SL.NO:CAA 201612

SRI SIVASUBRAMANIYA NADAR COLLEGE OF ENGINEERING

(An Autonomous Institution, Affiliated to Anna University, Chennai)
Rajiv Gandhi Salai (OMR), Kalavakkam - 603 110

THEORY EXAMINATIONS

Register Number	205001100		
Name of the Student	SHIVCHARAN T		
Degree and Branch	CSE, BE	Semester	VII
Subject Code and Name	UCS1703 - Graphics		
Assessment Test No.	CAT-I	Date	07/09/2023

Details of Marks Obtained

Part A Question No.	Part A Marks	Part B Question No.	Part B (a) Marks	Part B (b) Marks	Part B Total Marks	Part C Question No.	Part C (a) Marks	Part C (b) Marks	Part C Total Marks
1	2	7			4	10			5
2	2					11			
3	2	8			6	12			6
4	2								
5	2	9			4	13			
6	2								
Total (A)	12	Total (B)			14	Total (C)			11

Grand Total (A+B+C)	3	7		Marks (In Words)			
Signature of the Faculty							

① Frame Buffer :: component ~~in which~~ of the graphics system in which picture definition stored

- Stores the points to be drawn/plotted
- Also stores the intensity as pixels.

② Persistence in CRT Monitor:

- The time taken by the emitted light to decay to its $\frac{1}{10}^{th}$ of its original intensity
- Low Persistence means high Refresh Rate
- High Persistence depends upon the components of CRT system

③ DDA :

$A(1,6)$ & $B(5,9)$ — x_1, y_1; x_2, y_2

$$m = \frac{9-6}{5-1} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x}$$

$$= \frac{3}{4} = 0.75$$

$m = 0.75 > 0$ & $<= 1$ → Case 1

$m > 0$ & $m <= 1$

$x_{k+1} = x_k + 1$ (Sample along x)

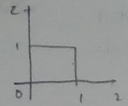
$y_{k+1} = y_k + m$

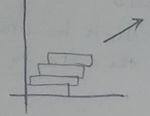
If $(x_1, y_1) = (2, 7)$

$x_2 = x_{1+1} = x_1 + 1 = 2+1 = 3$

$y_2 = y_{1+1} = y_1 + m = 7 + 0.75 = 7.75 \sim 8$

$\therefore (x_2, y_2) \equiv (3, 8)$ //





$Sh_x =$

$x' = x + Sh_x\, y$ (or) $x' = x + sh_x(y - y_{ref})$

$y' = y$ $\qquad$ $y' = y$

$$\begin{bmatrix} 1 & s_h & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \qquad \begin{bmatrix} 1 & s_h & -s_h y_{ref} \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

(6)

Uniform Scaling	Differential
i) When both the scaling factors are equal, $s_x = s_y$, it is called uniform scaling	When both are different, $s_x \neq s_y$, it is differential
ii) Uniform, equal proportion increase in size	Uneven scaling
iii) If $s_x = 1$ & $s_y = 1$, same size as original	If a scaling factor is ≤ 1, moves to the reference center else moves away from center

(8) Algorithm:

$(x_c, y_c) = (4, 5)$; $r = 4$

$P_{k+1} = P_k + 2\Delta y$, $P_k < 0$, plot y_k

$P_{k+1} = P_k + 2\Delta y - 2\Delta x$, $P_k \geq 0$, plot $y_k - 1$

$P_0 = 2\Delta y - \Delta x$

(8) Algorithm:

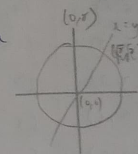
$P_{k+1} = P_k + 2x_{k+1} + 1$, < 0 , plot y_k

$P_{k+1} = P_k + 2x_{k+1} - 2y_{k+1} + 1$, ≥ 0 , plot $y_k - 1$

$P_0 = 1 - r$

Start from $(0, r)$, do till $x = y$, sample along x

Symmetric among octets.



