

# Computer Graphics (CSCI-GA 2270-001) - Assignment 4

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## 1 Common Information

The code was written in Ubuntu 18.04, with a cmake version 3.10.2 and C++ version 7.5.0. I have implemented all the algorithms in this assignment using the template functions provided in the github repo and have only used standard C++ libraries. I have commented the code so as to explain what I am trying to do in each block of the function.

## 2 Answers to Exercises

### 1. Exercise 1

- (a) The implementation of the intersection of a ray and a triangle is inside the function "intersect\_triangle()". The implementation is according to the description given in class.
- (b) The implementation of the simple ray tracer without any speed up is inside the Mesh::intersect() function. When the parameter speed\_up is set to false it runs a for loop and checks if the given ray intersects with any triangle in the mesh.

### 2. Exercise 2

- (a) The implementation of the intersection of a ray with an AABB is inside the function intersect\_box(). The function does not solve any equations and simply checks if the ray passes through the inside of the box.
- (b) The implementation of generating the AABB tree is inside the AABBTree constructor. The bottom-up construction method was used to generate the AABB trees. I have added comments inside the code to try to explain what each segment of the code tries to do.
- (c) The implementation of the speed up with AABB trees is inside Mesh::intersect() function. When the parameter speed\_up is set to true the ray tracer goes through the tree to check if the ray intersects with the AABB first and then when it reaches the leaf it checks if it intersects with a triangle.

When using speed up the time taken to render the image drops significantly lower. The images of the bunny and dragon using the speed up without any effects is shown in Figure 1, 2. Further, the rendered images when shadowing and reflection are used for the same objects are shown in figure 3, 4.

