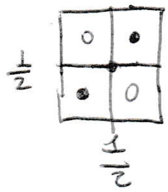
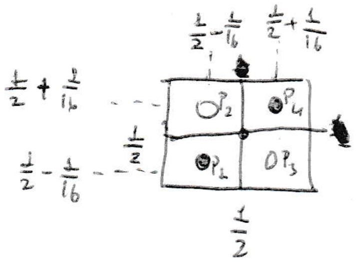
1/ Texture Resolution: 8x8

The point $\left(\frac{1}{2}, \frac{1}{2}\right)$ corresponds to the center of ~~the~~ the texture:



, every edge of the texel has the length: $\frac{1}{8} = 0{,}125$.

The center is at the half of its length, so: $\frac{1}{16}$, with this we have:



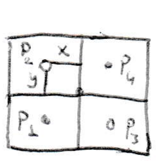
, with this we get our four nearest texels to the point: $\left(\frac{1}{2}, \frac{1}{2}\right)$, which is:

$$P_1\left(\frac{7}{16}, \frac{7}{16}\right), P_2\left(\frac{7}{16}, \frac{9}{16}\right), P_3\left(\frac{9}{16}, \frac{7}{16}\right), P_4\left(\frac{9}{16}, \frac{9}{16}\right)$$

For $\underset{\left(\frac{1}{2}, \frac{1}{2}\right)}{\underset{\downarrow}{P}}$ we get the following equation: (I_c: means color of Point)

$$P_c = (1-x)(1-y)\,P_{2c} + (1-x)y \cdot P_{1c} + xy\,P_{3c} + x(1-y)\,P_{4c}$$

for x, y:



$x = \frac{1}{2}$, $y = \frac{1}{2}$ (Consider $\overline{P_1 P_3} = 1$, $\overline{P_1 P_4} = 1$)

~~we don't need the exact value (just the ratio)~~ we calculate with the ratio (not the actual length).

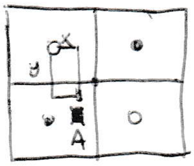
With $P_{1c} = P_{4c} = 0$, $P_{2c} = P_{3c} = 1$ we get:

$$P_c = \frac{1}{2}\,\frac{1}{2} \cdot 1 + \frac{1}{2} \cdot \frac{1}{2} \cdot 0 + \frac{1}{2} \cdot \frac{1}{2}\,1 + \frac{1}{2} \cdot \frac{1}{2} \cdot 0$$

$$= \frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$$ $= 0{,}5$, Point $\left(\frac{1}{2}, \frac{1}{2}\right)$ has the color $\frac{1}{2}$ (which should be gray)

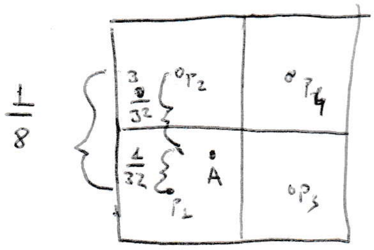
For the Point $\left(\frac{4}{8} - \frac{1}{4} \cdot \frac{1}{8}, \frac{4}{8} - \frac{1}{4} \cdot \frac{1}{8}\right)$, consider this:

This point is interpolated $-\frac{1}{32}$ on both axises, so we get:



$$A = \left(\frac{4}{8} - \frac{1}{4} \cdot \frac{1}{8}, \frac{4}{8} - \frac{1}{4} \cdot \frac{1}{8}\right)$$

$x = \frac{1}{4}$, $y = \frac{3}{4}$, because:



3:1 Ratio, analog with x axis.

So we get:

$$A_c = (1-x)(1-y) P_{2c} + (1-x) y P_{1c} + x y P_{3c} + x(1-y) P_{4c}$$

$$A_c = \frac{3}{4} \cdot \frac{1}{4} \cdot 1 + \frac{3}{4} \cdot \frac{3}{4} \cdot 0 + \frac{1}{4} \cdot \frac{3}{4} \cdot 1 + \frac{1}{4} \cdot \frac{1}{4} \cdot 0$$

$$= \frac{3}{16} + \frac{3}{16} = \frac{6}{16} = 0{,}375$$

So Point $\left(\frac{4}{8} - \frac{1}{4} \cdot \frac{1}{8}, \frac{4}{8} - \frac{1}{4} \cdot \frac{1}{8}\right)$ has the color 0,375, which is also gray but darker than Point $\left(\frac{1}{2}, \frac{1}{2}\right)$ has.

2/ Render from back to front with alpha-blending:

$C_D = \alpha_S C_S + (1-\alpha_S) C_D$, s: coming color

d: already-determined color

We have the following colors from back to from according to the task:
(α-Values included

$O_0 = (0,0,0,1)$, $O_1 = (0.25, 0, 0, 0.5)$, $O_2 = (1,1,1,0)$

$O_3 = (0.5, 0, 0, 0.5)$

With this we start from C_0 and come to front (to C_3):
(α-Values not included in C_i, α_i corresponds the value of alpha of O_i)

Step 1

$C_D = \alpha_0 C_0 = 1.(0,0,0) = (0,0,0)$

Step 2

$C_S = (0.25, 0, 0)$, $\alpha_S = 0.5$ $\quad C_D = 0.5(0.25,0,0) + 0.5(0,0,0)$

$= (0.125, 0, 0)$

Step 3

$C_S = (1,1,1)$, $\alpha_S = 0$ $\quad C_D = 0.(1,1,1) + 1.(0.125, 0, 0)$

$= (0.125, 0, 0)$

Step 4

$C_S = (0.5, 0, 0)$, $\alpha_S = 0.5$ $\quad C_D = 0.5(0.5,0,0) + 0.5(0.125,0,0)$

$= (0.25, 0, 0) + (0.0625, 0, 0)$

$= (0.3125, 0, 0)$

The seen color is $(0.3125, 0, 0)$