



RAJARATA UNIVERSITY OF SRI LANKA

FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences

Second Year Semester II Examination – April / May 2015

COM 2304 – COMPUTER GRAPHICS AND IMAGE PROCESSING

Time: THREE (3) hours

Examination Index No: _____

Important Instructions:

- This paper has 4 questions in 14 pages.
- Answer all questions (25 marks each).
- Write your answers in English using the space provided in this question paper.
- Do not tear off any part of this question paper.
- Note that questions appear on both sides of the paper.
- If a page is not printed, please inform the supervisor immediately.

Questions Answered:

Indicate by a cross (x), the numbers of the **four** questions answered.

	Question numbers				
	1	2	3	4	
To be completed by the candidate by marking a cross (x).					
To be completed by the examiners:					

Question 01

- i. What is the main functional difference between **Image Processing** and **Scene Analysis** components of a typical computer vision system? (2 Marks)

- ii. State how computer vision applies in the following disciplines using suitable examples. (6 Marks)

- **Surveillance**

- **Quality control**

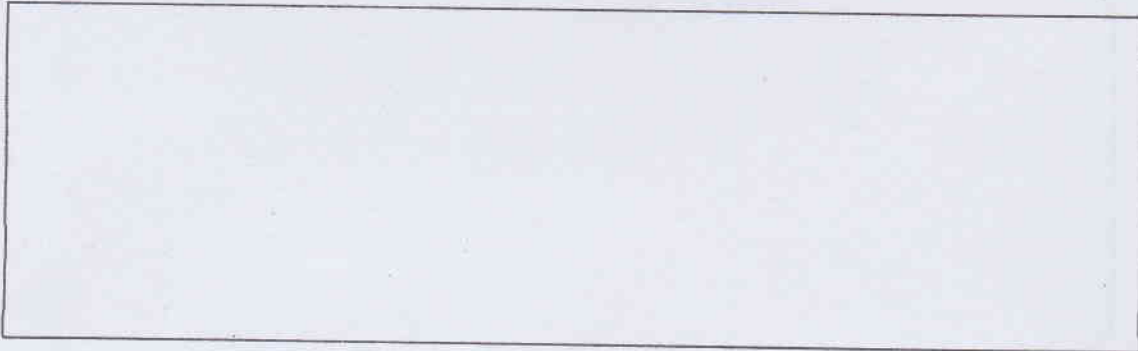
- **Analysis of medical images**

- iii. What is the size of the **Frame Buffer** if the display device screen has 512 raster lines and 512 pixels on each raster line? (2 Marks)

