



Course Title:	Digital Image Processing	Date:	02/05/2012
Course No:	0750474	Time Allowed:	1 Hour
Lecturer:	Dr. Qadri Hamarsheh	No. Of Pages:	2

Information for candidates

1. This examination paper contains 6 questions totaling 20 marks
2. The marks for parts of questions are shown in round brackets.

Advices to candidates

1. You should attempt all questions.
2. You should write your answers clearly.

Basic notions: The aims of the questions in this part are to evaluate the required minimal student knowledge and skills. Answers in the pass category represent the minimum understanding of basic concepts: Relationships between pixels, Distance Measures, Intensity Transformation, Histograms and Spatial Filtering.

Question 1 Multiple choices (circle the most appropriate one):**(4 marks)**

1. To map a narrow range of low gray-level input image into a wider range of output levels , we use
 - a) Log Intensity Transformation Function
 - b) Power-law Intensity Transformation Function
 - c) Inverse Log Intensity Transformation Function
 - d) Identity Intensity Transformation Function
2. The sum of all elements in the mask of the smoothing averaging spatial filtering must be equal to
 - a) m rows
 - b) n columns
 - c) $m * n$
 - d) 1
3. Sharpening the images is commonly accomplished by performing a spatial ----- of the image field.
 - a) Min Filter
 - b) Smoothing Filter
 - c) Integration
 - d) Differentiation
4. One of the following filters is nonlinear
 - a) Gaussian Filter
 - b) Averaging Filter
 - c) Laplacian Filter
 - d) Median

Question 2 Consider the two image subsets, S_1 and S_2 , shown in the following figure. For $V = \{1\}$, determine whether these two subsets are

(a) 4-adjacent, (b) 8-adjacent, or (c) m -adjacent.

(2 marks)

	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

Question 3 Explain the Gray-level slicing concept, its two methods and plots.

(2 marks)

Question 4 The following figures show

(3 marks)

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

Y \ X	Image				
	1	2	3	4	5
1	3	7	6	2	0
2	2	4	6	1	1
3	4	7	2	5	4
4	3	0	6	2	1
5	5	7	5	1	2

Laplacian mask		
0	1	0
1	-4	1
0	1	0

Low pass filter		
0.01	0.1	0.01
0.1	0.56	0.1
0.01	0.1	0.01

Compute the following:

- (a) The output of a 3×3 mean (average) filter at (3, 3). (0.5 mark)
- (b) The output of the 3×3 Laplacian filter shown above at (3, 3). (0.5 mark)
- (c) The output of the 3×3 low-pass filter shown above at (3, 3). (0.5 mark)
- (d) The histogram of the whole image. (1.5 mark)

Familiar and Unfamiliar Problems Solving: The aim of the questions in this part is to evaluate that the student has some basic knowledge of the key aspects of the lecture material and can attempt to solve familiar and unfamiliar problems of Intensity Transformation, Histograms, Spatial Filtering and programming these concepts using MATLAB.

Question 5 Write a Matlab script code to

(3 marks)

- Read an image "pout.tif" (256 gray levels).
- Calculate and plot the Cumulative Distribution Function for the image 'pout.tif'
- Add labels, text and title for your plot.

Question 6 Write a Matlab function called "imf_gaussian" that can handle a variable number of inputs, the code must contain error checking and validate the number of input arguments, the function must

- ❖ Read an image (the name of the image is given as an input argument).
- ❖ Perform smoothing using "Gaussian" filter mask with different options as the following.

1. **imf_gaussian (imagefilename, 'default')**

The 'default' option uses the 'fspecial' function to create the Gaussian filter mask, size of 7 rows and 7 columns, standard deviation equal 5, and filtering mode ='conv'.

2. **imf_gaussian (imagefilename, 'manual')**

The 'manual' option creates manually a Gaussian filter mask

Gaussian filter mask				
1	4	7	4	1
4	20	33	20	4
7	33	55	33	7
4	20	33	20	4
1	4	7	4	1

with standard deviation equal 5 and filtering mode ='conv'

3. **imf_gaussian (imagefilename, 'special', filtersize, sigma, filterMode)**

The 'special' option uses the 'fspecial' function to create the Gaussian filter mask with size defined by filtersize, standard deviation defined by sigma and filtering Mode defined by filterMode.

The default value are filtersize = [5 5], sigma =1, filtermode = 'corr'

- ❖ Display the original image and the filtered image depending on the calling mode.

(6 marks)

GOOD LUCK