



EASTERN UNIVERSITY, SRI LANKA
THIRD EXAMINATION IN SCIENCE -2012/2013
FIRST SEMESTER (May /June., 2016)
CS 301 – COMPUTER GRAPHICS
(PROPER AND REPEAT)

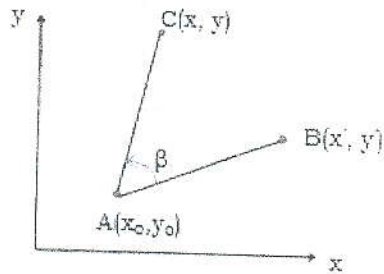
Answer all Questions

Time: 2 Hours

- i) What is meant by *computer graphics*?
- ii) Define the following terms:
 - a) Raster scan display;
 - b) Random scan display;
 - c) Modeling co-ordinate;
 - d) Normalized co-ordinates.
- iii) Derive the equations of *Bresenham's* line drawing algorithm with slope less than one.
- iv) Consider the *Midpoint* circle algorithm:
 - a) Derive the necessary equations to generate *Midpoint circle* algorithm.
 - b) Get all the pixel co-ordinates to draw the first quarter of the circle of radius, $r = 6$ with center $(3, 2)$. (*Apply this algorithm*)

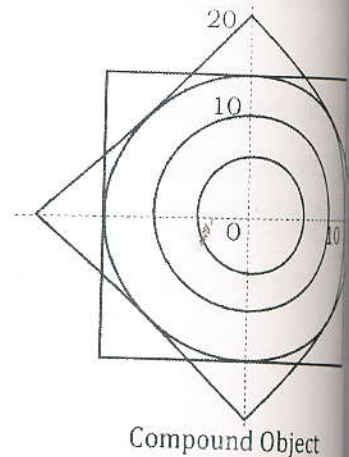
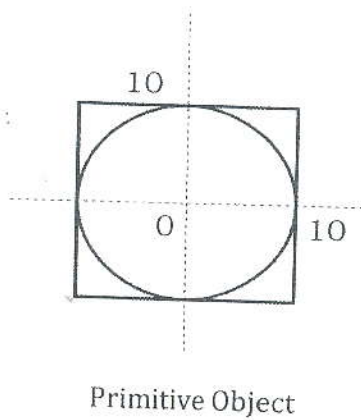
Q2) The basic two dimensional transformations in Computer graphics are translation, scaling, shearing, and rotation. A point in a two dimensional co-ordinate system can be represented in homogeneous co-ordinate system.

- i) Explain the use of homogeneous co-ordinate system in transformations.
- ii) Consider the Cartesian co-ordinate system. Let $A(x_0, y_0)$, $B(x', y')$ and $C(x, y)$ be three points on this co-ordinate system. The point $C(x, y)$ is obtained by rotating the point $B(x', y')$ by an angle β with respect to the point $A(x_0, y_0)$. Write the formulae for co-ordinates x and y .



- iii) Give the corresponding **matrices** (in homogeneous system) for each of the following two dimensional transformations in computer graphics:
 - a) Translation;
 - b) Scaling about pivot point;
 - c) Shearing in x-direction.

iv) Consider the figures:



Describe how you would draw the compound object from the primitive object. Give all the transformations needed in each step.

Consider the following two figures (i) and (ii), where ABCD and PQRS are two rectangles, where $PS=2 AD$ and $PQ=2.2 AB$.

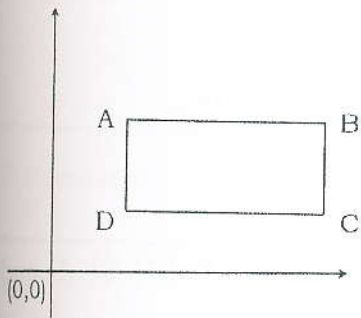
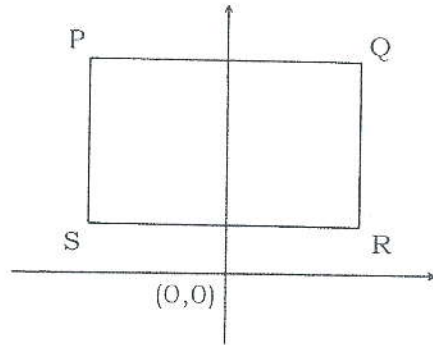


Figure (i)



Figure(ii)

Obtain the matrix to transform ABCD into PQRS.

Define the graphics terms **View port**, **Window** and **Clipping** in your own words:

Write down the steps of two- dimensional viewing transformation pipeline.

List out the types of Clipping.

Briefly explain the Cohen-Sutherland line clipping algorithm.

Let W be a window whose bottom-left corner is (75, 70) and the top right corner is (150, 180) and AB and CD are straight lines with A= (60, 80), B= (120, 150), C= (45, 100) and D= (155, 170). Apply the above algorithm to clip AB and CD against window W.

Q4)

- i) Give the equation for three Dimensional (3D) rotations about z -axis by an angle θ . Deduce the equation for rotation about x -axis and y -axis from the equations.
- ii) Write down the Reflection *matrices* for the following cases:
- Reflection with respect to the line $y=x$;
 - Reflection with respect to the line $y=-x$;
 - Reflection about an axis perpendicular to the xy plane;
 - Reflection about y -axis.
- iii) Reflect the diamond shape polygon whose vertices are $P(3,4)$, $Q(1,1)$ and $R(4,1)$ about:
- The horizontal line $y = 2$;
 - The horizontal line $y = 5$;
 - The vertical line $x = 3$;
 - The vertical line $x = 5$;
 - The line $y = x+2$.