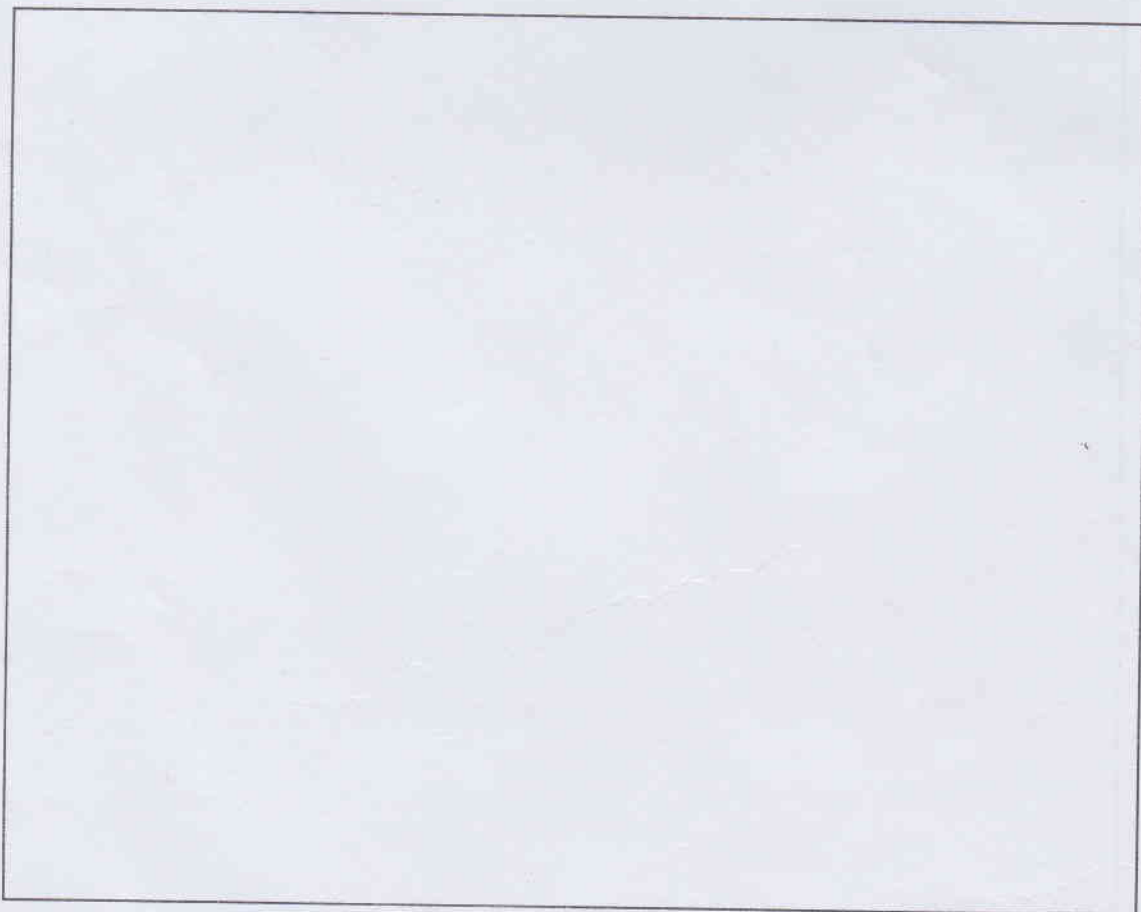
- iv. Sketch the basic components of an **Image Processing System** and label each and every component clearly. Briefly explain the purpose of those components. (9 Marks)



- v. Briefly describe the main visual difference between the **Intensity Histograms** of two gray scale images which have **Low Dynamic Range** and **High Dynamic Range** (2 Marks)

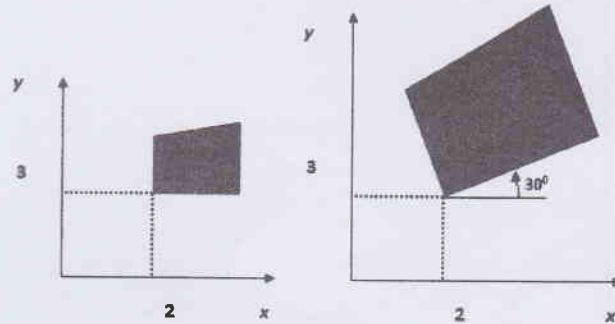


- vi. "Image will always lose some quality each time interpolation is performed during the image resizing." Justify the above statement using a suitable diagram of nearest neighbor interpolation method. (4 Marks)



Question 02

- i. Justify how to perform the following 2D transformation using **Homogeneous Coordinates**. "Rotate a polygon modeled at (x, y) coordinates (2, 3) by 30 degrees and scale it by 2 times." (6 Marks)