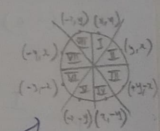
$r = 4$ & $(x_c, y_c) = (4, 5)$

~~Plot (0, r)~~ Plot $(0+4, 4+5) = (4, 9)$

k	P_k	(x_{k+1}, y_{k+1})	
0	$1-4 = -3 < 0$	$(1, 4)$	$x_{k+1} = x_k + 1$, $y_{k+1} = y_k$
1	$-3+2(1)+1 = 0 \geq 0$	$(2, 3)$	$y_{k+1} = y_k - 1$
2	$0+2(2)-2(3)+1 = 4-6+1 = -1 < 0$	$(3, 3)$	$y_{k+1} = y_k$

I

$\rightarrow x = y \rightarrow$ stop



Plotting octets

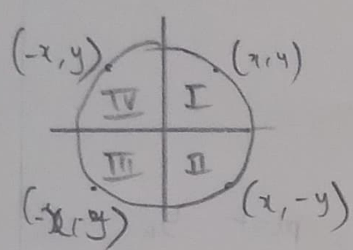
k	P_k	$(x_{k+1}+x_c, y_{k+1}+y_c)$	$x_{k+1}=x_k+1$
0	$P_0 = 1 - r = 1 - 4 = -3 < 0$	(5, 9)	$y_{k+1} = y_k$
1	$P_1 = -3 + 2(5) + 1 = 8 > 0$	(6, 8)	$y_{k+1} = y_k - 1$
2	$P_2 = 8 + 2(6) - 2(8) + 1 = 8 + 12 - 16 + 1 = 5 > 0$	(7, 7) $x = y \to$ stop	$y_{k+1} = y_k - 1$
		(8, 6)	
		(9, 5)	

$(x_0, y_0) = (4, 9)$

I octet

II octet (y, x) when (x, y) in I

I^st Quad



← Plotting Quad

~~I~~	~~II~~	~~III~~	~~IV~~
~~(4, 9)~~	~~(4,~~		
~~(5, 9)~~	~~(5, -9+5)~~		
~~(6, 8)~~	~~(6,~~		
~~(7, 7)~~	~~(7,~~		
~~(8, 6)~~	~~(8,~~		
~~(9, 5)~~	~~(9,~~		

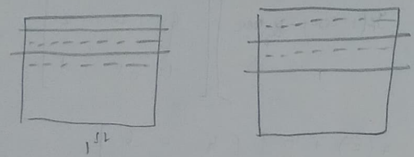
I	II	~~III~~ IV	III
(4,9) = (0+4, 4+5)	(0, -4+5) = (4, 1)	(-0+4, 9) = (4, 9)	(-0+4, -4+5) = (4, 1)
(5,9) = (1+4, 4+5)	(5, 1)	(3, 9)	(3, 1)
(6,8) = (2+4, 3+5)	(6, -3+5) = (6, 2)	(2, 8)	(2, 2)
(7,7) = (3+4, 2+5)	(7, 3)	(1, 7)	(1, 3)
(8,6) = (4+4, 1+5)	(8, 4)	(0, 6)	(0, 4)
(9,5) = (5+4, 0+5)	(9, 5)	(-1, 5)	(-1, 5)

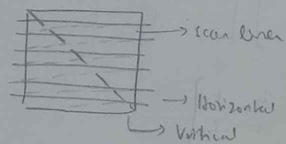
(9) Interlacing:

- Method by which ~~...~~ the display is updated in $1/2^{th}$ time taken to clear all the scan lines in the screen.

Method 1:

We will do iterations, in one iteration erase all the odd lines, in next iteration erase all the even lines.





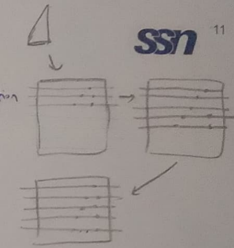
Horizontal → after drawing corner to ~~right~~ left end of screen

Vertical → after drawing, top left of screen.

(7) ~~Random~~:

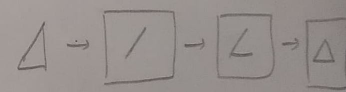
i) Raster:

- All the lines (scan lines) are drawn every iteration
- Pixels stored as points
- Refresh rate is fixed
- Relatively cheaper than raster
- Jagged points / lines
- 1 → up, 0 → down
- Coloured pixel – Pix ; B/W – Bix

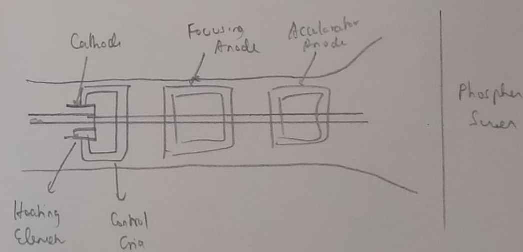


ii) ~~Raster~~ Random:

