RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. in Information Technology
Second Year – Semester I Examination – June/July 2022

ICT 2403 – Graphics and Image Processing

Time: Three (03) hours

- Answer the **ALL** questions.
- There are **TWENTY (20) MCQ** questions in **part A** and **Four (04) essay** questions in **part B**.
- Write the English letter of the most suitable or correct answer for each MCQ question along with the question number.
- Calculators are allowed

PART A

1. What is the difference between sampling and quantization?
   A) Analyzing coordinate values called sampling and deriving its image pixels called quantization.
   B) Analyzing image pixels is called sampling and deriving its coordinate values called quantization.
   C) Digitizing the coordinate values is called sampling and digitizing the amplitude values is called quantization.
   D) Digitizing the amplitude values is called sampling and digitizing the coordinate values is called quantization.
2. Which of the following is/are the correct statement(s)?
   A - Averaging blurs and reduces noise of an image
   B - Sharpening highlights fine details of an image
   C - Both averaging and sharpening highlight fine details of an image
   D - Both averaging and sharpening blurs and reduces noise of an image
   A) C B) D C) A and B D) C and D
3. Which of the following is/are correct statement(s)??
   A - "Filtering" refers to accepting (passing) or rejecting certain frequency components.
   B - Wrap around is an approach to deal with edges of an image in filtering.
   C - Low pass eliminate low frequency components such as characterized by edges and sharp details in an image
   A) A only C) A and B only
   B) B only D) All three statements are correct
4. Which of the following in an image can be removed by using smoothing filter?
   A) Smooth transitions of gray levels C) Sharp transitions of gray levels
   B) Smooth transitions of brightness levels D) Sharp transitions of brightness levels

5. Which of the following is not a non-interactive computer graphic?
   A) Screen savers
   B) Advertisement Banner
   C) Computer game
   D) Cartoon

6. Dilation followed by erosion is called:
   A) Opening B) Closing C) Blurring D) Translation

7. Dilation can be used for
   A) Bridging gaps B) Compression C) Decompression D) Translation

8. The reflection of set B is given as
   A) $\{w|w = -b\}$ B) $\{w|w = b\}$ C) $\{w = -b\}$ D) $\{w|w = -(-b)\}$

9. While performing the median filtering, suppose a 3x3 neighborhood has value (10, 20, 20, 20, 15, 20, 20, 25, 100), then what is the output value to be given to the pixel under filter?
   A) 15 B) 20 C) 100 D) 25

10. Edge detection in images is commonly accomplished by performing a spatial _____ of the image field.
    A) Multiplication B) Integration C) Differentiation D) Division

11. To map a narrow range of low gray-level input image into a wider range of output levels, we use,
    A) Log Intensity Transformation
    B) Power-law Intensity Transformation
    C) Inverse Log Intensity Transformation
    D) Identity Intensity Transformation

12. Which one of the following filters is nonlinear?
    A) Gaussian Filter
    B) Averaging Filter
    C) Laplacian Filter
    D) Median Filter

13. The quality of a picture obtained from a device depends on
    A) Dot size
    B) Number of dots per inch
    C) Number of lines per inch
    D) All of the mentioned

14. On raster system, lines are plotted with
    A) Lines
    B) Dots
    C) Pixels
    D) Curves

15. An accurate and efficient raster line-generating algorithm is
    A) DDA algorithm
    B) Mid-point algorithm
    C) Parallel line algorithm
    D) Bresenham's line algorithm

16. The transformation that is used to alter the size of an object is
    A) Scaling B) Rotation C) Translation D) Reflection

17. If the scaling factors values s_x and s_y are assigned the same value then
    A) Uniform rotation is produced
    B) Uniform scaling is produced
    C) Scaling cannot be done
    D) Scaling can be done or cannot be done

18. What is DPI?
    A) Dots Per Image
    B) Dots Per Inch
    C) Digital Picture Image
    D) Digital Picture Information

19. Representation types of Computer Graphics are;
    A) Scalar and Raster
    B) Vector and Raster
    C) Vector and Scalar
    D) None of These

20. A vector drawing is composed of,
    A) Paths B) Pixels C) Palette D) Square

PART B

1. a) Explain the nature in adaptation of brightness of actual intensity of colors to the human eye. State the difference between actual intensity and perceived intensity of colors to support your answer.

(04 marks)

b) The Aperture and the Shutter are two mechanisms used in camera to control the light falling onto the light-sensitive surface. Explain them briefly

(04 marks)

c) A display screen is labeled as 16" (16 inches) as its diagonal length. Its height and width are 800 and 1200 in pixels. Calculate the spatial resolution of the screen.

(04 marks)

d) Showing the steps, convert the RGB value **(100, 25, 30)** to a grayscale using given conversion methods.