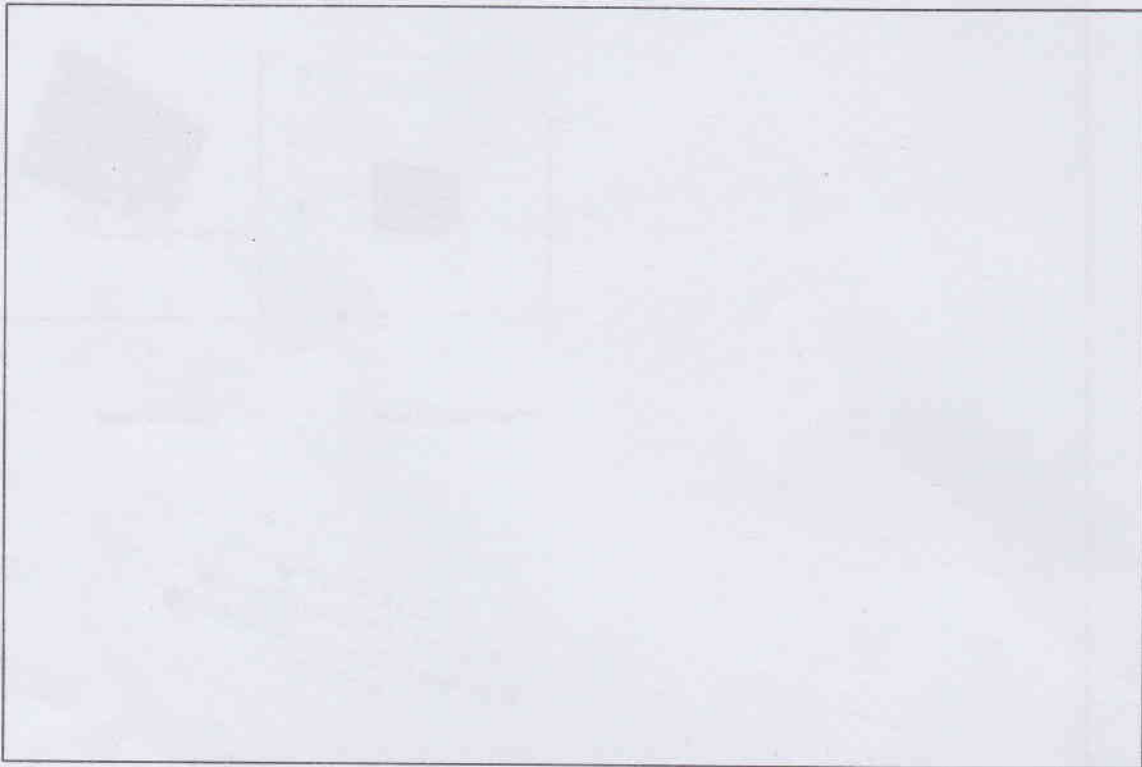


Polygon at (2, 3) point

Expected result

Library
Faculty of Applied Science
Rajaraja University of Sri Lanka
Mihintale.

- ii. There are two types of vehicle number plate images are input to an automated number plate recognition system. First type contains black characters on yellow background and the second type contains white characters in blue background. State the steps of a formal method that can use to identify the type of the number plate either first type or second type using a **Histogram Analysis** method. (5 Marks)



- iii. Answer the following (a), (b) and (c) questions based on the following C function

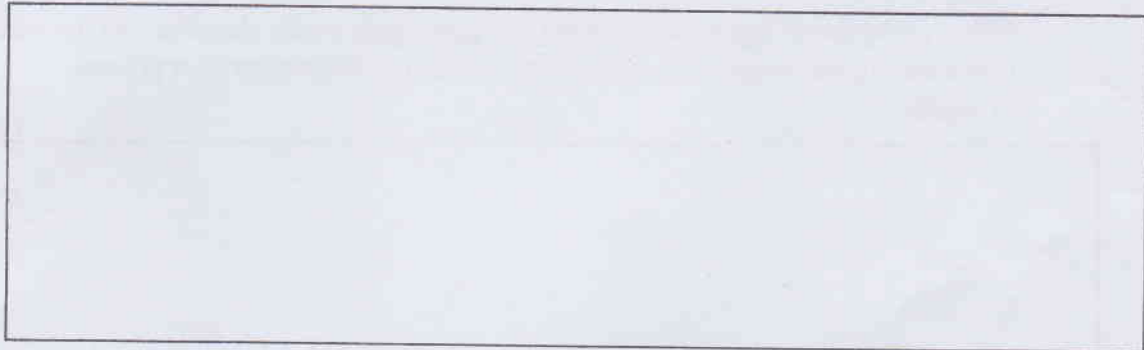
```
IplImage* function01(IplImage* img, float amount=200)
{
    CvSize imgSize = cvGetSize(img);
    IplImage* imgTemp = cvCloneImage(img);

    for(int y=0;y<imgSize.height;y++)
    {
        for(int x=0;x<imgSize.width;x++)
        {
            int randomValue = (char)((rand()/(float)0x7fff)-0.5)*amount;
            int pixelValue = cvGetReal2D(imgTemp, y, x)+randomValue;
            cvSetReal2D(imgTemp, y, x, pixelValue);
        }
    }
    img = imgTemp;
    return img;
}
```

