SIES Graduate School of Technology

Subject : CG
Roll No. : 1191/076
Assignment No. 1
Date : / /

1) Compare Random & Raster scan system

	Random scan system	Raster scan system
i)	Random scan system uses an electronic beam which operates like a pencil to create line image on the CRT screen. The picture is constructed out of a sequence of straight line segment	i) Raster scan display is based on intensity control of pixel in the form of rectangular box called raster on the screen. Information of on and off pixel is stored in refresh buffer or Frame buffer
ii)	This is a high-resolution system & more expensive	ii) This is a low-resolution system & comparitively less expensive
iii)	Solid pattern is tough to fill & the refresh rate depends on resolution of the picture	iii) Solid pattern is easy to fill & the refresh rate doesn't depends on picture
iv)	Any modification is easy	iv) Modification here is tough

2) Derive Midpoint circle algorithm

A) Given a circle centered at (0,0) & radius r & a point P(x,y)

$$F(p) = x^2 + y^2 - r^2$$

if $F(p) < 0$, the point is inside the circle
$F(p) = 0$, the point is on the perimeter
$F(p) > 0$, the point is outside the circle

In our program we ~~return~~ denote $F(p)$ with P. The value of ~~x~~ P is calculated at the midpoint of 2 contending pixel i.e. $(x-0.5, y+1)$. Each pixel

is described with a subscript k

$$P_k = (x_k - 0.5)^2 + (y_k + 1)^2 - r^2$$

Now,

$x_{k+1} = x_k$ or x_{k+1} , $y_{k+1} = y_k + 1$

$$P_{k+1} = (x_{k+1} - 0.5)^2 + (y_{k+1} + 1)^2 - r^2$$

$$= (x_{k+1} - 0.5)^2 + [(y_k + 1) + 1]^2 - r^2$$

$$= (x_{k+1} - 0.5)^2 + (y_k + 1)^2 + 2(y_k + 1) + 1 - r^2$$

$$= (x_{k+1} - 0.5)^2 + [(x_k - 0.5)^2 + (x_k - 0.5)^2] + (y_k + 1)^2 - r^2 + 2(y_k + 1) + 1$$

$$= P_k + (x_{k+1} - 0.5)^2 - (x_k - 0.5)^2 + 2(y_k + 1) + 1$$

$$= P_k + (x_{k+1}^2 - x_k^2) + (x_{k+1} - x_k)^2 + 2(y_k + 1) + 1$$

$$= P_k + 2(y_k + 1) + 1$$

3) Explain DDA Line drawing

The DDA is a scan conversion line algorithm based on calculating either Δy or Δx

Now,

$$y = mx + b$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$b = y - mx_1$$

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

$$b = y_1 - mx$$

Consider first a line with positive slope If the slope is less than or equal to 1, i.e. $m \leq 1$, we sample at unit x intervals ($\Delta x = 1$) & compute each successive y values as

$$y_{k+1} = y_k + m \quad , x = x_k + 1$$

For lines with $m > 1$, we reverse the role of x & y. That is, we sample at unit y intervals ($\Delta y = 1$) & calculate each succeeding x value as

$$x_{k+1} = x_k + \frac{1}{m} \qquad \because y_{k+1} = y_k + 1$$

These are based on the assumption that lines are processed from left to right if the processing is reversed, s.t. that start point is at right, then, either we have $\Delta x = -1$

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

or we have $\Delta y = -1$

$$x_{k+1} = x_k - \frac{1}{m}$$

4) $(10, 15)$ $(5, 25)$

$\Delta x = x_2 - x_1 = 5 - 10 = -5$
$\Delta y = y_2 - y_1 = 25 - 15 = 10$

$m = \frac{\Delta y}{\Delta x} = \frac{10}{-5} = -2$

$m < 1$

$\Delta y > \Delta x$

∴ total 10 steps

$x_{k+1} = x_k - \frac{1}{m} = x_k - \frac{1}{5/2} = x_k - \frac{1}{2} = x_k - 0.5$

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

10	15
10 − 0.2 = 9.8	15 + 1 = 16
9.8 − 0.2 = 9.6	16 + 1 = 17
9.6 − 0.2 = 9.4	17 + 1 = 18
9.4 − 0.2 = 9.2	18 + 1 = 19
9.2 − 0.2 = 9	19 + 1 = 20
9 − 0.2 = 8.8	20 + 1 = 21
	21 + 1 = 22
	22 + 1 = 23
	23 + 1 = 24
	24 + 1 = 25

10	15	(10, 15)
10 − 0.5 = 9.5 ≈ 10	15 + 1 = 16	(10, 16)
9.5 − 0.5 = 9 ≈ 9	16 + 1 = 17	(9, 17)
9 − 0.5 = 8.5 ≈ 9	17 + 1 = 18	(9, 18)
8.5 − 0.5 = 8	18 + 1 = 19	(8, 19)
8 − 0.5 = 7.5 ≈ 8	19 + 1 = 20	(8, 20)
7.5 − 0.5 = 7 ≈ 7	20 + 1 = 21	(7, 21)
7 − 0.5 = 6.5 ≈ 7	21 + 1 = 22	(7, 22)
6.5 − 0.5 = 6 ≈ 6	22 + 1 = 23	(6, 23)
6 − 0.5 = 5.5 ≈ 6	23 + 1 = 24	(6, 24)
5.5 − 0.5 = 5 ≈ 5	24 + 1 = 25	(5, 25)

4) (10,10) (18, 16)

$\Delta x = 18 - 10 = 8$
$\Delta y = 16 - 10 = 6$

$m = 0.75$
steps = 8

$x_{inc} = 8/8 = 1$ $y_{inc} = 6/8 = 0.75$

$x_1 = 11$	$y_1 = 10$ or 11 ✓ $m = 0.85$ or 0.71	11
$x_2 = 12$	$y_2 = 11$ or 12 ✓ 0.833 or 0.66	12
$x_3 = 13$	$y_3 = 12$ or 13 ✓	13
$x_4 = 14$	$y_4 = 13$ or 14 ✓	14
$x_5 = 15$	$y_5 = 14$ ✓ or 15	14
$x_6 = 16$	$y_6 = 14$ or 15 ✓	15
$x_7 = 17$	$y_7 = 15$ ✓ or 16	15
$x_8 = 18$	$y_8 = 16$	