# Overview

The scene rendered by the ray tracer shows a room with two boxes and 6 spheres. A piece of artwork showing a house on a hill is displayed on the back wall of the room. One of the spheres shows refractivity, another transparency, a procedurally generated pattern, and a globe texture. The scene is lit by a single spotlight pointing towards the box from above the camera.

# How to run

Extract the contents of the project and open the extracted folder such that the file “run\_csse\_lab” is visible.

**Linux mint (Lab computers)**

Running the bash script “run\_csse\_lab” will build and run the ray tracer.

**Windows 10**

Navigate to the OpenGLProject folder and open the “OpenGLProject.sln” with Microsoft Visual Studio. Run the program by clicking the “Local Windows Debugger” button

# Basic Features

**Scene Arrangement.** As mentioned in the overview, the scene contains a number of spheres, planes, and boxes (also constructed of planes).

**Transparency** is shown by 2 of the rightmost spheres. The group shows a solid blue sphere inside of a partially transparent blue sphere, inside of a partially transparent green sphere.

**Shadows** are seen throughout the scene. The intensity of the shadows cast by the sphere are proportional to the transparency coefficient of the sphere. Shadows of transparent objects can compound to create darker shadows; this is best seen by the spheres on the right, mentioned above. All shadows are limited by a minimum scene brightness.

**Compound Object**. The scene contains two boxes constructed from 6 planes each. The boxes are constructed such that many unique boxes can be added to the scene as if they were one object.

**Chequered Floor.** The floor plane of the scene shows a chequered yellow and green pattern. Each square section is 5 units deep and wide.

# Extensions

**Refraction** can be seen in the largest sphere. Refraction can be applied to any game object.

**Spotlight.** The main light source is a spotlight. The spotlight originates from above the camera and points roughly at the front of the centre box. The spotlight is setup such that the position, direction, and angle can be easily modified.

**Anti-Aliasing**. The ray tracer uses super sample anti-aliasing. It is possible to disable the anti-aliasing by setting an internal flag.

**Sphere Texturing**. The sphere on the left has a map of the earth mapped to it.

**Procedural Patterns** can be seen in the left and right walls, and the sphere closest to the camera. The walls are very simple, each colour component (red, green, and blue) is proportional to the coordinates (x, y, and z, respectively) relative to the room centre. The sphere has a constant blue component. The amount of red and green are calculated by finding the sine of linear combinations of the x, y, and z position components at that point.