



SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
SEPTEMBER 2013 SESSION

SUBJECT CODE : FSB 33503
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 6 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) An image can be viewed in 2D and 3D formation. Briefly discuss the 2D and 3D image formation
(4 marks)

- (c) Give two (2) broad techniques of image enhancement
(2 marks)

- (d) Figure 1 shows a matrix images with 5x5 scales. Calculate the mean, variance, standard deviation and histogram of its pixel values. Show the formula for mean, variance, standard deviation and histogram as a bar plot frequency of pixel vs pixel value

1	0	3	2	3
0	0	0	1	0
1	1	2	2	4
8	0	1	4	8
8	5	5	0	2

Figure 1: Matrix image of 5x5 scales

(10 marks)

Question 2

- (a) Explain briefly about image segmentation in term of meaning, goal and process in image processing .

(5 marks)

- (b) An object can be easily detected in an image if the object has sufficient contrast from the background. We use edge detection and basic morphology tools to detect a prostate cancer cell. The detection requires six (6) steps. State and explain in details for each step.

(12 marks)

- (c) Refer to **Figure 2**, state the process involved to transform Image A to Image B.

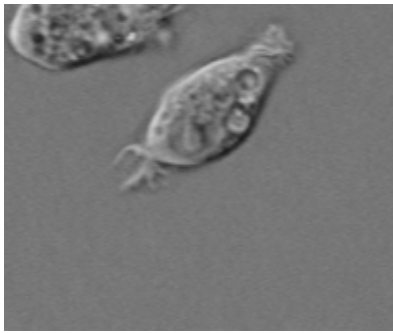


Image A

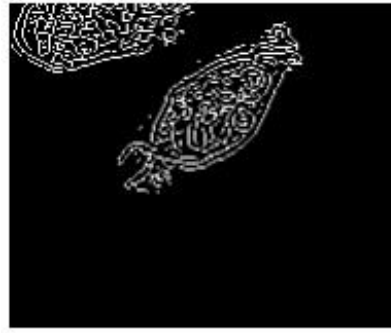


Image B

Figure 2

(3 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer TWO (2) questions only.

Please use the answer booklet provided.

Question 3

Figure 3 shows two (2) images and will be implemented extraction for classification.

$$\text{Image A} = \begin{bmatrix} 100 & 200 & 255 & 200 & 199 \\ 155 & 0 & 0 & 0 & 100 \\ 231 & 10 & 0 & 0 & 120 \\ 109 & 0 & 0 & 0 & 100 \\ 204 & 122 & 50 & 55 & 98 \end{bmatrix}$$

$$\text{Image B} = \begin{bmatrix} 1 & 0 & 5 & 0 & 199 \\ 5 & 70 & 80 & 100 & 0 \\ 2 & 10 & 0 & 0 & 0 \\ 9 & 0 & 0 & 0 & 10 \\ 0 & 2 & 0 & 5 & 98 \end{bmatrix}$$

Figure 3: Matrix images of each class

- (a) Sketch the view of the matrix images. (4 marks)

- (b) The matrix images have been converted to BW format with threshold value 10. Give the pixel values of both matrix images in Black and White format. (4 marks)

- (c) Compute the mean and standard deviation of both class images? (4 marks)

- (d) Write an algorithm to classify the images by using the mean statistical properties. (8 marks)

(e) Based on the two images in **Question 3(a)**, write the matlab code for below operations:

i. Add the two images and display the output images using subplot

(4 marks)

ii. Subtract between the images using `imsubtract` and `imabsdiff`. Display the output using subplot. Justify why the image output for this two functions displaying different intensity value.

(6 marks)

Question 4

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

(5 marks)

(b) State two technique of point processing enhancement

(4 marks)

(c) **Figure 4** shows the image that has been resized to 1.25 times from the original image. Write the matlab code to display this image as shown in **Figure 4**. (We could assume that the filename of the grayscale image is "circuit.tif").

(6 marks)

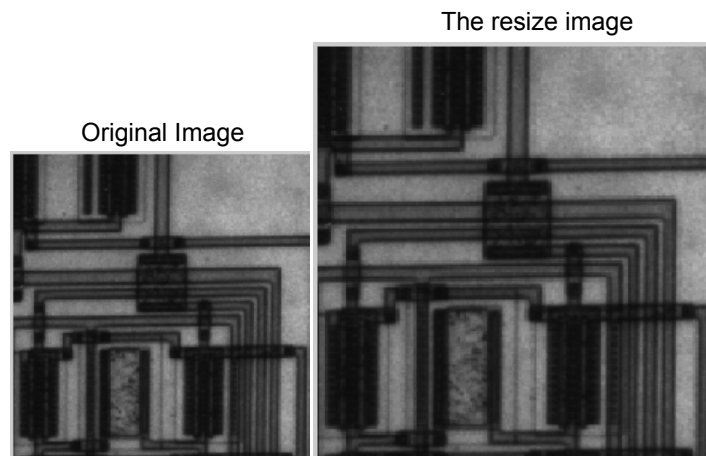


Figure 4: The resize image

- (d) Linear filtering of an image is accomplished through an operation called convolution. Based on the matrix image in Table 1, explain the four(4) steps to compute the (3,3) pixel convolution operation and in matlab code to rotate the instruction kernel.

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

- i. Translation
- ii. Rotation
- iii. Scaling

(6 marks)

(b) A point (P) of an object is rotate with an angle of θ as shown in Figure 5.

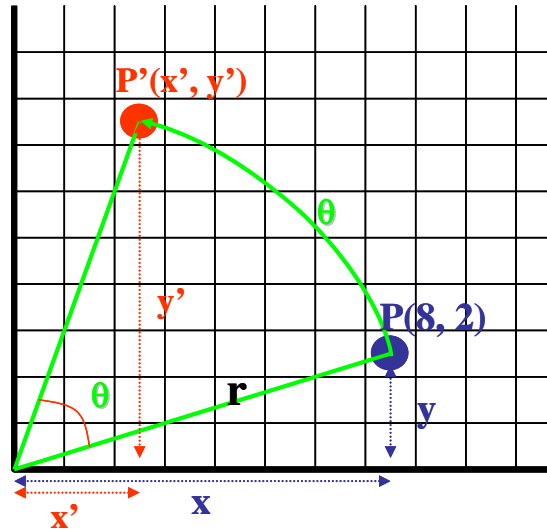


Figure 5: Rotation of a point (P) of an object

- i. Write the Rotation matrix of the above operation. Then, find the transformed point of an object, P' , after a point $P = (8, 2)$ has rotated in angle of 60° as shown in in Figure 5. (5 marks)

 - ii. Then the point P' (b(i)) is translated by $(-3, 4)$ to P_T . Write the translation matrix of the operation and find the point P_T . (5 marks)

 - iii. Finally the point P_T is scaled by a scale factor $(2, 0.5)$ to P_S . Write the scale matrix of the operation and find the point P_S . (5 marks)
- (c) 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 $(2, 0.5)$. Compare your finding with the result obtained in (b(iii)). (9 marks)

END OF QUESTIONS