1	C			
2				D
3		B		
4		B		
5			C	
6				D
7			C	
Total =				

PART 1: Multiple Choice Questions (7 marks)

1. Which graphics operation is applied to give a real look to the objects
   a) Projection on 2D
   b) Viewing and clipping
   c) Rendering
   d) Hidden surface elimination

2. State the type of continuity "if directions and magnitudes of tangents are equal at the joint in parametric cubic curves"
   a) Go
   b) G1
   c) Co
   d) C1

3. Identify which of the below conditions is not satisfactory for metaballs
   a) A point surrounded by a density field
   b) The density increases with distance from the point
   c) The density of multiple particles is summed
   d) A thresholding value is also chosen, to define a solid volume.

3. Identify the graphics operation that is applied to remove the distortion artifacts produced when representing a high-resolution signal at a lower resolution

A. Aliasing

B. Antialiasing

C. Scan conversion

D. Z buffering

6.In 2D-translation, a point (x, y) can move to the new position (x', y') by using the equation

a) $x'=x+Tx$ and $y'=y+Tx$
b) $x'=x+Tx$ and $y'=y+Ty$
c) $X'=x+Ty$ and $Y'=y+Tx$
d) $X'=x-Tx$ and $y'=y-Ty$

[A, B, R, L].

4. If the line is entirely within the window, then both points will have out-codes.

a) 0100
b) 0000
c) 1111
d) 1010

5. Recognize the transformation in which an object is moved from one position to another in circular path around a specified pivot point is called

a) Translation
b) Scaling
c) Rotation
d) Reflection

6. Identify the transformation in which the x and y coordinates are interchanged and their values are negated

a) Translation
b) Scaling
c) Rotation
d) Reflection

7. Identify which curves are defined by two endpoints and two other points that specify the gradient at the endpoints.?

a) B-splines
b) ß-splines
c) Bezier
d) Hermit

PART-II: 8 Marks

$x' = x\cos\theta - x\sin\theta$
$y' = y\cos\theta + x\sin\theta$

A(10,10)
B(10,25)
C(45,25)
D(45,10)

1. Given the 2D object below. Rotate the object by 90 degrees about
   a) the origin b) on the Reference Point (10,10).

$$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos 90 & -\sin 90 & 0 \\ \sin 90 & \cos 90 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{bmatrix} 10 & 10 & 45 & 45 \\ 10 & 25 & 25 & 10 \\ 1 & 1 & 1 & 1 \end{bmatrix} \end{array}$$

* because at point (a) the Rotate is about the origin there is no need to move the shap

[-10 -25 -25 -10]

3. Identify which of the below conditions is not satisfactory for metaballs

a) A point surrounded by a density field
b) The density increases with distance from the point
c) The density of multiple particles is summed
d) A thresholding value is also chosen, to define a solid volume.

4. If the line is entirely within the window, then both points will have out-codes.

a) 0100
b) 0000
c) 1111
d) 1010

5. Using Hermite curve, Polynomial can be specified by the position of, and gradient at, each endpoint of curve. The values of X'_1 = __________

A. a_0
B. a_1
C. $a_3 + a_2 + a_1 + a_0$
D. $3a_3 + 2a_2 + a_1$

6.In 2D-translation, a point (x, y) can move to the new position (x', y') by using the equation

a) x'=x+Tx and y'=y+Tx
b) x'=x+Tx and y'=y+Ty
c) X'=x+Ty and Y'=y+Tx
d) X'=x-Tx and y'=y-Ty

7. Identify which curves are defined by two endpoints and two other points that specify the gradient at the endpoints.?

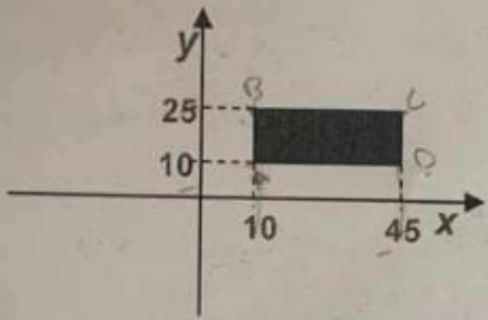
a) B-splines
b) ß-splines
c) Bezier
d) Hermit