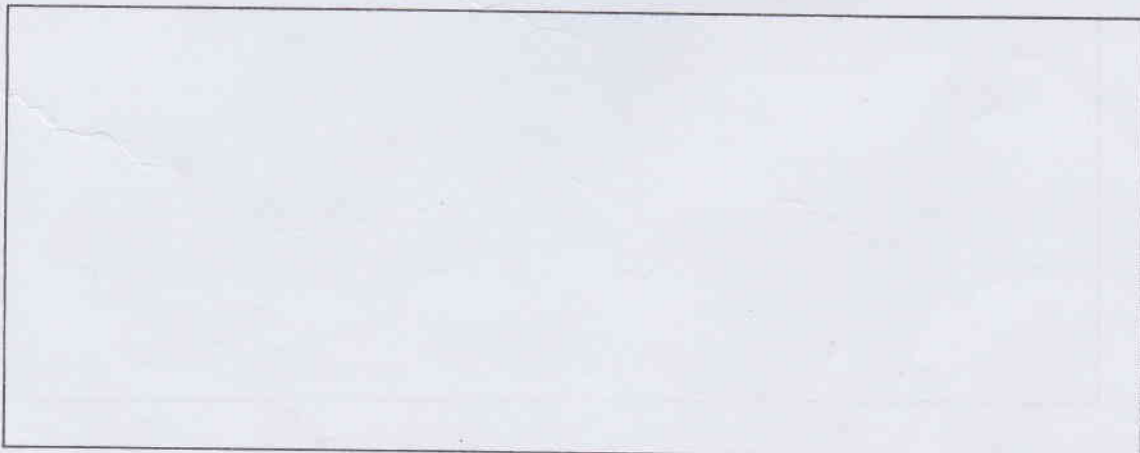
- a) Write suitable comments with related to the operations of the following selected statements. (3 Marks)

```
CvSize imgSize = cvGetSize(img);  
  
int pixelValue = cvGetReal2D(imgTemp, y, x)+randomValue;  
  
cvSetReal2D(imgTemp, y, x, pixelValue);
```

- b) State how this function effects to the input image "img". Note that "img" is an 8 bit single channel image. (1 Mark)



- c) What happen when value of the amount is change from 200 to 100? (2 Marks)



- iv. State the functional importance of the Laplacian Filter 02 comparing with Laplacian Filter 01 shown in the following Figure 1. (2 Marks)

