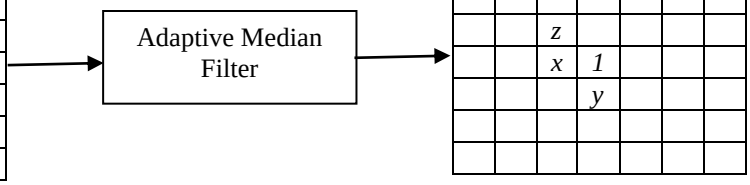


Fig.(b)

Question (5)

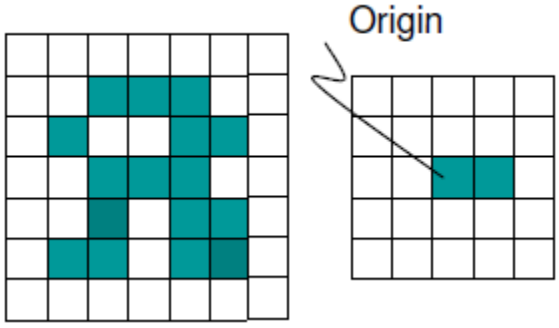
a) *Explain with examples the type of data redundancies?*

b) *You have a source with 6 symbols {a1, a2, a3, a4, a5, a6}. The probability for each symbol is z=[0.15 0.25 0.05 0.05 0.4 0.1].*

1. *Calculate the entropy of the source.*
2. *Create a Huffman code for the source.*
3. *Calculate the average word length of the source.*
4. *Calculate the coding efficiency for the Huffman code.*

Table 1: Desired histogram

Gray level f	0	1	2	3	4	5	6	7
Histogram h(f)	8	6	4	2	2	1	1	1



0	1	2	3	4
1	2	3	4	5
2	3	4	5	6
3	4	5	6	7
4	5	6	7	7

GOOD LUCK