CMPSC 457 Homework 2

Andrew Smith (azs7014)

1 Root Equations

$$f(x,y) = (x - x_c)^2 + (y - y_c)^2 - R^2 \qquad (Explicit)$$

$$R^2 = (x_i - x_c)^2 + (y_i - y_c)^2 \qquad (Radius^2)$$

$$m = (x_i + 1, y_i - \frac{1}{2}) \qquad (Midpoint)$$

$$m_E = (x_i + 2, y_i - \frac{1}{2}) \qquad (MidpointE)$$

$$m_{SE} = (x_i + 2, y_i - \frac{3}{2}) \qquad (MidpointSE)$$

$$d_i = (x_i - x_c + 1)^2 + (y_i - y_c - \frac{1}{2})^2 - R^2 \qquad (d_i)$$

2 d

This will be derived from (d_i) by multiplying it be 4. We will consider the center point to be $(0, 0)$ therefore eliminating x_c and y_c.

$$4 * d_i = d = 4(x + 1)^2 + 4(y - \frac{1}{2})^2 - 4R^2$$

First expand the squares.

$$d = 4(x^2 + 1 + 2x) + 4(y^2 + \frac{1}{4} - y) + 4R^2$$

Now we factor in the 16.

$$d = 4x^2 + 4 + 8x + 4y^2 + 1 - 4y + 4R^2$$

We now have our final equation.

$$d = 4x^2 + 4 + 8x + 4y^2 + 1 - 4y + 4R^2 \qquad (d)$$

3 $d > 0$

We will use $(MidpointE)$, $f(M_E) = (x + 2)^2 + (y - \frac{1}{2})^2 - R^2$

$$4f(M_E) = d_{next} = 4(x + 2)^2 + 4(y - \frac{1}{2})^2 - 4R^2$$

First we expand the squares again.

$$d_{next} = 4(x^2 + 4 + 4x) + 4(y^2 + \frac{1}{4} - y) + 4R^2$$

Now we factor in the 4 again.

$$d_{next} = 4x^2 + 4 + 8x + 4y^2 + 1 - 4y + 4R^2 + 8x + 12$$

Once we notice we can collapse some values into d.

$$d_{next} = (d) + 8x + 12 \qquad (d_{next}1)$$

4 $d < 0$

We will use $(MidpointSE)$, $f(M_{SE}) = (x+2)^2 + (y - \frac{3}{2})^2 - R^2$

$$4f(M_{SE}) = d_{next} = 4(x+2)^2 + 4(y - \frac{3}{2})^2 - 4R^2$$

First we expand the squares again.

$$d_{next} = 4(x^2 + 4 + 4x) + 4(y^2 + \frac{9}{4} - 3y) + 4R^2$$

Now we factor in the 4 again.

$$d_{next} = 4x^2 + 4 + 8x + 4y^2 + 1 - 4y + 4R^2 + 8x + 12 - 8y + 8$$

Once we notice we can collapse some values into d.

$$d_{next} = (d) + 8x - 8y + 20 \qquad (d_{next}2)$$