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MMTE-004

M. SC. (MATHEMATICS WITH APPLICATIONS IN COMPUTER SCIENCE) (MACS)

Term-End Examination

December, 2020

MMTE-004 : COMPUTER GRAPHICS

Time : $1\frac{1}{2}$ Hours *Maximum Marks : 25*

Note : *(i) Question **No. 1** is compulsory.*

*(ii) Attempt any **three** questions out of question no. **2** to **5**.*

(iii) Use of calculator is not allowed.

1. State whether the following statements are true *or* false. Justify your answers with a short proof or a counter-example : 5×2=10

   (a) Four bits binary code is used by Cohen-Sutherland line clipping algorithm for checking in which region of the plane the line lies.

(b) There can be only one principal vanishing point in a projected image.

(c) For a given image the image aspect ratio is same as its resolution.

(d) Two successive reflections about an axis do not change the original object position.

(e) The area of the ellipse that fits inside a rectangle with width W and height H is WH.

2. (a) Plot a circle at (5, 5) having a radius of 5 units using midpoint circle algorithm upto three iterations. 3

(b) Magnify the triangle P (1, 1), Q (3, 1) and R (2, 2) to twice of its size while keeping P (1, 1) fixed. 2

3. (a) Transform the scene in the world coordinate system with the viewpoint at (1, 2, 3). The view plane vector is (1, 1, 1) and the view up vector is (0, 1, 0). 3

(b) Differentiate between parallel projection and perspective projection. Give ***two*** differences. 2

4. (a) For a polygon with vertices $V_0(20, 30)$, $V_1(30, 10)$, $V_2(40, 20)$, $V_3, (50, 10)$, $V_4(50, 50)$, $V_5(40, 40)$, $V_6(30, 50)$ and $V_7(40, 30)$, prepare the initial sorted edge list and then make the active edge list for scan lines $y = 15, 30, 40, 45$. 3

(b) Trace the DDA algorithm for drawing a line segment from (0, 0) to (5, 5). 2

5. (a) Let P (t) be the Bezier curve defined over the interval [0, 1]. Prove the following : 3

(i) $P(0) = P_0, P(1) = P_n$

(ii) $P'(0) = n(P_1 - P_0)$

$P'(1) = n(P_n - P_{n-1})$

where n is the degree of Bezier curve, $P_0, P_1, ..., P_n$ are its control points and P′ is $\frac{dP(t)}{dt}$.

(b) Describe the following functions : 2

(i) gl scale $f(S_x, S_y, S_z)$

(ii) gl translate $f(d_x, d_y, d_z)$

(iii) gl rotate f (angle, V_x, V_y, V_z)