



# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION SEMESTER I SESSION 2021/2022

COURSE NAME : IMAGE PROCESSING

COURSE CODE : BEJ 42903

PROGRAMME CODE : BEJ

EXAMINATION DATE : JANUARY/FEBRUARY 2022

DURATION : 3 HOURS

INSTRUCTION : 1. ANSWERS **ALL** QUESTIONS.

2. THIS FINAL EXAMINATION IS A  
**ONLINE ASSESSMENT AND**  
**CONDUCTED VIA OPEN BOOK**

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

**Q1** **Figure Q1(a)** shows a grayscale image represented by unknown pixel intensity values, which sized 5 x 5 pixels.

- (a) Provide an example of a line existence in a grayscale image represented by pixel intensity values, which sized 5 x 5 pixels. Draw a matrix as in **Figure Q1(a)** consisting of the combination of any integer from your Identity Card Number (NRIC), number “0” and number “255”. Please write your NRIC number.

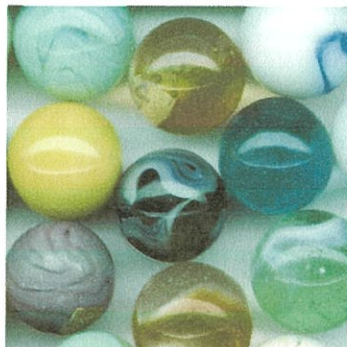
		$y$				
		1	2	3	4	5
$x$	1	?	?	?	?	?
	2	?	?	?	?	?
	3	?	?	?	?	?
	4	?	?	?	?	?
	5	?	?	?	?	?

**Original image,  $f(x,y)$**

**Figure Q1(a)**

(6 marks)

- (b) Figure Q1(b) shows the image corrupted by a type of noise. Analyze the noise characteristics in the image. Then answer the following questions.



(a) Original “marble” image



(b) Corrupted “marble” image

**Figure Q1(b)**

- (i) Suggest a technique/filter to remove the noise in **Figure Q1(b)**. (2 marks)
- (ii) Justify why do you suggest the filter in **Q1(b)(i)**. (2 marks)
- (iii) What are the expected effects to the output result after applying the suggested technique/filter in **Q1(b)(i)**? Discuss the effect of applying suggested technique/filter in **Q1(b)(i)** to the pixel intensity values in terms of line criteria for the matrix in **Q1(a)**. (4 marks)

(4 marks)

**Q2** Figure Q2 shows a  $3 \times 3$  filter for edge detection.

		$y$		
		1	2	3
$x$	1	-1	-1	-1
	2	2	2	2
	3	-1	-1	-1

(a)

		$y$		
		1	2	3
$x$	1	-1	-1	-1
	2	-1	8	-1
	3	-1	-1	-1

(b)

**Figure Q2**

- (a) Referring to **Figure Q1(a)**, compute the output of the filter as shown in **Figure Q2(a)** at pixel location (2,2). (10 marks)
- (b) Referring to **Figure Q1(a)**, compute the output of the filter as shown in **Figure Q2(b)** at pixel location (2,2). (10 marks)
- (c) Provide and elaborate THREE (3) segmentation applications that utilize fingerprint recognition. (12 marks)

**Q3** Figure Q3 shows  $3 \times 3$  structuring elements,  $B$ .

		$y$		
		1	2	3
$x$	1	1	2	3
	2	4	5	6
	3	7	8	9

$B$

**Figure Q3**

- (a) Find the output pixel value of **Figure Q1(a)** and  $B$  for pixel location at location at (1,1) **with using padding technique** for the erosion method. (16 marks)
- (b) Find the output pixel value of **Figure Q1(a)** and  $B$  for pixel location at location at (1,1) **without using padding technique** for the erosion method. (10 marks)
- (c) Based on result in **Q3(a)** and **Q3(b)**, which technique provide darker image result for **erosion**? Justify your answer. (4 marks)

TERBUKA

**Q4** In the field of medical imaging the use of computers is growing. Every day, a huge amount of data is produced from different medical imaging devices.

(a) Discuss briefly **TWO (2)** problems faced in handling this type of images. (8 marks)

(b) Discuss **TWO (2)** solutions how image compression technique can solve the problem in medical imaging. (8 marks)

(c) Discuss briefly **TWO (2)** wavelet transformation applications in medical imaging processing. (8 marks)

**-END OF QUESTIONS –**