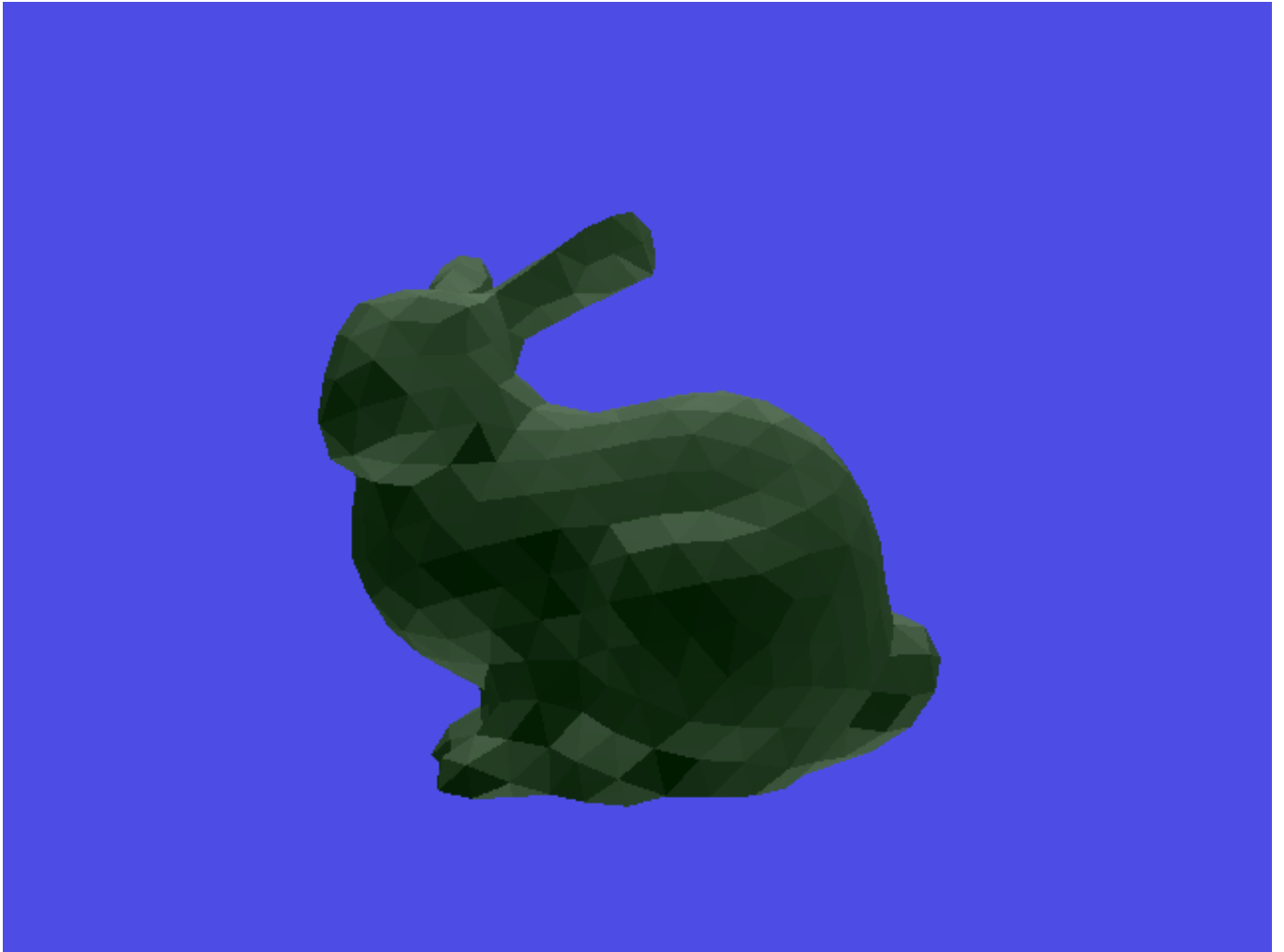


Figure 1: Rendered image of bunny with AABB tree without using effects such as shadows and reflection

