

UNIVERSITY OF RUHUNA
BACHELOR OF COMPUTER SCIENCE GENERAL DEGREE
LEVEL II (SEMESTER I) EXAMINATION - JULY 2016

CSC2143 – Computer Graphics and Image Processing (Theory)

Duration: 2 hours

Answer all questions

1)

- a) Write down a C programming code for Digital Differential Analyzer line drawing algorithm.
- b) Illustrate the algorithm stated in (1) (a) for the line segment with end points (19, 11) and (23, 14). You have to show coordinates of each pixel along the line segment. Draw the grid of pixels to show the line segment.
- c) Given a circle of radius 12, demonstrate the midpoint circle drawing algorithm by determining positions along the circle octant in the first quadrant from $x = 0$ to $x = y$.

2)

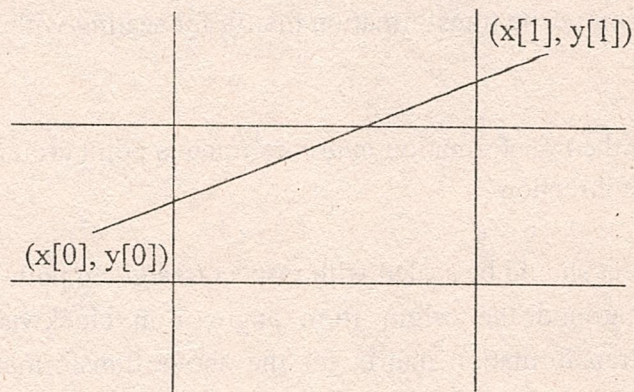
- a) Derive the composite transformation matrix for scaling with respect to the given point (x_0, y_0) .
- b) Write down the transformation matrix to rotate a point around the origin from θ angle in clockwise direction.
- c) First an object should be scaled with respect to a given point (x_0, y_0) . Then it needs to be rotated around the origin from angle θ in clockwise direction. Derive the composite transformation matrix for the above transformation using the results of (2) (a) and (2) (b).
- d) Compute the coordinates of the center of the triangle which has vertices $P_1 (10, 10)$, $P_2 (30, 10)$ and $P_3 (20, 40)$.
- e) The triangle mentioned in (2) (d) should be first scaled with respect its center with scaling factors $s_x = 2$, $s_y = 3$, and then it should be rotated around the origin from 30 degrees in clockwise direction. Compute the transformation matrix for the above transformation using the result in (2) (c). Further compute the coordinates of the new positions of the vertices of the triangle using the transformation matrix.

3)

- a) Following diagram shows region codes for Cohen Sutherland algorithm. Write down a C programming function which returns the corresponding region code once the coordinates of a point is given.

1001	1000	1010
0001	0000	0010
0101	0100	0110

- b) Demonstrate how Cohen Sutherland algorithm works for the line segment shown in following figure. Note that it intersects only with LEFT, TOP and RIGHT boundaries. Use the encoding scheme shown in (3) (a).



4)

a)

- i. Write down the important steps involved in the k-means clustering algorithm.
- ii. Write down four weaknesses of the k-means clustering algorithm.
- iii. Briefly explain how k-means algorithm can be used for image segmentation.

- b)
- i. Write down the lemma which is used to develop the interior points' algorithm which is used for finding the convex hull of a planer set of points.
 - ii. Write down the pseudo code of the interior points' algorithm mentioned in (4) (b) (i).
 - iii. Explain how convex hull algorithms can be applied in fast collision detection of objects in a video game.
- c) Write down the C programming function for flood filling algorithm using 4 connected neighborhood of pixels.