PART-II: 8 Marks

1. Given the 2D object below. Rotate the object by 120 degrees about
   a) the origin b) on the Reference Point (20,20).

tran -
rotate
tran +

(3 marks)



A (10 , 10)
B (10 , 25)
C (45 , 25)
D (45 , 10)

Calculate the new values and display the final result (10, 10)

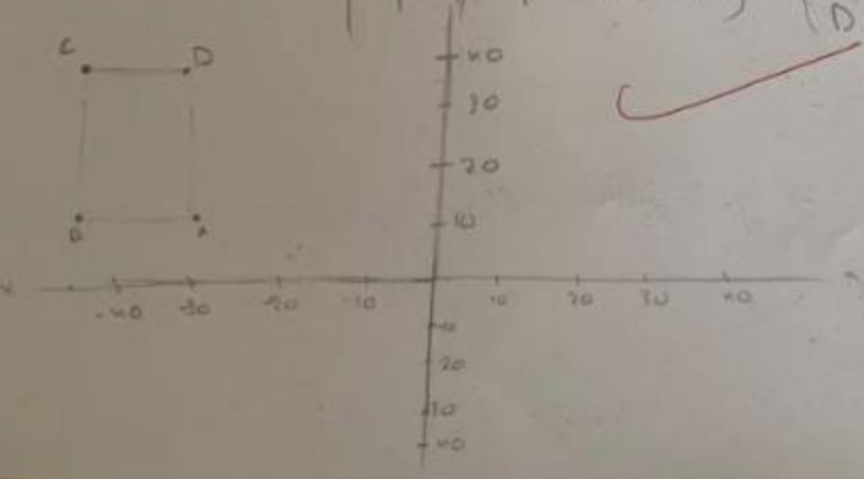
$$T_{com} = \begin{bmatrix} 1 & 0 & -10 \\ 0 & 1 & -10 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos 90 & -\sin 90 & 0 \\ \sin 90 & \cos 90 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 10 \\ 0 & 1 & 10 \\ 0 & 0 & 1 \end{bmatrix}$$

$$T_{compost} = \begin{bmatrix} 0 & -1 & -20 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$V' = T_{comp} * V$$

$$V' = \begin{bmatrix} 0 & -1 & -20 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 10 & 10 & 45 & 45 \\ 10 & 25 & 25 & 10 \\ 1 & 1 & 1 & 1 \end{bmatrix} \quad 3$$

$$= \begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{bmatrix} -30 & -45 & -45 & -30 \\ 10 & 10 & 45 & 45 \\ 1 & 1 & 1 & 1 \end{bmatrix} \end{array} = \begin{cases} A(-30,10) \\ B(-45,10) \\ C(-45,45) \\ D(-30,45) \end{cases}$$



Q1 $\quad 120^\circ \quad A(10,10) \quad B=(10,25) \quad C=(45,10) \quad D=(45,25)$

