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CONFIDENTIAL

SET B

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
SEPTEMBER 2013 SESSION

SUBJECT CODE	:	**FSB 33503 / FSB 43503**
SUBJECT TITLE	:	**IMAGE PROCESSING**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**3 HOURS**
DATE	:	

INSTRUCTIONS TO CANDIDATES

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **This question paper is printed on both sides of the paper.**
3. **Please write your answers on the answer booklet provided.**
4. **Answer should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of TWO (2) sections, Section A and B. Answer ALL questions in Section A. For Section B, answer two (2) questions only.**
6. **Answer all questions in English.**
7. **Graph paper is appended.**

THERE ARE 8 PRINTED PAGES OF QUESTIONS, AND ONE PAGE OF GRAPH PAPER EXCLUDING THIS PAGE

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

(a) List two (2) areas of image processing application. Give an example of each application

(4 marks)

(b) Briefly explain the steps to rotate the image in Figure 1. (Assume the given image is RGB)

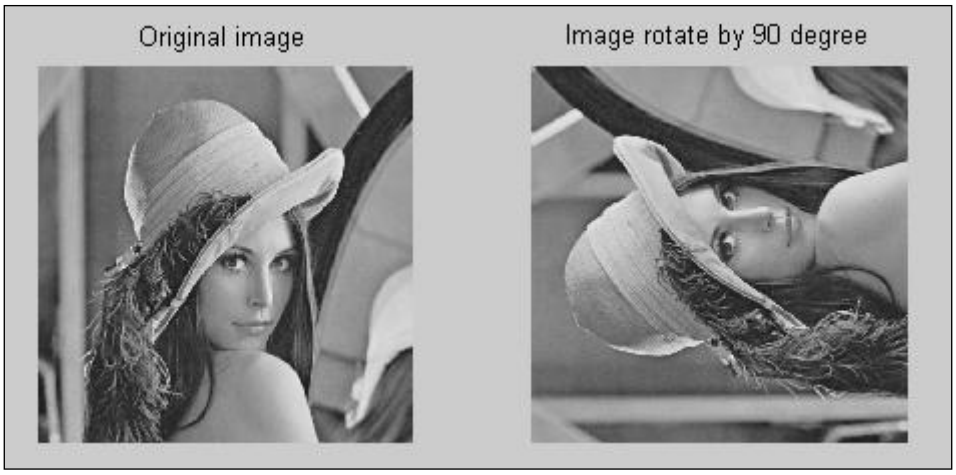

Figure 1: The image of Lena

(5 marks)

(c) Give two broad techniques of image enhancement

(2 marks)

(d) Figure 2 shows image enhancement using median filter**,** write the matlab code to remove the noise by using this filter (assume you need to add the noise using salt and paper techniques and the filename is “ceiling.tif”)

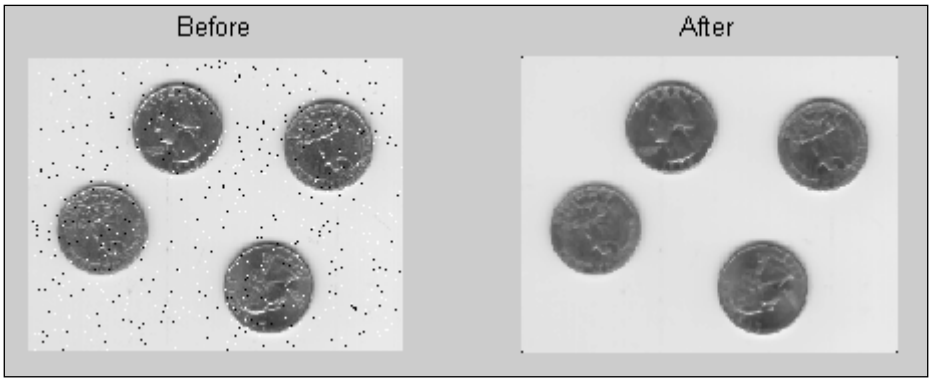

Figure 2: Image enhancement using median filter

(9 marks)

Question 2

(a) Explain in detail about image segmentation.

(5 marks)

(b) Dilation and erosion are two fundamental morphological operations. Based on the following codes, show the output for each line.

```
Line1: BW = zeros(10,10);
Line2: BW(3:6,3:8) = 1
Line3: SE = strel('square',3)
Line4: BW2 = imdilate(BW,SE)
Line5: BW2 = imerode(BW,SE)
```

(7 marks)

(c) In image processing, a technique known as median filter 3 x 3 neighborhoods could be used to enhance the quality of an image. A representation of an image is shown in Figure 3.

182	115	166	171	144	127	175	184	135	107
191	198	103	103	138	168	125	125	183	105
112	196	185	127	177	166	151	182	159	153
192	149	194	104	180	116	170	124	155	178
163	180	168	109	118	112	189	193	192	194
109	114	176	183	149	150	196	135	128	113
128	142	175	170	145	196	155	119	176	157
155	192	139	132	165	134	114	125	176	147
196	180	166	195	171	159	115	162	138	101
197	196	117	103	176	122	126	147	157	134

Figure 3: Matrix 10 * 10 image

For each of the following coordinate, explain by using illustrated figure the steps taken when we apply the median filter technique above. Show all your detail steps. (*Note: use replicate border pixels where applicable)*

i. (1,1)

(3 marks)

ii. (2:3,10)

(5 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer TWO (2) questions only.
Please use the answer booklet provided.

Question 3

(a) State two major problems that may affect the result of segmentation.

(2 marks)

(b) Describe the following morphological operations for binary images and give an example of their use in image processing:

i. Dilate image

ii. Closing

(4 marks)

(c) Connectivity refers to the way in which we define an object. There are three (3) ways to define the connectivity. Name and draw the diagram of the connectivity.

