EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATIN IN SCIENCE 2003/2004

FIRST SEMESTER (November/December, 2004)

CS301 Computer Graphics

Answer all questions

Time allowed: 2 Hours

Answer all parts.

(a). Explain **Bresenham's** line drawing algorithms to generate straight lines with the absolute value of the slope is greater than one. {30}

Describe how you could use your algorithm to draw straight lines with all cases of slope. {20}

Illustrate **Bresenham's** line drawing algorithm for the line with endpoints (-5, 10) and (-10, 18). {20}

(b). Describe Flood-Fill algorithm and Boundary-Fill algorithm to fill regions in a raster display. {30}

Describe **Liang-Barsky** line clipping method to clip a given line against a given window. {30}

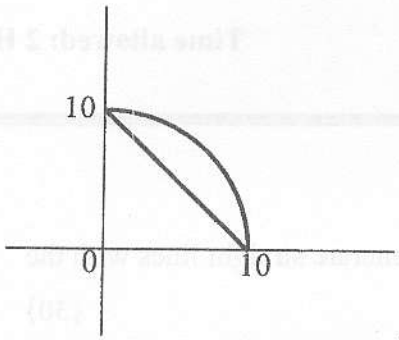
Describe briefly a method to clip lines, which performs fewer comparisons and divisions than **Liang-Barsky** line clipping method. {20}

Describe briefly the **Sutherland-Hodgeman** polygon clipping method to clip a given polygon against a given clip window. {30}

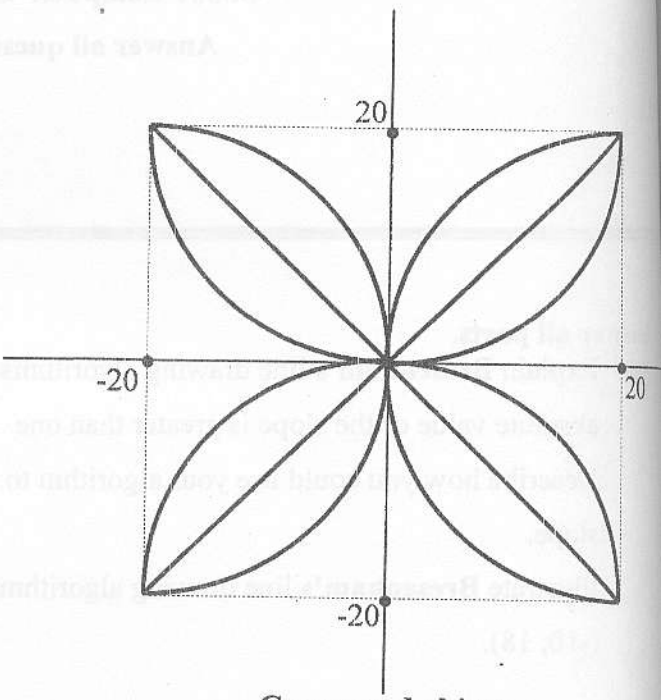
State the problem(s) in clipping polygons in this method and describe a method(s) to solve them. {20}

Q3 Describe briefly the basic transformations that would be useful in two-dimensional graphics. {30}

Consider the figures:



Primitive object



Compound object

Describe how you would draw the **compound object** from the **primitive object**. Give all the transformations needed in each step. {45}

Consider the following two figures **a** and **b,** where ABFC and PQFR are two rectangles, where **PR=2 AC** and **PQ=1.5 AB**

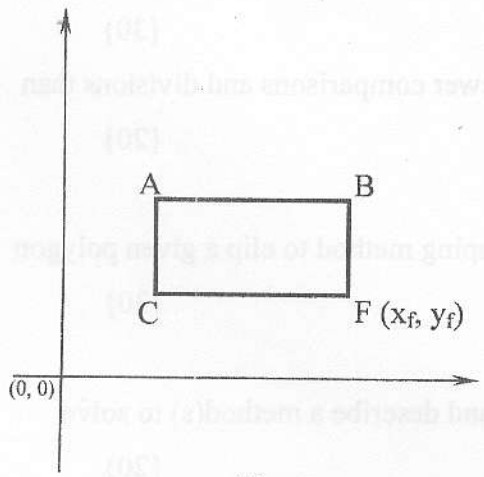


Figure: a

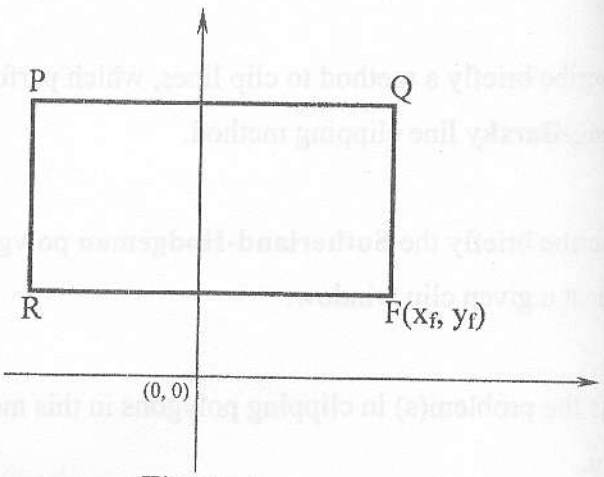


Figure: b

Obtain the matrix to transform ABFC into PQFR. {25}

Describe the perspective projection. {10}

Derive a transformation matrix to project a point P(x, y, z) on to $Q(x_v, y_v, z_v)$ 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 $(0, 0, z_{rp})$. {20}

Derive the transformation matrix for the orthographic parallel projection from the transformation matrix of perspective projection. {15}

Give transformation matrix that scale an object about the fixed point, $F(x_f, y_f, z_f)$, with the scaling factors S_x, S_y, and S_z in the x-axis, y-axis and z-axis directions, respectively. {10}

Consider the tetrahedron ABCD, where A = (5, 5, 5), B = (20, 0, 0), C = (0, 20, 0), D = (0, 0, 20).

Suppose this object is scaled about the fixed point A = (5, 5, 5) with the uniform scaling of 2.

Draw the images of the object obtained by the perspective projection on xy-plane with reference point at (0, 0, 25) and the orthographic parallel projection on xy-plane after the scaling. {30 + 15 = 45}