- Only few lines are drawn in hapzard order
- Smooth line
- Refresh rate depends
- Costlier than raster



(4)



2D Graphics:

$(x_m, y_m) \rightarrow (x_g, y_g) \rightarrow (x_n, y_n) \longrightarrow (x_d, y_d)$

Local / Model Coordinate — Global — Normalise — Device oriented

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THEORY EXAMINATIONS

Register Number	205001085		
Name of the Student	Sabarivasan . V		
Degree and Branch	BE CSE	Semester	VII
Subject Code and Name	UCS1703 Graphics and Multimedia		
Assessment Test No.	I	Date	7/9/2023

Details of Marks Obtained

Part A		Part B				Part C			
Question No.	Marks	Question No.	(a) Marks	(b) Marks	Total Marks	Question No.	(a) Marks	(b) Marks	Total Marks
1	1	7			2	10			5
2	0								
3	2	8			5	11			
4	0					12			10
5	2	9			—				
6	0					13			
Total (A)	5	Total (B)			7	Total (C)			15

Grand Total (A+B+C)	2	7		Marks (In Words)			
Signature of the Faculty							

PART - C

SSN

(10)

Bresenham's algorithm (x_1, x_2, y_1, y_2)
{
$x = x_1;$
$y = y_1;$
$dx = x_2 - x_1;$
$dy = y_2 - y_1$
$P = 2dy - dx$
while $(x \le x_2)$
{
put Pixel (x, y)
$x{+}{+};$
if $(P < 0)$
{ ~~$y_{k+1} = y_k$~~ } $P_k = P_k + 2dy$
else
{ ~~$y_{k+1} = y_k + 1$~~ $P_k = P_k + 2dy - 2dx$
$y{+}{+}$
}
}
}

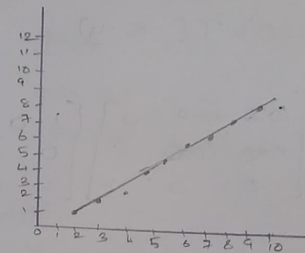
Given: (2,1) and (10,12)

$dx = 10-2 = 8$

$dy = 12-1 = 11$

$P = 2dy - dx = 2(11) - 8 = 14$

x	y	P
2	1	$14 > 0$; $P_{k+1} = 14+22-16 = 20$
3	2	$20 > 0$; $P_{k+1} = 20+22-16 = 26$
4	3	$26 > 0$; $P_{k+1} = 26+6 = 32$
5	4	$32 > 0$; $P_{k+1} = 32+6 = 38$
6	5	$38 > 0$; $P_{k+1} = 38+6 = 42$
7	6	$42 > 0$; $P_{k+1} = 42+6 = 48$
8	7	$48 > 0$ $P_{k+1} = 48+6 = 54$
9	8	$54 > 0$ $P_{k+1} = 54+6 = 60$
10	9	60



(12)

⇒ To rotate a triangle for a given pivot,

(i) Translate the triangle ~~to the~~ in such a way that pivot comes at origin.

(ii) Rotate the triangle by 180° counter clockwise

(iii) Again translate the triangle to its previous pivot coordinates.

$$R(\phi) = T(x,y) \cdot R(\theta) \cdot T(-x,-y)$$

$$= \begin{bmatrix} 1 & 0 & x \\ 0 & 1 & y \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -x \\ 0 & 1 & -y \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} \cos\theta & -\sin\theta & x \\ \sin\theta & \cos\theta & y \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -x \\ 0 & 1 & -y \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} \cos\theta & -\sin\theta & -x\cos\theta - y\cos\theta + x \\ \sin\theta & \cos\theta & -x\sin\theta - y\cos\theta + y \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} \cos & -\sin\theta & x(1-\cos\theta) + y\sin\theta \\ \sin\theta & \cos\theta & y(1-\cos\theta) - x\sin\theta \\ 0 & 0 & 1 \end{bmatrix} //$$

Given: (4,6) (2,2) (6,2)

Pivot: (4,6)

