Quiz #4 (CSE4190.410)
October 19, 2011 (Wednesday)

1. (10 points) In the line drawing algorithm of Bresenham, derive the initial value

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

$$\begin{aligned}
p_0 &= \Delta x(2m(x_0+1) - 2y_0 + 2b - 1) \\
&= \Delta x(2(mx_0+b) + 2m - 2y_0 - 1) \\
&= \Delta x(2y_0 + 2m - 2y_0 - 1) && \because\ y_0 = mx_0 + b \\
&= \Delta x(2m - 1) \\
&= \Delta x(2\frac{\Delta y}{\Delta x} - 1) && \because\ m = \frac{\Delta y}{\Delta x} \\
&= 2\Delta y - \Delta x
\end{aligned}$$

2. (10 points) Consider a rotation R_1 about an axis (0, 1, 0) by angle 60° and another rotation R_2 about an axis (0, 0, 1) by angle 60°. What is the axis and angle of the composite rotation R_1R_2?

$q_1 = (\frac{\sqrt{3}}{2}, 0, \frac{1}{2}, 0)$

$q_2 = (\frac{\sqrt{3}}{2}, 0, 0, \frac{1}{2})$

$q_2 \bullet q_1 = (\omega_2\omega_1 - \langle (x_2, y_2, y_2), (x_1, y_1, y_1) \rangle, \omega_2(x_1, y_1, y_1) + \omega_1(x_2, y_2, y_2) + (x_2, y_2, y_2) \times (x_1, y_1, y_1))$

$= (\frac{3}{4}, -\frac{1}{4}, \frac{\sqrt{3}}{4}, \frac{\sqrt{3}}{4}) = (\frac{3}{4}, \frac{\sqrt{7}}{4}(-\frac{1}{\sqrt{7}}, \frac{\sqrt{3}}{\sqrt{7}}, \frac{\sqrt{3}}{\sqrt{7}})$

axis: $\frac{1}{\sqrt{7}}(-1, \sqrt{3}, \sqrt{3})$

angle: $2\arccos(\frac{3}{4})$