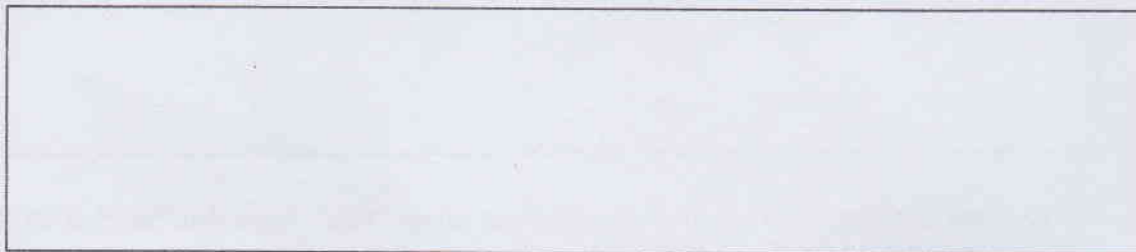
0	1	0
1	-4	1
0	1	0

Laplacian Filter 01

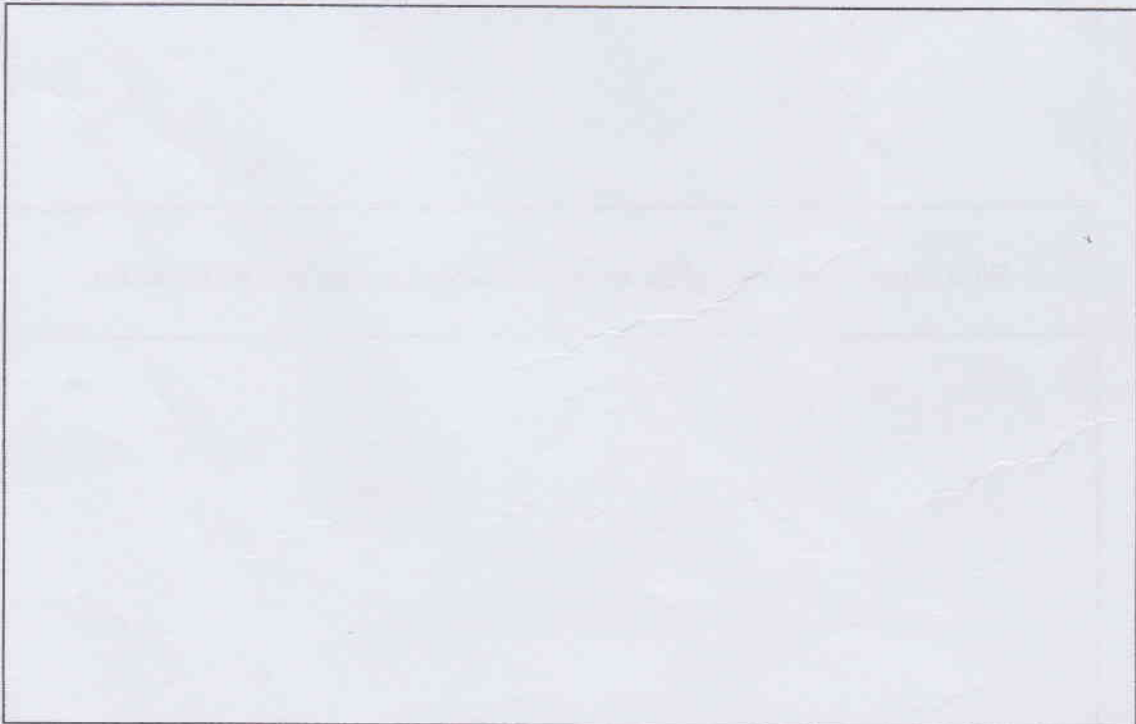
1	1	1
1	-8	1
1	1	1

Laplacian Filter 02

Figure 1



- v. Using a diagram of **Image Restoration Process Steps** briefly describe why we cannot obtain the original image $f(x,y)$ exactly after executing image restoration process. (6 Marks)



