1.

1. During assignment 1, I had written a line to set the color of every pixel to the background color no matter what, and forgot to remove it before adding other things. It took some time for me to finally realize the mistake and I thought all of my math functions were wrong.
2. 128 * 128 = 16,384 pixels, 16,384 rays

   5 shadow rays per pixel = 81,920 rays

   4 reflection rays per pixel = 65,536 rays

   4 refraction rays per pixel = 65,536 rays

   229,376 rays total
3. Difference
4. Implicit
5. $p = e_x + td_x = \alpha p_{0x} + \beta p_{1x} + \gamma p_{2x}$

   $p = e_y + td_y = \alpha p_{0y} + \beta p_{1y} + \gamma p_{2y}$

   $p = e_z + td_z = \alpha p_{0z} + \beta p_{1z} + \gamma p_{2z}$

   $\alpha + \beta + \gamma = 1$

   Unknowns are t, α, β, and γ
6. Total internal reflection is the mirror like effect that happens when a light ray goes from a dense medium to a less dense medium, and the angle of incidence is greater than the critical angle of the two mediums

   $\theta_i > \theta_c$

2.

1. Translate(u_x, u_y, u_z) RotateX(atan2(u_y, u_z)) RotateY(atan2(u_z, u_x)) RotateZ(atan2(u_y, u_x))
2. Let a = atan2(u_y, u_z)

   b = atan2(u_z, u_x)

$c = \text{atan2}(u_y, u_x)$

Multiplying everything out gets:

cos(b)cos(c)	-cos(b)sin(c)	sin(b)	u_x
sin(a)sin(b)cos(c) + cos(a)sin(c)	cos(a)cos(c) - sin(a)sin(b)sin(c)	-sin(a)cos(b)	u_y
sin(a)sin(c) - cos(a)sin(b)cos(c)	cos(a)sin(b)sin(c) + sin(a)cos(c)	cos(a)cos(b)	u_z
0	0	0	1

3.

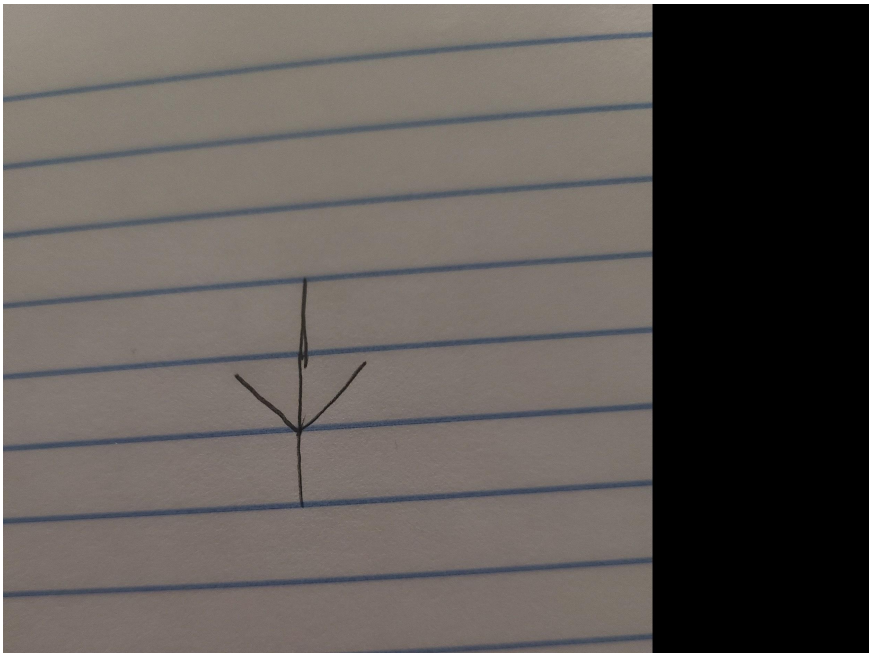
4. ***

5. ***

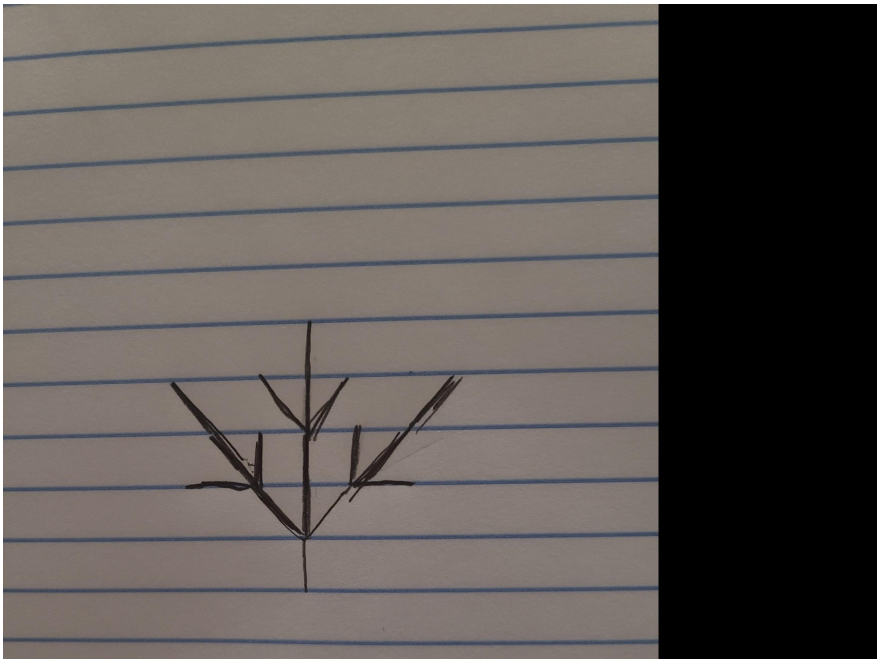
3.

1.

1. T [- B] [+ B] T B



2. T [- T [- B] [+ B] T B] [+ T [- B] [+ B] T B] T T [- B] [+ B] T B



2. X = S Y + Y - Y - Y Y + Y + Y - Y

   S = SS

   Y = Y + Y - Y - Y Y + Y + Y - Y

3.

   1. S Y + Y - Y - Y Y + Y + Y - Y
   2. S S Y + Y - Y - Y Y + Y + Y - Y + Y + Y ...
   3. S S S Y + Y - Y - Y Y + Y + Y - Y + Y - ...