RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Information and Communication Technology
Second Year - Semester I Examination – September/ October 2019

ICT 2403 – GRAPHICS AND IMAGE PROCESSING

Time: Three (03) hours

- This paper has 4 questions in 5 pages.
- **Answer ALL questions.**

1.

a) Which frequency bands used for Computer Axial Tomography (CAT), Fluorescence Microscope, Light Microscope and Magnetic Resonance Imaging (MRI)? **(04 marks)**

b) *"Computer vision is the transformation of data from a still or video camera into either a decision or a new representation."* Explain the underlined terms of the above computer vision definition by using suitable examples. **(04 marks)**

c) Calculate the number of Bytes required for storing the image consists of 64×32 samples and 256 grey levels. **(05 marks)**

d) What is meant by Image Enhancement? Why is it problem oriented? **(04 marks)**

e) State how computer vision applies in surveillance, quality control, analysis of medical images and robotics using suitable examples. **(08 marks)**

2.

a) What is the difference between sampling and quantization? **(04 marks)**

b) State why the higher frequency bands carry more energy per photon than the low frequency bands in Electro Magnetic Energy Spectrum? **(02 marks)**

c) Briefly describe the main visual difference between the <u>intensity histograms</u> of two gray scale images which have <u>low dynamic range</u> and <u>high dynamic range</u>? **(04 marks)**

d) State the suitable image processing technique(s) for evading following given cases.

(05 marks)

    i.   To remove salt and pepper noise from a gray scale image.

    ii.   To detect the vertical and horizontal edges in a gray scale image.

    iii.   To remove illumination imbalance of a gray scale image.

    iv.   To remove tiny extrusions recorded on the edge of circular shape object within a binary image.

    v.   To fill selected regions in a color image interactively using a specific color.

e) State why Homogeneous coordinate system was devised. **(02 marks)**

f) Justify how to perform following 2D transformation depicted in Figure 1 using <u>Homogeneous Coordinates</u>.

"Rotating a polygon modeled at x coordinate 3 and y coordinate 2 by 60^0 degrees and scale it by 1.5 times." **(08 marks)**
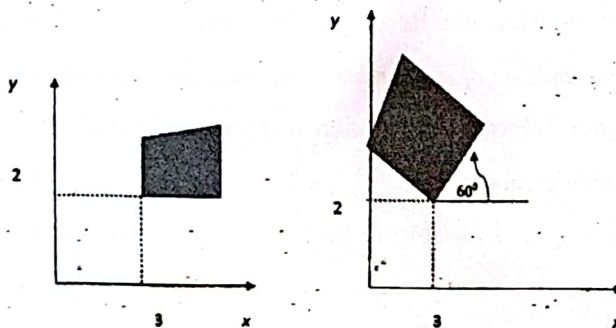
Expected result

Figure 1- Model for 2D transformation

3.

a) Apply <u>Sutherland-Hodgeman Polygon Clipping Algorithm</u> to clip the polygon (P, Q, R, S) shown in the clipping window (A, B, C, D) of the following Figure 2.   **(11 marks)**
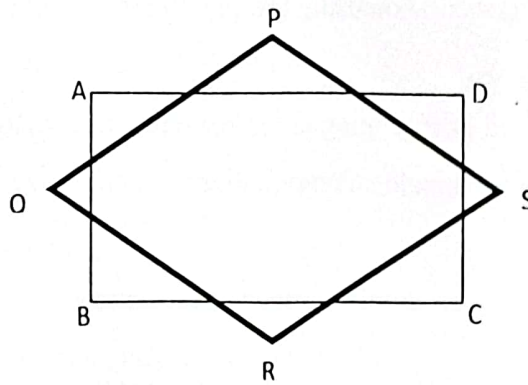

Figure 2 – Model for clipping

Cleary draw the clipping result according to the clipping edge using the table format given below (Clearly indicate the vertex labels).

Input	Left clipper (AB)	Right Clipper (CD)		Bottom Clipper (BC)		Top Clipper (AD)	
		input		input		input	
[P, Q]							
[Q, R]							
[R,S]							
[S,P]							
	Clipping Result 1	Clipping Result 2		Clipping Result 3		Clipping Result 4	

b) Image segmentation can be defined as a process that partition the entire spatial region occupied by an image R into n sub regions denoted as $R_1, R_2, R_3, \ldots\ldots\ldots\ldots R_n$. State five properties of image segmentation using the notations given in this definition.

(05 marks)

c) Explain how <u>appeal</u> and <u>exaggeration</u> are important in animation. **(04 marks)**

d) Write a short note on "Animation Creation Process". **(05 marks)**

4.

a) Apply $(f \bullet s)\text{-}f$ morphological operation for the image depicted in Figure 3 (a) using the structuring element given in Figure 3(b). Assume that f denotes the selected image in Figure 3(a) and s denotes the structuring element shown in Figure 3(b). Further, the black pixels represent OFF pixels (0) and white pixels represent ON pixels (255). Show all intermediate steps. **(06 marks)**
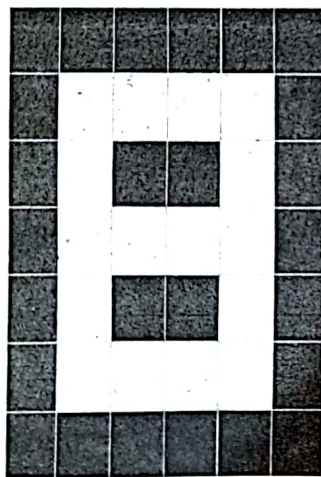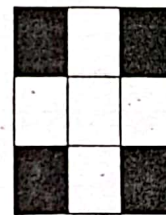
Black cells represents OFF (0) cells and White cells represents ON (255) cells.

(a) image   (b) Square shape structuring element

Figure 3: Image for Applying Morphological operations

b) A surveillance system captures an image of vehicle number plate using a digital camera. It has been observed that all of these captured images are suffered from low contrast, non-uniform illumination and impulse noise. Suggest a suitable <u>experimental method</u> for enhancing the captured images to eliminate those image degradations factors.

(04 marks)

c) Sketch a diagram of an optical sensor and label main parts of it. Briefly describe the function of the sensor. (05 marks)

d) Discuss the following Image Processing techniques (2 x 03 marks)

    i.   Gray Level Slicing

    ii.   Contrast Stretching

e) Explain the following implementation components in a typical image processing system. (3 x 02 marks)

    i.   Image Enhancement Component

    ii.   Image Segmentation Component

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