UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME   :   IMAGE PROCESSING

COURSE CODE   :   BIM 33203

PROGRAMME CODE   :   BIM

EXAMINATION DATE   :   JULY 2024

DURATION   :   3 HOURS

INSTRUCTIONS   :

1. ANSWER ALL QUESTIONS
2. THIS TEST IS CONDUCTED VIA
   ☐ Open book
   ☒ Closed book
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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Q1   In image compression, data redundancy is correlative to compression ratio. If datasets n_1 and n_2 have values of 48 and 6, respectively, calculate how much data (in percentage) in dataset n_2 will become redundant.

(4 marks)

Q2   The creation of information in an image can be regarded to be probabilistic. Based on the equation below, describe the major processes of estimating compression information in a pixel.

$$I(E) = log(\frac{1}{P(E)}) = - log(P(E)) \text{ units of information}$$

(12 marks)

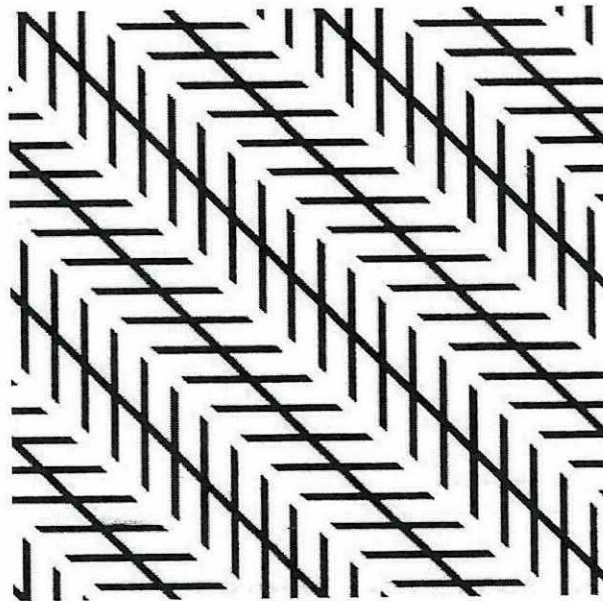**Q3**   Figure Q3.1 illustrates a sample of achromatic image with multi-angled lines.

Figure Q3.1

(a)   Describe the best procedures for detecting diagonal black lines in **Figure Q3.1**.

(6 marks)

(b)   Draw the output result of **Q3(a)**.

(2 marks)

Q4   **Figure Q4.1** displays a chromatic image of `objects.png` in various shapes and polygons. Using MATLAB™ as your image processing platform, write down all necessary commands for segmenting an object identified as *Y*. Your answer should also include an elaboration of the command lines used (in the form of a comment).
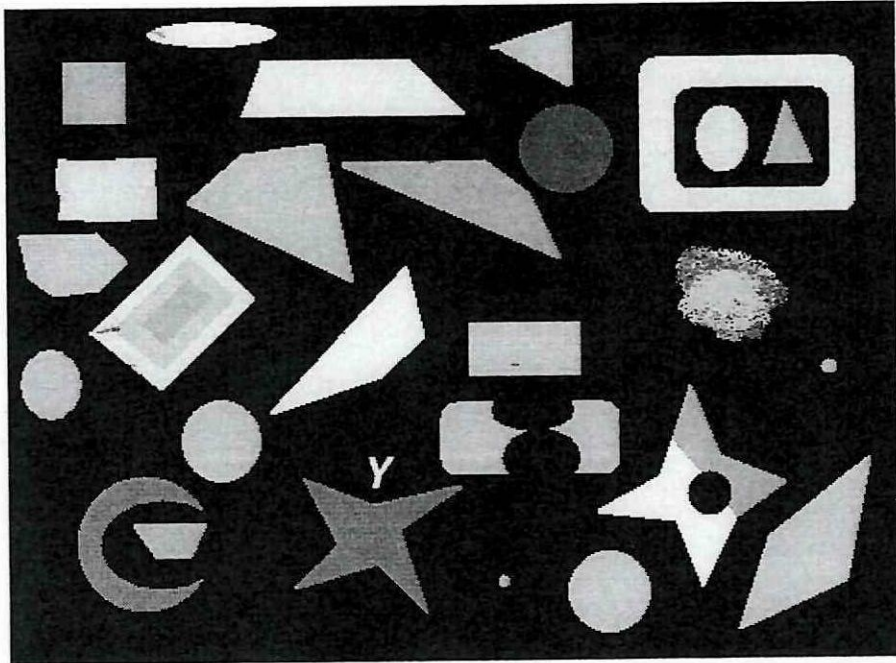
(8 marks)

