Exercise 8

Exercise 8.1 - Asymptotic Decider

Midpoint:

$$c = \frac{1}{4} * (f_{i,j} + f_{i+1,j} + f_{i,j+1} + f_{i+1,j+1})$$
$$= \frac{1}{4} * (-40 + 8 + 80 - 40)$$
$$= 2$$

Because $c > 0$, our lines are drawn the following:
Our top root is connected to our left root, and our bottom root is connected to our right root. We now just need to calculate our asymptotes:

$$x_c = \frac{f(0)}{f(1) - f(0)}$$
$$x_c(SouthWest, SouthEast) = \frac{5}{6}$$
$$x_c(NorthWest, NorthEast) = \frac{2}{3}$$
$$x_c(NorthEast, SouthEast) = \frac{1}{6}$$
$$x_c(NorthWest, SouthWest) = \frac{1}{3}$$

Exercise 8.2 - Octrees

32bit floating point $\rightarrow$ 4bytes for each voxel
only the last layer needs to store these voxels wich contains $500 * 500 * 200 = 50.000.000$ nodes

$$8^x \leq 50.000.000 \Rightarrow x = 9$$
$$layer_9 = 8^9 = 134.217.728 \text{ leaves}$$
$$layer_8 = 8^8 = 16.777.216 \text{ leaves}$$
$$layer_7 = 8^7 = 2.097.152 \text{ leaves}$$
$$layer_6 = 8^6 = 262.144 \text{ leaves}$$
$$layer_5 = 8^5 = 32.768 \text{ leaves}$$
$$layer_4 = 8^4 = 4096 \text{ leaves}$$
$$layer_3 = 8^3 = 512 \text{ leaves}$$
$$layer_2 = 8^2 = 64 \text{ leaves}$$
$$layer_1 = 8^1 = 8 \text{ leaves}$$
$$layer_0 = 8^0 = 1 \text{ leaves}$$

(a)

$$= 134.217.728 * 4 \text{ bytes}$$
$$= 536870912$$
$$\approx 537 \text{ MB}$$

(b)

$$= 134.217.728 + 2 * (16.777.216 + 2.097.152 + 262.144 + 32.768 + 4096 + 512 + 64 + 8 + 1)$$
$$= 172.565.650 * 4 \text{ bytes}$$
$$= 690262600 \text{ bytes}$$
$$\approx 690\text{MB}$$

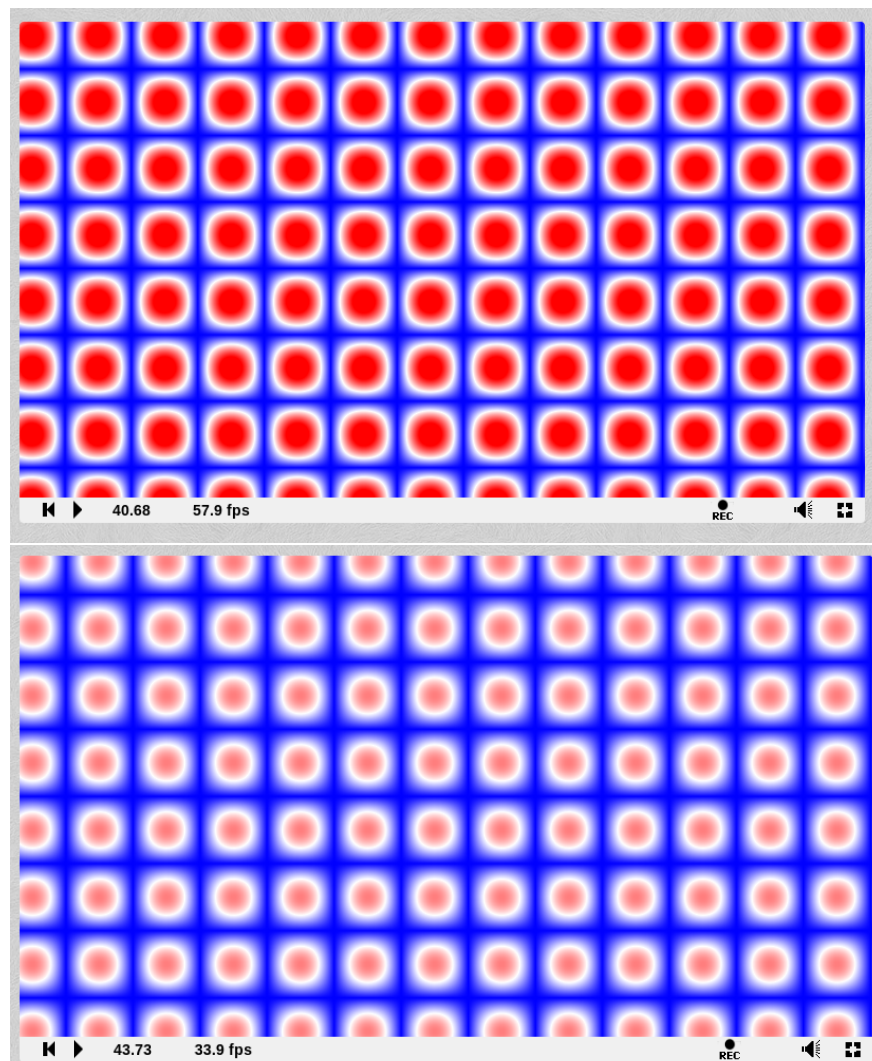# Exercise 8.3 - Color Mapping with Shaders

Figure 1: Screenshots