CG Practice Questions

Experiment No. 1

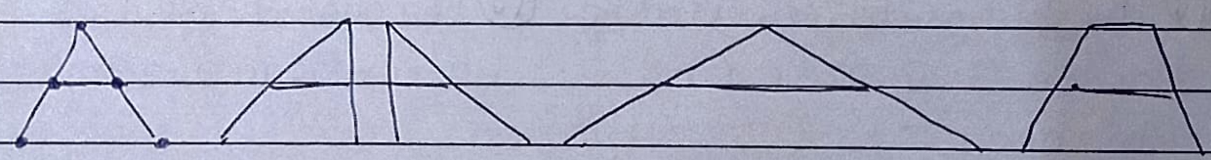
Q. Differentiate bet^n Random & Raster Scan.
List various methods for character generation & explain one.

1→

Random Scan	Raster Scan
(i) Random scan operates by directing the electron beam to only those locations where the picture is to be drawn.	(i) The electron beam starts at the top left corner of the screen and horizontally moves to the right.
(ii) Creation of diagrams using Random scan is easier, so can be used in engineering and scientific drawings.	(ii) Raster graphics can be used in animation.
(iii) Pen plotters and Direct storage view tube (DSVT) devices are used.	(iii) Cathode Ray Tubes (CRT) are used.
(iv) The cost of devices used for Random Scan are much higher.	(iv) The cost of devices used for Raster Scan are much cheaper.
(v) Requires less memory.	(v) Requires more memory.
(vi) Requires processor to controll.	(vi) No such requirement.

2→ Various methods for character generation:
① Stroke Method / Vector character generation method:
② Dot-matrix or bit-map method.
③ Starbust method

Stroke Method:
① This method creates characters by using a set of line segments.
② We could build our own stroke method by vector generation algorithm or by using any line generation method.
③ To produce a character we will give a sequence of commands that defines the start point and end points of the straight line.
④ By using this we change the scale of the characters. We can make a character twice as large as its original size. Similar we can get characters slanted also. By using this method we can change the style of characters also.
e.g.



Experiment No. 2

Q. How the special cases (vertical, horizontal and $|m|=1$) handled? Calculate the points between the starting point (5,6) and ending point (13,10) using DDA algorithm.

→ ① Vertical ($|m|>1$)

∴ ① In vertical, the slope is greater than 1, Δy is set to unit interval, i.e. $\Delta y = 1$ and corresponding x coordinate is computed.

∴ From equation of slope

$$m = \frac{\Delta y}{\Delta x} = \frac{1}{\Delta x} \quad \therefore \Delta x = \frac{1}{m}$$

co-ordinate value for next pixel is given as,

$$x_{k+1} = x_k + \Delta x = x_k + 1/m$$

$$y_{k+1} = y_k + \Delta y = y_k + 1$$

② Horizontal ($|m|<1$)

In horizontal the slope is less than 1; Δx is set to the unit interval i.e. $\Delta x = 1$ and corresponding y-coordinate is computed.

∴ From equation of slope

$$m = \frac{\Delta y}{\Delta x} = \frac{\Delta y}{1} \quad \therefore \Delta y = m$$

∴ co-ordinate value for next pixel is given as,

$$x_{k+1} = x_k + \Delta x = x_k + 1$$

$$y_{k+1} = y_k + \Delta y = y_k + m$$

CIASSMATE
Date:
Page:

③ $|m| = 1$

When the slope of the line is 1, i.e. line makes an angle of 45° with x-axis, we increment both coordinate value by 1. So $\Delta x = \Delta y = 1$

∴ coordinate value for next pixel is given as,

$x_{k+1} = x_k + \Delta x = x_k + 1$

$y_{k+1} = y_k + \Delta y = y_k + 1$

④ Let's take $(x_1, y_1) = (\cancel{20}\,5, \cancel{10}\,6)$

and $(x_2, y_2) = (\cancel{30}\,13, \cancel{18}\,10)$

slope of line $= m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10-6}{13-5} = \frac{4}{8} = \frac{1}{2} = 0.5$

