

# Computer Graphics

## CS606\_T2-21-22

### Assignment 3 Report - Group 4

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#### The Question:

3D rendering with lighting and shading, and rotation using quaternions with the objectives including - experimenting with lights and Blinn-Phong lighting model, experimenting with Gouraud and Phong shading models, and using quaternions for rotation. The two meshes used are a sphere and a teapot.

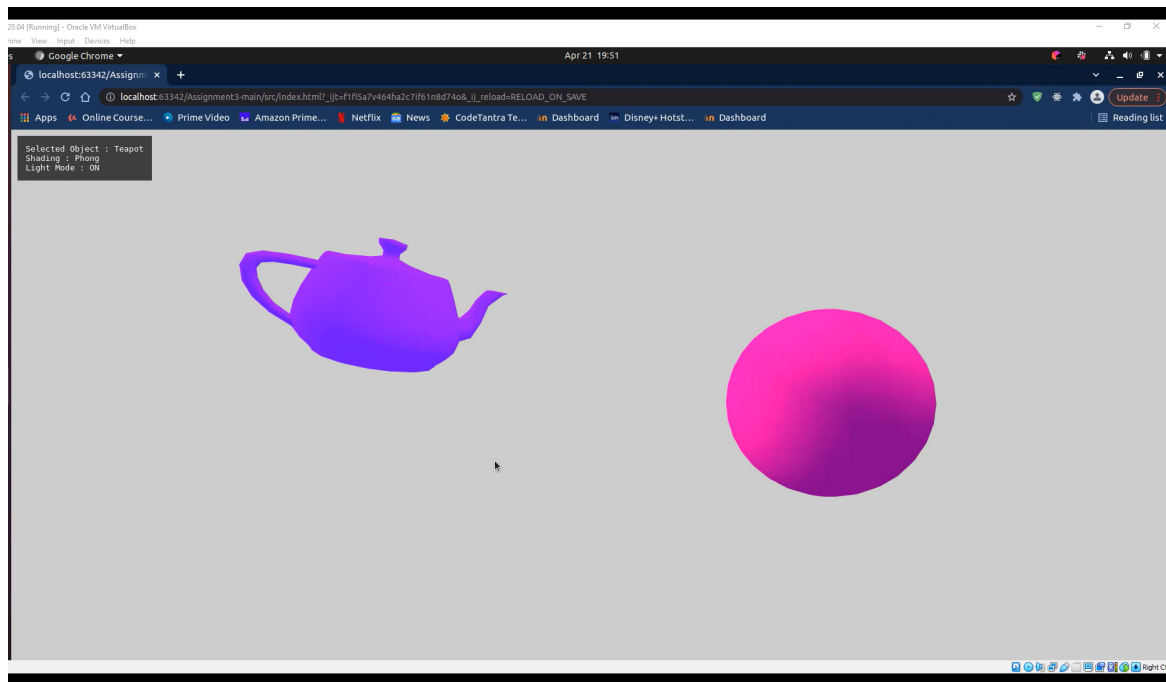
#### Implementation:

In this assignment, we were expected to implement the Blinn-Phong Lighting Model, shading models such as Phong and Gouraud, and quaternions for rotating the objects. We created a canvas then we imported 2 3D models, a teapot and a sphere model from .obj files. We used two lighting objects one for each object. An object's light can be turned on or off only when lighting mode is on. The Phong shading model is implemented in the Fragment shader and the Gouraud shading model in the Vertex Shader. To implement rotation, we used quaternions. We move the mouse to rotate the object which is selected. Scaling and other Affine transformations have also been implemented.

#### Key Bindings:

- '3' - To select the Teapot
- '4' - To select the Sphere
- '2' - To deselect the object
- 'i' - to enter illumination mode
- '0'/'1' - To off/on the light
- 's' to change the shading on the selected object
- 'h', 'l' - To translate light along the x-axis
- 'j', 'k' - To translate light along the y-axis
- 'a', 'd' - To translate light along the z-axis
- Arrow keys - To translate a selected object
- '+'/'-' to scale up/down the selected object

## The Two Solid Models:



## The Answers:

**Question 1: What are your observations of the distance attenuation terms used for lighting on the sphere and teapot/urn models?**

This required a lot of testing with the attenuation coefficients. The basic observation made is that as the distance of a point from the light source increases, the output decreases. This means attenuation is a function that is inversely proportional to the distance. The attenuation value should be between values 0 and 1.

**Question 2: What are your observations about the change in the shading model?**

We use two types of shading models in this assignment, Gouraud and Phong shading models. In Gouraud shading, we do not interpolate the normals, for each of the points so, the specular part will not appear smooth, which means the faces will still be visible (also called flat shading). In the Phong method of

shading, the surface will appear smooth. The Gouraud shading model is computed in the vertex shader and the Phong shading model in the fragment shader. These are the main observations about the change in the shading model.

**Question 3: What are your observations of the individual components of reflection in the Blinn-Phong model for each of the mesh models you have used?**

The Phong Lighting model is a combination of the diffuse reflection of rough surfaces with the specular reflection of shiny surfaces. We can observe that even though it's a good approximation of lighting, its specular reflection breaks down in certain conditions for example when the shininess property is less it results in a rough specular area.

### References:

- [https://www.youtube.com/playlist?list=PLjcVFFANLS5zH\\_PeKC6l8p0Pt1hzph\\_rt](https://www.youtube.com/playlist?list=PLjcVFFANLS5zH_PeKC6l8p0Pt1hzph_rt)
- <https://webglfundamentals.org>
- <https://www.youtube.com/watch?v=nloXOplUvAw&list=PLjEaoINr3zgFX8ZsChQVQsuDSjEqdWMAD>
- <https://www.youtube.com/watch?v=SMIIZddICDg>
- TA's repository on Github: <https://github.com/Amit-Tomar/T2-21-CS-606>