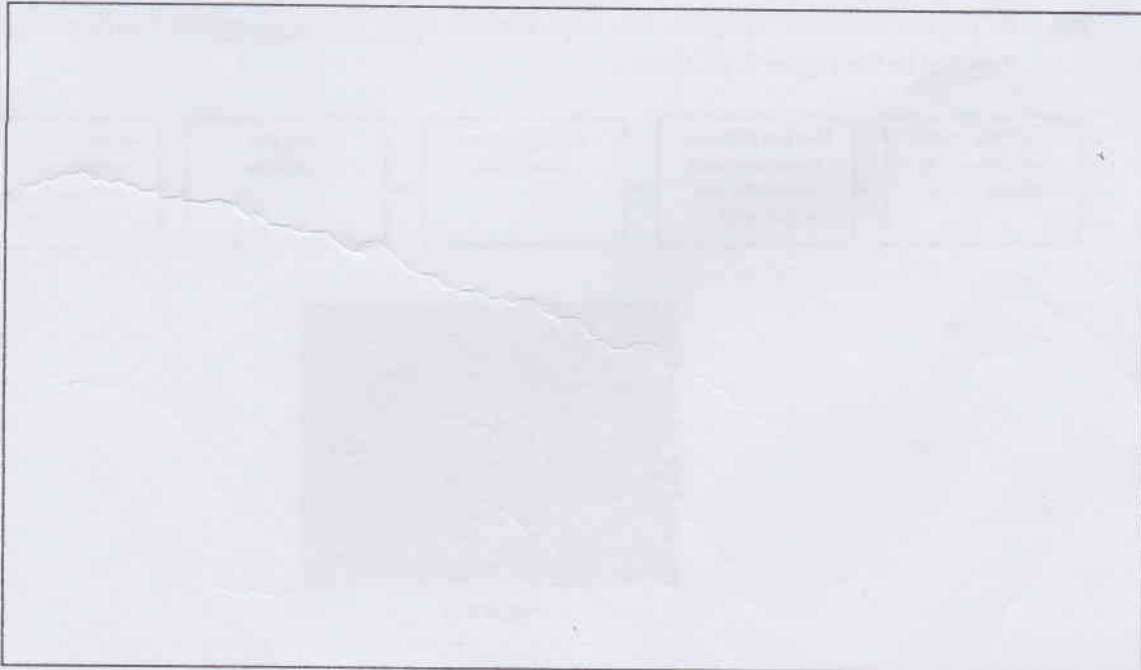
Question 03

- i. Justify the following statement
"Segmentation accuracy determines the eventual success or failure of computerized analysis procedures." (3 Marks)

- ii. Write an algorithm to count the number of seeds depicted in the following Figure 2. Note that the Figure 2 is a color image. (5 Marks)



Figure 2



- iii. Briefly describe the four major properties of Region Growing Algorithm and the importance of each of those properties. (6 Marks)



- iv. Following flowchart describes the steps used to count and segment the number of coins depicted in the Figure 3. (5 Marks)



Figure 3

Briefly explain the importance of each flowchart steps for obtaining the expected results.

- Load the image and convert to binary image
- Get the distance transform and normalize the result to $[0,1]$
- Apply global threshold
- Find the contours
- Apply watershed segmentation using detected contours

v. Compare the Global Threshold and Adaptive Threshold techniques (4 Marks)

vi. What is the difference between the Step Edge and the Ramp Edge in a digital image? (2 Marks)



- iv. Apply **Sutherland-Hodgeman Polygon Clipping Algorithm** to clip the (P, Q, R, S) polygon shown in the (A, B, C, D) clipping window of the following Figure 5. Clearly draw the clipping results according to the clipping edge using the space given below and indicate the vertex labels. (6 Marks)

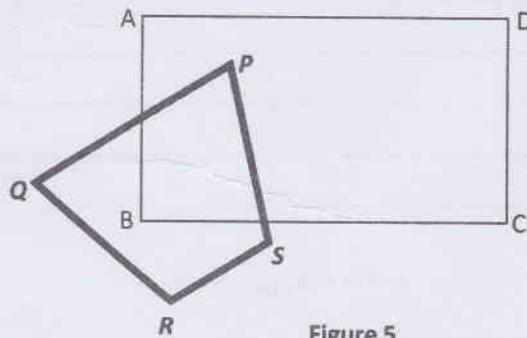


Figure 5

Input	Left clipper (AB)	Right Clipper (CD)	Bottom Clipper (BC)	Top Clipper (AD)
	</			

- v. Apply Digital Differential Analyzer Algorithm to draw the line from $(x_1, y_1) = (20, 10)$ to $(x_2, y_2) = (30, 18)$. (6 Marks)

Steps	x	y	Round(y)

***** END *****