

EASTERN UNIVERSITY, SRI LANKA
THIRD EXAMINATION IN SCIENCE 2001/2002
FIRST SEMESTER (April, 2002)
CS 301 - Computer Graphics

Answer All Questions

Time: 2 Hours

Q1

- (a) Explain briefly how you would remove the jagged line effect when a line is generated as a series of illuminated pixels.
- (b) Explain Bresenham's line algorithms to generate lines with the absolute value of the slope is less than one.

Show how you would modify your algorithm to draw lines with absolute slope greater than 1?

Illustrate Bresenham's line algorithm for the line with endpoints (5, -5) and (10, 5).

Q2

Describe the following two-dimensional transformations:

Translation

Scaling with respect to a given point P

Rotation about the origin

and derive the transformation matrices.

Let ABC be a triangle with coordinates $A=(10,10)$, $B=(50, 10)$, and $C=(30, 30)$. Find the coordinates of the triangle ABC after performing the following two transformations in order:

(i) rotation through 30° about $(10,10)$

(ii) rotation through -30° about the origin.

Consider the following two figures a and b, where ABCP and LMNP are two parallelograms, where $PL=1.5PA$ and $PN=2PC$

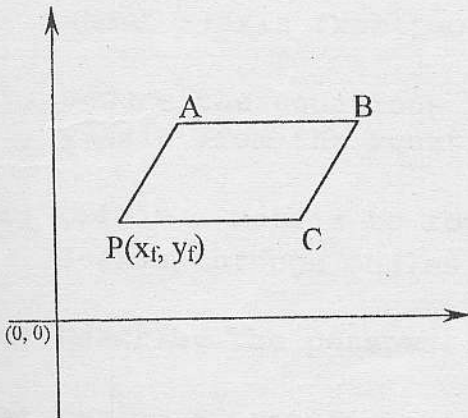


Figure: a

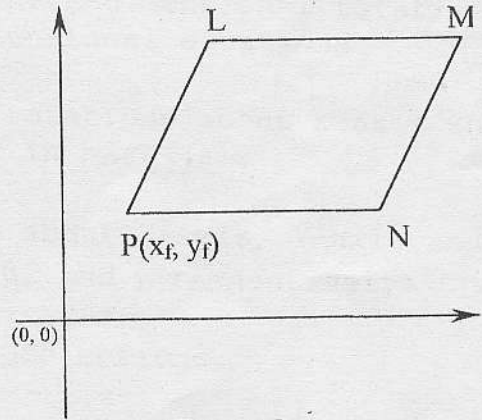


Figure: b

Obtain the matrix to transform PABC into PLMN.

Q3

State briefly why clipping is necessary.

Describe *Cohen-Sutherland* clipping method to clip a given line against a given window, with the aid of an example.

Describe briefly the *Sutherland-Hodgeman* polygon clipping method to clip a given polygon against a given clip window.

State the problems in clipping concave polygons in this method and show how you would clip them.

Q4

- (a) Write the equations for three-dimensional rotation about z-axis from two-dimensional equations.
- (b) Deduce the equations for rotations about x-axis and y-axis from the equations in part (a).
- (c) Obtain a matrix to rotate about X-axis, Y-axis and Z-axis through angles α , β , and γ respectively.
- (d) Describe the perspective projections.
- (e) Derive a transformation matrix to project a point $P(x, y, z)$ on to $Q(x', y', z')$ on a plane parallel to XY-plane but going through $(0, 0, Z_{vp})$. The type of projection applied is perspective with reference point at $(0, 0, Z_{rp})$.

Let $P = (-15, 5, 12)$, $Z_{vp} = 5$, and $Z_{rp} = 22$. Find the projected coordinate of the point P.