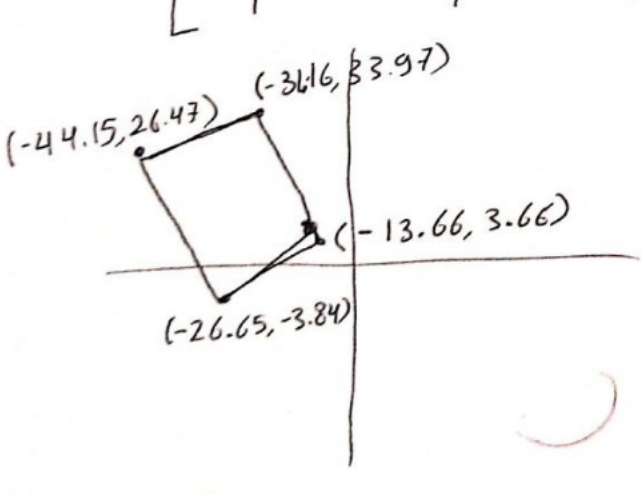
a) origin

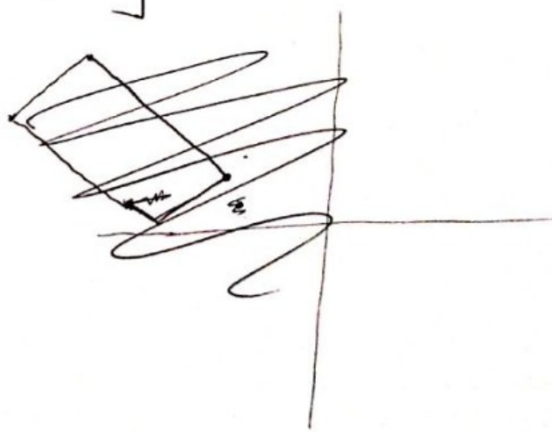
$$v = [A \quad B \quad C \quad D] = \begin{bmatrix} 10 & 10 & 45 & 45 \\ 10 & 25 & 10 & 25 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

$$T_{Rotate} = \begin{bmatrix} \cos 120 & -\sin 120 & 0 \\ \sin 120 & \cos 120 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} -0.5 & -\sqrt{3}/2 & 0 \\ \sqrt{3}/2 & -0.5 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$v' = \begin{bmatrix} -0.5 & -\sqrt{3}/2 & 0 \\ \sqrt{3}/2 & -0.5 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 10 & 10 & 45 & 45 \\ 10 & 25 & 10 & 25 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

$$v' = \begin{bmatrix} -13.66 & -26.65 & -31.16 & -44.15 \\ 3.66 & -3.84 & 33.97 & 26.47 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$





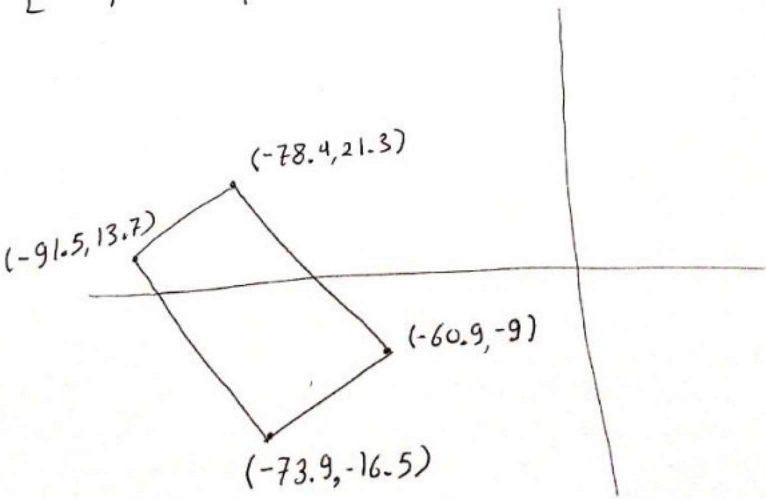
b) (20,20)

$$T_c = \begin{bmatrix} 1 & 0 & -20 \\ 0 & 1 & -20 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} -0.5 & -\sqrt{3}/2 & 0 \\ \sqrt{3}/2 & -0.5 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 20 \\ 0 & 1 & 20 \\ 0 & 0 & 1 \end{bmatrix}$$

$$T_c = \begin{bmatrix} -0.5 & -0.866 & -47.32 \\ 0.866 & -0.5 & -12.68 \\ 0 & 0 & 1 \end{bmatrix}$$

