THE OPEN UNIVERSITY OF SRI LANKA
BSc DEGREE PROGRAMME: LEVEL 05
FINAL EXAMINATION: SEMESTER 2 - 2023/2024
**CSU5311: COMPUTER GRAPHICS**
DURATION: **TWO HOURS** (2 HOURS)

Date: **18.04.2024**                                  Time: **1.30 pm – 3.30 pm**

**Answer FOUR (04) questions ONLY.**

**Q1.**

a) What are the three (03) main tasks of Computer Graphics?                (3 Marks)

b) Define and differentiate **Raster Graphics** and **Vector Graphics**.       (4 Marks)

c) Build the **2D -transformation matrices** for the followings.
   i.   Translation
   ii.  Rotation in origin
   iii. Rotation in Pivot Point $(p_x, p_y)$                               (9 Marks)
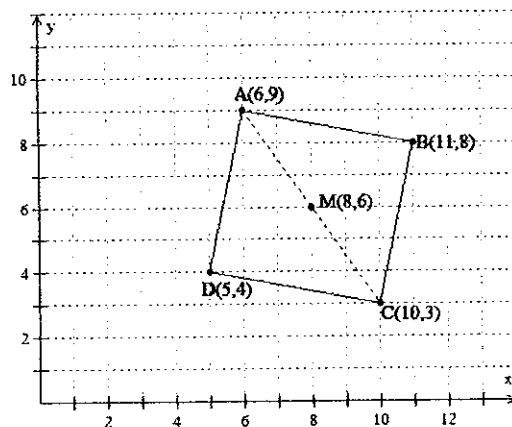
d) Figure 01 shows the untransformed state of a square.



*Figure 01*

i.  Find the homogeneous composite transformation matrix. First rotate the object by 60° anticlockwise about the origin in the xy plane, then reflection in Y axis.

ii. What are the new positions of the vertices of the triangle after applying above sequence of transformation?                    (9 Marks)

## Q2.

a) Define the following terms:
   I. Point
   II. Line
   III. Circle (3 Marks)

b) Explain the Line Stair Step Appearance. (6 Marks)

c) When finding coordinate values for a circle using Mid-Point Circle Algorithm, only need to generate the points for one quadrant or octants. Explain the reason for above fact. (6 Marks)

d) Given the center point coordinates (0, 0) and radius as 6, generate all the points to form a circle using Mid-Point Circle Algorithm. (10 Marks)

## Q3.

a) What is meant by **Clipping?** (3 Marks)

b) Briefly explain the two types of Polygon. (4 Marks)

c) Explain the Boundary Fill Algorithm with appropriate figure. (6 Marks)

d) Find the clipped lines and clipped positions in following Figure 02 using the Cohen-Sutherland Line clipping algorithm by clearly indicating the steps. (12 Marks)
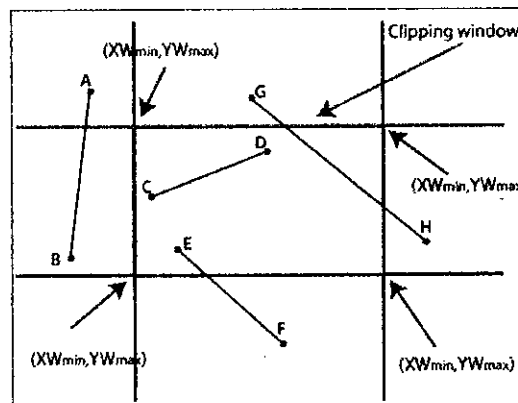


*Figure 02*

## Q4.

a) What do you mean by **Space-partitioning representations?** Explain in your own words.

(04 Marks)

b) Explain **The right-handed coordinate system** in your own words.

(03 Marks)

c) Explain what is Scaling and Shearing?

(06 Marks)

d) Scale a triangle with vertices at original coordinates (10,25,5), (5,10,5), (20,10,10) by $S_x=1.5$, $S_y=2$, and $S_z=0.5$ with respect to the origin. And after that for the resultant triangle apply y axis shearing if the shear parameters are 2 on X axis, 2 on Y axis and 3 on Z axis.

**The matrix for scaling with respect to the origin is,**

$$\begin{bmatrix} S_x & 0 & 0 & 0 \\ 0 & S_y & 0 & 0 \\ 0 & 0 & S_z & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

**and
y-axis shearing**

$$\begin{bmatrix} 1 & SH_x & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & SH_z & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

(12 Marks)

## Q5.

a) What are the types of perspective projection?

(03 Marks)

b) What is Oblique Parallel Projection and what are its types? Explain the types in your own words as well.

(07 Marks)

c) What are the three (03) types of 3D clipping algorithms? Explain one (01) of them in your own words.

(05 Marks)

d) Using a diagram explain General **three-dimensional transformation pipeline**, from modeling coordinates to final device coordinates.

(10 Marks)

**Q6.**

a) Explain in your own words, why do you need black color in CMYK color model?

(03 Marks)

b) Explain what is saturation in HSV colour model?

(03 Marks)

c) Give **two (02)** real world example for Global Illumination Models.

(04 Marks)

d) By drawing a diagram explain what is **Specular Reflection**.

(07 Marks)

e) By Drawing a diagram explain **Area Subdivision Method**.

(08 Marks)

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