Malaviya National Institute of Technology Jaipur
Department of Computer Science Engineering
Computer Graphics CST310
Mid-sem Examination, Date: Feb 29, 2024

Time: 4:15 pm-5:45 pm (1.5 hours)　　　Spring 2024, VI Semester　　　Max marks: 30

Instructions:

1. All questions are compulsory.

2. This paper has two pages, please turn it over.

3. Be precise in your answers.

1. (a) Write down a 4×4 matrix A which rotates a 3D point by angle $30°$ along the x-axis and translates to a point (15, 20, 10). **(2)**

   (b) Initially, let the point be located at the origin. What will be the new location of the point after applying the transformations of matrix A? **(2)**

   (c) Find the inverse of the following matrix:

   $$\begin{bmatrix} 3 & 10 \\ 2 & 7 \end{bmatrix}$$

   (2)

   (d) Explain in words the working of the flood-fill method of polygon filling. (30-40 words only) **(2)**

   (e) Explain in words the difference between image sampling and quantization. (30-40 words only) **(2)**

2. (a) Indicate using a table as well as a neat and clean graph which raster locations would be chosen by Bresenham's algorithm when scan-converting a line from pixel coordinate (1,1) to pixel coordinate (8,5). **(5)**

(b) Develop an algorithm for scan converting unfilled rounded rectangles (an example is shown in Figure 1) with a specified radius (r) for the quarter-circle corners. **(5)**
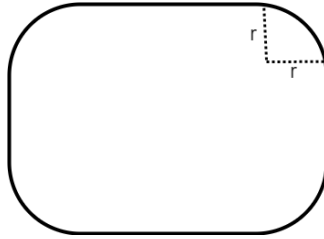

Figure 1: A rounded rectangle with quarter-circle corners of radius r.

3. (a) What is Perspective Projection? Write down the matrix representation of the Linear Model for Perspective Projection. **(2)**

(b) Consider the following Projection Matrix.

$$\begin{bmatrix} -9 & 2 & 3 & 1 \\ 3 & -9 & 6 & 1 \\ 2 & 6 & -10 & 1 \end{bmatrix}$$

Compute the following:

1. Camera Center
2. Vanishing point of X-axis
3. Image point of origin

(3)

(c) 1. Write the general form of a scaling matrix to a fixed point P(h,k).
   2. Using this form, magnify the triangle with vertices A(0,0), B(1,1), and C(5,2) to twice its size while keeping C(5,2) fixed. **(5)**

Best wishes