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Figure Q4.1

Q5 Given an input image as shown in **Figure Q5.1**, draw the probable outputs for 'erosion' and 'dilation', based on their respective structuring element patterns.
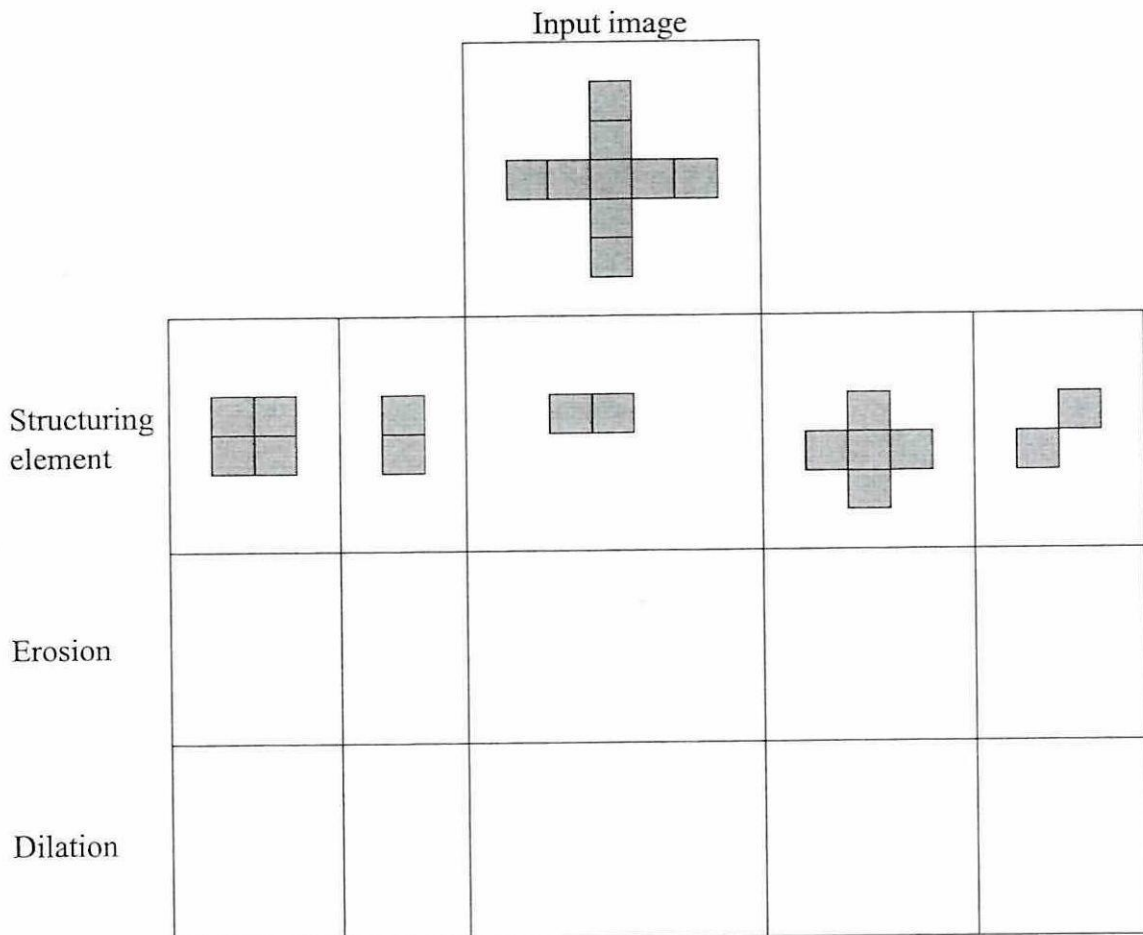
(10 marks)

Figure Q5.1

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Q6   By using `coins.png` as the input image and a hole-filling algorithm as the primary function:

   (a)   Explain (in MATLAB™ code only) how you can accurately display the output result.

   (5 marks)

   (b)   Illustrate what would happen to your result in **Q6(a)**, if these functions were applied subsequently:

   (i)   `bwconvhull`

   (2 marks)

   (ii)   `bwperim`

   (2 marks)

   (iii)   `bwskel`

   (2 marks)

Q7   Your new employer sent you both physical and digital business cards. Your digital business card template was provided to you under the name `bc_yourname_matric_fsktm.png`.

   (a)   By using the appropriate Optical Character Recognition (OCR) command lines, how do you read the image and display the results of the recognized text within your digital business card?

   (6 marks)

   (b)   How do you create and show boundary boxes around the recognised words on your digital business card?

   (2 marks)

   (c)   Your new employer is Universiti Tun Hussein Onn, and understandably, this name appears on both versions of your business cards. Following up on the preceding question (**Q7(b)**), how do you locate and highlight the word 'Universiti' on your digital business card?

   (4 marks)

Q8   In your own words, explain why the domain of object recognition is so important today. Your answer should also include at least **TWO (2)** real-world applications for this domain.

   (10 marks)

- END OF QUESTIONS -

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