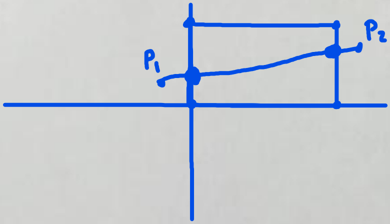
$$v' = T_c \cdot v = \begin{bmatrix} -0.5 & -0.866 & -47.32 \\ 0.866 & -0.5 & -12.68 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 10 & 10 & 45 & 45 \\ 10 & 25 & 10 & 25 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

$$v' = \begin{bmatrix} -60.98 & -73.97 & -78.48 & -91.47 \\ -9.02 & -16.52 & 21.29 & 13.79 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$



2 Consider the line from P1(-1,1) to P2(12,4). Determine its visibility against the clipping window defined by vertices (0,0), (10,0),(10,6),(0,6) using Cohen-Sutherland algorithm

(3 Marks)



$P_1 \rightarrow 0001$ non-zo

$P_2 \rightarrow \underline{0010}$

0000 zero

$P_1' \rightarrow 0000$

$P_2 \rightarrow \underline{0010}$ non-z

0000

$P_1' \rightarrow 0000$

$P_2' \rightarrow \underline{0000}$

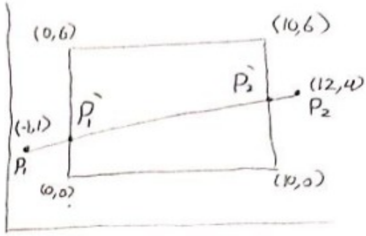
0000

Q2.

$P_1(-1,1)$

$P_2(12,4)$

$(0,0)\ (10,0)\ (10,6)\ (0,6)$



$P_1 \rightarrow 0001$

$P_2 \rightarrow 0010$

$AND = 0000$

Intersection point $P_1'(x_1', y_1')$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4-1}{12+1} = \frac{3}{13}$$

$$\frac{3}{13} = \frac{y_1' - y_1}{x_1' - x_1} \Rightarrow \frac{3}{13} = \frac{y_1' - 1}{0+1} = y_1' - 1$$

$$y_1' = \frac{3}{13} + 1 = \frac{16}{13} = \underline{1.23}$$

$$\boxed{\therefore P_1'(0, 1.23)}$$

Intersection point $P_2'(x_2', y_2')$

$$m = \frac{y_2 - y_2'}{x_2 - x_2'} \rightarrow \frac{3}{13} = \frac{4 - y_2'}{12-10}$$

$$\frac{3}{13} = \frac{4 - y_2'}{2} \rightarrow \frac{6}{13} = 4 - y_2' \rightarrow y_2' = 4 - \frac{6}{13}$$

$$y_2' = \frac{46}{13} = 3.54$$

$$\therefore \boxed{P_2'(10, 3.54)}$$

$t = 0.5$

2. Find the midpoint of a Hermite cubic spline with two end points as X0(3,3) & X1(8,7) and corresponding tangent vectors as X0`(0,6) & X1`(6,0)

3. The coordinates of four control points relative to a curve are given by P1(1,2) P2(3,4) P3(6, 6) and P4(10,8). Write the equations of Beizer curve and compute Bezeir curve for step size of 0.25.

t

(2 Marks)

Q3. $P_1(1,2)$

$P_2(3,4)$

$P_3(6,6)$ $P_4(10,8)$

$X_1 = 1$ $Y_1 = 2$

$X_2 = 3$ $Y_2 = 4$

$X_3 = 6$ $Y_3 = 6$

$X_4 = 10$ $Y_4 = 8$

X: $X = X_4 t^3 + 3X_3 t^2 (1-t) + 3X_2 t(1-t)^2 + X_1(1-t)^3$

$X = 10t^3 + 18t^2(1-t) + 9t(1-t)^2 + (1-t)^3$

Y: $Y = Y_4 t^3 + 3Y_3 t^2 (1-t) + 3Y_2 t(1-t)^2 + Y_1(1-t)^3$

$Y = 8t^3 + 18t^2(1-t) + 12t(1-t)^2 + 2(1-t)^3$

for $t = 0.25$

$X = 2.6875$

$Y = 3.5$