Line is in 1st quadrant, it is growing from left to right and slope $|m| < 1$, so set $\Delta x = 1$ and $\Delta y = m = 0.5$

$x_{k+1} = x_k + \Delta x = x_k + 1$

$y_{k+1} = y_k + \Delta y = y_k + 0.5$

K	(x_k, y_k)	$x_{k+1} = x_k + 1$	$y_{k+1} = y_k + 0.5$	Round (x_{k+1})
0	(5,6)	5+1=6	6+0.5=6.5	7
1	(6,7)	6+1=7	6.5+0.5=7	7
2	(7,7)	7+1=8	7+0.5=7.5	8
3	(8,8)	8+1=9	7.5+0.5=8	8
4	(9,8)	9+1=10	8+0.5=8.5	9
5	(10,9)	10+1=11	8.5+0.5=9	9
6	(11,9)	11+1=12	9+0.5=9.5	10
7	(12,10)	12+1=13	9.5+0.5=10	10
8	(13,10)			

Date :
Page :

Experiment No. 3

Q. Explain Bresenham's Algorithm with Derivation. Plot intermediate points between (2,3) to (10,6) using Bresenham's Algorithm

step1: Read two endpoints (x_0, y_0) and (x_1, y_1)

step2: Plot the first pixel (x_0, y_0)

step3: Compute the constants $\Delta x = x_1 - x_0$, $\Delta y = y_1 - y_0$
$m = \Delta y / \Delta x$

step4: if $(m<1)$: $P = 2\Delta y - \Delta x$
else: $P = 2\Delta x - \Delta y$

step5: if $(m<1)$

if $(P<0)$: $x_{i+1} = x_i + 1$
$y_{i+1} = y_i$
$P_{k+1} = P_k + 2\Delta y$

if $(P \geq 0)$ $x_{i+1} = x_i + 1$
$y_{i+1} = y_i + 1$
$P_{k+1} = P_k + 2\Delta y - 2\Delta x$

if $(m \geq 1)$

if $(P<0)$ $x_{i+1} = x_i$, $y_{i+1} = y_i + 1$
$P_{k+1} = P_k + 2\Delta x$

if $(P \geq 0)$ $x_{i+1} = x_i + 1$, $y_{i+1} = y_i + 1$
$P_{k+1} = P_k + 2\Delta x - 2\Delta y$

Step6: Repeat setep 4 Δx times

classmate

Date

Page

27 $(2,3)$ & $(10,6)$

→ Let us assume $(x_1, y_1) = (2,3)$ & $(x_2, y_2) = (10,6)$

$dx = (10-2) = 8$, $dy = (6-3) = 2$

$m = dy/dx = 2/8 = 1/4 < 1$

$\therefore p_0 = 2dy - dx = 4 - 8 = -4$

As $d < 0$, $\Delta E = 2dy = 4$

$\Delta NE = 2(dy - dx) = 2(2-8) = -12$

K	(x_K, y_K)	Decision	x_{K+1}	y_{K+1}	d_{new}
0	-		2	3	-4
1	(2,3)	$P_K < 0 \therefore E$	3	3	
2					
3					
4					
5					
6					
7					
8					

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Date

Page

k	(x_k, y_k)	x_{k+1}	y_{k+1}	P_k
0	–	2	3	-4
1	(2,3)	$2+1=3$	$3+0=4$	$P_k + \Delta E = -4+4=0$
2	(3,4)	$3+1=4$	$4+1=5$	$P_k + N\Delta E = 0-12=-12$
3	(4,5)	$4+1=5$	$5+0=5$	$-12+\Delta E = -12+4=-8$
4	(5,5)	$5+1=6$	$5+0=5$	$-8+4=-4$
5	(6,5)	$6+1=7$	$5+0=5$	$-4+4=0$
6	(7,5)	$7+1=8$	$5+1=6$	$0 \cancel{+4} -12 = \cancel{4} -12$
7	(8,6)	$8+1=9$	$6+0=6$	$-12+4=-8$
8	(9,6)	$9+1=10$	$6+0=6$	$-8+4=-4$
9	(10,6)	$10+1=11$	$6+0=6$	$-4+4=0$
10	(11,6)			