$\sin 180^\circ = 0$

$\cos 180^\circ = -1$

$R(\theta)$

$$X = \begin{bmatrix} 4 \\ 6 \\ 1 \end{bmatrix} \quad Y = \begin{bmatrix} 2 \\ 2 \\ 1 \end{bmatrix} \quad Z = \begin{bmatrix} 6 \\ 2 \\ 1 \end{bmatrix}$$

$$R'_x(\theta) = R(\theta) \cdot X$$

$$= \begin{bmatrix} \cos\theta & -\sin\theta & x(1-\cos\theta) + y\sin\theta \\ \sin\theta & \cos\theta & y(1-\cos\theta) - x\sin\theta \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 4 \\ 6 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} -1 & 0 & 4(2) \\ 0 & -1 & 6(2) \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 4 \\ 6 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} -4+8 \\ -6+12 \\ 1 \end{bmatrix} = \begin{bmatrix} 4 \\ 6 \\ 1 \end{bmatrix} //$$

$$R'_y(\theta) = \begin{bmatrix} -1 & 0 & 4(2) \\ 0 & -1 & 6(2) \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 2 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} -2+8 \\ -2+12 \\ 1 \end{bmatrix} = \begin{bmatrix} 6 \\ 10 \\ 1 \end{bmatrix}$$

$$R'_z(\theta) = \begin{bmatrix} -1 & 0 & 8 \\ 0 & -1 & 12 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 6 \\ 2 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} -6+8 \\ -2+12 \\ 1 \end{bmatrix} = \begin{bmatrix} 2 \\ 10 \\ 1 \end{bmatrix}$$

$\therefore$ The new points are

(4,6) (6,10) (2,10)

PART-B

(8) Given:

Centre = (4, 5)

Radius = 4.

$\Rightarrow P_0 = 1 - r = -3$

$P_k < 0$

$\hookrightarrow P_{k+1} = P_k + 1 + 2(x_{k+1})$

$P_k \geq 0$

$\hookrightarrow P_{k+1} = P_k + 1 + 2(x_{k+1}) - 2y_{k+1}$

k	(x_{k+1}, y_{k+1})	P
0	(0, 4)	-3
1	(1, 4)	0
2	(2, 3)	-1
3	(3, 3)	6
4	(4, 2)	13.

Centre (4, 5)

2nd Quadrant

~~(0,4)~~ (0,4)
(-1,4)
(-2,3)
(-3,3)
(-4,2)

3rd Quadrant

(0,-4)
(-1,-4)
(-2,-3)
(-3,-3)
(-4,-2)

4th Quadrant

(0,-4)
(1,-4)
(2,-3)
(3,-3)
(4,-2)

SSN

PART - A

SSN 11

(1) In frame buffer, the picture definition is stored. ~~In the~~ It is stored in the form of pixels ^intensity value^ on the graphics system.

(2) ~~The persistence in CRT monitor is~~

(3)

$\Delta y = 9-6 = 3$
$\Delta x = 5-1 = 4$ | Steps : 4

$x_{inc} = \frac{\Delta x}{step} = \frac{4}{4} = 1$

$y_{inc} = \frac{\Delta y}{step} = \frac{3}{4} = 0.75$

$\Rightarrow (x_2, y_2) = (2+1, 7+0.75)$

$= (3, 7.75)$

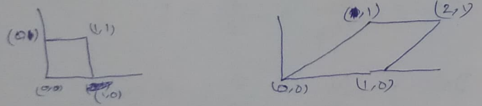
$= (3, 8)$ ✓

(2) ⇒ Persistence in a CRT monitor is defined as maintaining the clarity and accuracy of the pixels.

⇒ Increase in persistence, increases the refresh rate in CRT monitor.

(5) (b) distorts and may move the object based on the shearing reference line.

Justification:



After shearing along x-axis with shear factor $Sh_x = 1$.

(4) 2D Graphics pipeline

* Monitor
* Modelling coordinates
* Graphics system.

(6)

Uniform scaling	Differential scaling
Scaling is applied in uniform units.	Scaling is applied in terms of differentials of the variables.
May not create approximate result.	Creates approximate result.
Less modifications needed.	More modifications needed.

PART-B

(7) Random Scan systems

=> It is less costlier to build.

=> The electron beam is passed over a particular width of the screen.

=> Uses uniform scaling.

=> Has low refreshing rate.

Eg: PET tubes.

Raster scan systems

=> It is costlier to build.

=> The electron beam is passed over the entire screen.

=> It uses differential scaling.

=> Has high refresh rate.

Eg: TV set.