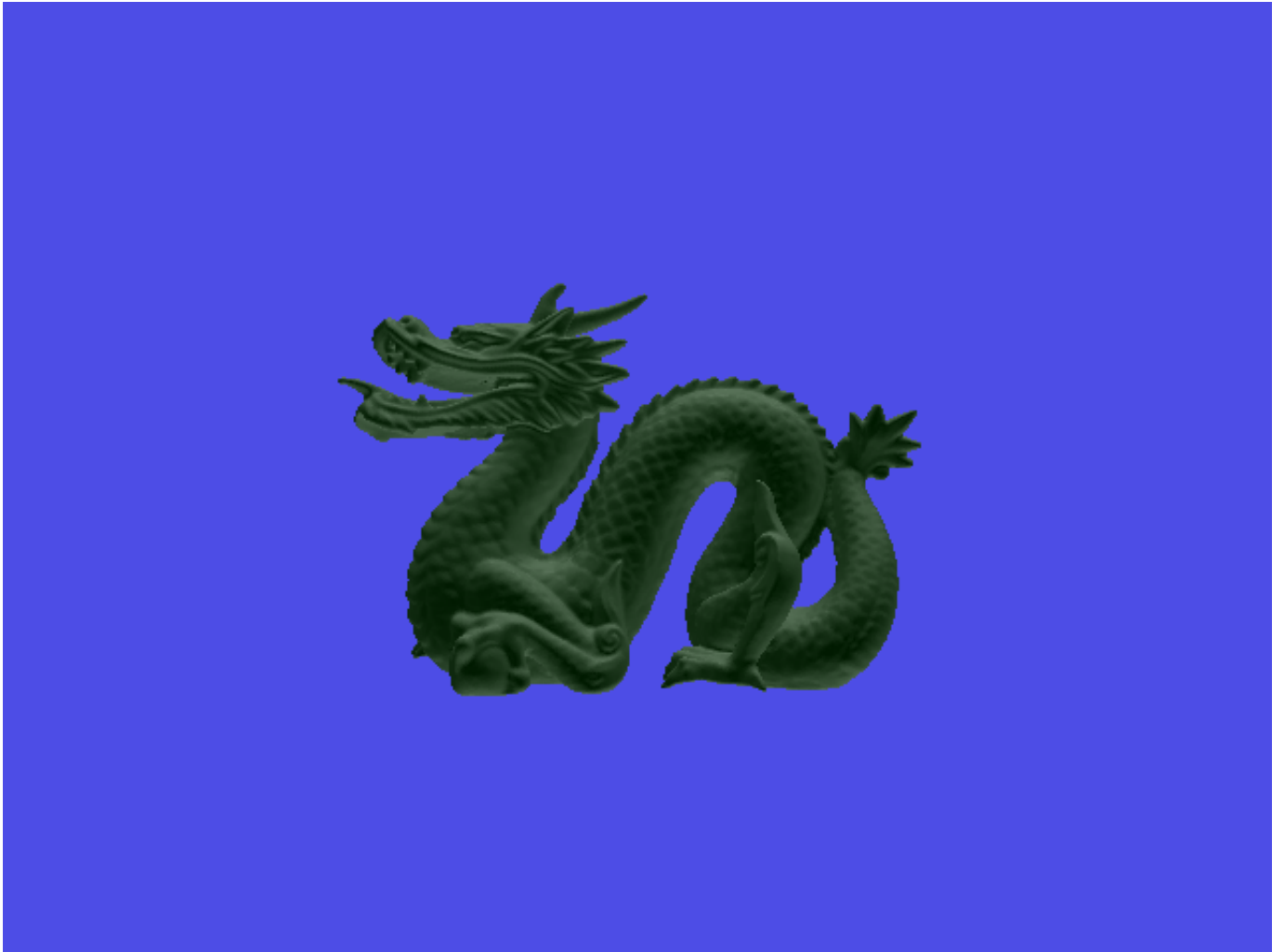


Figure 2: Rendered image of dragon with AABB tree without using effects such as shadows and reflection

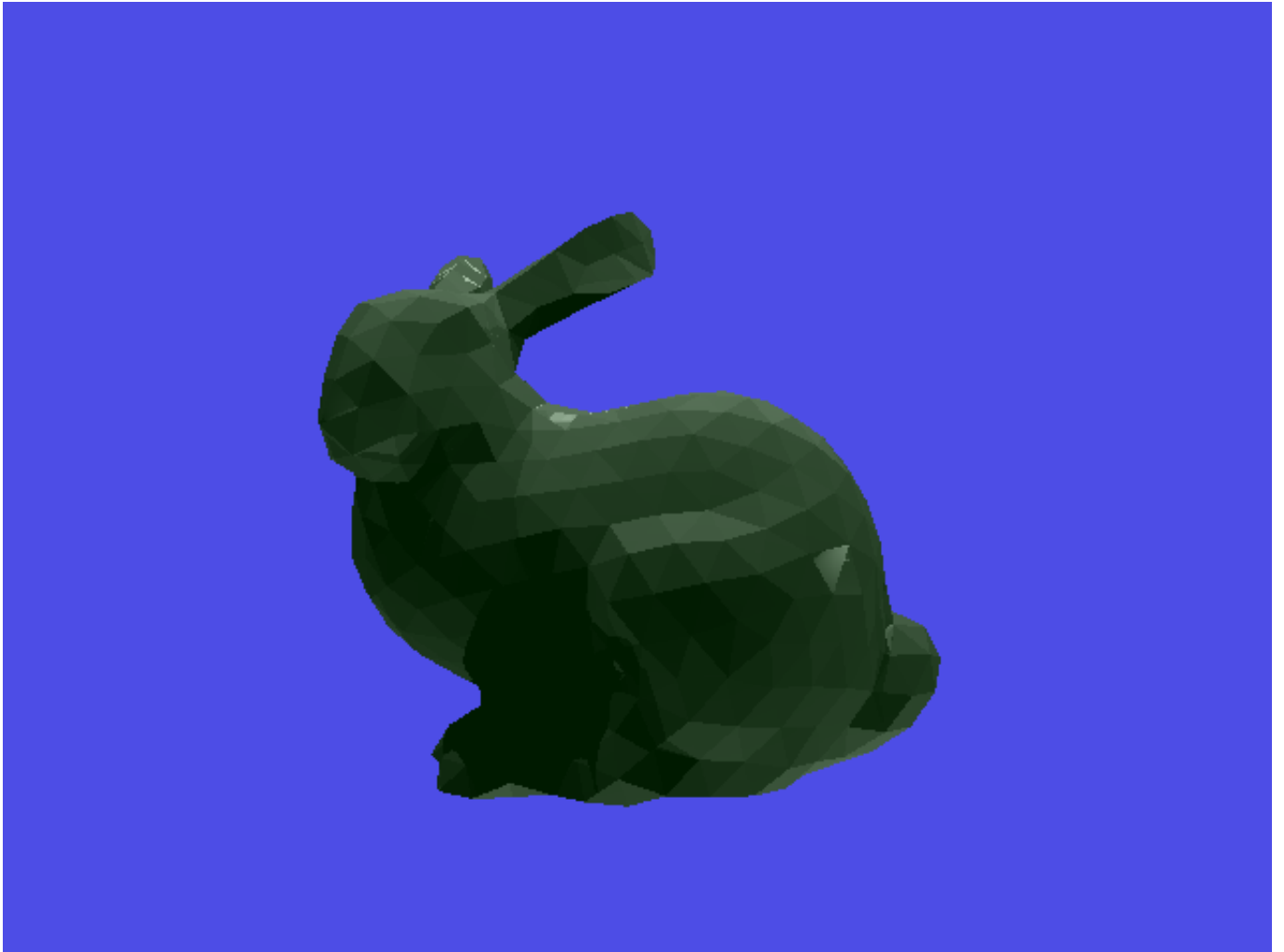


Figure 3: Rendered image of bunny with AABB tree with effects such as shadows and reflection