- Average method
- Weighted method (Luminosity method)
  - **HDTV method**

$$0.21 \times R + 0.72 \times G + 0.07 \times B$$

  - **PAL / NTSC method**

$$0.3 \times R + 0.59 \times G + 0.11 \times B$$

- Lightness method

(08 marks)

2. a) A Spatial Filter can be applied to an image in two ways. They are **correlation** and **convolution.** Explain them briefly.
(*You may use figures or/and examples to support your explanation*)

(4 marks)

b) There are several approaches used to deal with the edges of an image. Explain any two of them.
(*You may use figures or/and examples to support your explanation*)

(4 marks)

c) The MIN filter replaces current intensity value with the lowest/ darkest intensity value in the running mask.
Showing the steps, generate the intensity values of the output image by applying a 3×3 MIN filter on input 8-bit grayscale image given below.
(You may Replicate the border pixels to handle the edges of the given input image.)

100	125	235	240
129	122	223	235
123	125	212	123
201	205	129	125

Input image

b) A strip of a 3-bit grayscale image and their intensity values are given bellow.

0	0	1	2	3	4	4	4	7	7	7	0	0	7	0	0	4	6	4	0	0	1	2	3

I. Draw the intensity value graph of the given image strip.
II. Point out four (04) characteristics in color changes on the graph.
(The list of possible characteristics in color changes are as follows: Ramp, Step. Thin line, Isolated point. Flat Segment)
III. Calculate the 1st Order Derivative and the 2nd Order Derivative of the given image strip.

(07 marks)

3. a) Image segmentation is one of the key stages in the image analysis process.

I. Explain the usage of image segmentation in image analysis and knowledge generation process.
II. Image segmentation algorithms for monochrome images generally are based on one of two basic categories dealing with discontinuity and similarity properties of intensity values. What are those categories? Explain them briefly.

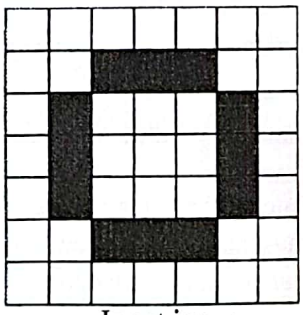
(06 marks)

b) Morphological image processing pursues the goals of removing imperfections appeared on images by accounting for the form and structure of the image.

I. Name the two (02) most basic morphological operations found in image processing. Explain them briefly.
II. List two applications of morphological operations.

(06 marks)

c) The compound morphological operations are used to do region filling in images. Showing the steps, fill the inner region of given input image using given structuring element.



Input image

Structuring element

(08 marks)

4. a) Explain the difference between interactive and non-interactive computer graphics. Clearly mention two applications for each category.

(06 marks)

b) Computer graphics can be represented in two different ways.

I. Name the two ways of representing computer graphics.
II. Explain them briefly.
III. Give one example software application for each representation method that use to create such types of computer graphics.

(06 marks)

c) The Bresenham Line Algorithm is shown here.

```
Procedure BLD (x1, y1, xn, yn: integer)
define dx, dy, x, y as integer
dx = xn − x1
dy = yn − y1
x = x1
y = y1
p = 2dy − dx
        while x ≤ xn
                putpixel(x, y)
                if p < 0
                        x = x + 1
                        p = p + 2dy
                else
                        x = x + 1
                        y = y + 1
                        p = p + 2dy − 2dx
                End if
        End while
End
```

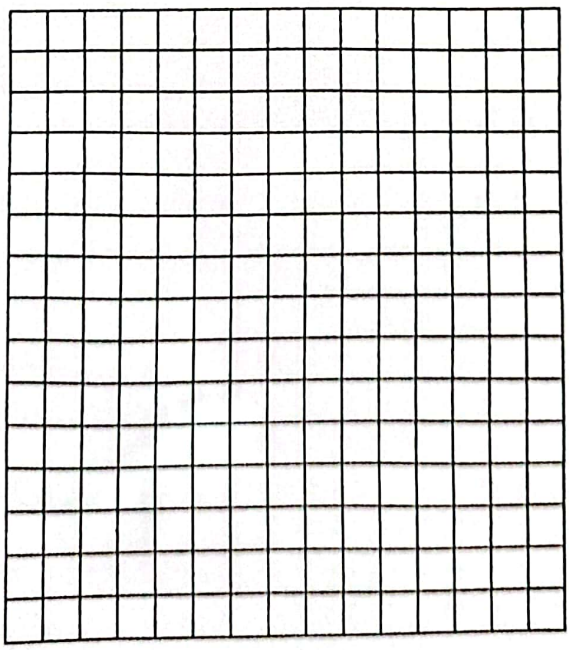

I. Trace this algorithm for the line with end points (2,2) and (12,7).

II. Draw the output.

(*You can use a table to summarize the calculations*)

(08 marks)

You can use this grid space to draw the output. If so, Please separate this page from the question paper and attach to the answer booklet.



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