(6 marks)

(d) The image of rice grains shown in Figure 4(a), illustrates how you can enhance an image to correct non-uniform illumination. Write the Matlab code to read the image of rice grains and display it. (Assume the filename of the image is “rice.png”).

(4 marks)

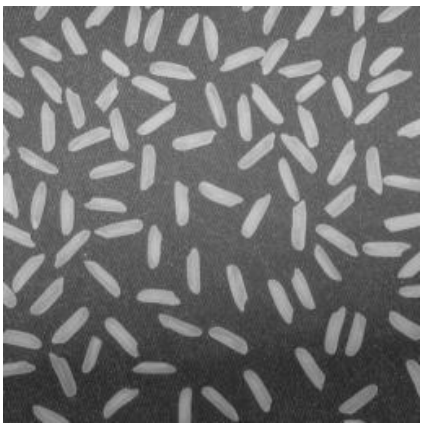

Figure 4(a): Original Image of rice grains

(e) The image and background are of class uint8 for Figure 4(b). Write the Matlab function code, IMSUBTRACT to subtract the background and display the output.

(4 marks)

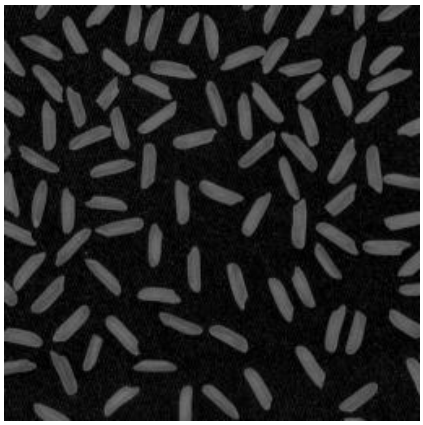

Figure 4(b): Image of rice grains after subtraction

(f) Figure 4(b) shows a darker image after subtraction. Write the Matlab code to enhance the image and display it as shown in Figure 4(c).

(4 marks)

Figure 4(c): Image of rice grains after enhancement

(g) Write the Matlab code to convert the image to binary image as shown in Figure 4(d) and display it**.**

(6 marks)

Figure 4(d): Binary Image of rice grains

Question 4

(a) Briefly explain about image enhancement and why we need to enhance the image.

(5 marks)

(b) List the two techniques of point processing in image enhancement

(5 marks)

(c) One way to enhance image is by reducing the pixel values using 3 by 3 neighborhood operations of minimum value. By using matrix image in Figure 5, show the steps to enhance the image at coordinate (2, 2).

	1	2	3	4	5
1	6	216	80	84	138
2	25	253	88	66	20
3	208	46	50	150	35
4	243	47	132	189	211
5	136	232	7	0	4

Figure 5: A matrix image of 5*5 scales

(5 marks)

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(d) Linear filtering of an image is accomplished through an operation called convolution. Based on the matrix image in **Table 1**, explain the four steps to compute the (3, 3) pixel convolution operation

(15 marks)

Table 1: The matrix of image A and the kernel

	1	2	3	4	5
1	136	11	139	65	97
2	42	37	40	140	83
3	90	19	118	53	49
4	86	145	18	48	143
5	54	61	99	19	129

Matrix Image A

8	1	6
3	5	7
4	9	2

Kernel

Question 5

(a) State the definition of transformation and why it is needed.

(4 marks)

(b) Give the definition of the following term in an image processing perspective:

i. Translation

ii. Rotation

iii. Scaling

(6 marks)

(c) Write the matlab code using **for loop** to transform the image from 'Before' to 'After' in Figure 6. (The size of image is 291*240 pixel, the filename of the image is 'pout.tif')

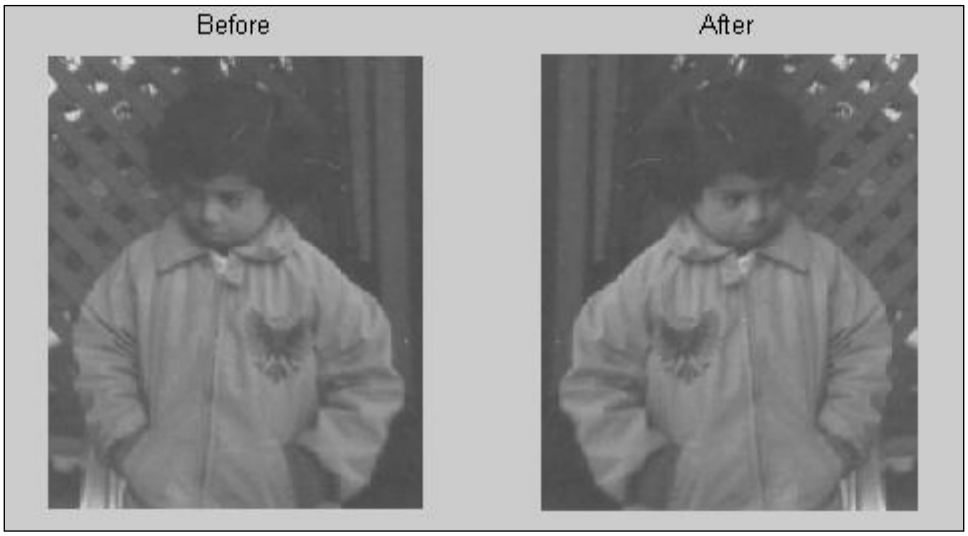

Figure 6: The image of Pout

(10 marks)

(d) Using homogenous composite transformation matrix, get the final point of P (8, 2) if the point is rotated by 60 degrees, then translate by (-3, 4), and finally scaled by the scale factor (2, 0.5).

(10 marks)

END OF QUESTIONS