CSE 4310: Introduction to Computer Vision
Summer 2021
Program #4: Overhead Item Scanning

In this assignment, you will implement a simple tabletop 3D object detector using PCL. You will be given a test PCD file taken from an RGB+D sensor looking down on a tabletop surface (the same test file provided with the assignment will be used for grading). The surface will contain up to 3 individual objects, which may be boxes or spheres. There will be at least a 2" gap between any object (no object will touch another object), but multiple copies of the same object may be present. Be sure to review the test file carefully when considering a detection strategy.

The program should take a single command line argument, which will contain the file path for the input point cloud (assumed to be an XYZRGBA PCD file). The program will output a single modified point cloud called "output.pcd".

Once the program is loaded, the file will be processed and a result will be displayed in the console and display window(s). There will be no runtime user interaction or visualization, the only output will be the saved file "output.pcd", which can be viewed with the point cloud viewer of your choice. A web viewer can be found at:

www.mcmurrough.net/pointcloud_viewer.

The result point cloud in the 3D viewer should be colored to represent what is in the scene. The table surface points should be colored blue, box objects green, and spherical objects red. Any other points should have their original color.

In the console window, you will display an inventory of what is detected in the scene. For example, a scene with 3 boxes and 2 spheres should print the following:

```
BOX COUNT: 3
SPHERE COUNT: 2
```

Your program should run on the class development environment using PCL. You must include a working CMakeLists.txt file with your source code. The program should be able to be compiled and executed by running the following set of commands in the program directory if C++ is used:

```
cmake .
make
./program4 <PATH TO FILE>
```

For example…

```
cmake .
make
```

```
./program4 scene.pcd
```

You may develop your application on your own system / OS, but it must run properly on the class development environment at the time it is evaluated. Submit your source code and all other necessary files to blackboard in a single zip file by the deadline. Late submissions will incur a penalty of 10 points per day after the deadline. **Do not submit any point clouds with your assignment, those will be generated programmatically for grading**.

Points will be assigned as follows:

1. Program opens and saves files as specified – 20 points
2. Program colors tabletop successfully – 20 points
3. Program colors boxes successfully – 20 points
4. Program colors spheres successfully – 20 points
5. Program counts successfully – 20 points

Partial credit may be given, at the discretion of the grader, for items which are not fully functional or contain bugs. You may be asked to demo your program to the grader if errors occur during the initial run. Write your code as cleanly as possible with proper formatting and comments in order to bolster your case for partial credit on non-functional features. It is highly recommended to follow a standard coding style, such as ANSI C++, Google C++, etc. in your program (HINT: The Code::Blocks IDE provided with the development environment has a built in formatter under the plugins menu).