

EASTERN UNIVERSITY, SRI LANKA
DEPARTMENT OF MATHEMATICS
THIRD EXAMINATION IN SCIENCE -2009/2010 (2011)
FIRST SEMESTER (June /July, 2011)
CS301 – COMPUTER GRAPHICS

Answer all Questions

Time: 2 Hours

Q1)

- a) What is meant by scan conversion in Computer graphics?
- b) What are the differences between **raster scan display & random scan display**?
- c) Derive the necessary equations to generate **Bresenham's circle** algorithm.
- d) Write the **Bresenham's circle** algorithm.
- e) Get all the pixel co-ordinates to draw a circle of radius $r = 10$ with center $(0, 0)$. (**Apply this algorithm**)
- f) Plot all the pixel co-ordinates to draw this complete circle.

Q2) The basic **2-D** transformations in Computer graphics are translation, scaling, and rotation.

A point $P(p,q)$ in a two dimensional coordinate system can be represented in homogeneous coordinate system in different ways.

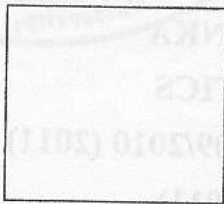
- a) Explain briefly how homogeneous coordinate system would be useful in transformation in computer graphics.
- b) Give the corresponding matrices (in homogeneous system) for each of the following transformations:
 - i. Translation
 - ii. Scaling
 - iii. Rotation

c)

Consider the squares shown below as object-1 and object-2;

D (0, 40)

C (40, 40)



A (0, 0)

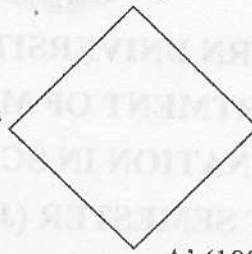
B (40, 0)

Object-1

C'

D'

B' $(100+10\sqrt{2}, 10+10\sqrt{2})$



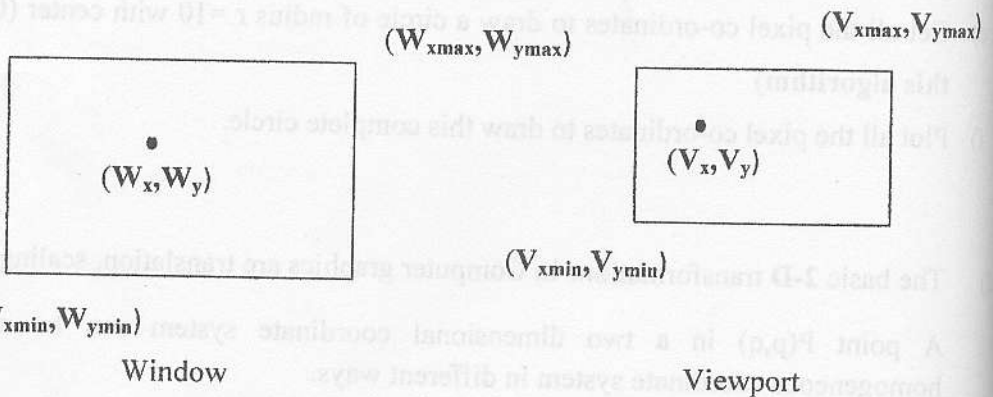
A' (100, 10)

Object-2

- Write down the steps and corresponding transformation matrices to obtain object-2 from object-1.
- Compute the coordinates of C' using the resultant transformation matrix.

Q3)

- Define window and viewport in Computer graphics.
- The following diagram shows a window and a viewport,



Write down the function to map a point (W_x, W_y) in the window to a point (V_x, V_y) the viewport.

- Write down the Liang-Barsky Line Clipping method.

d) Let W be a window whose bottom-left corner is $(100, 100)$ and the top right corner is $(200, 200)$ and AB be a straight line with $A = (50, 50)$ and $B = (150, 250)$. Apply the above algorithm to clip AB against W , and count in how many steps the clipping completes.

Q4)

- a) Give the equation for 3 Dimensional(3D) rotation about Y axis by an angle λ .
- b) Describe the parallel projection and perspective projection of a 3D object on to XY plane.
- c) Consider the objects ABCD positioned in a 3D coordinate system such that $A = (100, 0, 300)$, $B = (100, 0, 600)$, $C = (100 + 150\sqrt{3}, 0, 150)$ and $D = (50\sqrt{3}, 400, 150)$.

Find the perspective projection of this object on the XY plane with the Centre of Projection at $(0, 0, -100)$ and draw the projected image.