CS402: Computer Graphics

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Computer Graphics Revision

1 Bersenham's Algorithm

1. Input the two end points, and store the left end point in (x_0, y_0).

2. Load the the left end point into the frame buffer, i.e: plot (x_0, y_0).

3. Calculate the constants $\Delta y, \Delta x, 2\Delta y, 2\Delta y - 2\Delta x$

   And calculate the first decision parameter p_0

   $$p_0 = 2\Delta y - \Delta x$$

4. For each p_k, starting from k=0, perform the following test:

   (a) If $p_k < 0$ then the next point to plot is $(x_k + 1, y_k)$, and $p_{k+1} = p_k + 2\Delta y$

   (b) Otherwise, the next point to plot is $(x_k + 1, y_k + 1)$, and $p_{k+1} = p_k + 2\Delta y - 2\Delta x$

5. Repeat the step 4 Δx times.

1.1 Draw a line from (20,10) to (30,18)

$(x_0, y_0) = (20, 10)$

$\Delta y = 18 - 10 = 8$, $\Delta x = 10$, $2\Delta y = 16$, $2\Delta y - 2\Delta x = 16 - 20 = -4$

$$p_0 = 2\Delta y - \Delta x = 16 - 10 = 6$$

k	p_k	plot	
0	6	(21,11)	$p_1 = p_k + 2\Delta y - 2\Delta x = 6 - 4 = 2$
1	2	(22,12)	$p_2 = p_k + 2\Delta y - 2\Delta x = 2 - 4 = -2$
2	-2	(23,12)	$p_3 = p_k + 2\Delta y = -2 + 16 = 14$
3	14	(24,13)	$p_4 = p_k + 2\Delta y - 2\Delta x = 14 - 4 = 10$
4	10	(25,14)	$p_5 = p_k + 2\Delta y - 2\Delta x = 10 - 4 = 6$
5	6	(26,15)	$p_4 = p_k + 2\Delta y - 2\Delta x = 6 - 4 = 2$
6	2	(27,16)	$p_5 = p_k + 2\Delta y - 2\Delta x = 2 - 4 = -2$
7	-2	(28,16)	$p_8 = p_k + 2\Delta y = -2 + 16 = 14$
8	14	(29,17)	$p_9 = p_k + 2\Delta y - 2\Delta x = 14 - 4 = 10$
9	10	(30,18)	

2 Mid-point Algorithm

1. Input the radius r and the circle center (x_c, y_c) and obtain the first point on the circumference

   (a) $(x_c, y_c) = (0, r)$

2. Calculate the first decision parameter

   (a) $p_0 = \frac{5}{4} - r$

3. At each point p_k, starting from k=0, perform the test:

   (a) If $p_k < 0$ the next point to plot is $(x_k + 1, y_k)$, and $p_{k+1} = p_k + 2x + 1$

   (b) Otherwise, the next point to plot is $(x_k + 1, y_k - 1)$, and $p_{k+1} = p_k + 2x + 1 - 2y$

4. Determine the symmetry points on the other seven octants.

5. Move each calculated pixel position (x,y) onto the circular path centered on (x_c, y_c) and plot the *coordinate* values

   (a) x=x+x_c, $y = y + y_c$.

6. Repeat step 3 to 5 until $x \geq y$.

2.1 Plot the first octant of a cirlce whose center point is $(0, 0)$ and radius $= 10$

$$p_0 = 1 - r = 1 - 10 = -9$$

k	p_k	plot	2x	2y	
0	-9	(1,10)	2	20	$p_1 = -9 + 2 + 1 = -6$
1	-6	(2,10)	4	20	$p_2 = -6 + 4 + 1 = -1$
2	-1	(3,10)	6	20	$p_3 = -1 + 6 + 1 = 6$
3	6	(4,9)	8	18	$p_4 = 6 + 8 + 1 - 18 = -3$
4	-3	(5,9)	10	18	$p_5 = -3 + 10 + 1 = 8$
5	8	(6,8)	12	16	$p_6 = 8 + 12 + 1 - 16 = 5$
6	5	(7,7)			

3 DDA Algorithm

3.1 Draw a line from (20,10) to (30,18)

$$m = \frac{\Delta y}{\Delta x} = \frac{8}{10} = 0.8$$

If $m < 1$ then $y_{k+1} = y_k + m$

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

x	y	plot
21	10.8	(21,11)
22	11.6	(22,12)
23	12.4	(23,12)
24	13.2	(24,13)
25	14	(25,14)
26	14.8	(26,15)
27	15.6	(27,16)
28	16.4	(28,16)
29	17.2	(29,17)
30	18	(30,18)