Homework 5 / CPSC 314

5.1 a)

z' for $z=-n$: $\frac{f+n}{f-n} + \frac{2fn}{f-n}\cdot\frac{i}{-n} = \frac{f+n-2f}{f-n} = -1$

z' for $z=-f$: $\frac{f+n}{f-n} + \frac{2fn}{f-n}\cdot\frac{1}{-f} = \frac{f+n-2n}{f-n} = 1$

b)

$z'' = a z' + b$ with $a\cdot(-1)+b=0 \Rightarrow a=b$

$a+b = 2^N - 1$

$\Rightarrow a = b = \frac{2^N-1}{2}$

c) first: determine combined mapping of parts a), b):

$$z'' = \frac{2^N-1}{2}\left(\frac{f+n}{f-n} + \frac{2fn}{f-n}\cdot\frac{1}{z}\right) + \frac{2^N-1}{2} = (2^N-1)\frac{fn}{f-n}\cdot\frac{1}{z} + \frac{2^N-1}{2}\underbrace{\left(\frac{f+n}{f-n}+1\right)}_{=\frac{2f}{f-n}}$$

$$= (2^N-1)\frac{fn}{f-n}\cdot\frac{1}{z} + (2^N-1)\frac{f}{f-n}$$

(easy to verify: $z=-n \Rightarrow z''=0$; $z=-f \Rightarrow z''=\frac{2^N-1}{2}$)

now: invert this mapping (solve for z):

$$z = \frac{(2^N-1)\frac{fn}{f-n}}{z'' - (2^N-1)\frac{f}{f-n}}$$

finally: plug in numbers (I work in units of meters here)

$$z_{\Delta n} = \frac{65535\cdot\frac{1000\cdot 0.1}{1000-0.1}}{1-65535\cdot\frac{1000}{1000-0.1}} = -0.100,001,52$$

$\Rightarrow$ resolution of (1 μm) close to near plane!

$$z_{\Delta f} = \frac{65535\cdot\frac{1000\cdot 0.1}{1000-0.1}}{65534-65535\cdot\frac{1000}{1000-0.1}} = -867.6$$

$\Rightarrow$ at far plane resolution is worse than 100 m!

5.2

a) $dst'_R = 0.75\, dst_R = src_R \cdot dst_R$

$dst'_G = 0.25\, dst_G$

$dst'_B = 0.25\, dst_B$

(dst': after blending; dst: before blending)

b) glBlendFunc (GL_ZERO, GL_SRC_COLOR)

or: glBlendFunc (GL_DST_COLOR, GL_ZERO) !

RGBA = (0.75, 0.25, 0.25, ?) (alpha doesn't matter)

c) channels are multiplied. Multiplication commutes

d) see "over" operator discussed in class