OpenGL Programming Exercise

1 - 2

Everything has started with a triangle.

3

Then came the time of a sphere.

It was constructed by mapping spherical coordinates (θ, φ), such that φ∈[0, 2π], θ∈[0, π] to planar coordinates. Longitudes are divided into segments, the ends of which are then connected into triangles. First, I did it with a lot of points located at the poles of the sphere, but I also wanted to try to do it in a way that there is only one point per pole, and all the nearby points are connected directly to the pole point instead of duplicating the same point several times. This should reduce the time of applying a transformation to the mesh since there are less points to process. I created a vector where I added vertices' coordinates in an order that is convenient to operate with, going first through the first column, then second, third, etc. There were some problems and mistakes during implementation but finally it worked nice.
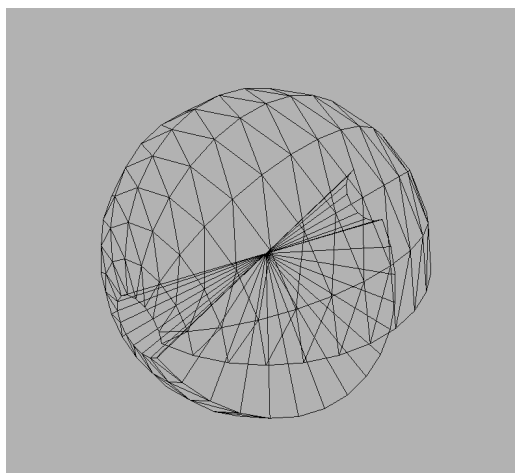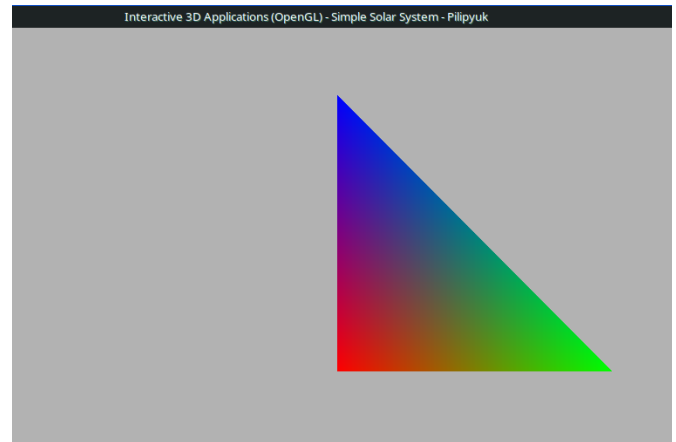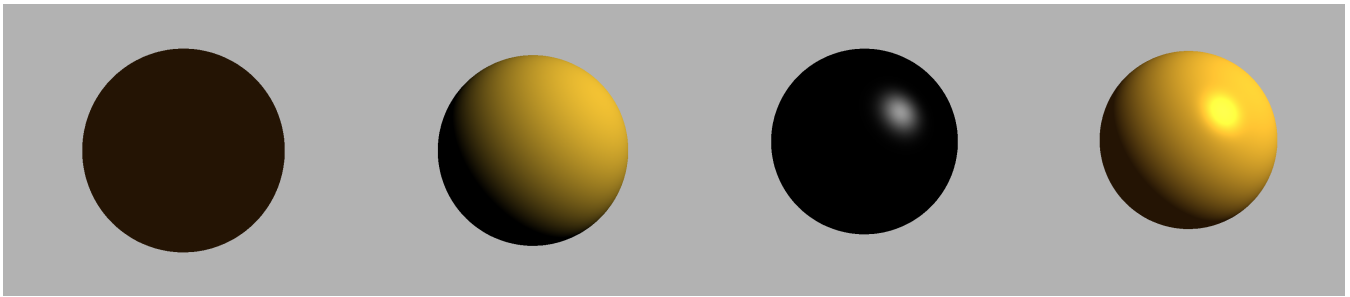
A sphere with mistakes
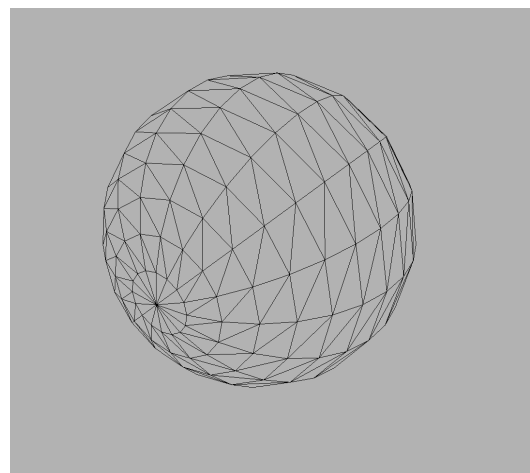
A good sphere

And shading by Phong lighting model was implemented.

4

Instead of stopping on only one sphere, three spheres then were created. This is implemented by drawing the same sphere object three times with different model transformation matrices and other parameters, such as color or the strength of the specular part of a shadow. Earth and Moon are lighted by a source located at (0, 0, 0).

5

Static world was nor real enough and required more movement. Earth rotations are calculated with respect to the axises in its local coordinate system before the translation to its position in the world space. The Moon transformations are calculated with respect to Earth translated from the center, but without counting its rotation. I also added rotation of the Sun because it looked too unnaturally static among rotating objects.

In order to check if rotations were correct while not having textures, I added an extra sphere which was static in respect to the sphere that was being checked, but in some distance, so that I could see how the orientation of the sphere changed.

6

After all the space objects being of a solid color, they obtained a more advanced appearance. I added textures of Earth and Moon that were provided. And for Sun to not be the simplest one, I also found and added a beautiful texture.