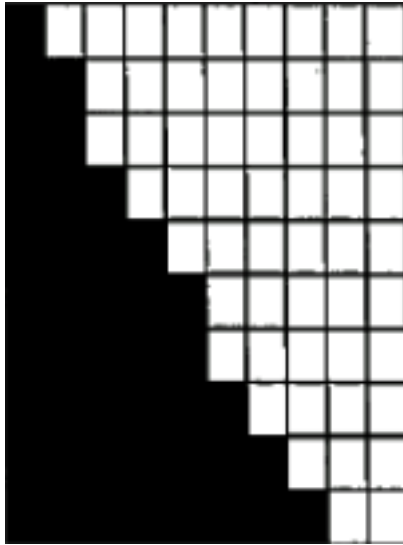


Homework 5: Ray Tracing

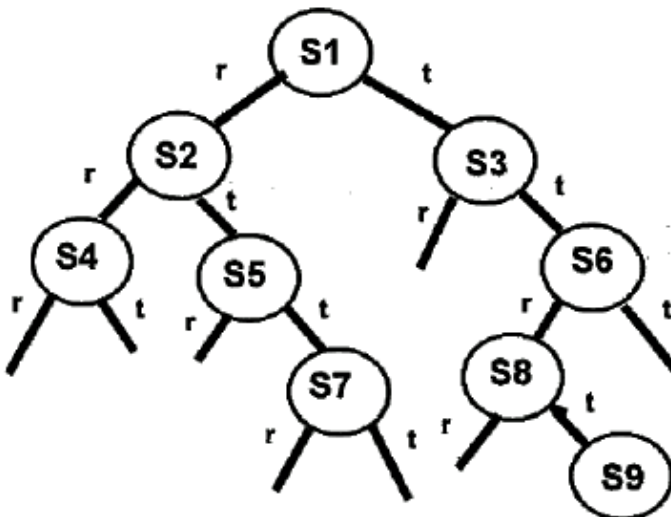
Due Date: Friday, November 9th

1. There is a scene with one black triangle in it. When this scene is ray traced with a standard ray tracer, this is the result we get:



Describe what changes can be made to the **raytracing** algorithm in order to smooth out the jagged line.

2. Define the difference between local and global illumination.
3. If we generate a raytree that looks like this:



- a. Which surfaces are reflective?
- b. Which surfaces are refractive?
- c. Which surfaces are neither reflective nor refractive?

4. You are designing a very simple ray tracer with shadows and reflections (no refractions). It should render scenes with a single color channel (grayscale images). The critical part of this program is a function called *trace* that takes a *ray* and recursion *depth* as arguments and returns a pixel intensity. The *trace* function should call itself recursively where appropriate to accomplish the final task. In a top-level loop in the bigger program, *trace* would be called for a *ray* emanating from each pixel in the image with a recursion *depth* value of 0.

Write a pseudo-code definition for *trace(ray, depth)*.

Follow a consistent syntax and use any of the definitions provided below. If your code needs to make use of any other functions or global values, give a one line description of what you are accessing.

Helpful Assumptions:

- All lights have unit intensity (1) and do not fall off with distance.
- Calling *trace* with a ray that does not intersect any object should result in a background color.
- Every point on every object has half diffuse reflectance and half perfect-mirror reflectance.
- No object emits light on its own.
- 0 represents Black

Global values:

- MAX_DEPTH – maximum recursion depth
- OBJECTS – collection of objects in the scene
- LIGHTS – list of lights in scene
- BACKGROUND_INTENSITY – some background color (single channel)

Utility functions:

- SomeObject | None = **closest_object**(Ray, OBJECTS)
- True | False = **can_see**(Ray, Light)
- OutgoingRay = **reflect**(IncomingRay, Object)
- Intensity = **diffuse**(Object, Ray, Light)