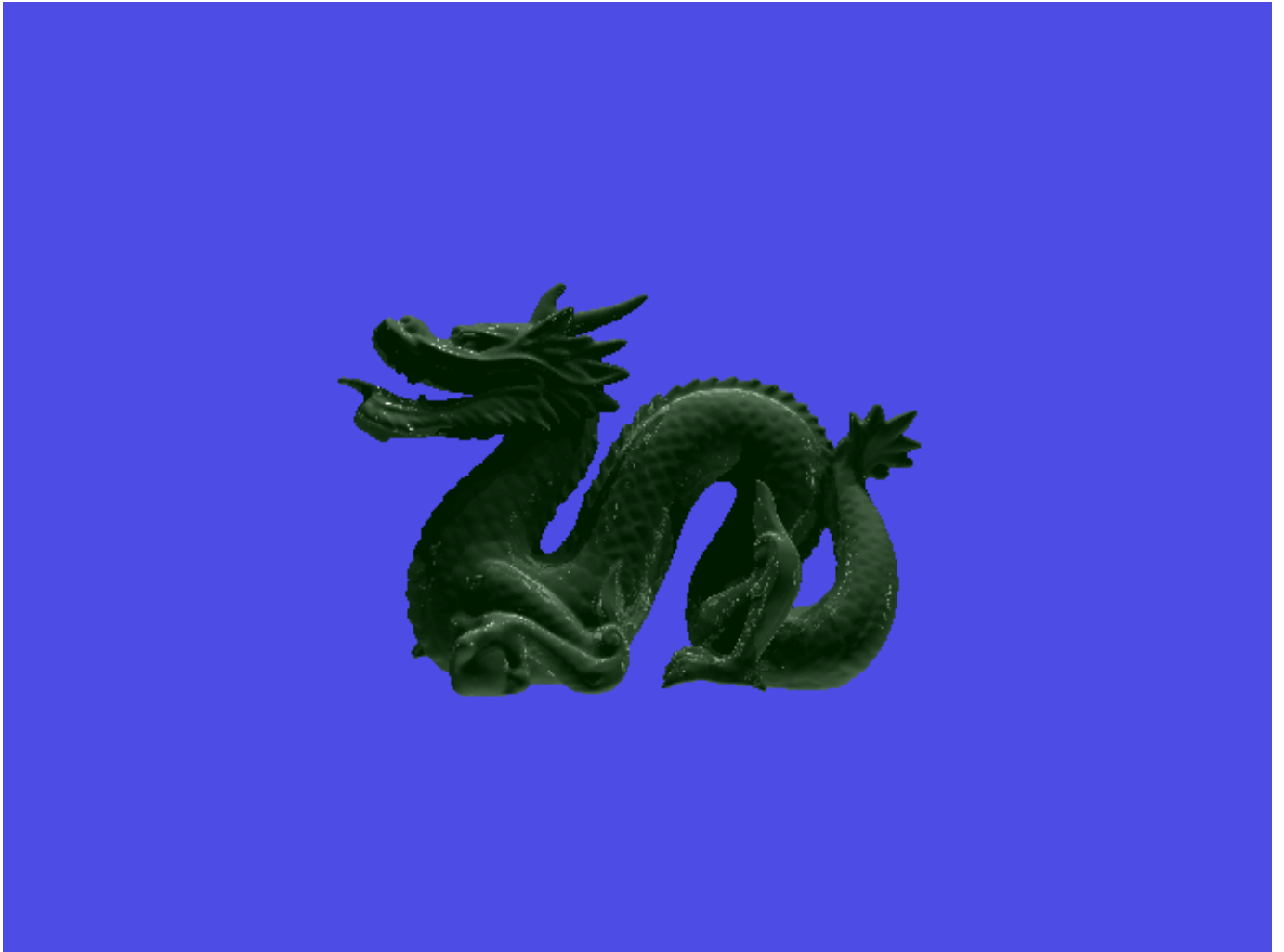


Figure 4: Rendered image of dragon with AABB tree with effects such as shadows and reflection