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ASSIGNMENT 7

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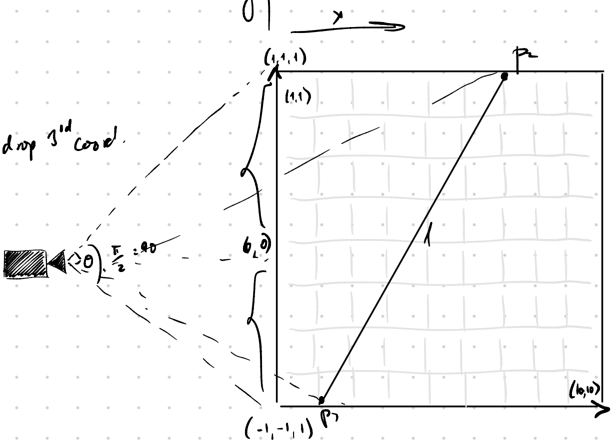


Exercise 1.

Because $z = 1$, drop 3rd coord.

$\frac{10 \text{ pixels}}{2 \text{ units}} = 1 \text{ unit} = 5 \text{ pixels}$

$(-1,-1,2)/2 = \left(-\frac{1}{2}, -\frac{1}{2}, 1\right)$

$l: p_1 = (-1,-1,2), \quad p_2 = (7,1,10)$

- Intersections of p_1 & p_2:

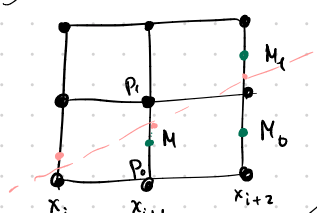
$q_1 = (-0.5, -0.5) \qquad q_2 = \left(\frac{7}{10}, \frac{1}{10}\right)$

- Convert to image coordinates:

$y = 0 - (-dy) \cdot r$
$x = 0 + (-dx) \cdot r$

$q_1 = (3, 8) \qquad q_2 = (9, 5)$

Midpoint Algorithm:



$$F = \begin{cases} x = \text{mid}(x) + dx \\ y = \text{mid}(y) - dy \end{cases}$$

Initial: $F(M) = (-(5-8)) + \frac{3-3}{2} = 0.$

		Coords:
$F(x_1) = 0 - 3 = -3 < 0$ $F(y_1) = 0 - 3 + 6 = 3 > 0$	below =>	(4, 8)
$F(x_2) = -3 - 3 = -6 < 0$ $F(y_2) = -3 - 3 + 6 = 0 = 0$	on =>	(5, 7)
$F(x_3) = 0 - 3 = -3 < 0$ $F(y_3) = 0 - 3 + 6 = 3 > 0$	below =>	(6, 7)
"	"	(7, 6)
		(8, 6)
		(9, 5)

a) start : (4,8) middle : (6,7) q_2 = (9,5)

$$p^2 = \frac{1}{(1-\lambda)\frac{1}{p_1^2} + \lambda\left(\frac{1}{p_2^2}\right)} = \frac{1}{\frac{1}{4} + \frac{1}{20}} = \frac{1}{\frac{3}{10}} = \frac{10}{3} \approx 3$$

b) $p_1 \rightsquigarrow$ red, (1,0,0)

$p_2 \rightsquigarrow$ green, (0,1,0)

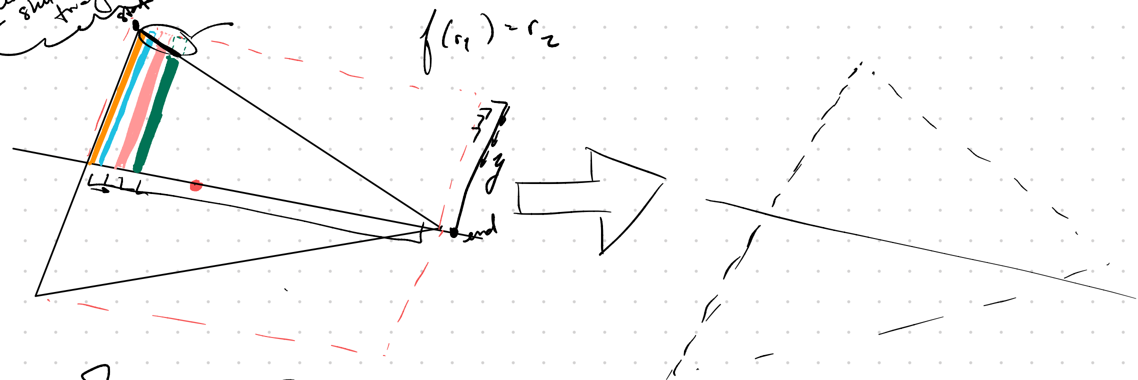
$\Rightarrow$ middle $\rightsquigarrow$ rgb $= \left[(1 \cdot 0{,}5 + 0 \cdot 0{,}5),\ (0 \cdot 0{,}5 + 1),\ 0\right] = \left(\frac{1}{2}, \frac{1}{2}, 0\right)$

$$A = \frac{(1-\lambda)\frac{P_1}{p_1^2} + \lambda\frac{P_2}{p_2^2}}{\frac{1}{p^2}} = \frac{\left(1-\frac{1}{2}\right)\frac{P_1}{2} + \frac{1}{2}\cdot\frac{P_2}{10}}{\frac{1}{\frac{10}{3}}} = \frac{\frac{1}{4}(1,0,0) + \frac{1}{20}(0,1,0)}{\frac{3}{10}} = \left(\frac{5}{6}, \frac{1}{6}, 0\right)$$

Exercise 2

We assume: we have a triangle, with 3 known vertices. We draw a line through one of the 3 vertices, via the barycentric center. Then the two triangles can be considered seperately.

Idea: (colouring the area of the triangle sketch pixel by pixel.)



Properties of Barycentric Coordinates:

1. Ratio of Areas is constant
2. $\Sigma = 1$

By knowing the ratio of the width to height, x and y, after setting each of the triangles in bounding boxes, we observe (at one end of the triangle), whether the point lies within the coordinates, due to its "barycentricity" (the left vertex will be (1,0,0) and right one (0,0,1), and top vertex stays 0).
Each pixel is handled in relation to the ratio between the position of the pixel relative to the x, y, and then adjusting the barycentric coordinates accordingly.

Pseudo-code (sort of):

method cutTriangle():
→ cut triangle with one vertice to point
→ getHeights()
for x = 0, 1000
$r_1 = 0 - 0 = 1$
$r_2 = 1 - 0 = 1$
$0 < y < h$
$r_2 = \left(-\frac{1}{2} - \frac{1}{2}h\right) / 500$

if aboveTriangle():
continue

if belowTriangle():
if $0 < y < h_2 \cdot r_2$ & $0 < y < h$

constructBox(x, y)

NOT COMPLETE